STATE OF MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
SWAN UNIT

Scout Lake Multiple Timber Sales Project Executive Summary

December 2011

Initial Proposal and Public Concerns

Swan River State Forest, Montana Department of Natural Resources and Conservation (DNRC), is planning the Scout Lake Multiple Timber Sales Project. The proposed sale area is located approximately 8 miles south of Swan Lake, Montana on school trust lands primarily on the east side of the forest. The project area totals approximately 15,586 acres and includes all or portions of Sections 16, 18, 19, 20, 21, 27, 28, 29, 32, 33, and 34, Township 24 north, Range 17 west, Sections 6, 8, 16, 18, 20, 22, 26, 28, 30, and 34, Township 23 north, Range 17 west, and Section 36, Township 23 north, Range 18 west. The project area also includes the existing and proposed roads needed to access and support the proposed project activities. (See *VICINITY MAP*, page 2, and *PROPOSED PROJECT AREA MAP*, page 3.)

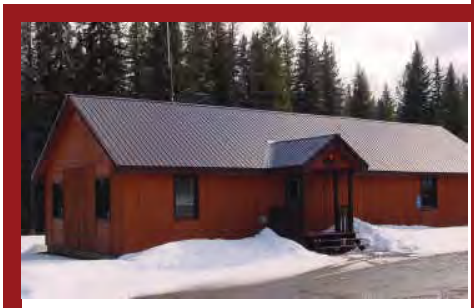
This Executive Summary is part of the Draft Environmental Impact Statement (DEIS) for the Scout Lake Multiple Timber Sales Project.

The DEIS presents:

- descriptions of a no-action alternative and 2 action alternatives and tells how each alternative would affect Swan River State Forest.
- a detailed analysis that explains how the project would affect or impact specific wildlife species, old growth, water quality, fish habitat, etc.

This Executive Summary:

- is designed in accordance with the Montana Environmental Policy Act (MEPA) rules;
- is written to be easily understood with supporting photographs and maps;
- briefly describes the project proposal and the alternatives that have been considered; and
- informs you of the next step in this project.



Swan River State Forest Headquarters

DNRC has the task of managing State school trust lands. The primary purposes of this timber sale project are to provide income for the school trust, grow new stands of healthy trees, and improve the growth and vigor of the remaining trees. This project follows the *State Forest Land Management Rules (Annotated Rules of Montana [ARM] 36.11.401 through 36.11.450)* and is based on the premise that, for the foreseeable future, timber management will continue to be the primary source of revenue. Timber management will also be the primary tool for achieving biodiversity objectives on State forest lands.

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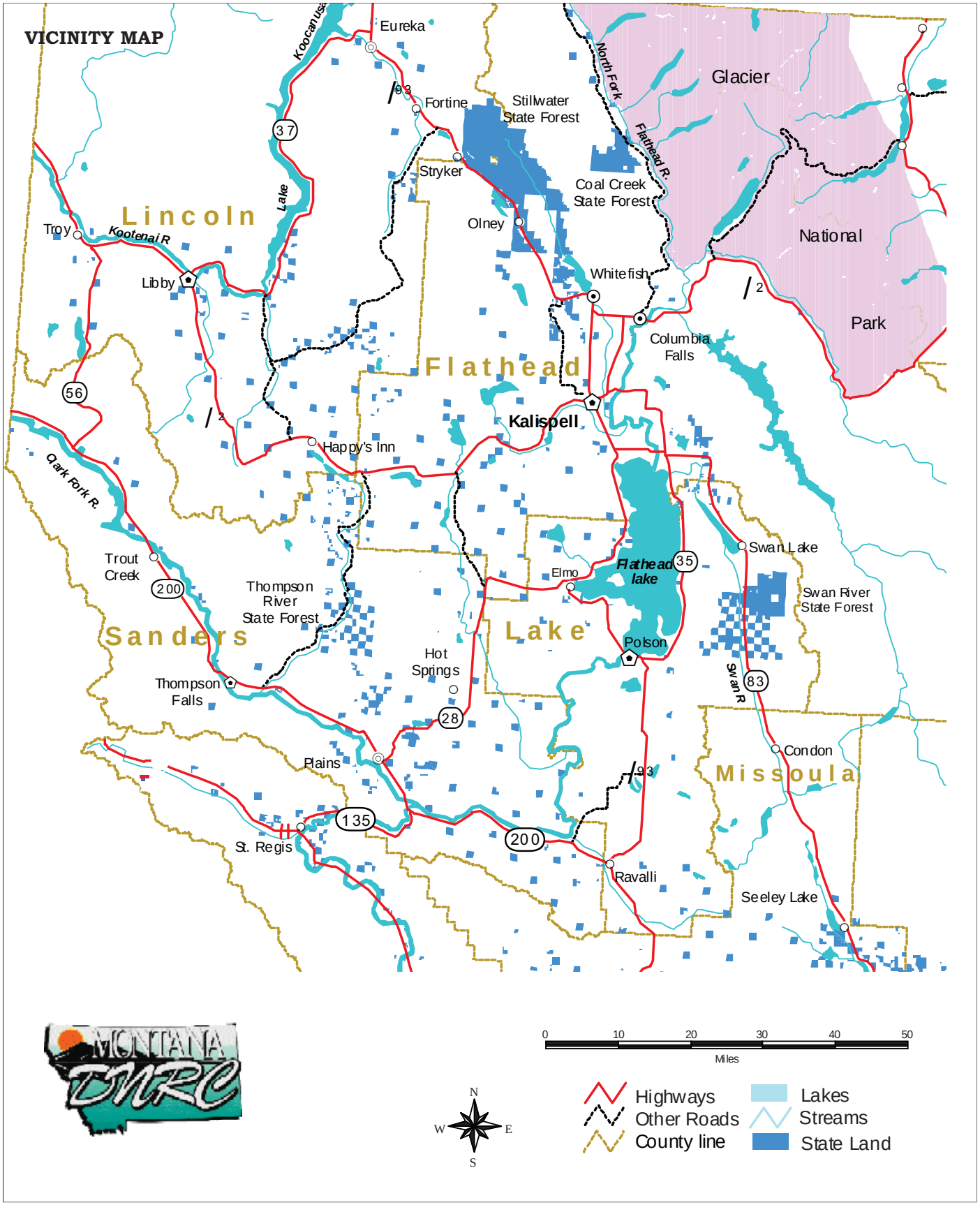
VICINITY MAP
Eureka
Koocanusa
Fortine
Stillwater State Forest
North Fork
Flathead R.
Glacier
National
Park
Stryker
Coal Creek State Forest
Olney
Lincoln
Lake
Troy
Kootenai R
Libby
Whitefish
Columbia Falls
Flathead
Kalispell
Happy's Inn
Clark Fork R.
Trout Creek
Thompson River State Forest
Elmo
Flathead lake
Swan Lake
Swan River State Forest
Sanders
Lake
Polson
Hot Springs
Thompson Falls
Swan R
Condon
Plains
Missoula
St. Regis
Ravalli
Seeley Lake
0 10 20 30 40 50
Miles
N
W
E
S
Highways
Other Roads
County line
Lakes
Streams
State Land

Scout Lake Multiple Timber Sale Proposed Project Area

N

0 0.5 1 2 Miles

Legend

Streams

Type

- Artificial Path
- Intermittent Stream
- Perennial Stream

Roads

Road Class

- Highway
- Open
- Lakes
- Scout Lake Proposed Project Area
- Other DNRC Parcels

Prepared by
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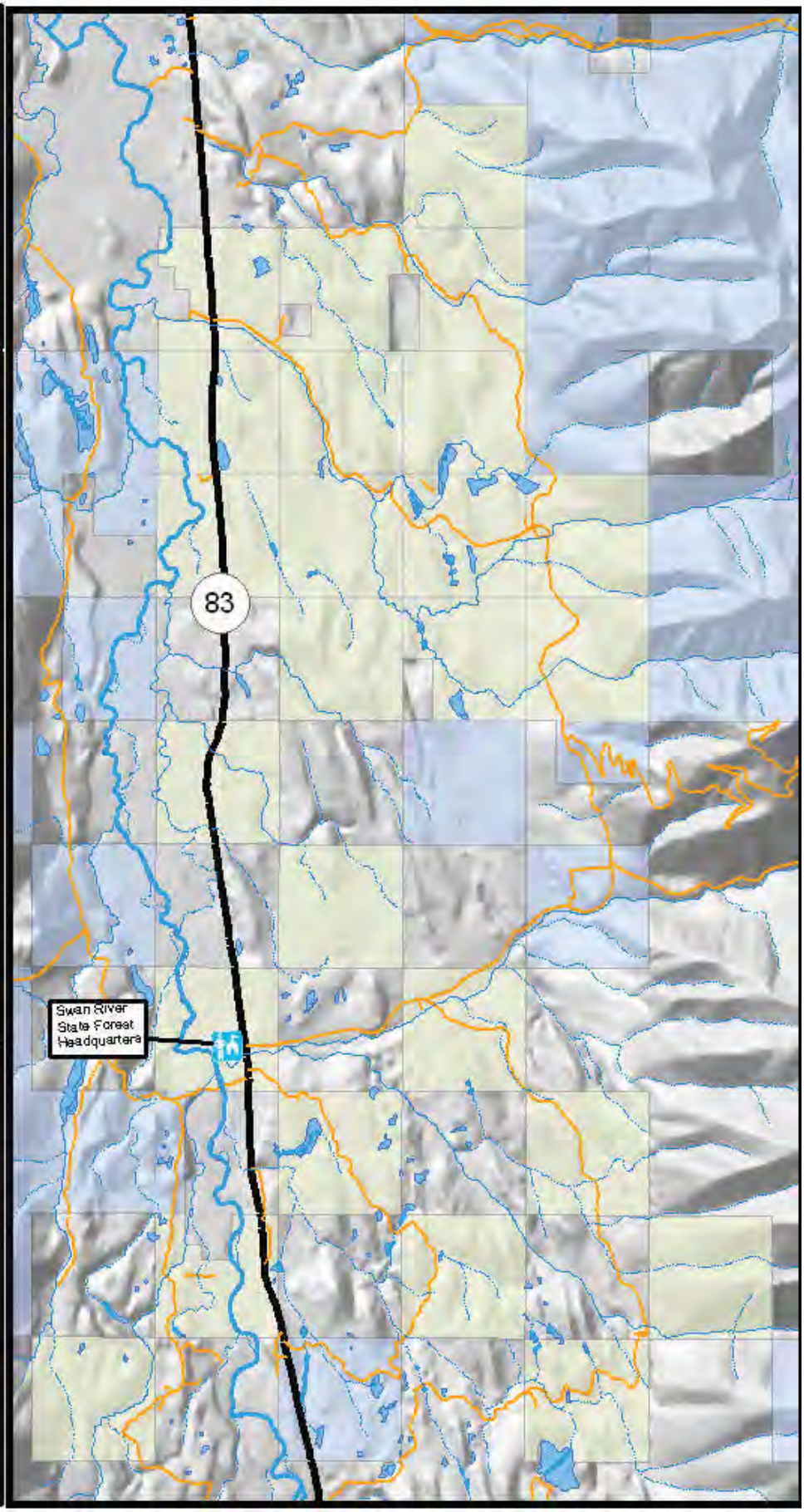
NAD 1983 State Plane Montana FIPS 2500



Accomplishments to be Achieved by the Action Alternatives

Depending on whether an action alternative is chosen, and which one, 6 to 8 timber sales would be sold and harvested during a 3- to 5-year operating period. The proposed timber sale projects would harvest 19.0 to 21.1 million board feet (MMbf) of timber (3,905 to 4,311 truckloads of logs) from 2,009 to 2,634 acres.

In addition this project would:

- return the forest stands to a desired future condition;
- harvest trees that have been affected by insects and diseases, thereby reducing fuel loads and, subsequently, fire hazards;
- generate $1,415,627 to $1,529,705 for the Common School trust in support of public schools (kindergarten through grade 12);
- construct or reconstruct 22.5 to 35.5 miles of new roads and improve 33 to 60 miles of existing roads to meet Best Management Practices;
- install/repair 4 stream crossings and install 1 temporary bridge;
- prepare logged areas to grow new trees by piling slash and scarifying the ground to allow seeds to germinate naturally or plant trees.

Developing the Project and Displaying the Concerns

On March 13, 2003, the Department adopted the *Administrative Rules for Forest Management (Rules)*. The Rules provide guidance on how DNRC will manage their forests and deal with specific items that need to be considered when planning and conducting a timber sale. The ID Team followed these rules during the development of this timber sale project proposal. The Rules may be found on the web at: www.dnrc.mt.gov/trust/default.asp. In general these Rules cover how the following items should be managed:

- biodiversity (the forest conditions are managed for a desired mix of stand structures and forest types);
- roads;
- watersheds;
- fisheries;
- wildlife species, including those listed as threatened, endangered, and sensitive, and big game;
- weeds; and
- economics.

Actions are taken to make ensure minimal amounts of sediment and debris do not enter creeks.

The proposed timber sale projects would harvest 19.0 to 21.1 million board feet of timber (3,905 to 4,311 truckloads of logs) from 2,009 to 2,634 acres.

Roads would be constructed, reconstructed or improved to meet Best Management Practices.

Initial Proposal and Public Concerns

During the initial stages of this project, adjacent landowners, interested parties, and the public were informed of the proposed action and invited to submit any issues or concerns they may have.

In April of 2010, DNRC solicited public comments through the distribution of the Scout Lake Multiple Timber Sale Initial Proposal. The proposal included maps, objectives, and contact information, and was mailed to individuals, agencies, internal DNRC staff, industry representatives, and other organizations that had expressed interest in Swan River State Forest's management activities. Additionally, public notices were placed in area newspapers. The period to submit comments was 30 days; 12 responses were received.

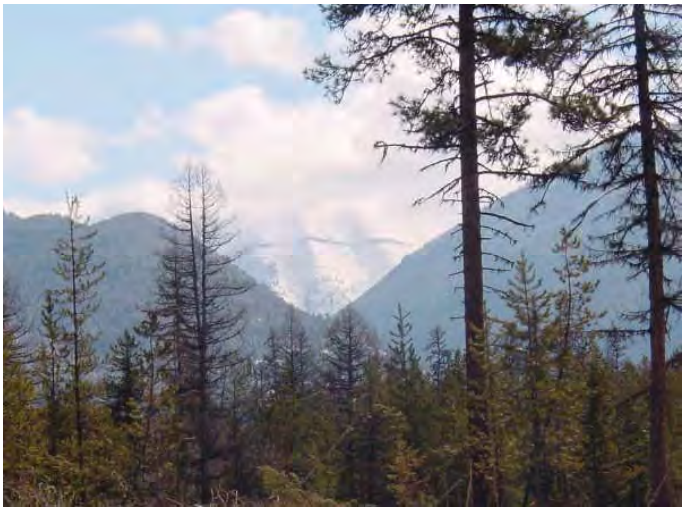
DNRC also held a field tour October 20, 2010. A second field tour in September 2011 was offered, but was canceled due to a lack interest. Newsletters were also distributed to interested parties during November 2010 and July 2011; no additional comments were received.

The Interdisplinary Team (ID Team) reviewed the responses and identified more than 81 issues related to the project. Along with issues raised by DNRC staff, field work, and requirements imposed by applicable rules, laws, and regulations, the issues from the public provided the ID Team the framework to develop a reasonable range of alternatives.

After discussing these concerns and studying the area, we found that explanations were needed of the effects that the proposed timber sale project would have on the following resources:

- Vegetation (trees, including old growth)
- Watershed and hydrology (water)
- Fisheries
- Wildlife
  - Threatened and endangered species
    - Canada lynx
    - Grizzly bear
  - Sensitive species
    - Fisher
    - Flammulated Owl
    - Pileated woodpecker
    - Gray wolf
  - Big game species
- Geology and soils
- Economics
- Air quality
- Recreation
- Aesthetics

Shade-intolerant trees, such as western larch and Douglas-fir, would not grow in shaded areas.



Foreground and background views of Swan Peak.

Summary of Alternatives

After studying the list of concerns, 2 possible choices (Action Alternative B and Action Alternative C) were developed by the ID Team. Each was designed to address a particular concern or group of concerns.

- ***No Action Alternative A***
  - Timber would not be harvested.
  - No money would be contributed to the Common School trust or the Forest Improvement Program.
  - Roads would not be built or improved.
  - Old-growth stands would not be treated or maintained.
  - Forest cover and connectivity for wildlife travel would not be altered.
  - Insect infestations and disease infections would likely increase.
  - Road maintenance projects, fire suppression, and recreation activities would continue as in the past.
  - The viewshed would not change.
  - New risks to fisheries or water quality/ quantity would not be created.

- ***Action Alternative B***
  - 19.0 MMbf of timber would be harvested from 2,009 acres.
  - Approximately $1,529,705 would be contributed to the Common School trust and $745,913 would be contributed to the Forest Improvement Program.
  - Approximately 33 miles of roads would be improved, 15 miles of roads would be reconstructed, and 5 miles of new roads would be built.
  - Road construction and improvements would enhance the infrastructure and the ability to suppress fires in the long-term.
  - Four stream crossings (1 wet and 3 dry) and 1 temporary bridge would be installed.
  - Insect and disease issues would be managed and treated.
  - Approximately 683 acres of old-growth habitats would be harvested, thus removing 521 acres from the old-growth status.
  - Effects to fisheries, water quality, and water quantity would be spread over an area that includes Cedar, Goat, Perry, In-pa-ah, Soup, and Cilly creeks.

Timber sales create jobs for loggers to help support the local economy.

Four stream crossings and one temporary bridge will be installed.

- ***Action Alternative C***
  - 21.1 MMbf of timber would be harvested from 2,634 acres.
  - Approximately $1,415,627 would be contributed to the Common School trust and $827,964 would be contributed to the Forest Improvement Program.
  - 60 miles of roads would be improved, 20 miles of roads would be reconstructed, and 8 miles of new roads would be built.
  - Four stream crossings (1 wet and 3 dry) and 1 temporary bridge would be installed.
  - Insect and disease issues would be managed and treated; maintenance of additional stands would be allowed.
  - Approximately 538 acres of old-growth habitats would be harvested, thus removing 146 acres from the old-growth status.
  - Management of old-growth stands would focus on maintenance/restoration-type treatments.
  - Effects to fisheries and water quality and quantity would be spread over an area that includes Cedar, Squeezer, Goat, Perry, In-pa-ah, Soup, Napa, and Cilly creeks.

Money earned from timber sales helps support schools to educate our children

GENERAL DIFFERENCES OF THE ACTION ALTERNATIVES

Differences among the action alternatives:

- Number of acres harvested
- Amount of board feet harvested
- Amount of money generated for the Common School trust
- Amount of acres removed from the old-growth status
- Miles of new road to be built
- Miles of existing roads to be maintained
- Acres of stand promoted to desired future conditions
- The intensity of insect and disease treatments

A photo of a western larch/Douglas-fir timber stand that was taken in the Swan Valley around 1910.

A western larch/Douglas-fir timber stand in Swan Valley today.

Summary of Effects

VEGETATION

The vegetation on Swan River State Forest is different now than what was there historically and what is desired in the future. Trees that are able to grow in shade and stands of mixed conifers (Engelmann spruce, western red cedar) are plentiful, while trees that are unable to grow in shade (western larch, Douglas-fir, and western white pine) are more scarce. Presently, the acres of trees in the seedling-sapling age class have been reduced, while trees in the old-stand age class are overly plentiful.

Stands where thinning and regeneration harvest treatments are used would shift the forest vegetation toward the desired future condition. Shade-tolerant and mixed-conifer species would be removed to allow western larch, ponderosa pine, Douglas-fir, and western white pine to regenerate. Stands where selective harvest treatments are used would give existing trees more room to grow, thus creating healthier, stronger forests.

Shade-tolerant and mixed-conifer species would be removed to allow western larch, ponderosa pine, Douglas-fir, and western white pine to regenerate.

The insect and disease problems in the project area on Swan River State Forest include the mountain pine beetle and various root diseases that attack many of the species that are present. The white pine blister rust, dwarf mistletoe, and Indian paint fungus are also present. Therefore, a number of trees selected for harvesting are those affected by insects and diseases.

Approximately 25.4 percent of Swan River State Forest is considered to be old growth. The project area contains 3,541 acres of old-growth stands. Depending on the action alternative, from 538 to 683 acres of old growth would be harvested. This would curtail disease infections and insect infestations in old-growth stands and potentially reduce mortality in Douglas-fir, grand fir, subalpine fir, western red cedar, western larch, lodgepole pine, and western white pine.

Wildfires across Swan River State Forest vary in frequency and intensity, leaving an assorted pattern of age classes and covertypes. The amount of fine fuels would increase immediately following timber harvesting under both action alternatives. However, piling and burning slash and other various fuel treatments would reduce these hazards.

Sensitive plants were found in the project area in wet meadows, areas not usually considered for timber harvesting. No sensitive plant species were found in the proposed harvest units; therefore sensitive plants, would not likely be affected by the proposed action.

Canada thistle, spotted knapweed, yellow hawkweed, orange hawkweed, and common St. John's-wort are established along road edges in the project area. Weed seed would continue to be

introduced by forest recreationists, log hauling, and other logging activities on neighboring ownerships. Swan River State Forest may initiate spot spraying under the Forest Improvement Program to reduce the spread of noxious weeds along roads. Under the action alternatives, log hauling and moving equipment would introduce seeds from other sites. However, weed establishment and spread would be reduced by requiring contractors to wash and have their machinery inspected prior to entering the project area. Required grass seeding of new and disturbed roads and landings, spot spraying areas of new weed infestations, and spraying herbicides on roadsides would also help.

WATERSHED AND HYDROLOGY

During project planning, the watersheds of Cedar, Cilly, Goat, In-pa-ah, Perry, Soup, South Woodward, and Squeezer creeks and portions of Swan River were assessed to determine how these creeks would be affected by the increased sedimentation and streamflow that is related to cutting trees, constructing and improving roads, and other logging activities. Sediment levels were measured and possible impacts from the proposed activities were studied. A determination was made that sediment levels in Van Lake and Cilly, Goat, In-pa-ah, South Woodward, and Squeezer creeks would be unaffected. Thus, Van Lake and these creeks were dismissed from further sedimentation analysis. Currently, Cedar Creek receives approximately 34.7 tons, Soup Creek receives 29.3 tons, and Swan River receives 0.4 tons of sediment per year. The road improvements under both of the action alternatives would either not change sediment delivery to some creeks or would reduce the amount of sediment delivered to the creeks by 0.3 to 27.8 tons per year.

Cilly, Goat, In-pa-ah, Perry, Soup, South Woodward, and Squeezer creeks were measured for current water levels (water yield) and were assessed for possible impacts from the proposed activities. The water yield in the South Woodward Creek watershed is presently about 7.9 percent; Cilly Creek is 7.5 percent; Goat Creek is 4.5 percent; In-pa-ah/Perry Creek is 8.4 percent; Soup Creek is 2.6 percent, and Squeezer Creek is 4.0 percent. Under the action alternatives, water yield would either remain the same or increase by up to 2.1 percent, depending on the creek.

An excavator installing a windrow to inhibit sediment from entering the stream below.

FISHERIES

Westslope cutthroat trout, bull trout, a number of native fish species, and 3 nonnative fish species are present in the project area. The U.S. fish and Wildlife Service has listed bull trout as 'threatened' under the Endangered Species Act. Both bull trout and westslope cutthroat trout are listed as Class-A Montana Animal Species of Concern.

Impacts are not expected in areas where harvesting activities would affect the presence of native fisheries populations. Currently, impacts unfavorable to native fish populations in the

project area, mainly adverse impacts from nonnative fish species, are moderate to high. This timber sale is expected to have a positive effect on these fisheries by providing new habitat free of nonnative fish species. Subsequently, long-term risks to native westslope cutthroat trout populations would be reduced.

Issues that the proposed actions may affect fisheries habitat features negatively were raised during the scoping process. These habitat features include flow regime (annual stream-flow characteristics), sediment, channel forms, the riparian condition, large woody debris, stream temperature, macroinvertebrate richness (the relative abundance and diversity of insects and worms found throughout a streambed), and connectivity. The following paragraphs explain the expected effects on the 8 analysis areas included in the project area.

Both action alternatives would likely cause low impacts or no impacts to South Woodward Creek; the exception being a moderate risk of impacts to sediment.

Under both action alternatives, the Cedar Creek, Goat Creek, Swan River and Adjacent Face Drainage Group, Squeezer Creek, and Small Drainage Group analysis areas would likely experience low impacts to channel forms, riparian condition, large woody debris, temperature, and macroinvertebrate richness; sediment would likely experience moderate impacts; and connectivity would likely experience no impacts.

Under both action alternatives, Soup Creek would likely experience low impacts to flow, channel forms, riparian condition, large woody debris, temperature, and macroinvertebrate richness; sediment would likely experience high impacts; and connectivity would experience minor positive impacts.

WILDLIFE

General Habitat Attributes

The mixed-conifer covertypes is currently overrepresented on Swan River State Forest, which has increased habitat for wildlife species that use dense forest stands. Species that use the more-open stands have fewer habitats available. More mature stands exist than young stands; therefore, species that require younger-aged stands have less available habitat. Under both action alternatives, some covertypes would be converted from shade-tolerant to shade-intolerant and older stands would be replaced with younger stands. Thus, future habitat would be more in keeping with historic conditions and the desired future conditions.

About 3,542 acres of old growth exist in the project area. The proposed harvesting would reduce the amount of old growth in the project area by 150 acres to 502 acres and average patch sizes would be reduced under both action alternatives. Therefore, minor effects to wildlife species that use old-growth habitats would be expected.

Forest connectivity has been fairly well maintained in the project area. Approximately 8,665 acres of connected forest in the project area provide habitats that allow wildlife species to move without being easily detected. The action alternatives would reduce the amount of connected forest by 19.3 to 25.6 percent. Therefore, minor effects to wildlife connectivity would be expected.

Currently, the potential for linkage in the project and cumulative effects analysis areas is very good, human development is low, riparian areas are abundant and heavily vegetated, the density of open roads is relatively low, and hiding cover is relatively high. Under both action alternatives, the density of open roads would not increase. Temporarily, road usage would increase, causing the total road density to increase by 4.9 to 8.0 miles. Thus, the short-term effects would be moderate, while the long-term effects would be minor.

Snags and coarse woody debris are more dense in the project area's older stands than were historically present, while the younger stands are likely below historical densities. Under the action alternatives, snag densities and coarse woody debris would decrease to a minimum of 2 large snags and 2 snag recruits per acre and 10 to 25 tons of coarse woody debris per acre on between 2,010 and 2,636 acres. The higher densities of snags and stands with higher densities of coarse woody debris would likely remain on nearly 5,000 acres in the project area. Species that use snags and/or coarse woody debris for living requirements would have less available habitat. Overall, minor adverse effects to wildlife species using snags and coarse woody debris would be anticipated.

THREATENED AND ENDANGERED SPECIES

- **Canada Lynx**

  Approximately 7,931 acres of lynx habitats exist in the project area that are dominated by forested travel/other and mature foraging habitats. Landscape connectivity of forested habitats is relatively unbroken. Under the action alternatives, between 107 and 226 acres of denning habitats and between 789 and 839 acres of mature foraging habitat would be removed. Additionally, between 176 and 378 acres of forested travel/other habitats would also be moved into temporary non-lynx habitats. Collectively, between 1,122 and 1,393 acres would change to temporary non-lynx habitats. Low to moderate changes in connectivity would be expected for both action alternatives.

- **Grizzly Bear**

  Currently, grizzly bear hiding cover is abundant in the project area and the entire Swan River State Forest. Between 1,538 and 2,088 acres of hiding would be reduced in the project area, depending on the action alternative. This would result in minor adverse effects to grizzly bear hiding cover.

  An increase in open road density could lead to an increase in conflicts between humans and grizzly bears and displacement of grizzly bears. The project area has approximately 2.4 miles of permanent, open roads and an additional 102 miles of restricted roads that are closed to motorized use by the general public. Under both action alternatives, miles of open road would not change, but mileages of restricted roads would increase by 5 to 8 miles. Therefore, no effects to grizzly bears would occur as a result of changes in open roads and negligible effects would be anticipated with the proposed increases in total road density.

  Grizzly bears depend on secure areas of suitable habitat. Approximately 4.6 percent of the project area contains habitat that provides security. Depending on the action alternative, this habitat would be reduced by 195 or 239 acres (a 1.3- to 1.6-percent reduction). Between 1,512 and 1,518 acres would be harvested in spring habitat in the linkage zone. Therefore, low to moderate adverse impacts to secure habitats would be anticipated under both action alternatives.

Hiding cover, an important feature for grizzly bears, is abundant on Swan River State Forest.

SENSITIVE SPECIES

- **Fisher**

  The project area has approximately 8,045 acres of fisher habitat; many of the wet areas along creeks are preferred fisher covertypes. Harvesting activities under the action alternatives would avoid riparian areas, but would reduce or remove upland fisher habitats by 1,603 to 1,763 acres, depending on the action

alternative. Additionally, the mature upland stands in preferred fisher covertypes would be removed on an additional 8 to 9 acres. Harvesting would reduce the amount of snags and coarse woody debris and landscape connectivity could be altered, but activities would avoid the riparian areas where fishers are more commonly found. No changes to public motorized access or the potential for trapping mortality would be anticipated. Therefore, minor adverse effects to fisher would be anticipated under both action alternatives.

- **Flammulated Owl**

  Approximately 1,196 acres of potential flammulated owl habitats exist in the project area and only 1,639 in the cumulative effects analysis area. Under the action alternatives, proposed timber harvesting would open the canopy while favoring ponderosa pine on between 46 and 208 acres of potential flammulated owl habitats. Therefore, negligible beneficial effects to flammulated owls would be expected with both action alternatives.

- **Gray Wolf**

  For an area to support a wolf pack, white-tailed deer and elk must be available. These big game species are abundant in both the project and cumulative-effects analysis areas. Winter range for big game species is fairly common in both the project area and cumulative-effects analysis area. Reductions in winter-range capabilities would likely alter big game use of the winter range; however, mature forested stands would generally remain well connected and provide a suitable network of cover capable of facilitating movements of wintering big game. Elevated human-disturbance levels would also alter big game use and, subsequently, wolf use of the project area when the timber sale project is active. Thus, moderate effects to wolf prey availability would be anticipated with the action alternatives.

  Landscape features commonly associated with denning and rendezvous sites for gray wolves occur in both the project area and entire Swan River State Forest. Between 58.8 and 58.9 percent of the proposed units (1,182 to 1,553 acres) could only be harvested during the grizzly bear denning period (November 16 through March 31). This seasonal restriction would limit the potential for disturbance to wolves during the spring period when they are more susceptible to disturbance at dens and rendezvous sites. Much of the remaining acres would also have seasonal restrictions limiting potential disturbance during the spring period as well. Minor adverse effects to disturbance levels at den and rendezvous sites would be anticipated under both of the action alternatives.

  Human activity on open and closed roads, which could affect wolf use of the area, is variable throughout the project area. Hiding cover is abundant in the project area, but management activities could potentially result in an increased interaction between wolves and humans, resulting in wolves using this area less. Hiding cover would be reduced by 1,538 to 2,088 acres, depending on the action alternative. The density of open roads would not change under either action alternative. Between 4.9 and 8.0 miles of roads would be constructed; these roads would be restricted after harvesting activities have been completed. Therefore, minor adverse effects to the potential for conflicts between humans and wolves and general wolf disturbance would be anticipated.

- **Pileated Woodpecker**

  Approximately 4,389 acres contain potential pileated woodpecker nesting habitat; another 6,771 acres of sawtimber stands contain potential foraging habitats. Under the action alternatives, harvesting would modify both the nesting and potential foraging habitats. Between 1,108 and 1,149 acres of nesting habitat and between 729 and 1,184 acres of potential foraging habitat would be modified under the action alternatives. Therefore, minor to moderate negative effects to pileated

woodpeckers would be expected with both of the action alternatives.

A pileated woodpecker feeding its young is a sensitive species.

BIG GAME SPECIES

- **Big Game Winter Range**

The project area, which includes both white-tailed deer and elk habitat, provides both winter habitat and security cover. White-tailed deer are abundant in the project area, which contains more than 14,000 acres of elk and white-tailed deer winter range. Under the action alternatives, between 2,010 and 2,636 acres of winter range would be harvested, with between 1,197 and 1,314 acres incapable of improving any adverse effects of severe winter conditions following logging. Thus, the proposed action alternatives would result in moderate adverse effects to big game winter range.

Approximately 2,966 acres of the project area are part of larger patches of elk security habitat, which reduces elk vulnerability and increases hunter opportunity. Swan River State Forest contains 13,999 acres of habitats that meet the distance, cover, and size requirements of elk security habitat. Changes in open roads or motorized access would not occur under either action alternative. The 4.9 to 8.0 miles of permanent, restricted road to be built with this project could increase nonmotorized access. Elk security habitat would be reduced by 296 to 346 acres and another 54 to 210 acres would be modified under the action alternatives, likely reducing the effectiveness of those modified habitats. Therefore, minor adverse effects to elk security habitats would be expected under both action alternatives.

Swan River State Forest contains 13,999 acres of habitats that meet the distance, cover, and size requirements of elk security habitat.

GEOLOGY AND SOILS

This analysis considers the current level of impacts to soils in the project area and determines the potential effects of the harvesting and management activities. The majority of the proposed activities would harvest stands that have not been previously entered. While previous harvest units in the project area would continue to recover from past impacts, between 8.5 and 19.5 percent (depending on the action alternative) of soils in the project area would be impacted by skidding logs, operating equipment, and constructing new roads.

No sites of persistent erosion exist in the project area, and the potential for upland erosion and sediment transport in the upland harvest units is low under Action Alternatives B and C. Also, the proposed activities of both action alternatives would have moderate impacts on nutrient pools and site productivity for a short duration. Fifteen to 25 tons per acre of coarse and fine woody debris would be retained on site under both action alternatives.

During field review of the project area, only one small slope failure was noted. Slopes prone to instability are present in the project area, but minimal activities are planned for those locations. During harvesting activities and for a short period following these activities, the risk of increased

slope instability is moderate under Action Alternatives B; the risk of instability is low under Action Alternative C.

ECONOMICS

Income from timber sales is transferred to the Office of Public Instruction for Common Schools and to the individual agencies. Revenue is distributed to various education institutions through the legislative process. Should an action alternative be selected, the money generated would help pay for students to attend school in Montana.

The direct effects associated with the action alternatives are estimated to earn between $1.4 and $1.5 million in state trust land revenue, provide between 145 and 161 timber industry jobs, and produce between $4.5 and $5.0 million in timber industry earnings.

AIR QUALITY

Air quality is generally excellent in the analysis area because emission sources are limited and wind dispersion is consistent throughout most of the year. Emissions do not affect local population centers, impact zones, or Class I Areas beyond the standards of the Environmental Protection Agency and Department of Environmental Quality.

Smoke from prescribed burning and dust from road construction, maintenance, and travel would be produced under both action alternatives. However, burning days would be controlled and monitored by the Department of Environmental Quality and the smoke-monitoring unit of the Montana/Idaho Airshed Group and would meet the Environmental Protection Agency standards; therefore, direct and indirect effects of burning activities would be minimized.

Effects to air quality from dust are expected to be localized to roadways and areas directly adjacent to the roadways. Vegetative barriers and measures to decrease the dust are expected to greatly limit the dispersion of dust beyond those areas.

RECREATION

Several miles of roads are open, seasonally restricted, and closed to public motorized access throughout the area. Big game species are abundant throughout both the project area and the cumulative-effects analysis area, affording many hunting opportunities. Revenue is generated by a number of recreational licenses in the area. Under both action alternatives, no changes would occur in open roads or motorized access. A 1- to 2.4-percent increase in road miles would be available for public nonmotorized recreation. No negative direct or indirect effects to hunting are expected.

Hunting is an active sport on Swan River State Forest.

Effects to recreationists during the work week are expected to be moderate to high as a result of these forest-management activities, while effects to recreationists during the weekend are expected to be minimal. No changes in revenue produced by recreational licenses are expected.

AESTHETICS

Several miles of road and acres of previously harvested forest are potentially visible from specific observation points, but vegetation in the foreground currently block these views. Under the action alternatives, increases in the amount of visible acres and road miles would be insignificant due to obstructions in the foreground and middleground of each observation point. If harvest units next to regenerating or unharvested stands were visible from observation points, the harvest units would appear relatively stark.

Currently, traffic, harvesting operations, rock blasting, and gravel crushing all produce noise

throughout Swan River State Forest. Noise from these activities coincides with the rotational schedule required under the Swan Valley Grizzly Bear Conservation Agreement. Under the action alternatives, effects to noise levels in the project area as a result of harvesting operations, harvest-related traffic, and gravel pit operations are expected to be moderate during the work week and minor during the weekend.

Aesthetics are important to people that recreate on Swan River State Forest.

OVERVIEW OF THE DEIS

The DEIS contains a more complete description of the purpose, development, analyses, alternatives, and potential impacts associated with the proposed action.

To receive a copy of the Scout Lake Multiple Timber Sale Project DEIS, please contact Karen Goode by phone at 406-754-2301, by mail at 34925 MT Hwy 83, Swan Lake MT 59911 , or by email at kgoode@mt.gov. The document is also available online at www.dnrc.mt.gov/env_docs.

The DEIS has been sent to interested parties that have, over the course of this project, requested these documents. A 30-day comment period will follow the publication of the DEIS. Following the comment period, a Final Environmental Impact Statement (FEIS) will be developed, published, and sent to those that have received the DEIS. No sooner than 15 days following publication of the FEIS, Dan Roberson, Swan River State Forest Unit Manager, will choose an alternative, or a combination of alternatives. His recommendation will then be sent to the Land Board, whose members are charged with

Dept Natural Resources and Conservation

Karen Goode, Project Leader

Swan River State Forest

34925 MT Highway 83

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Fax: 406-754-2884

E-mail: kgoode@mt.gov

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DEPARTMENT OF NATURAL RESOURCES
AND CONSERVATION

BRIAN SCHWEITZER, GOVERNOR

SWAN RIVER STATE FOREST

STATE OF MONTANA

Phone: (406) 754-2301
Fax: (406) 754-2884

Swan River State Forest
34925 MT Hwy 83
Swan Lake MT 59911

December 16, 2011

SCOUT LAKE MULTIPLE TIMBER SALE PROJECT
DRAFT ENVIRONMENTAL IMPACT STATEMENT

Enclosed is a copy of the Scout Lake Multiple Timber Sale Project Draft Environmental Impact Statement (DEIS). I encourage you to carefully review the information presented in the DEIS and provide comments to Karen Goode, Project Leader, Swan River State Forest, 34925 MT Highway 83, Swan Lake, Montana 59911. **Comments must be received by January 17, 2012.** Along with your comments, please be sure to include your name, address, telephone number, and the title of the DEIS for which you are providing comments.

The proposed project is located approximately 8 miles south of Swan Lake, Montana in Swan River State Forest.

The Department does not present a preferred alternative of the two action alternatives analyzed in the DEIS. The proposed harvest volumes range from 0 with No-Action Alternative A to between 19.0 and 21.1 MMbf with Action Alternatives B and C, respectively.

This DEIS was designed to address Swan River State Forest's primary commitment to Montana's mandated timber-harvest levels over a three-year period. This approach analyzes cumulative effects to valuable resources and improves coordination for project planning within the active subunits as scheduled by the Swan Valley Grizzly Bear Conservation Agreement.

The Executive Summary conveys information and is written so that a person of any interest level can understand the contents. Chapter III-Existing Environment and Environmental Effects in the DEIS contains the bulk of the scientific analysis. I welcome your thoughts and comments.

Sincerely

Daniel J. Roberson
Unit Manager
Swan River State Forest
34925 MT Highway 83
Swan Lake, MT 59911
(406) 754-2301

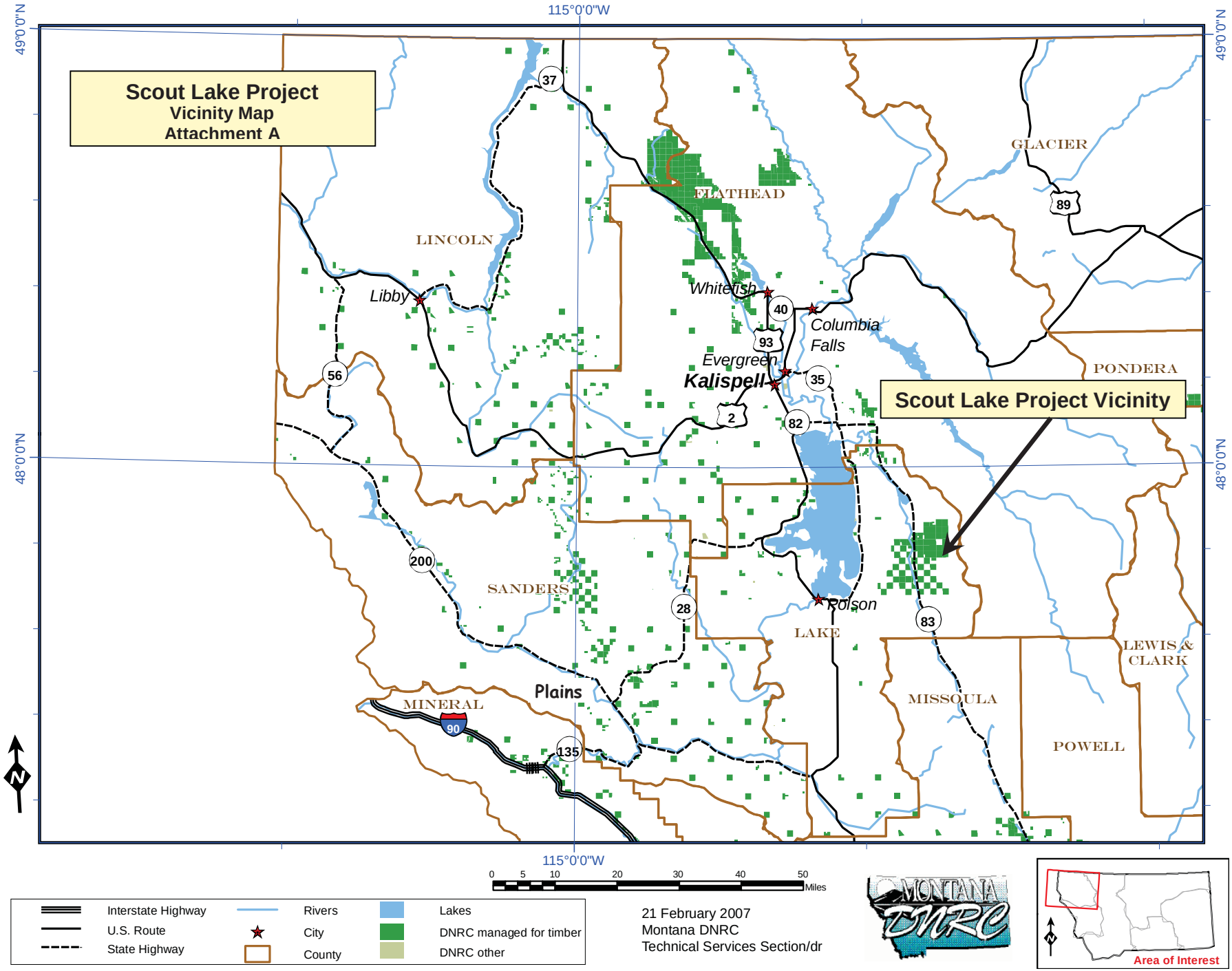
SCOUT LAKE MULTIPLE TIMBER SALE PROJECT

DECEMBER 2011

Draft Environmental Impact Statement

DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

SWAN RIVER STATE FOREST


Scout Lake Project
Vicinity Map
Attachment A
Scout Lake Project Vicinity
115°0'0"W
49°0'0"N
48°0'0"N
LINCOLN
FLATHEAD
GLACIER
PONDERA
SANDERS
LAKE
MINERAL
MISSOULA
LEWIS & CLARK
POWELL
Libby
Whitefish
Columbia Falls
Evergreen
Kalispell
Polson
Plains
37
40
93
35
2
82
56
200
28
83
135
90
89
0 5 10 20 30 40 50 Miles
Interstate Highway
U.S. Route
State Highway
Rivers
City
County
Lakes
DNRC managed for timber
DNRC other
21 February 2007
Montana DNRC
Technical Services Section/dr
MONTANA DNRC
Area of Interest

Scout Lake
Multiple Timber Sale
Proposed
Project Area

N

0 0.5 1 2 Miles

Legend

Streams

Type

- Artificial Path
- Intermittent Stream
- Perennial Stream

Roads

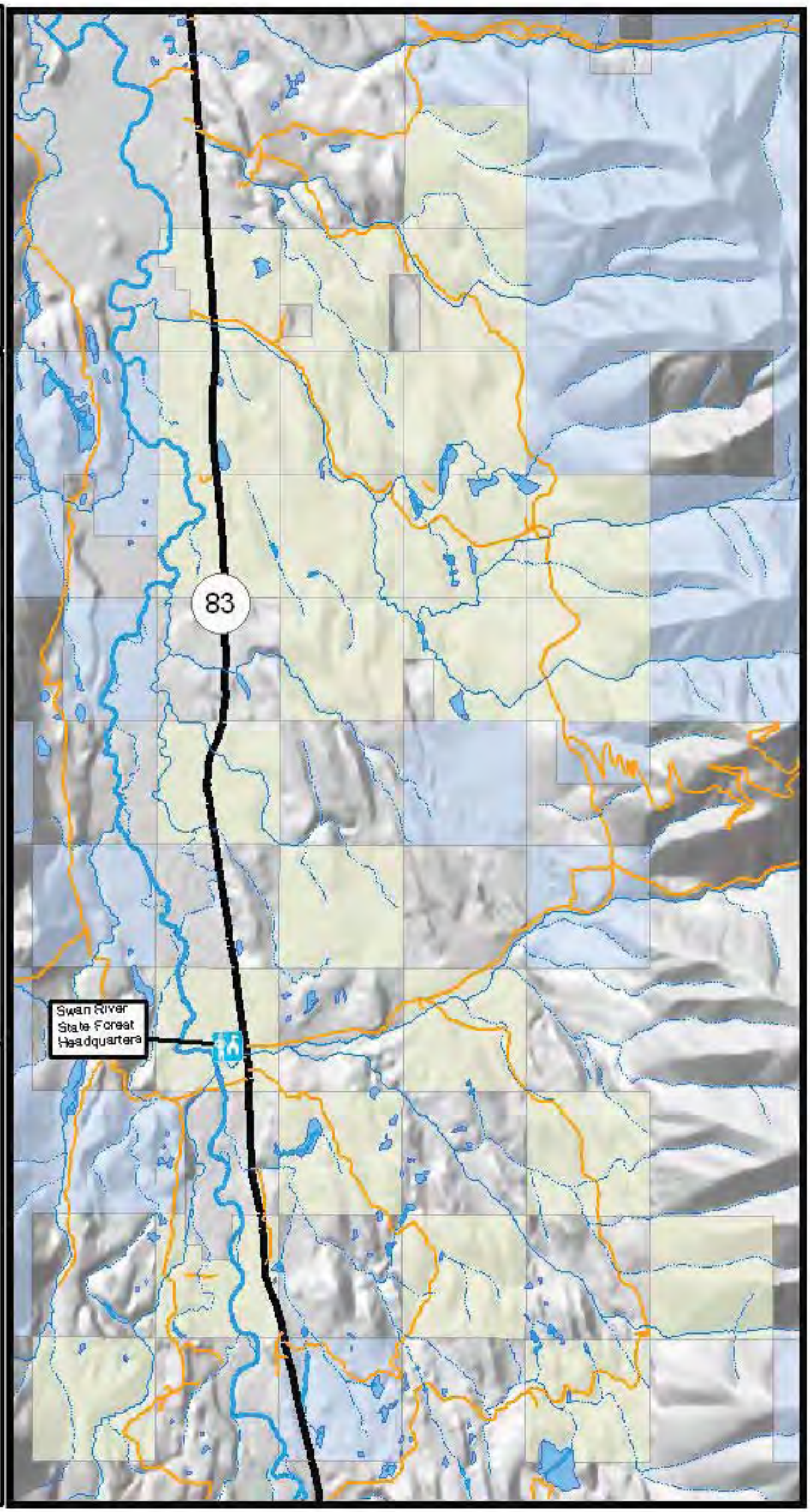
Road Class

- Highway
- Open

- Lakes
- Scout Lake Proposed Project Area
- Other DNRC Parcels

Prepared by
Montana Department of
Natural Resources & Conservation
November 2011

NAD 1983 State Plane Montana FIPS 2500



SCOUT LAKE MULTIPLE TIMBER SALE PROJECT
DRAFT ENVIRONMENTAL IMPACT STATEMENT
PREFACE

This document has been designed and developed to provide the decisionmaker with sufficient information to make an informed, reasoned decision concerning the proposed Scout Lake Multiple Timber Sales Project (proposed action) and to inform the interested public about this project so they may express their concerns to the project leader and decisionmaker.

The DEIS consists of the following sections:

- Chapter I – Purpose and Need
- Chapter II – Alternatives
- Chapter III – Existing Environment and Environmental Effects
- Stipulations and Specifications
- References
- List of Preparers
- Scoping List and Respondents
- Glossary
- Acronyms and Abbreviations

CHAPTERS I and *II* offers a summary overview of the proposed action. These chapters have been written so nontechnical readers can easily understand the purpose and need of the proposed action, alternatives to the proposed action, and the potential environmental, economic, and social effects associated with the no-action and action alternatives.

CHAPTER I provides a brief description of the proposed action and explains key factors about the project, such as:

1) the purpose and need of the proposed action, which includes the project objectives;

2) the *Environmental Impact Statement* (*EIS*) process, which includes how scoping is done and the decisions made by the decisionmaker concerning this project;

3) the proposed schedule of activities;

4) the scope of this *Draft Environmental Impact Statement* (*DEIS*), which includes other relevant projects, issues studied in detail, and issues eliminated from further analysis, and

5) the relevant laws, regulations, and consultations with which DNRC must comply.

CHAPTER II provides detailed descriptions of the No-Action and the Action Alternatives. Included is a summary comparison of project activities associated with each alternative and a summary comparison of the predicted environmental effects of each alternative. These

comparisons provide the decisionmaker a clear basis for choice between the No-Action and Action Alternatives.

CHAPTER III briefly describes the past and current conditions of the pertinent ecological and social resources in the project area that would be meaningfully affected, establishing a part of the baseline used for the comparison of the predicted effects of the alternatives. Chapter III also presents the detailed, analytic predictions of the potential direct, indirect, and cumulative effects associated with the No-Action and Action Alternatives.

STIPULATIONS AND SPECIFICATIONS includes a list of measures designed to prevent or reduce the potential effects to the resources considered in this DEIS.

REFERENCES lists the references utilized in the DEIS.

LIST OF PREPARERS lists the preparers of the DEIS.

SCOPING LIST AND RESPONDENTS lists the persons, agencies, and organizations that are listed to receive scoping documents, newsletters, and public participation activities associated with the proposed action. This list also contains those individuals who submitted issues and concerns regarding the proposed action.

GLOSSARY defines the technical terms used throughout the document.

ACRONYMS AND ABBREVIATIONS lists the acronyms and abbreviations used throughout the document.

CHAPTER I
PURPOSE AND NEED

LOCATION OF THE PROJECT

Swan River State Forest, Montana Department of Natural Resources and Conservation (DNRC), Trust Land Management Division, is proposing the Scout Lake Multiple Timber Sale Project. The project area is approximately 8 air miles southeast of Swan Lake on school trust lands in the eastern portion of Swan River State Forest. The project area is approximately 15,586 acres and includes all or portions of the following sections:

SECTIONS	TOWNSHIP	RANGE
16, 18, 19, 20, 21, 27, 28, 29, 32, 33, 34	24N	17W
6, 8, 16, 18, 20, 22, 26, 28, 30, 34	23N	17W
36	23N	18W

The project area also includes existing and proposed roads needed to access the project area and support the proposed activities (the *VICINITY MAP* on back of front cover and *PROJECT AREA MAP* located in front of this document).

PURPOSE AND NEED

The Scout Lake Multiple Timber Sale project area has a variety of stands in differing stages of development. Some stands are young, vigorous, and healthy, while others are older with reduced vigor and multiple insect and disease issues. In many stands, the current forest covertype is moving away from, or no longer, matches DNRC's desired covertype for the site. Forest-management activities would improve health, vigor, and the development of desired future covertypes, while also reducing the risk against losses from insects, diseases, and fire. Active forest management in the project area would produce revenue for the trust beneficiaries while encouraging the development of sustainable forest conditions consistent with programmatic goals of managing for healthy and biologically diverse forests.

The lands involved in the proposed action are held by the State of Montana for the support of the Common School Trust (*Enabling Act of February 22, 1889*). The *Board of Land Commissioners (Land Board)* and DNRC are required by law to administer these trust lands to produce the largest measure of reasonable and legitimate return over the long run for these beneficiary institutions (*1972 Montana Constitution, Article X, Section 11; Montana Code Annotated [MCA] 77-1-202*).

Management of the lands in the project area is guided by DNRC's *State Forest Land Management Plan* (*SFLMP*) and *Forest Management Rules* (*Administrative Rules of Montana [ARM] 36.11.401* through *456*). The *SFLMP* has the following philosophy:

"Our premise is that the best way to produce long-term income for the trust is to manage intensively for healthy and biologically diverse forests. Our understanding is that a diverse forest is a stable forest that will produce the most reliable and highest long-term revenue stream. Healthy and biologically diverse forests would provide for sustained income from both timber and a variety of other uses. They would also help maintain stable trust income in the face

of uncertainty regarding future resource values. In the foreseeable future, timber management will continue to be our primary tool for achieving biodiversity objectives." (DNRC 1996a: Record of Decision [ROD] 1 and 2)

PROJECT OBJECTIVES

DNRC has developed the following project objectives:

- Restore/maintain biodiversity by moving forest stands towards desired future conditions.
- Improve forest health and vigor by addressing insect and disease issues.
- Contribute to sustainable yield for Swan River State Forest in order to generate long-term revenue for the Common School Trust, and support sustainable local communities.
- Develop and improve the transportation system and infrastructure for long-term management, fire suppression, and public access.
- Improve water quality by removing and rehabilitating sediment point sources, and meet *Best Management Practices (BMPs)* on all project roads, including haul routes to Highway 83.
- Reduce fuel loads and wildfire hazards by decreasing ground and ladder fuel loads.
- Restore and/or maintain stands in an old-growth status.
- Plan and schedule all activities to comply with the *Swan Valley Grizzly Bear Conservation Agreement (SVGBCA)*.

DNRC has developed 2 action alternatives designed to meet the proposed project objectives to varying degrees (see *CHAPTER II – ALTERNATIVES*).

THE SWAN VALLEY GRIZZLY BEAR CONSERVATION AGREEMENT

DNRC is a cooperator in the *SVGBCA*, which guides the timing and location of forest-management activities.

The philosophy of the *SVGBCA* is to concentrate management activities of the cooperators into specific areas called 'subunits' on a rotating basis. This provides bears areas that are relatively free of management for extended periods. Cooperators may manage in any subunit during the denning period (November 16 through March 31), but management during the nondenning period is only allowed in a subunit that is 'open' according to the rotating schedule. Open periods are 3 years, followed by a rest period of 6 years. The rotation schedule influences where DNRC schedules its management activities on Swan River State Forest.

The Scout Lake Multiple Timber Sale project area includes all or parts of Goat Creek, Lion Creek, South Fork Lost Soup, and Porcupine/Woodward subunits. According to the *SVGBCA* schedule management would be scheduled in 2 subunits during the nondenning period: Goat Creek opens in 2012 and closes in 2015; South Fork Lost Soup opens in 2015 and closes in 2017.

Porcupine/Woodward, South Fork Lost Soup, and Lion Creek subunits would have management activities scheduled during the denning period.

DNRC would prepare 6 to 8 timber sales ranging from 0.5 to 4 million board feet (MMbf) across the subunits. Rather than analyze each sale individually, this *Environmental Impact Statement (EIS)* has been developed to assess the impacts of all the sales.

DRAFT ENVIRONMENTAL IMPACT STATEMENT PROCESS

This section describes the process by which the *Interdisciplinary Team (ID Team)* developed this *Draft Environmental Impact Statement (DEIS).* The *DEIS* was developed in compliance with the *Montana Environmental Policy Act (MEPA)*; *MCA 75-1-101* through *75-1-324*, and DNRC *Procedural Rules (ARM 36.2.521* through *543*).

PUBLIC INVOLVEMENT

DNRC invited interested individuals, agencies, and organizations to identify issues and concerns associated with this proposed action. Public involvement activities included public scoping, field tours, and newsletters.

PUBLIC SCOPING

Public scoping occurs in the initial stages of the *EIS* process. Interested parties are informed that DNRC is proposing an action and invited to submit their comments related to the proposed action (*ARM 36.2.526*).

In April 2010, DNRC distributed the Initial Proposal and invited public comments. Public notices were placed in the *Missoulian*, Kalispell's *Daily Inter Lake*, and Swan Valley's *Pathfinder* newspapers. The *Initial Proposal* was mailed to individuals, agencies, internal DNRC staff, industry representatives, and other organizations that had expressed interest in the Swan River State Forest management activities (see *SCOPING LIST AND RESPONDENTS*). The *Initial Proposal* included the objectives of the project, maps of the project area, and contact information. During the 30-day comment period, a total of 12 responses were received.

FIELD TOURS

Fall 2010

DNRC hosted a field tour on October 20, 2010. DNRC staff members and 3 participants visited stands in and adjacent to the proposed harvest units. Questions and concerns were recorded and cross-referenced with comments received during the *Initial Proposal* scoping period to ensure that relevant issues were captured.

Fall 2011

DNRC offered to host a second field tour in September 2011. Two parties considered it, but declined. One party requested and received maps of the project area and cutting units.

NEWSLETTERS

Newsletter 1

On November 22, 2010, the ID Team sent a newsletter to individuals/groups on the scoping list. The purpose of this newsletter was to:

- update the project development since the initial proposal scoping period;

- introduce the ID Team and decisionmaker to the public;
- summarize relevant issues identified up to that point; and
- invite comments on the proposed action.

No comments were received.

Newsletter 2

On July 15, 2011, the ID Team sent a second newsletter out to individuals/groups on the scoping list to:

- update the project development since the first newsletter;
- summarize the proposed action alternatives;
- invite comments on the proposed action and alternatives; and
- solicit interest in on-site field tours of the proposed project area.

No written comments and 3 requests to be kept informed were received.

DEVELOPMENT OF ISSUES AND ALTERNATIVES

After reviewing the responses received during the scoping period and the other public participation events, the ID Team identified more than 81 issues related to the project (see *ISSUES STUDIED IN DETAIL AND ISSUES ELIMINATED FROM FURTHER ANALYSIS* under *SCOPE OF THIS DEIS* later in this chapter). These issues, issues raised by the ID Team, and requirements imposed by applicable rules, laws, and regulations provided the framework by which the ID Team developed a range of alternatives. The ID Team designed the action alternatives to meet the project objectives to varying degrees and identified the direct, indirect, and cumulative impacts on relevant resources in the project area.

DRAFT ENVIRONMENTAL IMPACT STATEMENT

During spring and summer of 2011, the ID Team prepared the *DEIS* for publication. Upon publication, a letter of notification was sent to individuals on the scoping list (see *SCOPING LIST AND RESPONDENTS*).

FINAL ENVIRONMENTAL IMPACT STATEMENT

After public comments are received, compiled, and addressed, DNRC will prepare a *Final Environmental Impact Statement (FEIS)* or adopt the *DEIS* as the *FEIS*. The *FEIS* would consist primarily of a revision of the *DEIS* that would incorporate new information based on public and internal comments. The *FEIS* would also include responses to substantive comments within the scope of the project that were received during the 30-day public review period of the *DEIS*.

NOTIFICATION OF DECISION

Following publication of the *FEIS*, the decisionmaker will review public comments, the *FEIS*, and information contained in the project file. No sooner than 15 days after the publication of the *FEIS*, the decisionmaker will consider and determine the following:

- Do the alternatives presented in the *FEIS* meet the project's purpose and objectives?
- Are the proposed mitigations adequate and feasible?

- Which alternative (or combination/modification of alternatives) should be implemented and why?

These determinations will be published and all interested parties will be notified. The decisions presented in the published document will become recommendations from DNRC to the Land Board. Ultimately, the Land Board will make the final decision to approve or not approve the project.

PROPOSED SCHEDULE OF ACTIVITIES

After the decision is published, and if an action alternative is selected, DNRC would prepare 6 to 8 sales from 0.5 to 4 MMbf each, approximately, over a 3- to 5-year operating period. The first timber sale contract package would tentatively be scheduled for presentation to the Land Board in April 2012. If the Land Board approves the timber sales, the sales may be advertised that spring. The other contracts would subsequently be presented to the Land Board; upon approval these sales would be advertised intermittently from the spring of 2012 through the summer of 2017. After each sale is sold, harvesting and roadwork activities would take place for 2 to 3 years. The anticipated end date of harvesting activities is September 2017. Posttreatment activities, such as site preparation, planting, and hazard reduction, would follow harvesting activities.

SCOPE OF THIS DEIS

This section describes those factors that went into determining the scope (depth and breadth) of this environmental analysis.

RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS

In order to adequately address the cumulative impacts of the proposed action on relevant resources, each analyst must account for the impacts of past, present, and reasonably foreseeable actions within a determined analysis area. The locations and sizes of the analysis areas vary by resource (watershed, soils, etc.) and species (bull trout, grizzly bear, etc.) and are further described by resource in *CHAPTER III – EXISTING ENVIRONMENT AND ENVIRONMENTAL IMPACTS*.

Past, present, and reasonably foreseeable actions on DNRC-managed lands and adjacent land ownerships were considered for each analysis conducted for this *EIS*. DNRC often lacked data regarding actions on adjacent land ownerships; therefore, resource specialists were limited to qualitatively describing and considering, rather than quantifying, such actions for cumulative impacts.

The following list encompasses other relevant DNRC actions considered in this *DEIS*:

- First Chance Salvage Project (Spring 2007)
  - 6 acres
  - Section 32, T24N, R17W
  - 29.3 thousand board feet (Mbf)

- Retreat Letter Permit
  - 1 acre
  - Section 18, T23N, R17W
  - 13.91 Mbf
- Lucky Logger Salvage Project (Summer/Fall 2007)
  - 84 acres
  - Section 12, T23N, R18W
  - 47 Mbf
- Three Creeks Timber Sale Project (Summer 2007 through Winter 2011)
  - 1,884 acres
  - Sections 1, 3, 4, 9, 10, 15, 16, 22, 25, and 27, T23N, R17W
  - 23.7 MMbf
- Micro Goat Salvage Project (Summer 2008)
  - 100 acres
  - Section 16, T23N, R17W
  - 88.97 Mbf
- Low Wood Salvage Project (Summer 2008)
  - 60 acres
  - Sections 12 and 14, T23N, R18W
  - 100 Mbf
- Winter Blowdown Salvage Timber Permit Project (Summer 2008)
  - 240 acres
  - Sections 16, 20, 30, 32, and 34, T23N, R17W
  - 200 Mbf
- Main Wood 10 Salvage Permit (Winter 2008/ Winter 2009)
  - 50 acres
  - Section 10, T23N, R18W
  - 25 Mbf
- Section 28 Salvage Permit (Summer 2009)
  - 80 acres
  - Section 28, T23N, R18W
  - 100 Mbf

- South Woodward Gravel Pit (Summer 2009)
  - 5 acres
  - Section 24, T23N, R18W
  - 11.81 Mbf
- Swan Burn Salvage (Summer 2010)
  - 18 acres
  - Sections 3, 4, 9, 10, 16, and 27, T24N, R17W
  - 60 Mbf
- 26 Jump Up Road (Summer 2010)
  - 2 acres
  - Section 26, T24N, R18W
  - 14.18 Mbf
- White Donut – White Porcupine Sale 3 (Summer 2010)
  - 13 acres
  - Section 23, T24N, R18W
  - 200 Mbf
- Woodward Pointed Face Precommercial Thinning Project (Summer/Fall 2010 through Summer 2011)
  - 176 acres
  - Sections 2 and 12, T23N, R18W and Section 34, T24N, R18W
- White Porcupine Sale 1 (Summer 2010 through Summer 2012)
  - 217 acres
  - Section 2, T23N, R18W and Section 34, T24N, R18W
  - 2.90 MMbf
- Luckow Lodgepole 612 (Fall 2010)
  - 100 acres
  - Sections 18, 32 T23N, R17W
  - 78 Mbf
- White Porcupine Sale 2 (Fall 2010 through Fall 2012)
  - 316 acres
  - Sections 22 and 23, T24N, R18W
  - 4.325 MMbf

- Shay Post and Pole (Spring 2010)
  - 10 acres
  - Section 30, T23N, R18W
  - 935 lineal feet
- Shay 2 Post and Pole (Spring/Summer 2011)
  - 25 acres
  - Section 30, T23N, R18W
  - 3024 lineal feet
- Lodgepole 2 612 (Summer 2011)
  - 40 acres
  - Section 18, T23N, R17W
  - 100 Mbf
- White Pine Pruning Project (Summer 2011)
  - 225 acres
  - Sections 2, 12, and 14, T23N, R18W
  - Sections 19, 27, 29, and 30, T24N, R17W
  - Sections 23, 24, 26, 34, and 36, T24N, R18W
- White Pine Precommercial Thinning Project (Summer 2011)
  - 52 acres
  - Section 14, T23N, R18W and Section 19, T24N, R17W and Section 24, T24N, R18W
- White Wood – White Porcupine Sale 4 (Summer/Fall 2011 through Fall 2012)
  - 222 acres
  - Section 2, T23N, R18W and Section 34, T24N, R18W
  - 2.017 MMbf
- White Cliffs – White Porcupine Sale 5 (Summer 2011 through Summer 2012)
  - 240 acres
  - Section 16, T23N, R18W
  - 4.048 MMbf
- White Tailed – White Porcupine Sale 6 (Summer/Fall 2011 through Fall 2014)
  - 221 acres
  - Sections 22, 26, 28, and 34, T24N, R18W
  - 2.775 MMbf

- White Cedar – White Porcupine Sale 7 (Summer/Fall 2011 through Fall 2014)
  - 256 acres
  - Sections 22, 23, and 26, T23N, R18W
  - 3.269 MMbf
- White Bird – White Porcupine Sale 8 (Summer/Fall 2011 through Fall 2014)
  - 20 acres
  - Section 2, T23N, R18W
  - 201 Mbf
- Shay 3 Post and Pole (not started)
  - 25 acres
  - Section 30, T23N, R18W
  - 2000 lineal feet
- South Lost Soup Subunit (2015 through 2017) – sections and volume unknown

ISSUES STUDIED IN DETAIL AND ISSUES ELIMINATED FROM FURTHER ANALYSIS

Issues are statements of concern about the potential impacts the project may have on various resources. The ID Team identified over 81 issues raised internally and by the public. Some issues were determined to be relevant and within the scope of the project. These were included in the impacts analyses and used to assist the ID Team in developing a reasonable range of alternatives (*TABLE I - 1 – ISSUES STUDIED IN DETAIL*). Issues that were eliminated from further analysis were those that were determined to not be relevant to the development of alternatives or were beyond the scope of the project, and were, therefore, not carried through the impacts analyses (*TABLE I - 2 – ISSUES ELIMINATED FROM FURTHER ANALYSIS*).

TABLE I-1 – ISSUES STUDIED IN DETAIL. *Issues studied in detail by resource area and where addressed in the EIS.*

ISSUES STUDIED IN DETAIL	WHERE ADDRESSED IN DEIS
VEGETATION	
Harvesting activities may affect the forest covertypes through species removal or species composition change.	Chapter III, pages 6 through 13
Harvesting activities may affect age classes through tree removal.	Chapter III, pages 14 through 17
Harvesting activities may affect forest old-growth amounts and quality through tree removal.	Chapter III, pages 17 through 38
Harvesting activities (e.g. roads and logging) may affect patch size and shape through tree removal.	Chapter III, pages 38 through 46
Harvesting activities may affect forest fragmentation through tree removal.	Chapter III, pages 46 through 48
Harvesting activities may affect the forest stand vigor through tree removal.	Chapter III, pages 48 through 51
Harvesting activities may affect the forest stand structure through tree removal.	Chapter III, pages 51 through 53

Harvesting activities may affect forest crown cover through tree removal.	Chapter III, pages 53 through 56
Harvesting activities may affect forest insect and disease levels through tree removal (both suppressed/stressed and infested/infected).	Chapter III, pages 56 through 64
Harvesting activities may affect forest fire conditions, levels and hazards through tree removal, increased public access, and/or fuel reduction.	Chapter III, pages 64 through 68
Harvesting activities may affect sensitive plant populations through ground disturbance.	Chapter III, pages 68 through 69
Harvesting activities may affect noxious weeds population and presence through ground disturbance and weed introduction.	Chapter III, pages 69 through 70
WATERSHED AND HYDROLOGY	
Timber harvesting and road construction has the potential to increase water yield, which, in turn, may affect erosive power, sediment production, and stream channel stability.	Chapter III, pages 86 through 97
Timber harvesting and road construction may increase sediment delivery into streams/lakes and affect water quality.	Chapter III, pages 86 through 97
Timber-harvesting activities may adversely affect water quality by reducing shade and increasing stream temperatures.	Chapter III, pages 86 through 97
Project activities may adversely affect water quality.	Chapter III, pages 86 through 97
FISHERIES	
The project may affect fish populations' presence and genetics.	Chapter III, pages 113 through 114
The project may affect fish habitat by modifying flow regime.	Chapter III, pages 117 through 126
The project may affect fish habitat by modifying sediments.	Chapter III, pages 114 through 116
The project may affect fish habitat by modifying channel forms.	Chapter III, pages 117 through 126
The project may affect fish habitat by modifying riparian function.	Chapter III, pages 119 through 126
The project may affect fish habitat by modifying amounts of large woody debris.	Chapter III, pages 119 through 126
The project may affect fish habitat by modifying stream temperature.	Chapter III, pages 119 through 126
The project may affect fish habitat by modifying stream nutrients.	Chapter III, pages 119 through 126
The project may affect fish habitat by modifying stream connectivity.	Chapter III, pages 119 through 126
WILDLIFE	
The proposed activities could result in changes in the distribution of different covertypes on the landscape, which could affect wildlife.	Chapter III, pages 130 through 132
The proposed activities could alter the representation of stand-age classes on the landscape, which could affect wildlife.	Chapter III, pages 132 through 135
The proposed activities could affect wildlife species associated with old-growth forests by reducing the acreage of available habitat.	Chapter III, pages 135 through 139
The proposed activities could result in disturbance or alteration of forested corridors and connectivity, which could inhibit wildlife movements.	Chapter III, pages 139 through 151

The proposed activities could reduce forested cover, which could adversely affect habitat linkage for wildlife.	Chapter III, pages 139 through 151
The proposed activities could result in changes in patch size and shape and cause fragmentation of interior forest habitat for wildlife.	Chapter III, pages 151 through 154
The proposed activities could reduce the number and distribution of snags, which could adversely affect species closely associated with these habitats.	Chapter III, pages 154 through 163
The proposed activities could reduce levels of coarse woody debris, which could adversely affect species associated with these habitat attributes.	Chapter III, pages 154 through 163
The proposed activities could result in a reduction of hiding cover that is important for grizzly bears, which could result in: 1) increased displacement of grizzly bears, 2) avoidance of otherwise suitable habitat, and/or 3) increased risk of bear-human conflicts.	Chapter III, pages 168 through 177
The proposed activities could result in an increase in the density of roads, which could result in increased displacement of grizzly bears and increased risk of bear-human conflicts.	Chapter III, pages 168 through 177
The proposed activities could result in a decrease in secure areas for grizzly bears, which could result in increased displacement of grizzly bears.	Chapter III, pages 169 through 177
The proposed activities could result in the alteration of suitable Canada lynx foraging, and denning habitat, rendering habitat unsuitable for supporting Canada lynx.	Chapter III, pages 177 through 187
The proposed activities could reduce bald eagle nesting and perching habitats and/or disturb nesting bald eagles.	Chapter III, pages 187 through 191
The proposed activities could reduce the amount and/or quality of fisher habitats, which could alter fisher use of the area.	Chapter III, pages 191 through 197
The proposed activities could alter flammulated owl habitat by reducing canopy closure and increasing tree spacing, but could remove snags needed by flammulated owls for nesting.	Chapter III, pages 198 through 201
The proposed activities could result in reduced habitat quality on winter range for white-tailed deer and elk, which could lead to reduced prey availability and reduce the potential for the area to support a wolf pack.	Chapter III, pages 201 through 211
The proposed activities could result in disturbance of wolves at denning or rendezvous sites, which could lead to pup abandonment and/or risk of mortality.	Chapter III, pages 201 through 211
The proposed activities could result in increased human disturbance and the potential for wolf-human conflicts that could alter wolf use of suitable habitats.	Chapter III, pages 201 through 211
The proposed activities could reduce suitable nesting and foraging habitat for pileated woodpeckers, which could alter pileated woodpecker use of the area.	Chapter III, pages 212 through 217

The proposed activities could remove forest cover on important winter ranges, which could lower their capacity to support white-tailed deer and elk.	Chapter III, pages 217 through 228
The proposed activities could remove elk security cover, which could affect hunter opportunity and the quality of local recreational hunting.	Chapter III, pages 229 through 233
GEOLOGY AND SOILS	
Traditional ground-based harvesting operations have the potential to compact and displace surface soils, which reduces hydrologic function, macroporosity, and soil function.	Chapter III, pages 246 through 250
Harvesting operations have the potential to increase erosion of productive surface soils off-site.	Chapter III, pages 246 through 250
Harvesting activities associated with the proposed actions may cumulatively affect long-term soil productivity.	Chapter III, pages 246 through 250
Activities associated with the proposed actions, such as timber harvesting and road construction, have the potential to increase slope instability through increased water yields, road surface drainage concentration, and exceedence of resisting forces.	Chapter III, pages 246 through 250
The removal of large volumes of both coarse and fine woody material through timber harvesting reduces the amount of organic matter and nutrients available for nutrient cycling, possibly affecting the long-term productivity of the site.	Chapter III, pages 246 through 250
ECONOMICS	
The project may increase funding for the Montana education system, school trust fund, and public buildings.	Chapter III, pages 254 through 260
The project may increase timber-related employment.	Chapter III, pages 254 through 260
The project may affect nonmarket issues.	Chapter III, pages 254 through 260
The project may stimulate the local economy.	Chapter III, pages 254 through 260
AIR QUALITY	
Dust produced from harvesting activities, road building and maintenance, and hauling associated with this project may adversely affect local air quality.	Chapter III, pages 261 through 265
Smoke produced from logging slash piles and prescribed burning associated with this project may adversely affect local air quality.	Chapter III, pages 261 through 265
RECREATION	
The proposed action may affect public motorized use, non-motorized uses, and hunting.	Chapter III, pages 266 through 272
The proposed action may affect the revenue generated by recreational uses.	Chapter III, pages 266 through 272
AESTHETICS	
Activities associated with this project may adversely affect local viewsheds and scenic vistas.	Chapter III, pages 274 through 280
Activities associated with this project may increase local noise levels.	Chapter III, pages 274 through 280

TABLE I-2 – ISSUES ELIMINATED FROM FURTHER ANALYSIS. *Issues eliminated from further analysis and accompanying rationale.*

ISSUES ELIMINATED FROM FURTHER ANALYSIS	RATIONALE
Road building associated with this project will increase the already too large road network on Swan River State Forest.	When planning transportation systems, DNRC is instructed to plan for the minimum number of road miles (*ARM 36.11.421[1]*). DNRC occasionally needs to construct additional roads in order to access timber stands for management. Obliterating all historical roads on the landscape would be cost-prohibitive. An historical road that is causing resource damage is prioritized for corrective actions to lessen or eliminate its negative impacts. The action alternatives in this *DEIS* contain different projected road amounts by alternative (see *DESCRIPTION OF ALTERNATIVES* in *CHAPTER II – ALTERNATIVES*). Both action alternatives attempt to minimize the miles of proposed road construction.
This DEIS should disclose the net economic gain or loss of lands unsuitable for forest management for biological or economic reasons.	This issue is beyond the scope of the project. The analysis within an EIS is required to analyze the impacts on the human environment associated with the alternatives being considered; in this case, the no-action and action alternatives. An analysis of the economic suitability of various DNRC-managed lands for various types of management would not provide a necessary and adequate assessment for meeting requirements of *MEPA* for the type of project that is being proposed. Additionally, in this project area, no biologically unsuitable lands for timber management were identified, although the area does contain some brushed-in areas, creeks, and springs. Foresters have also considered the whole project area, with scrutiny applied to the economics of harvesting and reforestation. The proposed action alternatives utilize conventional, cost-effective ground-based harvesting systems and a minor amount of skyline harvesting systems. The proposed reforestation activities are also common practice and are economically feasible on the areas proposed for harvesting.

The DEIS should disclose the rate of growth from past cutting units and the number of times past logging units have been replanted.	This request is beyond the scope of this project. DNRC has not regularly monitored growth rates of previously harvested stands, but instead relies on the previous research of forest growth and yield for various forest types, as well as regional forest growth and yield models. Additionally, growth rates of current or previously harvested stands were not a primary consideration in developing objectives or selecting stands for treatment in the proposed project. DNRC uses planting when a natural seed source does not exist or when natural regeneration does not achieve adequate stocking levels following harvesting. The use of regeneration surveys required by *ARM 36.11.420*, in harvested stands ensure that DNRC monitors the effectiveness of silvicultural treatments, and also identifies areas where planting may be needed. Because this project has no treatments proposed for recently planted stands in the project area, this request falls beyond the scope of the project and requires no further analysis.
Disclose the basis for the growth and yield calculation on Swan River State Forest. Show the differences between past project yield and current project yield. Are there additional actions being taken to improve yield?	This request is beyond the scope of this project and pertains to the sustainable-yield calculation, which is a complex statewide project. The sustainable-yield calculation for Swan River State Forest and all of DNRC's forestland is determined using the best available forest-inventory data, modeling current and future growth, the ability of each site to grow trees (site index), standing board-foot volume, manageable forest acres, logging systems, forest-management rules and policy, and expected levels of forest-management activities. Data does not exist to directly compare past project yield to current project yield. Measuring forest yield or growth takes decades if it is to be done for an individual site and is intended to compare a past project to the results of the next project. Tracking forest growth and yield is done by large-scale forest inventories. DNRC uses growth and volume estimates provided by the *USFS* and *Forest Inventory and Analysis* group to monitor changes in yield over time. In addition to *Forest Inventory and Analysis* data, DNRC is continuously collecting new *SLI* and plot data that provides the ability to monitor forest condition, stand size, and stocking level. The information provided by these inventories provides a means by which to observe forest-wide changes in yield over time. Many factors can increase yield rates, including replacing older, slower-growing stands with younger, faster-growing stands; planting harvest units with superior seed stock; and thinning younger stands for the purpose of reducing resource competition and increasing the growth rate for residual trees. For more information, refer to the *2004 Sustained Yield Calculation Report* online

	at: *http://dnrc.mt.gov/trust/pdfs/2004_MT_SYC_Report_20041120.pdf*
What data is collected and methodology used to figure the next sustained yield calculation?	As this issue is directly related to a separate programmatic document that was available for public comment, and which was completed in 2004, it was determined to be beyond the scope of the proposed action and, thus, was eliminated from further analysis.
Montana Environmental Policy Act (*MEPA*) alternatives must fully examine other viable economic options.	This issue was determined to be beyond the scope of the proposed action and was thus eliminated from further analysis. While this project incorporates programmatic activities, the decision to be made is specific to the proposed action and is not intended to affect DNRC program or policy guidance.
DNRC must track the costs expended to plan and implement this timber sale.	Itemized cost accounting involves many unknown variables and is conducted at the programmatic level, rather than on a project-by-project basis. In this *DEIS* (see *ECONOMICS ANAYLIS* in *CHAPTER III – EXISTING ENVIRONMENT AND ENVIRONMENTAL IMPACTS*), project costs are estimated based on the most recent annual programmatic revenue-to-cost ratios. A more detailed review of programmatic costs is available in the *Trust Land Management Division Fiscal Year 2010 Return on Assets Report (DNRC 2010a)* and *Annual Report (DNRC 2010b).*
DNRC should put existing old-growth stands on longer rotations.	DNRC management decisions regarding old growth at the project level follow *ARM 36.11.418(a)* and *(c).* When considering old-growth management at the project level, careful attention is given to many variables, including (but not limited to): covertypes, stand locations, patch sizes, habitat connectivity, insect/disease risk, etc. This approach has allowed DNRC to evaluate conservation biology principles and tradeoffs at the landscape scale and have improved flexibility to address stand changes and economic losses brought about by natural-disturbance agents, such as insects, diseases, and wildfire. *DNRC* must also consider the requirements of *MCA 77-5-116*, which is a law that prohibits DNRC from establishing old-growth deferrals and set-asides without compensation to trust beneficiaries. For each timber sale project on Swan River State Forest, stand maps are produced to help evaluate management priorities and trade-offs necessary for informed decisionmaking. Old-growth stands receiving uneven-aged harvesting will be managed under a relatively long rotation with DNRC's current approach. Environmental impacts on old growth are described in *OLD GROWTH* under *VEGETATION ANALYSIS in CHAPTER III – EXISTING ENVIRONMENT AND ENVIRONMENTAL IMPACTS.* The estimated amounts of old growth prior to this project and the amount of old growth after this project (by alternative) are also disclosed.
Other stands should be put on long rotations so that they develop old-growth characteristics.	DNRC management decisions regarding stands on longer rotations at the project level follow *ARM 36.11.418(a).*

The EIS should fully disclose the current condition of streams in the sale area.	This statement is not a specific issue; however, the *HYDROLOGY* and *FISHERIES* analyses discuss existing stream conditions in the project area.
DNRC's use of twenty-five foot stream buffers is not adequate to protect streams from increases in sediment and temperature nor do they provide for habitat complexity.	Any riparian timber harvesting conducted on state trust lands adjacent to fish-bearing streams must implement the *Streamside Management Zone Law* (*SMZ*) and *Rules* and *Forest Management Rules* that apply to *Riparian Management Zones* (*RMZ*), which include buffers with a minimum width of 50 feet.
Ensure that biological diversity is maintained.	Under the *SFLMP* philosophy, DNRC believes that making efforts to emulate natural disturbance patterns, processes, and covertype distributions is a reasonable and responsible way to help ensure that ecosystem processes and endemic species that evolved with them are maintained. The *SFLMP* also encourages managers to explore new findings and adapt management accordingly.
DNRC needs to quantify what current habitat availability, local population monitoring, and the current status of species numbers indicate about current population health in this landscape.	DNRC attempts to promote biodiversity by taking a 'coarse-filter approach', which favors an appropriate mix of stand structures and compositions on state trust lands (*ARM 36.11.404*). Appropriate stand structures are based on ecological characteristics (e.g., landtype, habitat type, disturbance regime, unique characteristics). A coarse-filter approach assumes that if landscape patterns and processes are maintained similar to those with which the species evolved, the full complement of species would persist and biodiversity would be maintained. This coarse-filter approach supports diverse wildlife populations by managing for a variety of forest structures and compositions that approximate historic conditions across the landscape. DNRC cannot assure that the coarse-filter approach will adequately address the full range of biodiversity; therefore, DNRC also employs a 'fine-filter' approach for threatened, endangered, and sensitive species (*ARM 36.11.406*). The fine-filter approach focuses on a single species' habitat requirements and considers the status for each listed species that may be affected. For each species or habitat issue, existing conditions of wildlife habitats are described and compared to the anticipated effects of the proposed no-action alternative and each action alternative to determine the foreseeable effects to associated wildlife habitats. If suitable habitat conditions for a particular species exist within any defined DNRC project area, that species is considered as present, thus, local population monitoring is typically not conducted.
The process of road obliteration does not immediately halt soil erosion from roads.	DNRC is not proposing any road obliteration of existing roads as part of this project. Potential sediment delivery to streams from existing and proposed road locations, including temporary roads and their obliteration, is disclosed in the *HYDROLOGY ANALYSIS*.
DNRC has not completed a *Habitat Conservation Plan* and does not	DNRC is in the process of completing a *Habitat Conservation Plan* for an incidental take permit. Although not completed, this plan does

implement certain components of the *Habitat Conservation Plan* in its projects.	not preclude DNRC from conducting timber-management activities.

RELEVANT AGREEMENTS, LAWS, PLANS, PERMITS, LICENSES, AND OTHER REQUIREMENTS

Management activities on the lands in the proposed project area must comply with the following agreements, laws, plans, permits, licenses, and other requirements.

ENABLING ACT (1889) AND 1972 MONTANA CONSTITUTION

By the *Enabling Act* approved February 22, 1889, the United States Congress granted certain lands to the State of Montana for the support of common schools and other public institutions. These lands are held in trust for the specific trust beneficiaries to which they were assigned and ultimately for the people of the State of Montana (*1972 Montana Constitution Article X, Section 11*). The lands involved in the proposed project area are designated to generate revenue for the Common School Trust. The Land Board and DNRC are required by law to administer these lands to produce the largest measure of reasonable and legitimate return over the long run for this beneficiary institution *(MCA 77-1-202).*

STATE FOREST LAND MANAGEMENT PLAN

DNRC developed the *SFLMP* to "provide field personnel with consistent policy, direction, and guidance for the management of state forested lands" (DNRC *1996b: Executive Summary*). The *SFLMP* provides the philosophical basis, technical rationale, and direction for DNRC's forest-management program. The *SFLMP* is premised on the philosophy that the best way to produce long-term income for the trust is to manage intensively for healthy and biologically diverse forests. In the foreseeable future, timber management will continue to be the primary tool for achieving biodiversity objectives on Swan River State Forest and other DNRC-managed forested trust lands.

DNRC FOREST MANAGEMENT RULES

DNRC's *Forest Management Rules* (*ARM 36.11.401* through *456*) are the specific legal resource management standards and measures under which DNRC implements the *SFLMP* and subsequently its forest-management program. The *Forest Management Rules* were adopted in March 2003 and provide the legal framework for DNRC project-level decisions and provide field personnel with consistent policy and direction for managing forested state lands including Swan River State Forest. Project design considerations and mitigations developed for this project comply with the *Forest Management Rules*.

SUSTAINABLE YIELD CALCULATION

DNRC is required to recalculate the annual sustainable yield for forested trust lands at least every 10 years (*MCA 77-5-221* through *223*). DNRC defines the *Annual Sustainable Yield* as:

> "*the quantity of timber that can be harvested from forested state lands each year in accordance with all applicable state and federal laws, including but not limited to the laws*

pertaining to wildlife, recreation and maintenance of watersheds and in compliance with water quality standards that protect fisheries and aquatic life and that are adopted under the provisions of Title 75, Chapter 5, taking into account the ability of state forests to generate replacement tree growth (MCA 77-5-221)."

Programmatic environmental commitments related to biodiversity, forest health, threatened and endangered species, riparian buffers, old growth, and desired species mix and covertypes are incorporated into the calculation of the annual sustainable yield. The current annual sustainable yield is 53.2 MMbf and was calculated and adopted by the Land Board in 2004. The annual portion for Swan River State Forest was determined to be 6.7 MMbf.

MONTANA ENVIRONMENTAL POLICY ACT AND DNRC PROCEDURAL RULES

DNRC's management activities on state school trust lands are subject to the planning and environmental assessment requirements of *MEPA* (*MCA 75-1-101* through *324*). *MEPA* and its implementing rules (*ARM 36.2.521* through *543*) provide a public process that assures Montana's citizens that a deliberate effort is made to identify impacts before the state government decides to permit or implement an activity that could have significant impacts on the environment.

MEPA requires *DNRC* and other state agencies to inform the public and other interested parties about proposed projects, the potential environmental impacts associated with proposed projects, and alternative actions that could achieve the proposed project objectives.

SWAN VALLEY GRIZZLY BEAR CONSERVATION AGREEMENT

The *SVGBCA* is a cooperative agreement between *DNRC*, *Plum Creek*, *Flathead National Forest (FNF)*, and *United States Fish and Wildlife Service (USFWS).* The SVGBCA contains agreed-upon mitigations that are designed to reduce impacts to grizzly bears in the Swan Valley while allowing the cooperating parties to manage timber. As a cooperator, *DNRC* must abide by the terms and mitigations contained in the *SVGBCA*.

MEMORANDUM OF UNDERSTANDING AND CONSERVATION AGREEMENT FOR WESTSLOPE CUTTHROAT TROUT AND YELLOWSTONE CUTTHROAT TROUT IN MONTANA

DNRC is a signatory to this 2007 statewide cooperative agreement along with 17 other agencies and organizations. The cutthroat trout management goals of the agreement include the long-term persistence of each of the subspecies across their historical ranges, maintenance of the genetic integrity, and diversity of nonintrogressed populations. Diversity of life histories represented by remaining cutthroat trout populations and protection of the ecological, recreational, and economic values associated with each subspecies are also management goals of this agreement.

RESTORATION PLAN FOR BULL TROUT IN THE CLARK FORK RIVER BASIN AND KOOTENAI RIVER BASIN, MONTANA

DNRC, along with 8 other agencies and organizations, is a signatory to this 2000 collaborative agreement. The goal of this management plan is the application of a framework of conservation strategies designed to reverse or halt the decline of bull trout throughout western Montana.

The plan includes guidance for protecting existing stable populations and specific recommendations for restoring populations that have declined.

MONTANA BEST MANAGEMENT PRACTICES

DNRC's *BMPs* for forestry consist of forest stewardship practices that reduce forest-management impacts to water quality and forest soils. The implementation of *BMPs* by DNRC is required under *ARM 36.11.422*. Key forestry *BMP* elements include:

- streamside management;
- road design and planning;
- timber harvesting and site preparation;
- stream-crossing design and installation;
- winter logging; and
- storing, handling, and application of hazardous substances.

STREAM PRESERVATON ACT PERMIT

Department of Fish, Wildlife, and Parks, (DFWP) has jurisdiction over the management of fisheries and wildlife in the project area. A *Stream Preservation Act Permit (124 Permit)* is required for activities that may affect the natural shape and form of any stream or its banks or tributaries.

SHORT-TERM EXEMPTION FROM MONTANA'S WATER-QUALITY STANDARDS

Department of Environmental Quality (DEQ) has jurisdiction over water-quality standards in the project area. A *Short-Term Exemption from Montana Surface Water Quality and Fisheries Cooperative Program (3A Authorization)* may be required if temporary activities would introduce sediment above natural levels into streams or if *DFWP* deems a permit is necessary after reviewing the mitigation measures in the *124 Permit*.

MONTANA/IDAHO AIRSHED GROUP

DNRC is a member of the *Montana/Idaho Airshed Group*, which was formed to minimize or prevent smoke impacts while using fire to accomplish land-management objectives and/or fuel-hazard reduction (*Montana/Idaho Airshed Group 2006*). As a member, *DNRC* must submit a list of planned burns to the *Smoke Monitoring Unit* describing the type of burn in acres, and the location and elevation of each burn site. The *Smoke Monitoring Unit* provides timely restriction messages by airshed. *DNRC* is required to abide by those restrictions and burn only when conditions are conducive to good smoke dispersion.

AIR QUALITY MAJOR OPEN BURNING PERMIT

DEQ issues permits to entities that are classified as major open burners (*ARM 17.8.610*). *DNRC* is permitted to conduct prescribed wildland open burning activities in Montana that are either deliberately or naturally ignited. Planned prescribed burn descriptions must be submitted to *DEQ* and the *Smoke Monitoring Unit of the Montana/Idaho Airshed Group*. All burns must be conducted in accordance with the major open burning permit.

COOPERATIVE ROAD MAINTENANCE

DNRC currently shares a number of reciprocal road access agreements with *FNF* and *Trust for Public Lands*. *DNRC* would need to obtain 1 temporary road use permit through a section involved in the proposed project area.

CHAPTER II
ALTERNATIVES

INTRODUCTION

This chapter describes in detail the no-action alternative and 2 action alternatives of the proposed action. This chapter will focus on the:

- ID Team
- development of the action alternatives;
- description of each alternative;
- summary comparison of project activities associated with each alternative;
- summary comparison of how each alternative achieved the proposed project objectives and summary comparison of the predicted environmental impacts of each alternative; and
- stipulations and specifications common to all action alternatives.

INTERDISCIPLINARY TEAM

An ID Team was formed to work on the proposed action in the spring of 2010. The ID Team consisted of a project leader and resource specialists from various disciplines, including fisheries, wildlife biology, hydrology, geology and soils, policy, and forestry. The role of the ID Team was to summarize issues and concerns, develop alternatives of the proposed action in the project area, and analyze the potential environmental impacts of the alternatives on the human and natural environments.

The ID Team began reviewing resources in the proposed project area soon after the initial scoping period began. Field reviews were conducted and data were collected in the project area to aid in the analyses for affected resources, including vegetation, watershed and hydrology, fisheries, wildlife, geology and soils, economics, air quality, recreation, and aesthetics. The ID Team conducted in-depth quantitative and qualitative analyses of the data to assess the existing environment for each affected resource and determine the potential environmental impacts of each alternative on the affected resources.

DEVELOPMENT OF ALTERNATIVES

Based on data collected from the field and issues received from the public and internally, the ID Team developed a range of alternatives designed to meet project objectives described under *PROJECT OBJECTIVES* in *CHAPTER I – PURPOSE AND NEED* (see *FIGURE II-1 - ACTION ALTERNATIVE B* and *FIGURE II-2 – ACTION ALTERNATIVE C*. The action alternatives incorporate harvest unit design, prescriptions, mitigations, and road activities that allow DNRC to conduct forest-management activities consistent with direction contained in the *SFLMP* and *Forest Management Rules*.

The estimated timber volume produced by each alternative is based on stand volume data obtained from the *Stand Level Inventory* (*SLI*) and other available data used in the analysis. Advertised volumes may vary from the preliminary estimated volumes due to the increased statistical accuracy of measured data obtained during sale layout. While the estimated log

volume may be different, the environmental impacts are based on acres treated and postharvest stand conditions.

DESCRIPTION OF ALTERNATIVES

This section describes No-Action Alternative A and Action Alternatives B and C. All are considered viable alternatives for selection. *TABLE II-1 – COMPARISON OF ACTIVITIES* summarizes and compares project activities associated with each alternative.

FIGURE II-1 – ACTION ALTERNATIVE B. *Proposed haul routes, units, and prescriptions.*

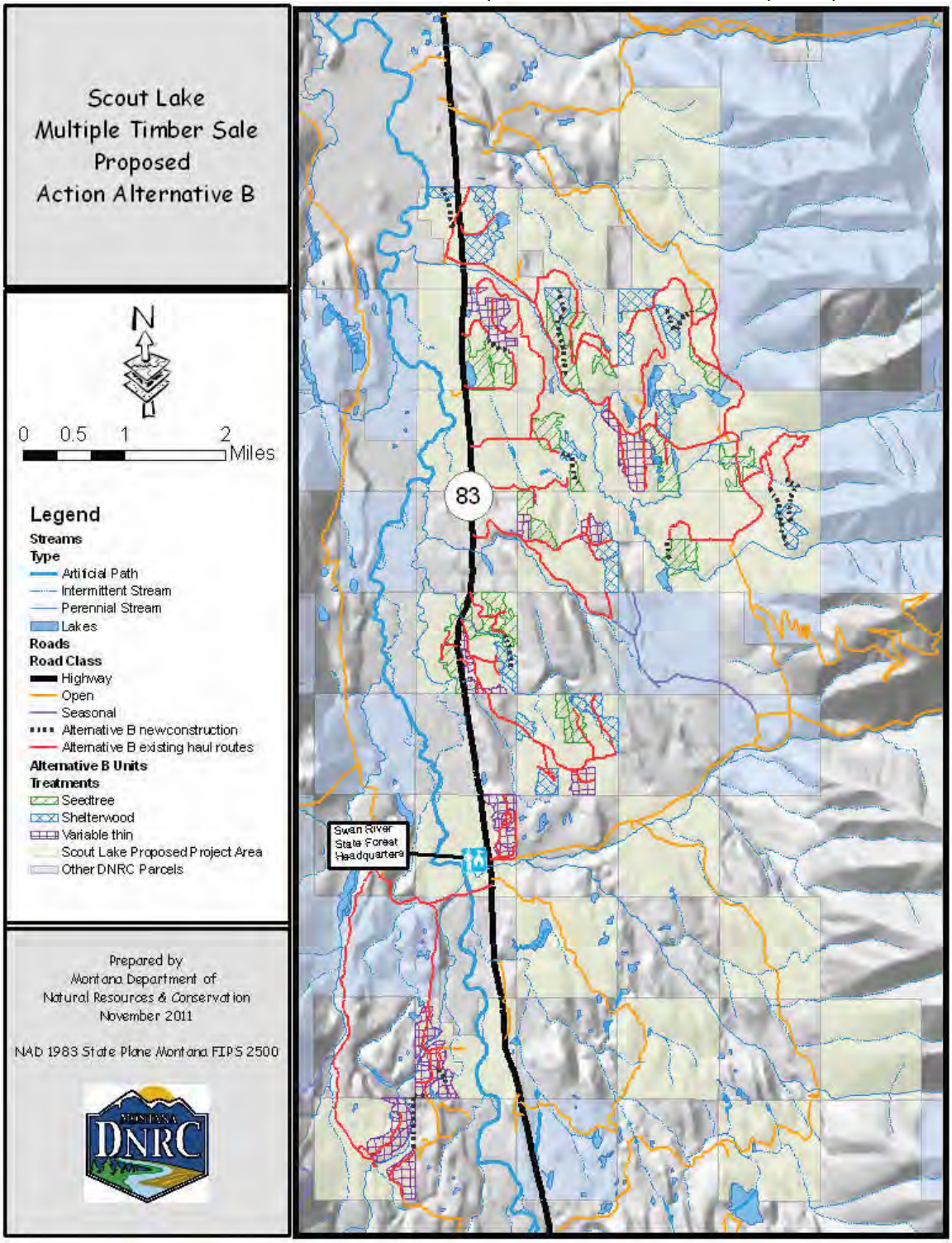


FIGURE II-2 – ACTION ALTERNATIVE C. *Proposed haul routes, units, and prescriptions.*

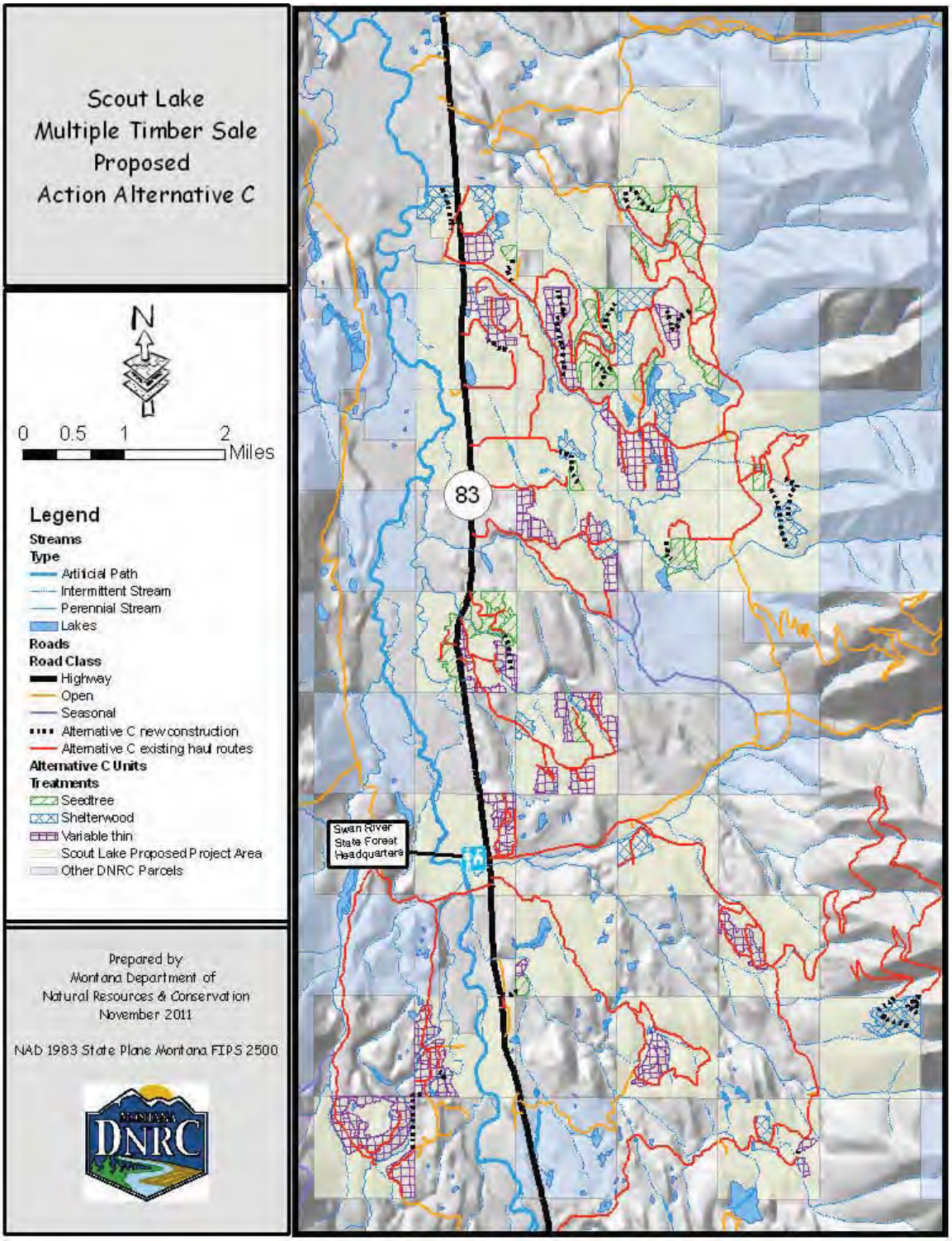


TABLE II-1 – COMPARISON OF ACTIVITIES. *Summary comparison of project activities of the no-action and action alternatives.*

ALTERNATIVE	VOLUME (MMbf)	TOTAL ACRES	OLD-GROWTH ACRES	SILVICULTURAL PRESCRIPTION (ACRES)	HARVEST METHOD	STREAM CROSSINGS	MILES OF ROADWORK
A	0	0	0	None	None	None	None
B	19.0	2,009	683	Variable thin (696) Seedtree (720) Shelterwood (593)	Combination of tractor and forwarder	1 wet install in Section 30, T23N, R17W 3 dry install in Sections 27 and 29, T24N, R17W 1 temporary bridge in Section 30, T23N, R17W	33 miles of road maintenance 15 miles of road reconstruction 5 miles of new road construction 2.5 miles of temporary road construction
C	21.1	2,634	538	Variable thin (1,438) Seedtree (691) Shelterwood (505)	Combination of tractor, forwarder, and cable	1 wet install in Section 30, T23N, R17W 3 dry install in Sections 27 and 29, T24N, R17W 1 temporary bridge in Section 30, T23N, R17W	60 miles of road maintenance 20 miles of road reconstruction 8 miles of new road construction 3.5 miles of temporary road construction

ACHIEVEMENT OF PROJECT OBJECTIVES

The following is a list of project objectives with brief identifiers that link the objectives to *TABLE II-2 – ACHIEVEMENT OF OBJECTIVES*, which summarizes how each alternative would achieve the project objectives set forth under *PROJECT OBJECTIVES* in *CHAPTER I – PURPOSE AND NEED*. Listed after each objective is an indicator that will be used to measure how and to what extent each alternative meets or measures up to each project objective.

- **Biodiversity** – Promote biodiversity by moving forest stands towards desired future conditions.

  Indicator – Proportional change in covertype acres toward desired future conditions.

- **Insect and disease** – Improve forest health and vigor by addressing insect and disease issues.

  Indicator – Number of acres treated that are at moderate to high risk of insect and disease problems.

- **Yield and revenue** – Meet the sustainable yield for Swan River State Forest in order to accomplish its long-term ecological objectives, maximize long-term revenue for the Common School Trust, and support local communities.

  Indicator – Volume harvested and revenue generated.

- **Transportation** – Develop and improve the transportation system and infrastructure for long-term management, fire suppression, and public access.

  Indicator – Miles of new road construction, reconstruction, and maintenance along with their associated development costs.

- **Water quality** – Improve water quality by removing and rehabilitating sediment point sources, and meet *BMPs* on all project roads, including haul routes to Highway 83.

  Indicator – Miles of road reconstructed, improved, or maintained to reduce potential sediment delivery to streams.

- **Fuel loads** – Reduce fuel loads and wildfire hazards by decreasing ground and ladder fuel loads.

  Indicator – Acres treated with seedtree, shelterwood, and thinning prescriptions in the project area. Additionally, treating stands adjacent to private landowners.

TABLE II-2 – ACHIEVEMENT OF OBJECTIVES. *Summary comparison of predicted achievement of project objectives for the no-action and action alternatives.*

PROJECT OBJECTIVES	**ALTERNATIVES**		
	A	**B**	**C**
Biodiversity (covertype) *change in acreage* percentages of increase or decrease by project area/Swan River State Forest	No changes in acreages from existing covertype.	Ponderosa pine *plus 76 acres* 0.49/0.18 percent increases Western larch/Douglas-fir *plus 63 acres* 0.40/0.18 percent increases Western white pine *plus 937 acres* 5.99/2.24 percent increases Lodgepole pine *0 acres* Mixed Conifer *minus 1,121 acres* 7.17/2.68 percent decreases Subalpine fir *0 acres* Douglas-fir *plus 45 acres* 0.29/0.11 percent increases	Ponderosa pine *plus 36 acres* 0.23/0.09 percent increases Western larch/Douglas-fir *plus 126acres* 0.80/0.30 percent increases Western white pine *plus 646 acres* 4.13/1.55 percent increases Lodgepole pine *0 acres* Mixed Conifer *minus 798 acres* 5.10/1.91 percent decreases Subalpine fir *0 acres* Douglas-fir *minus 50 acres* 0.32/0.12 percent decreases
Biodiversity (age class) *Change in acres* percentages of increase or decrease by project area/Swan River State Forest	No changes in acreages from existing age class.	No age *0 acres* 0 to 39 years *plus 1,313 acres* 3.15/8.43 percent increases 40 to 99 years *minus 89.22 acres*	No age *0 acres* 0 to 39 years *plus 1,189 acres* 7.63/2.85 percent increases 40 to 99 years *minus 118 acres*

		0.57/0.21 percent decreases 100 to 149 *minus 254 acres* 1.63/0.61 percent decreases 150-plus years *minus 458 acres* 2.93/1.1 percent decreases Old growth *minus 512 acres* 3.28/1.23 percent decreases	0.76/0.28 percent decreases 100 to 149 *minus 367 acres* 2.36/0.88 percent decreases 150-plus years *minus 561 acres* 3.59/1.35 percent decreases Old growth *minus 142 acres* 0.91/0.34 percent decreases
Insect and disease	0 acres	2,010 acres of low to high levels of insect and disease problems treated	2,636 acres of low to high levels of insect and disease problems treated
Yield and trust revenue	0 MMbf and $0	19 MMbf and $1,529,705	21.1 MMbf and $1,415,627
Transportation	0 miles	22.5 miles of new road construction/reconstruction at a cost of $297,000 and 33 miles of road improvements at a cost of $87,120	35.5 miles of new road construction/reconstruction at a cost of $607,200 and 60 miles of road improvements at a cost of $158,400
Water Quality	0 replacements and improvements	Approximately 48 miles of road would be reconstructed, improved, or maintained to reduce potential sediment delivery.	Approximately 80 miles of road would be reconstructed, improved, or maintained to reduce potential sediment delivery.
Fuels loads	0 acres	1,313 acres	1,189 acres

ALTERNATIVE COMPARISON OF ENVIRONMENTAL IMPACTS

TABLE II-3 – COMPARISON OF IMPACTS summarizes the existing environment and the predicted environmental impacts of each alternative. The impacts are categorized by resource area and further subdivided by an abbreviated version of the issues listed in *TABLE I-1 – ISSUES STUDIED IN DETAIL*.

TABLE II-3 – COMPARISON OF IMPACTS. *Summary comparison of predicted environmental impacts of the no-action and action alternatives.*

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
VEGETATION			
Covertype representation The proposed activities may affect the forest covertypes through species removal or species composition change.	Mixed-conifer stands are currently overrepresented compared to historic data and desired future conditions. Western larch/ Douglas-fir and western white pine covertypes are currently underrepresented on Swan River State Forest.	***No-Action Alternative A***	
		No effects are anticipated.	Shade-tolerant species would continue to regenerate, leading to an increase in the mixed-conifer covertype and a gradual loss of the seral-dominated covertypes, such as western larch/Douglas-fir and western white pine.
		Action Alternative B	
		In the project area, the western larch/Douglas-fir covertype would increase from 7.57 to 7.97 percent, the western white pine covertype would increase from 5.66 to 11.67 percent, the Douglas-fir covertype would increase from 2.22 to 2.51 percent, the ponderosa pine covertype would increase from 10.76 to 11.25 percent, and the mixed-conifer covertype would decrease from 62.58 to 55.39 percent.	Cumulative effects would result in a trend of increasing seral covertypes across areas where management has occurred.
		Action Alternative C	
		In the project area, the western larch/Douglas-fir covertype would increase from 7.57 to 8.38 percent, the western white pine covertype would increase from 5.66 to 9.80 percent, the lodgepole pine	Cumulative effects would result in a trend of increasing seral covertypes across areas where management has occurred.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		covertype would increase from 5.54 to 5.75 percent, the ponderosa pine covertype would increase from 10.76 to 10.99 percent, the Douglas-fir covertype would decrease from 2.22 to 1.90 percent, and the mixed-conifer covertype would decrease from 62.58 to 57.51 percent.	
Age-class representation The proposed activities may affect age classes through tree removal.	Comparison of the current age class distribution by covertype across the entire Swan River State Forest to historical data for *Section M333C* demonstrates reduced acreage in the seedling-sapling age class and an overabundance in the old-stands age class in most covertypes.	***No-Action Alternative A***	
		No immediate change in the proportion of existing age classes is expected unless a large disturbance, such as wildfire, occurs.	Cumulative effects would result in a trend of increasing seral covertypes across areas where management occurred.
		Action Alternative B	
		Regeneration treatments and the subsequent planting or natural regeneration would increase the 0-to-39-year age class by 3.2 percent on Swan River State Forest and by 8.4 percent, or 1,313 acres, in the project area. The old-stand age class would be reduced by 2.3 percent on Swan River State Forest and by 6.2 percent, or 979 acres, in the project area.	Cumulative effects would result in a trend of reducing the acres in the older age classes while increasing the acres in the younger age classes.
		Action Alternative C	
		Regeneration treatments and subsequent planting or natural	Cumulative effects would result in a trend of reducing the acres in the

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		regeneration would increase the 0-to-39-year age class by 2.9 percent on Swan River State Forest and by 7.7 percent, or 1,197 acres, in the project area. The old-stand age class would be reduced by 1.7 percent on Swan River State Forest and by 4.5 percent, or 712 acres, in the project area.	older age classes while increasing the acres in the younger age classes.
Old-growth representation The proposed activities may affect old-growth amounts and quality through tree removal.	Swan River State Forest currently has 10,603 acres of old growth, which is equal to 25.4 percent of its total acreage. The project area contains 3,541 acres of old growth, which is equal to 22.7 percent of the project area.	***No-Action Alternative A***	
		Existing old-growth stands would continue to experience substantial mortality of large Douglas-fir, grand fir, and western white pine trees, increasing the snag and down woody debris components of those stands. Some stands may no longer be in the old-growth classification as a result of the gradual or sudden loss of many large trees due to insects, diseases, drought, competition, etc.	Current levels of old-growth acres would not change in the short term. As stands continue to mature and large trees eventually die, some stands may no longer meet the old-growth definition.
		Action Alternative B	
		The old-growth amount on Swan River State Forest would decrease to 10,090 acres, which is equal to 24.2 percent of the total acreage. The project area would contain 3,029 acres of old growth, which is equal to 19.4 percent of the project	Cumulative effects would result in a trend of reducing the acres in old growth.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		area.	
		Action Alternative C	
		The old-growth amount on Swan River State Forest would decrease to 10,460 acres, which is equal to 25.1 percent of the total acreage. The project area would contain 3,399 acres of old growth, which is equal to 21.8 percent of the project area.	Cumulative effects would result in a trend of reducing the acres in old growth.
Patch size and shape The proposed activities may affect patch size and shape through tree removal.	Current project area mean patch sizes by age class: Nonforested - 19.4 acres 0 to 39 years - 24.9 acres 40 to 99 years - 40.1 acres 100 to old stand - 50.1 acres Old stand - acres Overall - 46.3 acres Current project area mean old-growth patch size - 61.1 acres Current project area mean patch sizes by covertype: Douglas-fir - 49.5 acres Lodgepole pine - 45.4 acres Mixed conifer - 243.8 acres Nonforested - 19.4 acres Nonstocked - 13.5 acres Ponderosa pine - 30.5 acres	***No-Action Alternative A***	
		Age class, old growth, and covertype patch sizes would not be immediately affected. Over time, the forest would tend to homogenize, leading to larger patches of older stands, especially in the absence of significant fires or disturbance events. Over time, the effects to the old-growth patch size would be uncertain. If existing large trees remain alive and new large trees develop in old-age stands, the mean patch size of old growth would likely increase. If existing large trees continue to die and new large trees fail to develop, the mean patch size of old growth would likely decrease. Over time,	Overall, age patches are reduced from historic conditions and active management has cumulatively increased the overall patch size of younger age classes. Old-growth patches are likely reduced from historic conditions as well. Covertype patch sizes have been reduced from historic conditions. Active management of forested lands suggests an increase in early seral species such as western larch and ponderosa pine. However, the result may also be the retention of a mixed-conifer covertype postharvest.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	Subalpine fir - 14.9 acres Hardwood - 21.6 acres Western larch/Douglas-fir - 31.9 acres Western white pine - 35.3 acres Overall - 67.5 acres	diversity of habitats in terms of covertype patches would likely be reduced through forest succession, resulting in an increase in mean size of patches dominated by shade-tolerant species.	
		Action Alternatives B and C	
		The mean old-stand patch size would be reduced to 88.94 acres with Action Alternatives B and C. Other age patches would be only marginally affected except the 0-to-39-year-old class, where mean patches would be increased with each action alternative.	Overall, age-class patches are reduced from historic conditions and active management has cumulatively increased the overall patch size of younger age classes. Old-growth patches and covertype patch sizes have been reduced from historic conditions. Active management of forested lands suggests an increase in early seral species such as western larch and ponderosa pine. However, the result may also be the retention of a mixed-conifer covertype postharvest.
Fragmentation The proposed activities may affect fragmentation through road construction and tree removal.	The majority of the project area is a matrix or mosaic of well-stocked stands interspersed with past regeneration harvesting activities. Some man-made patches in harvest units range	***No-Action Alternative A***	
		No direct effects to forest fragmentation would occur. A reduction in fragmentation would occur if additional harvesting is not imposed by management and existing patches of nonmature forest grow to maturity.	Cumulative effects would result in an increase in fragmentation in areas where regeneration harvest units occur and in a decrease in areas where regeneration harvest units do not occur and existing patches of nonmature forest grow

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	from 4 to 138 acres, while some areas have not been previously entered and represent a continuous forest of stands uninfluenced by human activities, but of various stocking levels due to past insect infestation,		to maturity.
		Action Alternatives B and C	
		For the areas proposed for regeneration harvesting, the primary effects would be creating a larger area of younger stands with a corresponding reduction in mature forest stands with occasional untreated, reserve patches. The areas proposed for variable thinning would be more similar to adjacent mature stands of timber and would not contribute to fragmentation.	An overall increase in the size of younger age-class patches and a decrease in the size of older age classes would occur where regeneration harvest units are proposed.
Vigor The proposed activities may affect the vigor of forest stands through tree removal.	In terms of vigor classifications, the project area consists of 926.5 acres of full vigor (5.9 percent), 8,282.7 acres of good to average vigor (53.1 percent), 5,473.3 acres of just below average to poor vigor (35.1 percent), 71.0 acres of poor vigor (0.5 percent), and 832.9 acres of nonforest (5.3 percent).	***No-Action Alternative A***	
		No direct effects for stand vigor would occur. Vigor may decrease as insect infestations and disease infections continue to affect stands or if a large disturbance, such as a wildfire, occurs.	Current stand vigor would remain the same across the forest. Mortality and aging of trees or groups of trees would reduce vigor in localized areas. Large reductions in vigor would occur if a large fire came through the area.
		Action Alternative B	
		Vigor classifications as a result of Action Alternative B would consist of 2,239.6 acres of good vigor (14.4 percent), 7,732.2 acres of good to average vigor (49.6 percent), 4,720.5 acres of just below average to poor vigor (30.3	Areas where harvesting has occurred would have increased vigor. Areas where harvesting has not occurred would have decreased bigor and the trees would no longer perform to their highest potential and would

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		percent), 61.2 acres of poor vigor (0.4 percent), and 832.8 acres of nonforest (5.3 percent).	become susceptible to insects and diseases, etc.
		Action Alternative C	
		Vigor classifications as a result of Action Alternative C would consist of 2,122.9 acres of good vigor (13.6 percent), 8,094.9 acres of good to average vigor (51.9 percent), 4,474.9 acres of just below average to poor vigor (28.7 percent), 61.2 acres of poor vigor (0.4 percent), and 832.8 acres of nonforest (5.3 percent).	Areas where harvesting has occurred would have increased vigor. Areas where harvesting has not occurred would have decreased bigor and the trees would no longer perform to their highest potential and would become susceptible to insects and diseases, etc.
Stand structure The proposed activities may affect the forest stand structure through tree removal.	Current stand structure classifications and percentages in the project area: Single-storied - 24.7 percent Two-storied - 30.1 percent Multistoried - 39.9 percent Nonforest - 5.3 percent	***No-Action Alternative A***	
		No immediate change in the proportion of stand structure is expected unless a large disturbance, such as wildfire, occurs.	The cumulative effects to stand-structure distributions due to previous activities are represented in descriptions of the current conditions. Those effects have been to reduce the acres in multistoried stand structures while increasing the acres in the single-storied stand structure through even-aged management.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		Action Alternative B	
		The following stand structure proportions would change: The single-storied stand would increase 453.7 acres (27.6 percent), while the two-storied stand would increase 999.9 acres (36.5 percent), and the multistoried stand would decrease 1,453.6 acres (30.6 percent).	The cumulative effects to stand-structure distributions due to previous activities are represented in descriptions of the current conditions. Those effects have been to reduce the acres in multistoried stand structures while increasing the acres in the single-storied stand structure through even-aged management.
		Action Alternative C	
		The following stand structure proportions would change: The single-storied stand would increase 296.8 acres (26.6 percent), while the two-storied stand would increase 1,338 acres (38.7 percent), and the multistoried stand would decrease 1,634.7 acres (29.4 percent).	The cumulative effects to stand-structure distributions due to previous activities are represented in descriptions of the current conditions. Those effects have been to reduce the acres in multistoried stand structures while increasing the acres in the single-storied stand structure through even-aged management.
Crown cover The proposed activities may affect the forest crown cover through tree removal.	In terms of overall crown cover in the project area, 50.1 percent of stands are well-stocked, 33.4 percent show medium stocking, 11.2 percent are poorly stocked, 0.6 percent are nonstocked, and 4.7	***No-Action Alternative A***	
		Overall crown cover and stocking would likely increase over time in the absence of disturbances. Were large fires to occur, overall crown cover would be reduced. Ongoing insect and disease issues would reduce crown cover and	Current crown cover would remain the same across the forest. Over time, crown cover would be expected to increase in the absence of disturbance. Mortality of trees or groups of trees would reduce the crown cover in localized areas.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	percent are nonforested. Sawtimber stocking in the project area shows that 16.1 percent of stands are well stocked, 37.2 percent of stands have medium stocking, and 19.5 percent are poorly stocked.	sawtimber stocking in some areas prior to understory regeneration.	Large reductions in crown cover would occur if a large fire came through the area.
		Action Alternative B	
		The project area would consist of approximately 40.8 percent well-stocked stands, 34.3 percent medium-stocked stands, 19.6 percent poorly-stocked stands, 0.6 percent nonstocked stands, and 4.7 percent nonforested stands.	Overall reductions of crown cover in well-stocked stands would be dispersed across the landscape. Representation of medium-stocked stands would increase following harvesting, as would poorly stocked stands. As stands regenerate, crown cover would increase.
		Action Alternative C	
		The project area would consist of approximately 37.6 percent well-stocked stands, 37.6 percent medium-stocked stands, 19.5 percent poorly-stocked stands, 0.6 percent nonstocked stands, and 4.7 percent nonforested stands.	Overall reductions of crown cover in well-stocked stands would be dispersed across the landscape. Representation of medium-stocked stands would increase following harvesting, as would poorly stocked stands. As stands regenerate, crown cover would increase.
Insects and diseases The proposed activities may affect forest insect and disease levels through tree removal (both suppressed/	The major forest insects and diseases currently affecting forest productivity on Swan River State Forest include Armillaria root disease, red-brown butt rot, larch dwarf	***No-Action Alternative A***	
		Sawlog volume, and the corresponding revenue, would continue to be lost from the project area due to insect and disease effects in inaccessible stands with large trees. Salvage	Some salvage harvesting of insect-infested and disease-infected trees would occur, but at a slower, less effective rate and not in association with this project. Forest stands would maintain dense stocking

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
stressed and infested/ infected).	mistletoe, white pine blister rust, Indian paint fungus, red ring rot, Douglas-fir bark beetle, fir engraver, and mountain pine beetle.	harvesting would continue in areas where stands are accessible without building roads.	levels, which contribute to the spread of insects, diseases, and fuel loading, which could lead to high-intensity fires, unnatural forest structures, and overall poor stand health. Current forest conditions would continue.
		Action Alternatives B and C	
		Harvest treatments would remove trees affected by insects and diseases. Action Alternative B (treating 1,313 acres) with site-intensive management type treatments would do the most to control rates of spread, economic value loss, and volume loss in the project area. Action Alternative C treats 833 acres with moderate and moderate to high levels of insect and disease issues.	Timber-management activities generally implemented prescriptions that reduce losses and recover mortality due to insects and diseases. Stand-regeneration treatments are producing stands with species compositions more resilient to the impacts of forest insects and diseases. Thinning treatments have further reduced the percentage of infected or infested trees.
Fire effects The proposed activities may affect forest fire conditions, levels, and hazards through tree removal, increased public access, and/or fuel reduction.	The fire regime across Swan River State Forest is variable in frequency and intensity and is creating a mosaic pattern of age classes and covertypes.	***No-Action Alternative A***	
		Wildfire hazards would not change substantially in the short term. With continued fuel accumulation from down woody debris, the potential for wildfire increases. Large-scale, stand-replacing fires may be the outcome.	The risk of wilfires would continue to increase as a result of long-term fire suppression.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		Action Alternatives B and C	
		Immediately following timber harvesting, the amount of fine fuels would increase. Hazards would be reduced through various fuel-treatment measures such as piling and burning.	Fuel loadings would be reduced in treated stands, decreasing wildfire risks in these specific areas.
Sensitive plants The proposed activities may affect sensitive plant populations through ground disturbance.	The majority of sensitive plants and their related habitat features were found in wet meadows, which are not normally classified as forest stands or considered for timber harvesting. No species of concern were found in the proposed units.	***No-Action Alternative A***	
		No effects are anticipated.	No effects are anticipated.
		Action Alternatives B and C	
		No effects are expected because no populations of sensitive plants occur in the harvest units.	If changes occur in the water-yield or nutrient level, sensitive plant populations may, in turn, be affected. Given the level of the proposed and active harvesting on Swan River State Forest and other land in the project area, no measurable changes in water yield or nutrient levels are anticipated from any of the proposed action alternatives.
Noxious weeds The proposed activities may affect noxious weed populations and presence through ground disturbance and weed introduction.	Spotted knapweed , orange hawkweed , yellow hawkweed , Canada thistle , oxeye daisy, and common St. John's-wort have become established along road edges in the project area.	***No-Action Alternative A***	
		Weed seed would continue to be introduced by recreational use of the forest, log hauling, and other logging activities on adjacent land ownerships. Swan River State Forest may initiate spot spraying to reduce noxious weed spread along its roads under the Forest Improvement (FI) program.	Current population levels would continue to exist and may increase over time.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		Action Alternative B and C	
		Log hauling and equipment movement would introduce seeds from other sites. Weed establishment and spread would be reduced by grass seeding new and disturbed roads and landings, spot spraying of new infestations, requiring contractors to wash and have machinery inspected prior to entering the project area, and roadside herbicide spraying.	The action alternatives, together with other management and recreational activities on Swan River State Forest, would provide an opportunity for the transfer of weed seeds and increased establishment of noxious weeds. Preventative actions facilitated by the Lake County Weed Board and active weed- management activities performed by Swan River State Forest would reduce the spread and establishment of noxious weeds, as well as the impacts resulting from the replacement of native species.
WATERSHED AND HYDROLOGY			
Timber harvesting and road construction has the potential to increase water yield, which, in turn, may affect erosive power, sediment production, and Stream-channel stability	Existing annual water yields for watersheds in the Scout Lake Project Area: Cilly Creek-7.5 percent Goat Creek-4.5 percent In-Pa-Ah/Perry Creek-8.4 percent Soup Creek-2.6 percent South Woodward Creek-7.9 percent Squeezer Creek-4.0 percent	***No-Action Alternative A***	
		No direct or indirect increase in annual water yields would occur because no timber harvesting and road construction activities would occur.	No change in cumulative annual water yields would occur. The cumulative annual water yields would be the same as the existing annual water yields for each watershed. All watersheds would remain below the recommended threshold for annual water-yield increases.
		Action Alternative B	
		Direct and indirect increases to annual water yields in each	All watersheds would remain below the recommended threshold

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		watershed: Cilly Creek - 0.8 percent Goat Creek - greater than 0.1 percent In-Pa-Ah/Perry Creek - 2.1 percent Soup Creek - 0.7 percent South Woodward Creek - 0 percent Squeezer Creek - 0 percent	for annual water-yield increases. Cumulative annual water-yield increases for each watershed: Cilly Creek - 8.3 percent Goat Creek - 4.5 percent In-Pa-Ah/Perry Creek - 10.5 percent Soup Creek - 3.3 percent South Woodward Creek - 7.9 percent Squeezer Creek - 4.0 percent
		Action Alternative C	
		Direct and indirect increases to annual water yields in each watershed: Cilly Creek - 2.1 percent Goat Creek - greater than 0.1 percent In-Pa-Ah/Perry Creek - 1.7 percent Soup Creek - 0.6 percent South Woodward Creek - greater than 0.1 percent Squeezer Creek - 0.4 percent	All watersheds would remain below the recommended threshold for annual water-yield increases. Cumulative annual water-yield increases for each watershed: Cilly Creek - 9.6 percent Goat Creek - 4.5 percent In-Pa-Ah/Perry Creek - 10.1 percent Soup Creek - 3.2 percent South Woodward Creek - 7.9 percent Squeezer Creek - 4.4 percent

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
Timber harvesting and road construction may increase sediment delivery into streams/lakes and affect water quality.	Sediment sources in each watershed and along the proposed haul route in each watershed were modeled using a procedure adapted from the *Washington Forest Practices Board.* The following list is the estimated potential tons-per-year sediment delivery into streams in each watershed in the project area, followed by the estimated potential on the haul route (tons per year): Cedar Creek - 70.8 (34.7) Cilly Creek - 2.9 (1.1) Goat Creek - 18.8 (4.7) In-pa-ah Creek - no delivery observed Soup Creek - 30 (29.3) South Woodward Creek - 19.4 (0) Squeezer Creek - 1.5 (0.9) Van Lake - no delivery observed Swan River and face drainages - 0.9 (0.4)	***No-Action Alternative A***	
		No direct or indirect increase or reduction in sediment delivery would occur as part of this project.	No change in cumulative sediment delivery would occur. The sediment delivery would change as funding for road maintenance is available.
		Action Alternative B	
		Road maintenance, reconstruction and new road construction would result in the following net changes to the sediment delivery in each watershed: Cedar Creek - 27.8 tons per year reduction Cilly Creek - no reduction or increase Goat Creek - no reduction or increase In-pa-ah Creek - no reduction or increase Soup Creek - 22.3 tons per year reduction South Woodward Creek - no reduction or increase Squeezer Creek - no reduction or increase Van Lake - no reduction or increase Swan River and face drainages - 0.3 tons per year reduction	Road maintenance, reconstruction and new road construction would result in the following net post-project modeled potential cumulative sediment delivery from roads: Cedar Creek - 42.8 tons per year Cilly Creek - 2.9 tons per year Goat Creek - 18.8 tons per year In-pa-ah Creek - no increased delivery Soup Creek - 7.7 tons per year South Woodward Creek - 19.4 tons per year Squeezer Creek - 1.25 tons per year Van Lake - no increased delivery Swan River and face drainages - 0.6 tons per year

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		Action Alternative C	
		Road maintenance, reconstruction and new road construction would result in the following net changes to the sediment delivery in each watershed: Cedar Creek - 27.8 tons per year reduction Cilly Creek - 0.7 tons per year reduction Goat Creek - 2.2 tons per year reduction In-pa-ah Creek - no delivery observed Soup Creek - 22.3 tons per year reduction South Woodward Creek - no reduction or increase Squeezer Creek - no reduction or increase Van Lake - no reduction or increase Swan River and face drainages - 0.3 tons per year	Road maintenance, reconstruction and new road construction would result in the following net post-project modeled potential cumulative sediment delivery from roads: Cedar Creek - 42.8 tons per year Cilly Creek - 2.9 tons per year Goat Creek - 16.6 tons per year In-pa-ah Creek - no increased delivery Soup Creek - 7.7 tons per year South Woodward Creek - 19.4 tons per year Squeezer Creek - 1.25 tons per year Van Lake - no increased delivery Swan River and face drainages - 0.6 tons per year

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
Timber harvesting activities may adversely affect water quality by reducing shade and increasing stream temperature.	A review of the 2009 aerial photos from the Natural Resource Information System website was used to assess the riparian area in the project area watersheds. To define the riparian area, all Class 1 streams were buffered by 120 feet on each side. The delineated riparian area was then categorized as impacted or not impacted by management. These are the estimated acres of riparian area in each watershed followed by the estimated percent that have been impacted: Cedar Creek - 185 acre/2-percent impacts Cilly Creek - 245 acre/3-percent impacts Goat Creek - 479 acre/8-percent impacts In-pa-ah Creek - 197 acre/42-percent impacts Soup Creek - 424 acre/14-percent impacts South Woodward Creek - 525	***No-Action Alternative A***	
		No change in delineated riparian area impacts is associated with this alternative.	No change in delineated riparian area impacts is associated with this alternative. Cumulative area impacted would be the same as the existing condition.
		Action Alternative B	
		Stream shading would be reduced by approximately 1.1 acres in the Cedar Creek watershed. This would equate to less than .1 percent of the defined riparian area in the watershed.	Stream shading on Class 1 streams would remain the same as the existing condition for all watersheds except Cedar Creek. The 1.1 acre reduction in defined riparian canopy would not result in a measurable change to the percent impacted; therefore, the percentage of the defined riparian area impacted would be the same as the existing condition.
		Action Alternative C	
		Stream shading would be reduced by approximately 1.1 acres in the Cedar Creek watershed. This would equate to less than 0.1 percent of the defined riparian area in the watershed.	Stream shading on Class 1 streams would remain the same as the existing condition for all watersheds except Cedar Creek. The 1.1 acre reduction in defined riparian canopy would not result in a measurable change to the percent impacted, therefore the percentage

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	acre/31-percent impacts Squeezer Creek - 370 acre/1-percent impacts Van Lake - 100 acre/12-percent impacts		of the defined riparian area impacted would be the same as the existing condition.
FISHERIES			
Populations	Existing impacts to native fisheries populations within each analysis area range from moderate to high.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		No direct or indirect impacts to fisheries populations (including species presence or absence and genetics) are expected to occur in any of the analysis areas as a result of the proposed actions	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
Flow regime	Negligible to low existing impacts due to water yield increases occur in the analysis areas. The variables of existing seasonal peak flow volume, timing, and duration are expected to be within the range of natural variability for all analysis areas.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		A low risk of very low additional impacts to water yield are expected in all analysis areas. A low risk of low impacts to peak seasonal flow volume, flow time, and flow duration are expected.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Sediment	Existing impacts to sediment are low in all of the analysis areas, except for: moderate impacts in the Cedar Creek and Soup Creek analysis areas.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		A moderate risk of low additional sediment impacts to fisheries resources is expected in all analysis areas in the short term and long term, except a high risk of moderate impacts is expected in the short term in the Soup Creek analysis area.	See *CUMULATIVE EFFECTS* summary below.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Channel forms	Existing impacts to channel forms are very low to low in all of the analysis areas, except for: low to moderate impacts in the Cedar, Soup, and South Woodward creeks and Small Drainage Group analysis areas.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See Cumulative Effects summary below.
		Action Alternative B	
		A low to moderate risk of low additional impacts to channel forms is expected in all analysis areas.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Riparian condition	Existing impacts to riparian function are low in all of the analysis areas, except for: moderate impacts in the South Woodward Creek and Small Drainage Group analysis areas.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		A low risk of very low additional impacts to riparian condition is expected in all analysis areas, except a low risk of low impacts is expected in the Cedar Creek analysis area.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
Large woody debris (LWD)	Existing impacts to LWD are very low to low in all of the analysis areas, except for: moderate impacts in the South Woodward Creek and Small Drainage Group analysis areas.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		A low risk of very low additional impacts to LWD is expected in all analysis areas, except a low risk of low impacts is expected in the Cedar Creek analysis area.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Stream temperature	Existing impacts to stream temperature are negligible to low in all of the analysis areas, except for: moderate impacts in the Soup Creek, Swan River, and Adjacent Face Drainage Group analysis areas.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		A low risk of low additional impacts to stream temperatures is expected in all analysis areas.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Macroinvertebrate richness	Existing impacts to macroinvertebrate richness are very low to low in all of the analysis areas, except for: low to moderate existing impacts in the Soup Creek Analysis	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		A low risk of low additional impacts to macroinvertebrate	See *CUMULATIVE EFFECTS* summary below.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	Area.	richness is expected in all analysis areas.	
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Connectivity	No existing impacts to the connectivity of native fisheries occur in any of the analysis areas; moderate impacts to the connectivity of nonnative fisheries occurs in the Small Drainage Group, Soup and South Woodward creeks analysis areas.	***No-Action Alternative A***	
		No impacts would occur beyond those already described in *EXISTING ENVIRONMENT.*	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative B	
		No direct or indirect impacts to connectivity would occur in any of the analysis areas as a result of the proposed actions, except a minor, positive impact is expected in the Soup Creek Analysis Area.	See *CUMULATIVE EFFECTS* summary below.
		Action Alternative C	
		Same as Action Alternative B.	See *CUMULATIVE EFFECTS* summary below.
Cumulative effects to fisheries resources	A moderate to high cumulative impact occurs in all analysis areas. Although other contributing factors currently affect fisheries resources, this existing collective impact to fisheries is primarily a result of the adverse effects of nonnative fish populations on native fisheries.	***No-Action Alternative A***	
		Not applicable	Considering all impacts collectively, a moderate risk of moderate to high cumulative impacts is expected to continue to occur (same as *EXISTING CONDITION*). Although the anticipated moderate to high cumulative effect is a function of all potentially related impacts, the elevated cumulative effect in the analysis areas is primarily due to

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
			adverse impacts from nonnative fish species.
		Action Alternative B	
		Not applicable	Using the cumulative effects described for No-Action Alternative A as a baseline, the anticipated collective direct and indirect effects due to implementing Action Alternative B are expected to contribute a moderate risk of additional low impacts to fisheries resources. Consequently, a moderate risk of moderate to high cumulative impacts to fisheries resources is expected in all analysis areas, which is fundamentally the cumulative effect to fisheries resources described for No-Action Alternative A. Although the anticipated moderate cumulative effect is a function of all potentially related impacts, the elevated cumulative effect in the analysis areas is primarily due to adverse impacts from nonnative fish species.
		Action Alternative C	
		Not applicable	Same as Action Alternative B.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
GEOLOGY AND SOILS			
Physical Soil Properties	Approximately 8.7 percent of the project area has naturally ameliorating impacts on skid trails and log lands from previous harvesting.	***No-Action Alternative A***	
		No impact, improving trend.	
		Action Alternatives B and C	
		A high probability of low- to moderate-level impacts for moderate durations (stand rotation) would be expected.	Moderate probability of moderate level impacts for moderate durations (stand rotation) would be expected.
Erosion	Soils are erosively stable with no rill or gully erosion observed outside of road prisms in the project area.	***No-Action Alternative A***	
		No impacts would be expected; the trend would remain stable.	
		Action Alternatives B and C	
		Low probability of low level impacts.	No cumulative impacts expected.
Site Nutrients	Site nutrients vary spatially, dependant on aspect, elevation, habitat type, duff depth, and amount of fine woody debris. In general, no existing impacts from previous entries would be expected.	***No-Action Alternative A***	
		No impacts would be expected; the trend would continue to increase.	
		Action Alternatives B and C	
		A low probability of low-level impacts would be expected for a short duration (15 to 20 years).	A high probability of low-level cumulative impacts for moderate durations (stand rotation).
Long-term Productivity	Soils are high in productivity due to ash-capped soils, climate, and high precipitation. Low-level impacts would be expected from prior entries in areas of temporary roads and primary skid trails.	***No-Action Alternative A***	
		No impacts would be expected; the trend would continue to increase.	
		Action Alternatives B and C	
		A low probability of low-level impacts would occur for a short duration (15 to 20 years).	A moderate probability of low-level cumulative impacts to long-term productivity would occur for moderate durations (stand rotation).

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
ECONOMICS			
Income	Three-county area economy relies on income in the forestry, logging, and wood-product-manufacturing sectors. State forest timber sales generate approximately 10 percent of income in the statewide timber market as measured by volume supplied. The unknown is exactly how much income is generated from these sectors in the 3-county area or statewide.	***No-Action Alternative A***	
		$0 total income earned.	Cumulative income effects are limited by the scale of the initial project. Measuring cumulative income effects with any certainty is difficult.
		Action Alternative B	
		$4,521,851 total income earned in log markets prior to manufacturing.	Cumulative income effects are limited by the scale of the initial project. Measuring cumulative income effects with any certainty is difficult.
		Action Alternative C	
		$4,998,467 total income earned in log markets prior to manufacturing.	Cumulative income effects are limited by the scale of the initial project. Measuring cumulative income effects with any certainty is difficult.
Employment	The 3-county area economy relies on employment in the forestry, logging, and wood-product-manufacturing sectors. State forest timber sales support approximately 10 percent of employment in the statewide timber and lumber market as measured by volume supplied. How many jobs available in these	***No-Action Alternative A***	
		0 annual jobs supported by the proposed alternative	Cumulative employment effects are limited as more timber sales in the region are required to maintain employment in the forestry, logging, and wood-products-manufacturing sectors.
		Action Alternative B	
		145 annual jobs supported by the proposed alternative.	Cumulative employment effects are limited as more timber sales in the region are required to maintain employment in the forestry,

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	sectors in the 3-county area are unknown. State labor statistics identify over 2,618 jobs in the wood-product-manufacturing sector, and 679 jobs in the forestry and logging sector statewide.		logging, and wood-products-manufacturing sectors.
		Action Alternative C	
		161 annual jobs supported by the proposed alternative.	Cumulative employment effects are limited as more timber sales in the region are required to maintain employment in the forestry, logging, and wood-products-manufacturing sectors.
AIR QUALITY			
Smoke produced from prescribed burning associated with the proposed action may adversely affect local air quality.	Air quality in the analysis area is generally excellent and has limited local emission sources and consistent wind dispersion throughout most of the year. Emissions do not affect local population centers, impact zones, or Class 1 Areas beyond *Environmental Protection Agency* (*EPA*) and *DEQ* standards.	***No-Action Alternative A***	
		No effects anticipated.	
		Action Alternatives B and C	
		Burning days would be controlled and monitored by *DEQ* and the smoke monitoring unit of the *Montana/Idaho Airshed Group* and would meet *EPA* standards; thereby, the direct and indirect effects of burning activities would be minimized.	Cumulative effects to air quality are not expected to exceed *EPA* and *DEQ* standards.
Dust produced from road construction, road maintenance, harvest-related traffic, and gravel-pit operations associated with the proposed action may adversely affect local air quality.		***No-Action Alternative A***	
		No effects anticipated.	
		Action Alternatives B and C	
		Direct and indirect effects to air quality are expected to be localized to the roadways and areas directly adjacent to the roadways. Vegetative barriers and abatement measures are expected to greatly limit the dispersion of	Cumulative effects to air quality are not expected to exceed *EPA* and *DEQ* standards.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		particulate matter beyond those areas.	
RECREATION			
Activities associated with the proposed action may affect recreational uses in the area and the subsequent revenue generated by such uses. The recreational uses of particular concern include public motorized use, hunting, and other public nonmotorized uses.	Several miles of road open, seasonally restricted, and closed to public motorized access exist throughout the area. Big game species are currently abundant throughout both analysis areas, affording many hunting opportunities. Ongoing forest-management activities temporarily displace recreationists to areas free of management. Revenue is generated by a number of recreational licenses throughout the area.	***No-Action Alternative A***	
		No effects anticipated.	
		Action Alternatives B and C	
		No changes in open roads or motorized access would occur. A 1- to 2.4-percent increase in road miles would be available for public nonmotorized recreation. No adverse direct or indirect effects to hunting are expected. As a result of forest-management activities, direct and indirect effects to recreationists during the work week are expected to be moderate to high, while direct and indirect effects to those who recreate during the weekend are expected to be minimal. No changes in revenue-producing recreational licenses are expected	Cumulative effects would result in increases in nonmotorized public access and further displacement of recreationists from active harvesting areas during typical business hours. Adverse cumulative effects are expected to be minor since recreationists would continue to have recreational opportunities throughout inactive subunits.
AESTHETICS			
Views Activities associated with the proposed action may affect visual quality as seen from specific observation	Several acres previously harvested and road miles are potentially visible from specific observation points, yet currently are inhibited by existing vegetative barriers in the foreground. The existing	***No-Action Alternative A***	
		No effects anticipated.	
		Action Alternatives B and C	
		Increases in the amount of visible acres and road miles would be negligible due to obstructions in the foreground and middleground	The contribution of visible harvested acres and new road miles under each action alternative as seen from each observation

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
points in the area.	landscape has various modifications of vegetative textures, forms, lines, and colors affecting the visual quality of the area.	of each observation point. Most visible acres from the observation points would appear relatively stark in contrast when adjacent to regenerating or unharvested stands.	point would be minor in comparison to what exists currently throughout the landscape.
Noise levels Activities associated with the proposed action may affect local noise levels.	Traffic, harvesting operations, rock blasting, and gravel crushing all produce noise throughout the area. Noise generated from these activities coincides with the rotational schedule required under the SVGBCA.	***No-Action Alternative A***	
		No effects anticipated.	
		Action Alternatives B and C	
		Direct and indirect effects to noise levels as a result of harvesting operations, harvest-related traffic, and gravel-pit operations associated with the action alternatives are expected to be moderate during the work week and minor during the weekend.	Except during periods of rock blasting and gravel crushing, cumulative effects to noise would not be expected to increase beyond current levels found in the cumulative-effects analysis area.
WILDLIFE			
Covertype The proposed activities could result in changes in the distribution of covertypes on the landscape, which could affect wildlife.	In the project area, mixed-conifer covertypes exceed historic amounts by 53 percent. However, western larch/Douglas-fir types are underrepresented by 18 percent and western white pine types are underrepresented by 29 percent. These conditions would benefit species that	***No-Action Alternative A***	
		Through natural forest succession, the abundance and representation of shade-tolerant tree species would continue to increase; benefitting wildlife species associated with those tree species and more dense forest conditions in the project area. Localized adverse effects to wildlife more closely associated with open forest conditions and shade-intolerant	Through natural forest succession, the abundance and representation of shade-tolerant tree species would continue to increase; benefitting wildlife species associated with those tree species and more dense forest conditions in the cumulative-effects analysis area. Adverse cumulative effects to wildlife more closely associated with open forest conditions and

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	prefer dense stands containing moderate to high proportions of shade-tolerant tree species.	tree species would be anticipated over time.	shade-intolerant tree species would be anticipated over time.
		Action Alternative B	
		Proposed activities would result in covertype conversions on 1,121 acres; primarily mixed-conifer covertypes being converted to western white pine covertypes. Lesser increases in western larch/Douglas-fir and ponderosa pine covertypes would also be anticipated, resulting in positive effects for wildlife species associated with shade-intolerant covertypes. Habitat quality would be adversely affected for species that use forest covertypes dominated by shade-tolerant tree species.	Endemic wildlife species that evolved under historic disturbance regimes would generally benefit from the proposed cumulative changes in covertype distributions. However, benefits would generally be realized in the longer term due to the necessary time required for covertype conversions to occur. Cumulative effects would tend to be positive for species that use shade-intolerant covertypes at the possible expense of those that benefit from an abundance of shade-intolerant types on the landscape.
		Action Alternative C	
		Proposed activities would result in covertype conversions on 848 acres; primarily mixed-conifer covertypes being converted to western white pine cover types. Lesser increases in western larch/Douglas-fir and ponderosa pine covertypes would also be anticipated resulting in positive effects for wildlife species	Endemic wildlife species that evolved under historic disturbance regimes would generally benefit from the proposed cumulative changes in covertype distributions. However, benefits would generally be realized in the longer term due to the necessary time required for covertype conversions to occur. Cumulative effects would tend to

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		associated with shade-intolerant covertypes. Habitat quality would be adversely affected for species that use forest covertypes dominated by shade-tolerant tree species.	be positive for species that use shade-intolerant covertypes at the possible expense of those that benefit from an abundance of shade-intolerant types on the landscape.
Age Class The proposed activities could alter the representation of stand age classes on the landscape, which could adversely affect wildlife.	In the project area, stands in the 0-to 39-year age class are slightly underrepresented. Stands in the 40-to-99-year age class are slightly overrepresented. Those in the 100-to-149-year age class are similar to historical conditions. Whereas, older stands 150 years old and greater are overrepresented by about 7 percent. Similar trends exist in the cumulative-effects analysis area.	***No-Action Alternative A***	
		In the short-term, no effects to age class would be expected. Over time and in the absence of natural disturbance, proportions of older to younger stands would become greater. This would lead to an increasing deviation from historic distributions of age classes, potentially promoting a reduction in the level of available habitat over time for species associated with young forest conditions.	In the short-term, no effects to age class would be expected. Over time and in the absence of natural disturbance, proportions of older to younger stands would become greater. This would lead to an increasing deviation from historic distributions of age classes, potentially promoting a cumulative reduction in the level of available habitat over time for species associated with young forest conditions.
		Action Alternative B	
		Regeneration harvests would convert older-aged stands to the youngest age class on 1,233 acres. Stands greater than 100 years old would continue to comprise over half of the project area. Reductions in habitat could cause adverse effects to wildlife species that prefer mature forest	Cumulative effects to wildlife species would be slightly negative to species associated with older forest stands, but positive for species that use younger age classes. In time, habitat proportions would more closely reflect the proportions under which wildlife in western Montana

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		conditions. Wildlife species that use meadows and young forests would benefit.	evolved, resulting in potential benefits to biodiversity.
		Action Alternative C	
		Regeneration harvests would convert older-aged stands to the youngest age class on 1,087 acres. Stands greater than 100 years old would continue to comprise over half of the project area. Reductions in habitat could cause adverse effects to wildlife species that prefer mature forest conditions. Wildlife species that use meadows and young forests would benefit.	Cumulative effects to wildlife species would be slightly negative to species associated with older forest stands, but positive for species that use younger age classes. In time, habitat proportions would more closely reflect the proportions under which wildlife in western Montana evolved, resulting in potential benefits to biodiversity.
Old Growth The proposed activities could affect wildlife species associated with old-growth forests by reducing the acreage of available habitat and by increasing fragmentation.	The project area has 3,542 acres of old growth, which represents about 23 percent of the forest acres. The average patch size in the project area is 60 acres. Similarly, there are 10,603 acres of old growth across the 41,700-acre Swan River State Forest, representing 25 percent of that area. Average patch size in the cumulative-effects analysis area is 83 acres.	***No-Action Alternative A***	
		No changes to the amounts, quality, or spatial arrangement of old-growth would occur. Old-growth-associated wildlife species would not be affected.	No changes in the amounts, quality, or spatial arrangement of old-growth would occur. No cumulative effects to old-growth-associated wildlife species would be expected.
		Action Alternative B	
		The total amount of old growth would be reduced on the project area by 14 percent. The number of large patches would slightly increase, but average large patch size would decrease by 25 percent.	The total amount of old growth would be reduced on Swan River State Forest area by 5 percent. The number of large patches would remain essentially the same. The average large patch size would

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		About 162 acres would be treated using old-growth maintenance or restoration treatments to perpetuate old-growth attributes. Stands in the 'mature' and 'old forest' categories would continue to represent 50 percent of the forested acres. A low level of adverse direct and indirect effects to wildlife associated with old-growth forests would be expected.	decrease by 8 percent. About 162 acres would be treated using old-growth maintenance or restoration treatments to perpetuate old-growth attributes. Stands in the 'mature' and 'old forest' age categories on Swan River State Forest would continue to represent approximately 53 percent of the forested acres. A low level of adverse cumulative effects to wildlife associated with old-growth forests would be expected.
		Action Alternative C	
		The total amount of old growth would be reduced on the project area by 1 percent. The number of large patches would slightly increase, but average large patch size would decrease by 5 percent. About 402 acres would be treated using old-growth maintenance or restoration treatments to perpetuate old-growth attributes. Stands in the 'mature' and 'old forest' categories would continue to represent 51 percent of the forested acres. A low level of adverse direct and indirect effects to wildlife associated with old-	The total amount of old growth would be reduced on Swan River State Forest area by 1 percent. The number of large patches would remain essentially the same. The average large patch size would decrease by less than 1 percent. About 402 acres would be treated using old-growth maintenance or restoration treatments to perpetuate old-growth attributes. Stands in the 'mature' and 'old forest' age categories on Swan River State Forest would also continue to represent approximately 53 percent of the

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		growth forests would be expected.	forested acres. A low level of adverse cumulative effects to wildlife associated with old-growth forests would be expected.
Habitat Connectivity and Fragmentation The proposed activities could result in alteration of the connectivity, patch size and amount of forest edge associated with forested habitat, which could reduce habitat quality and inhibit wildlife use and movements.	In the project area existing patch connectivity is high and 8,665 acres provide habitat that would facilitate movement of wildlife. The average patch size is 232 acres and approximately 216 miles of edge are present. In the cumulative-effects analysis area, 32,227 acres provide habitat that would facilitate movement of wildlife. The average patch size is 409 acres and approximately 621 miles of edge are present.	***No-Action Alternative A***	
		No changes from existing conditions regarding forest connectivity or habitat fragmentation would be anticipated.	
		Action Alternative B	
		Tree density would be reduced on 1,676 acres of upland mature forest resulting in a 19.3 percent reduction in forest acres that provide habitat connectivity. Average patch size would be reduced to 166 acres, representing a 28 percent reduction from existing conditions. Forest edge would be reduced by 17 miles (8 percent). A low to moderate degree of adverse effects to interior wildlife species would be anticipated.	Forest connectivity would be maintained along major drainages and riparian areas in the cumulative-effects analysis area. Forest acres providing connectivity would be reduced by 1,676 acres. Average patch size would be reduced to 354 acres representing a 13 percent reduction from existing conditions. Forest edge would be reduced by 9 miles (1.4 percent). A low degree of adverse effects to interior wildlife species would be anticipated.
		Action Alternative C	
		Tree density would be reduced on 2,216 acres of upland mature forest resulting in a 25.6-percent reduction in forest acres that provide habitat connectivity. Average patch size would be reduced to 119 acres, representing	Forest connectivity would be maintained along major drainages and riparian areas in the cumulative effects analysis area. Forest acres providing connectivity would be reduced by 2,216 acres. Average patch size would be

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		a 49-percent reduction from existing conditions. Forest edge would be reduced by 17 miles (8 Percent). A moderate degree of adverse effects to interior wildlife species would be anticipated.	reduced to 310 acres representing a 24.3-percent reduction from existing conditions. Forest edge would be reduced by 5 miles (0.8 percent). A low degree of adverse cumulative effects to interior wildlife species would be anticipated.
WILDLIFE (Continued)			
Linkage The proposed activities could increase open-road densities, increase human developments, and reduce forested cover, which could adversely affect linkage habitat for wildlife.	Project area lands contribute to high quality linkage habitat. Open-road amounts are relatively low at 2.4 linear miles and 1 primary area of existing human development exists (DNRC administrative buildings). In the project area, 8,801 acres (56 percent) of hiding cover exist. Highway 83 bisects the cumulative-effects analysis area, but the density of open roads in 5 affected grizzly bear subunits is relatively low. Existing human development is low in this area. Riparian areas and hiding cover are abundant.	***No-Action Alternative A***	
		No effects to important linkage attributes, or wildlife linkage habitat would be anticipated.	
		Action Alternative B	
		Open roads would not increase. Restricted roads would increase by 4.9 miles, and an additional 2.5 miles of temporary road would be established and used. A total of 55.4 miles of restricted roads would be accessed and used over the 3- to 4-year operating window. No additional human development would occur. Cover would be reduced on 1,538 acres (9.9 percent of the project area); however, 46 percent would remain across the project area and ample cover would be retained in riparian areas. Moderate short-term and minor long-term	Open roads would not increase. Restricted roads would increase by 4.9 miles, and an additional 2.5 miles of temporary road would be established and used. A total of 55.4 miles of restricted roads would be accessed and used over the 3- to 4-year operating window. No additional human development would occur. Cover would be reduced on 1,538 acres; however, 46.7 percent would remain across the cumulative-effects analysis area and ample cover would be retained in riparian areas. Low short-term and minor long-term negative effects to linkage habitat would be

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		negative effects to linkage habitat would be anticipated.	anticipated.
		Action Alternative C	
		Open roads would not increase. Restricted roads would increase by 8.2 miles, and an additional 3.5 miles of temporary road would be established and used. A total of 92.7 miles of restricted roads would be accessed and used over the 3- to 4-year operating window. No additional human development would occur. Cover would be reduced on 2,088 acres (13.2 percent of the project area); however, 43 percent would remain across the project area and ample cover would be retained in riparian areas. Moderate short-term and minor long-term negative effects to linkage habitat would be anticipated.	Open roads would not increase. Restricted roads would increase by 8.2 miles, and an additional 3.5 miles of temporary road would be established and used. A total of 92.7 miles of restricted roads would be accessed and used over the 3- to 4-year operating window. No additional human development would occur. Cover would be reduced on 2,088 acres; however, 45.9 percent would remain across the cumulative-effects analysis area and ample cover would be retained in riparian areas. Low short-term and minor long-term negative effects to linkage habitat would be anticipated.
Snags and Coarse Woody Debris The proposed activities could reduce the abundance and alter the distribution of snags and coarse woody	Estimated snag densities per acre by size class were 7 small, 3 medium, and 2 large for an average total of 12 snags per acre in the project area. Coarse woody debris estimates ranged from 0 to 77	***No-Action Alternative A***	
		No short-term changes in the abundance or distribution of snags or coarse woody debris would occur. Availability of these habitat attributes would increase over time and benefit associated wildlife species.	There would be no short-term cumulative changes in the abundance or distribution of snags or coarse woody debris. Availability of these habitat attributes would increase over time and benefit associated wildlife

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
debris, which could adversely affect species closely associated with these habitat attributes.	tons per acre and averaged 16 tons. Approximately 17,579 acres (42.2 percent) of forested stands in the cumulative-effects analysis area (DNRC-managed state lands only) were estimated to contain abundant snags and coarse woody debris.		species.
		Action Alternative B	
		Snag densities would be decreased on 2,010 acres due to influences of logging, commercial removal, and human safety considerations. A minimum of 2 large snags and 2 large recruitment trees per acre would remain in harvest units. No additional firewood cutting risk would be created. Coarse woody debris would also be altered on the 2,010 acres. However, amounts after harvesting would likely exceed existing levels and, would at a minimum, be retained at levels of 10 to 25 tons per acre. A low level of adverse effects to wildlife associated with snags and coarse woody debris would be anticipated.	Snag densities would be decreased on 2,010 acres due to influences of logging, commercial removal, and human safety considerations. A minimum of 2 large snags and 2 large recruitment trees per acre would remain in harvest units. No additional firewood cutting risk would be created. Coarse woody debris would also be altered on the 2,010 acres. However, amounts after harvesting would likely exceed existing levels and, would at a minimum, be retained at levels of 10 to 25 tons per acre. An appreciable abundance of snags and coarse woody debris would remain on 16,127 acres in the cumulative-effects analysis area. A minor level of adverse cumulative effects to wildlife associated with snags and coarse woody debris would be anticipated.
		Action Alternative C	
		Snag densities would be decreased on 2,636 acres due to influences of logging, commercial removal, and human safety	Snag densities would be decreased on 2,636 acres due to influences of logging, commercial removal, and human safety considerations. A

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		considerations. A minimum of 2 large snags and 2 large recruitment trees per acre would remain in harvest units. No additional firewood cutting risk would be created. Coarse woody debris would also be altered on the 2,636 acres. However, amounts after harvesting would likely exceed existing levels and, would at a minimum, be retained at levels of 10 to 25 tons per acre. A low level of adverse effects to wildlife associated with snags and coarse woody debris would be anticipated.	minimum of 2 large snags and 2 large recruitment trees per acre would remain in harvest units. No additional firewood cutting risk would be created. Coarse woody debris would also be altered on the 2,636 acres. However, amounts after harvesting would likely exceed existing levels and, would at a minimum, be retained at levels of 10 to 25 tons per acre. An appreciable abundance of snags and coarse woody debris would remain on 15,739 acres in the cumulative-effects analysis area. A minor level of adverse cumulative effects to wildlife associated with snags and coarse woody debris would be anticipated.
Grizzly Bear The proposed activities could result in a reduction of hiding cover that is important for grizzly bears, which could result in: 1) increased displacement of grizzly bears, 2) avoidance of otherwise	Hiding cover exists on 56 percent of the DNRC-managed state lands in the project area. Presently, hiding cover is fairly abundant in each of the subunits.	***No-Action Alternative A***	
		No effects would be anticipated.	
		Action Alternative B	
		The proposed harvesting would remove 1,538 acres of hiding cover from the existing 8,801 acres of hiding cover in the project area. Thus, minor adverse direct and indirect effects would be anticipated.	Proposed activities would reduce the amount of hiding cover in the individual cumulative-effects analysis areas by up to 8.4 percent. Similarly, the amount of hiding cover across all ownerships in the individual cumulative-effects analysis areas would be reduced to

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
suitable habitat, and/or 3) increased risk of bear-human conflicts.			between 59.5 and 72.1 percent, all of which would exceed the 40-percent minimum threshold required in the *SVGBCA*. Thus, minor adverse cumulative effects would be anticipated.
		Action Alternative C	
		The proposed harvesting would remove 2,088 acres of hiding cover from the existing 8,801 acres of hiding cover in the project area. Thus, minor adverse direct and indirect effects would be anticipated.	Proposed activities would reduce the amount of hiding cover in the individual cumulative-effects analysis areas by up to 12.7 percent. Similarly, the amount of hiding cover across all ownerships in the individual cumulative-effects analysis areas would be reduced to between 58.6 and 72.1 percent, all of which would exceed the 40-percent minimum threshold required in the *SVGBCA*. Thus, minor adverse cumulative effects would be anticipated.
The proposed activities could result in an increase in the density of roads, which could result in increased displacement of grizzly bears and increased risk of bear-human conflicts.	Presently, the project area has roughly 2.4 miles of open roads. At the larger scale, the individual cumulative-effects analysis areas have between 19 and 28 percent, with an open-road density greater than 1 mile per square mile of open road.	***No-Action Alternative A***	
		No effects would be anticipated.	
		Action Alternatives B and C	
		No new open roads would be constructed; thus, no changes in open-road densities would be anticipated.	No changes in open-road amounts or densities would be anticipated; thus, no changes in open-road densities would be anticipated.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
The proposed activities could result in a decrease in secure areas for grizzly bears, which could result in increased displacement of grizzly bears and risk of bear-human conflicts.	Security habitat currently exists on approximately 4.6 percent of the project area, much of which are included in larger blocks of security habitats that extend beyond the project-area boundary. The individual cumulative-effects analysis areas have between 15 and 42 percent in security habitats. On the DNRC-managed portions, between 62.5 and 94.7 percent of the individual cumulative-effects analysis areas exceed 2 miles per square mile of total-road density.	***No-Action Alternative A***	
		No effects would be anticipated.	
		Action Alternative B	
		Approximately 195 acres of security habitat would be removed. An increase in total road densities and disturbance levels associated with commercial timber harvesting would be anticipated. Harvesting would alter 1,512 acres of spring habitats in the linkage zone. Roughly 59 percent of the proposed units could be harvested only during the grizzly bear denning period, limiting potential disturbance to grizzly bears. Thus, minor adverse direct and indirect effects would be anticipated.	Minor reductions in security habitats would further reduce existing amounts in the individual cumulative-effects analysis areas to between 3.2 to 32.7 percent. Proposed road construction would increase the ranges of total road densities in affected subunits to 63.3 to 95.4 percent. Proposed harvesting would not alter spring habitats in the linkage zone in the Porcupine Woodward and Lion Creek cumulative-effects analysis areas, but could alter spring habitats in the linkage zone in the Goat Creek (479 acres) and South Fork Lost Soup (1,032 acres) cumulative-effects analysis areas. Thus, low to moderate cumulative effects would be anticipated.
		Action Alternative C	
		Approximately 239 acres of security habitat would be removed. An increase in total road densities and disturbance levels associated with commercial timber harvesting would be anticipated. Harvesting would	Minor reductions in security habitats would further reduce existing amounts in the individual cumulative-effects analysis areas to between 3.2 to 32.5 percent. Proposed road construction would increase the ranges of total-road

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		alter 1,518 acres of spring habitats in the linkage zone. Roughly 59 percent of the proposed units could be harvested only during the grizzly bear denning period, limiting potential disturbance to grizzly bears. Thus, minor adverse direct and indirect effects would be anticipated.	densities in affected subunits to 63.3 to 95.5 percent. Proposed harvesting would not alter spring habitats in the linkage zone in the Porcupine Woodward and Lion Creek cumulative-effects analysis areas, but could alter spring habitats in the linkage zone in the Goat Creek (479 acres) and South Fork Lost Soup (1,038 acres) cumulative-effects analysis areas. Thus, low to moderate cumulative effects would be anticipated.
Canada Lynx The proposed activities could result in the alteration of Canada lynx foraging habitat, denning habitat, and suitable habitat, rendering it unsuitable for supporting Canada lynx.	Approximately 7,931 acres of Canada lynx habitat occur in the 15,591-acre project area. Much of this habitat was identified as forested travel/other and mature foraging habitats, with lesser amounts of denning and temporarily not available habitats. Mature foraging and forested travel/other suitable habitats dominate the Goat Creek, Lion Creek, and South Fork Lost Soup cumulative-effects analysis areas; meanwhile the Porcupine	***No-Action Alternative A***	
		In the short term, no changes in Canada lynx habitat elements would be expected. In the longer term, natural succession would advance several classes forward, generally improving several classes of Canada lynx habitats; however, the further reduction in young foraging habitats would be expected in the absence of new regenerating stands to replace the limited, existing stands succeeding beyond young foraging habitat. Thus, minor beneficial direct and indirect effects would be anticipated.	
		Action Alternative B	
		Proposed activities would reduce canopy cover and horizontal cover, converting available Canada lynx habitats into temporary non-lynx habitats on 1,122 acres. Thus, minor adverse direct and indirect effects would be anticipated.	Conversion of denning habitat (107 acres in the South Fork Lost Soup Subunit) and mature foraging habitats (29 acres in Goat Creek and 743 acres in the South Fork Lost Soup Subunit) to temporary non-lynx habitats would alter available habitats, but all

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	Woodward cumulative-effects analysis area is dominated by forested travel/other habitats and denning habitats.		cumulative-effects analysis areas would exceed DNRC's commitment for Canada lynx habitats as required under *ARM 36.11.435*. Thus, minor adverse cumulative effects would be anticipated.
		Action Alternative C	
		Proposed activities would reduce canopy cover and horizontal cover, converting available Canada lynx habitats into temporary non-lynx habitats on 1,393 acres. Thus, minor adverse direct and indirect effects would be anticipated.	Conversion of denning habitat (226 acres in the South Fork Lost Soup Subunit) and mature foraging habitats (29 acres in Goat Creek and 810 acres in the South Fork Lost Soup Subunit, and 18 acres in the Porcupine Woodward Subunit) to temporary non-lynx habitats would alter available habitats, but all cumulative-effects analysis areas would exceed DNRC's commitment for Canada lynx habitats as required under *ARM 36.11.435*. Thus, minor adverse cumulative effects would be anticipated.
Bald Eagle The proposed activities could reduce bald eagle nesting and perching structures and/or disturb nesting bald	The project area includes the Van Lake bald eagle nest site and a portion of the associated nest site, primary use, and home range areas. Eagles have been documented on	***No-Action Alternative A***	
		No effects to eagles would be anticipated.	
		Action Alternative B	
		No effects to eagles would be anticipated.	
		Action Alternative C	
		Approximately 3 acres of one proposed harvest unit exists in the	Any potential disturbance and/or noise from the proposed harvesting

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
eagles.	Van Lake for at least the last 7 years. The territory has produced at the minimum of 6 chicks in the last 5 years, and the nesting success is unknown for 1 year. The aquatic habitat associated with this bald eagle territory includes Van Lake, Swan River, and several smaller wet meadows and wetlands in the project area.	primary use area associated with the Van Lake bald eagle territory, and an additional 247 acres of proposed harvest units occur in the home range associated with the territory. The proposed unit in the primary-use area would receive a shelterwood treatment, which would alter existing upland habitats, but would retain some structural and ecological characteristics important to eagles such as large emergent trees, snags, and potential perch and roost trees. This unit would be harvested between November 16 and February 1, limiting potential disturbance during the nesting season. Thus, minor direct and indirect effects would be anticipated.	would be additive to existing disturbances; however, no changes in bald eagle behavior would be anticipated. Emergent trees exist across ownerships in the home range. Thus, minor adverse cumulative effects would be anticipated.
Fisher The proposed activities could reduce the amount and/or quality of fisher habitats, which could alter fisher use of the area.	An estimated 8,045 acres of fisher habitat, potentially suitable for foraging, resting, denning, and travel activities, occur in the upland and riparian areas (7,512 upland acres and 533 riparian acres) in the project area. Much of the	***No-Action Alternative A***	
		No effects to fishers would be expected under this alternative. Little change to the 8,045 acres of potential fisher denning and foraging habitats would be expected. Habitats that are conducive to fisher denning and travel may improve over time due	Fisher habitats on DNRC-managed state lands in each of the cumulative-effects analysis areas would remain between 70.1 and 85.3 percent in the uplands and between 82.2 and 96.9 percent in the riparian areas. In the longer term, available fisher habitats in

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	riparian areas in the project area are preferred fisher covertypes (64 percent), and much of the preferred fisher covertypes (533 of 630 acres, or 85 percent) are moderately or well-stocked. These acres likely support the structural features necessary for use as fisher resting and denning habitats in addition to serving as travel habitats and maintaining landscape connectivity. Within the individual cumulative-effects analysis-areas, there are between 1,403 and 2,327 acres of riparian areas that are associated with 32to 100 miles of perennial and 27to 66 miles of intermittent streams. Within the cumulative-effects analysis areas, between 82.2 and 96.9 percent of the DNRC-managed acreage in preferred fisher covertypes in the riparian areas currently supports moderate- to well-	to increased tree growth and canopy closure; however, foraging opportunities may decline due to the lack of diversity in habitat such as edge and younger age-class stands.	the uplands and riparian areas would increase as stands develop more overhead cover. Thus, minor positive cumulative effects would be anticipated.
		Action Alternative B	
		Of the 8,045 acres of potential fisher habitats in the project area, 1,603 upland acres would be harvested and negligible riparian habitats would be altered. In each harvest unit, leave trees, at least 2 large snags, and 10 to 25 tons of coarse woody debris per acre would be retained, providing some fisher habitat attributes. Thus, minor adverse direct and indirect effects would be anticipated.	Available fisher habitat in the uplands would decline by up to 16.7 percent on DNRC-managed state lands in each of the cumulative-effects analysis areas. Negligible reductions in riparian habitats due to the proposed road construction near Cedar Creek would occur. Within the individual cumulative-effects analysis areas, between 82.2 and 96.9 percent of preferred fisher covertypes on DNRC-managed lands would continue providing structural features that could facilitate fisher use, which would continue to exceed the 75-percent threshold established in *ARM 36.11.440(1)(b)(i)*. Thus, minor adverse cumulative effects would be anticipated.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	stocked densities of sawtimber; thus, each of the cumulative-effects analysis areas exceed the 75-percent threshold established in *ARM 36.11.440(1)(b)(i)*. Additionally, within the cumulative-effects analysis areas, between 70.1 and 85.3 percent of the uplands on DNRC -managed lands in preferred fisher covertypes currently support moderate- to well-stocked densities of sawtimber, indicating potential upland fisher habitats.	***Action Alternative C***	
		Of the 8,045 acres of potential fisher habitats in the project area, 1,763 upland acres would be harvested and negligible riparian habitats would be altered. In each harvest unit, leave trees, at least 2 large snags, and 10 to 25 tons of coarse woody debris per acre would be retained, providing some fisher habitat attributes. Thus, minor adverse direct and indirect effects would be anticipated.	Available fisher habitat in the uplands would decline by up to 18.7 percent on DNRC-managed lands in each of the cumulative-effects analysis areas. Negligible reductions in riparian habitats due to the proposed road construction near Cedar Creek would occur. Within the individual cumulative-effects analysis areas, between 82.2 and 96.9 percent of preferred fisher covertypes on DNRC-managed state lands would continue providing structural features that could facilitate fisher use, which would continue to exceed the 75-percent threshold established in *ARM 36.11.440(1)(b)(i)*. Thus, minor adverse cumulative effects would be anticipated.
Flammulated Owl The proposed activities could alter flammulated owl habitat by reducing canopy closure and increasing tree spacing, and could remove snags needed by flammulated	Approximately 1,196 acres of the project area and approximately 1,639 acres in the cumulative-effects analysis area are potential flammulated owl habitat. Some potential habitats may exist on some of the 22,377	***No-Action Alternative A***	
		Continued succession could convert available habitats into denser stands with more Douglas-fir, which would reduce available habitats. Thus, minor adverse direct and indirect effects would be anticipated.	Continued succession could convert available habitats into denser stands with more Douglas-fir, which would reduce available habitats. No changes to existing habitats on other ownerships would occur. Thus, negligible adverse cumulative effects would

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
owls for nesting.	acres of closed and open forest on other ownerships in the cumulative-effects analysis area.		be anticipated.
		Action Alternative B	
		Canopy on roughly 48 acres of potential flammulated owl habitats would be opened up while favoring ponderosa pine, which would improve habitats for flammulated owls in this small area. Thus, minor positive direct and indirect effects would be anticipated.	Slight improvements in a small amount of flammulated owl habitats would be anticipated. Thus, negligible positive cumulative effects would be anticipated.
		Action Alternative C	
		Canopy on roughly 208 acres of potential flammulated owl habitats would be opened up while favoring ponderosa pine, which would improve habitats for flammulated owls in this small area. Thus, minor positive direct and indirect effects would be anticipated.	Slight improvements in a small amount of flammulated owl habitats would be anticipated. Thus, negligible positive cumulative effects would be anticipated.
Gray Wolf The proposed activities could result in reduced habitat quality on winter range for white-tailed deer and elk, which could lead to reduced prey availability and reduce the potential for	Big game species are abundant in the project area and cumulative-effects analysis area. Big game winter range is also fairly common in the project area and cumulative-effects analysis area. In the cumulative-effects analysis area, 30,925 acres of white-	***No-Action Alternative A***	
		No effects would be anticipated.	
		Action Alternative B	
		Stand density and mature forested cover would be reduced on 2,010 acres, including approximately 1,197 acres that would be incapable of ameliorating adverse effects of severe winters for big game following proposed	Stand density and mature forested cover would be reduced on 2,010 acres, including approximately 1,197 acres that would be incapable of ameliorating adverse effects of severe winters for big game following proposed treatments.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
the area to support a wolf pack.	tailed deer and 38,102 acres of elk winter range exist, as well as numerous meadows and other openings near water.	treatments. Thus, moderate adverse direct and indirect effects would be anticipated.	Thus, low to moderate adverse cumulative effects would be anticipated.
		Action Alternative C	
		Stand density and mature forested cover would be reduced on 2,636 acres, including approximately 1,314 acres that would be incapable of ameliorating adverse effects of severe winters for big game following proposed treatments. Thus, moderate adverse direct and indirect effects would be anticipated.	Stand density and mature forested cover would be reduced on 2,636 acres, including approximately 1,314 acres that would be incapable of ameliorating adverse effects of severe winters for big game following proposed treatments. Thus, low to moderate adverse cumulative effects would be anticipated.
The proposed activities could result in disturbance of wolves at denning or rendezvous sites, which could lead to pup abandonment and/or increased risk of mortality.	Landscape features commonly associated with denning and rendezvous sites occur in the project area and each of the cumulative-effects analysis areas. No den or rendezvous sites are known to exist in the project area or cumulative-effects analysis areas, but given the uncertainty associated with the wolves in the area and the presence of favorable landscape features, the assumption could be made that both den and rendezvous sites likely occur in some	***No-Action Alternative A***	
		No effects would be anticipated.	
		Action Alternatives B and C	
		Proposed harvesting could disrupt wolves at den or rendezvous sites. Approximately 59 percent of the proposed units could only be harvested during the grizzly bear denning period (November 16 through March 31). This seasonal restriction would limit the potential for disturbance to wolves during the spring period when they are more susceptible to disturbance at den and rendezvous sites. Thus, minor adverse direct and indirect effects would be anticipated.	Much of the proposed harvesting would occur in the winter period or would occur outside of the time periods when wolves would be using den or rendezvous sites. Additionally, mitigations would be included with both action alternatives to reduce the risk of potential disturbance to wolves at den and rendezvous sites, should one be confirmed in any of the cumulative-effects analysis areas. Thus, negligible adverse cumulative effects would be anticipated.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	portion of the project area or cumulative-effects analysis areas.		
The proposed activities could result in increased human disturbance and the potential for wolf-human conflicts that could alter wolf use of suitable habitats.	Human activity, generally in the form of dispersed and locally concentrated recreation, ranges from high along Swan River to low along the high elevations of the Mission and Swan divides. Roughly 2.4 miles of open roads provide some motorized public access to the project area. Between 30.1 to 44.9 percent of DNRC-managed state lands within the individual cumulative-effects analysis areas exceed an open-road density of 1 mile per square mile. In addition, in the individual cumulative-effects analysis areas, 67.5 to 214.3 miles of restricted roads provide considerable non-motorized access. Hiding cover is fairly abundant in the project area (8,801 acres, 56.5 percent) and cumulative-effects analysis areas (61.4 to 72.3 percent).	***No-Action Alternative A***	
		No effects would be anticipated.	
		Action Alternative B	
		Proposed activities could increase human activities in wolf habitats, thereby increasing the potential for disturbing wolves. The risk of human-wolf conflicts and/or wolf mortality in the project area could be increased through additional human access and reduced hiding cover attributable to new road construction and timber-harvesting operations. Approximately 4.9 miles of new, restricted road would be constructed to harvest the proposed units. Timber harvesting would remove 1,538 acres of hiding cover for 10 to 20 years. Thus, minor adverse direct and indirect effects would be anticipated.	Proposed activities could increase human activities in wolf habitats, thereby increasing the potential for disturbing wolves. Approximately 4.9 miles of new, restricted road would be constructed to harvest the proposed units, which would increase the amount of restricted road in the cumulative-effects analysis area by up to 4.1 percent. Hiding cover would be removed, reducing hiding cover on DNRC-managed portions of the cumulative-effects analysis area by up to 8.4 percent and overall across the cumulative-effects analysis areas by up to 3.4 percent. Thus, minor adverse cumulative effects would be anticipated.
		Action Alternative C	
		Proposed activities could increase human activities in wolf habitats, thereby increasing the potential	Proposed activities could increase human activities in wolf habitats, thereby increasing the potential for

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
		for disturbing wolves. The risk of human-wolf conflicts and/or wolf mortality in the project area could be increased through additional human access and reduced hiding cover attributable to new road construction and timber-harvesting operations. Approximately 8.2 miles of new, restricted road would be constructed to harvest the proposed units. Timber harvesting would remove 2,088 acres of hiding cover for 10 to 20 years. Thus, minor adverse direct and indirect effects would be anticipated.	disturbing wolves. Approximately 8.2 miles of new, restricted road would be constructed to harvest the proposed units, which would increase the amount of restricted road in the cumulative-effects analysis area by up to 5.6 percent. Hiding cover would be removed, reducing hiding cover on DNRC-managed portions of the cumulative-effects analysis area by up to 12.7 percent and overall across the cumulative-effects analysis areas by up to 4.1 percent. Thus, minor adverse cumulative effects would be anticipated.
Pileated Woodpecker The proposed activities could reduce suitable nesting and foraging habitat for pileated woodpeckers, which could alter pileated woodpecker use of the area.	In the project area, potential pileated woodpecker nesting habitat exists on approximately 4,389 acres and another 6,771 acres of sawtimber stands are potential foraging habitats. In the cumulative-effects analysis area, potential pileated woodpecker nesting habitat exists on approximately 6,079 acres (19.2 percent) of DNRC-	***No-Action Alternative A***	
		Negligible effects to pileated woodpeckers would be anticipated in the short-term; in the long term, succession would reduce pileated woodpecker habitats.	
		Action Alternative B	
		Harvesting would remove 1,108 acres of potential nesting habitats and another 729 acres of potential foraging habitats; total removal would be approximately 1,837 acres (a 16.5-percent reduction) in the project area. Thus, minor adverse direct and indirect effects	Potential nesting habitat would be reduced to 4,971 acres (a 18.2-percent reduction) and foraging habitats would be reduced to 15,469 acres (a 4.5-percent reduction) on DNRC-managed lands in the cumulative-effects analysis area. Thus, low to

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	managed state lands and an additional, 16,198 acres (51.1 percent) of sawtimber stands on DNRC-managed state lands in the cumulative-effects analysis area that are potential foraging habitats. Some potential pileated woodpecker habitats also exist on the 22,377 acres of forested habitats on other ownerships in the cumulative-effects analysis area.	would be anticipated.	moderate adverse cumulative effects would be anticipated.
		Action Alternative C	
		Harvesting would remove 1,149 acres of potential nesting habitats and another 1,184 acres of potential foraging habitats; total removal would be approximately 2,333 acres (a 20.9-percent reduction) in the project area. Thus, minor adverse direct and indirect effects would be anticipated.	Potential nesting habitat would be reduced to 4,930 acres (a 18.9-percent reduction) and foraging habitats would be reduced to 15,469 acres (a 7.3-percent reduction) on DNRC-managed lands in the cumulative-effects analysis area. Thus, low to moderate adverse cumulative effects would be anticipated.
Big Game Winter Range The proposed activities could remove forest cover on important winter ranges, which could lower their capacity to support elk, mule deer, and white-tailed deer.	In the project area elk winter range occurs on 14,925 acres, mule deer winter range occurs on 3,086 acres, and white-tailed winter range occurs on 14,341 acres. Dense, forest cover capable of lessening severe winter conditions occurs on 3,747 acres in the project area. In the cumulative-effects analysis area, elk winter range occurs on 38,102 acres, mule deer winter range occurs on 14,408 acres, and white-tailed deer winter range occurs on 30,925	***No-Action Alternative A***	
		No effects would be anticipated.	
		Action Alternative B	
		Mature forest cover would be altered on 2,010 acres in the project area, of which 1,314 acres would be rendered incapable of lessening adverse winter conditions for elk and deer. Retained cover patches would generally remain well connected. About 34.1 miles of restricted road and 28 miles of existing open road would be used to conduct timber-harvesting activities. Of the 2,010 acres affected, 1,182 would be harvested in the winter. A	Mature forest cover would be altered on 2,010 acres (2 percent of the cumulative-effects analysis area), of which 1,314 acres would be rendered incapable of lessening adverse winter conditions for elk and deer. Of the 2,010 acres affected, 1,182 would be harvested in the winter. Over 4,500 acres of dense forest cover would remain in the cumulative-effects analysis area. Retained cover patches would generally remain connected. About 55.4 miles of road would be

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
	acres. Dense, forest cover capable of lessening severe winter conditions occurs on 6,380 acres in the project area.	moderate degree of adverse effects to winter-range habitat and associated big game species would be anticipated.	used for timber-harvesting activities in addition to 78 miles of existing open road in winter range areas. A low to moderate degree of adverse effects to winter-range habitat and associated big game species would be anticipated.
		Action Alternative C	
		Mature forest cover would be altered on 2,636 acres in the project area, of which 1,197 acres would be rendered incapable of lessening adverse winter conditions for elk and deer. Retained cover patches would generally remain connected. About 47.2 miles of restricted road and 28 miles of existing open road would be used to conduct timber-harvesting activities. Of the 2,636 acres affected, 1,553 would be harvested in the winter. A moderate degree of adverse effects to winter-range habitat and associated big game species would be anticipated.	Mature forest cover would be altered on 2,636 acres (2 percent of the cumulative-effects analysis area), of which 1,197 acres would be rendered incapable of lessening adverse winter conditions for elk and deer. Of the 2,636 acres affected, 1,553 would be harvested in the winter. Over 4,500 acres of dense forest cover would remain in the cumulative-effects analysis area. Retained cover patches would generally remain connected. About 92.7 miles of road would be used for timber-harvesting activities in addition to 78 miles of existing open road in winter range areas. A low to moderate degree of adverse effects to winter-range habitat and associated big game species would be anticipated.

RESOURCE ISSUE	EXISTING ENVIRONMENT	DIRECT AND INDIRECT IMPACTS	CUMULATIVE IMPACTS
WILDLIFE (Continued)			
Elk Security Habitat The proposed activities could remove elk security cover, which could affect hunter opportunity and the local quality of recreational hunting.	In the project area, 2,966 acres (19 percent) of security habitat are present. In the cumulative-effects analysis area 13,999 acres (33.6 percent) of security habitat are present, exceeding the 30 percent recommended amount (*Hillis et al. 1991*).	***No-Action Alternative A***	
		No effects would be anticipated.	
		Action Alternative B	
		Elk security habitat would be removed on 296 acres (a 10-percent reduction) and 5.2 linear miles of permanent restricted road would be constructed. Minor adverse effects associated with reductions in elk security habitat and elk vulnerability would be anticipated.	Elk security habitat would be removed on 296 acres (a 2.1-percent reduction). Following harvesting, security habitat would remain on 33.4 percent of the cumulative-effects analysis area. Minor adverse cumulative effects associated with reductions in elk security habitat and elk vulnerability would be anticipated.
		Action Alternative C	
		Elk security habitat would be removed on 346 acres (11.7 percent) and 8.0 linear miles of permanent restricted road would be constructed. Minor adverse effects associated with reductions in elk security habitat and elk vulnerability would be anticipated.	Elk security habitat would be removed on 346 acres (a 2.5-percent reduction). Following harvesting, security habitat would remain on 32.7 percent of the cumulative-effects analysis area. Minor adverse cumulative effects associated with reductions in elk security habitat and elk vulnerability would be anticipated.

CHAPTER III – EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS

INTRODUCTION

This chapter is a summary of resource conditions as they relate to the proposed Scout Lake Multiple Timber Sale Project. The current, or existing, condition can be viewed as a baseline to compare changes resulting from the selection of any alternative. How each alternative may affect the environment is also described. For more complete assessments and analyses related to the resources for both scientific and judicial review, refer to the appropriate section of this DEIS.

VEGETATION ANALYSIS

INTRODUCTION

This analysis describes current vegetative conditions on Swan River State Forest and discloses the potential direct, indirect, and cumulative environmental effects that may result under each alternative associated with the proposed action.

ISSUES AND MEASUREMENT CRITERIA

Issues regarding the effects of harvesting activities on the various vegetation components were identified through public and internal scoping. These issues are listed in *TABLE I-1 – ISSUES STUDIED IN DETAIL* and are reiterated at the beginning of each topic section (cover type, age class, etc). Various measurement criteria were utilized to evaluate the effects of the alternatives, depending on the vegetative component. The criteria used for evaluation are described under *ANALYSIS AREAS* and *ANALYSIS METHODS*, below.

ANALYSIS AREAS

Direct and Indirect Effects

The analysis area for the direct and indirect effects was examined at the nested scales of the entire Swan River State Forest and the Scout Lake Multiple Timber Sale project area *(*see *PROJECT AREA MAP* located before *CHAPTER I – PURPOSE AND NEED)*.

Considering effects at each nested scale is important because activities within 1 scale can influence all scales and effects at 1 scale may be unapparent or misleading in representation of effects at another scale.

Cumulative Effects

The analysis area used to assess cumulative effects includes all ownerships within the perimeter of Swan River State Forest. Lands adjacent to or within the perimeter of Swan River State Forest, such as the *U.S. Forest Service (USFS)* and DFWP; private, noncommercial, and Trust for Public Lands/The Nature Conservancy (formerly Plum Creek) will be addressed to the extent possible. While *DNRC* does not have adequate data to quantitatively discuss conditions or ownership changes on other lands in the analysis area, we acknowledge that management actions on these other lands can have ecological effects to resources on DNRC-managed lands; thus, these effects will be discussed qualitatively.

ANALYSIS METHODS

Effects to forest vegetation are described and analyzed in terms of covertype representation, age-class distributions, old-growth amounts and attribute levels, patch dynamics, forest fragmentation, stand structure and vigor, crown cover, fire effects, the role of insects and diseases, sensitive plants, and noxious weeds. Specific methods used to analyze each of those attributes are further described in the following effects analyses.

Direct and Indirect Effects

Direct and indirect effects analyses for both the entire Swan River State Forest and project-level analysis area are presented throughout the *DEIS*. Much of the analysis uses data from DNRC's

stand-level inventory (*SLI)*. The *SLI* quantifies stand characteristics for all forest stands in Swan River State Forest and is incorporated into DNRC's *Geographic Information System (GIS).* The *SLI* is updated annually to account for harvesting activities and periodically through reinventory. This process provides *DNRC* foresters with current data for use in analyses of proposed management activities.

Volume information for the majority of the stands proposed for treatment was collected during a pretimber sale cruise in May and July of 2011. This data was used to develop estimates of final harvest volumes and residual stand conditions. During the cruise, DNRC personnel also made ocular verification of the old-growth status of stands.

Cumulative Effects

Since ongoing and future timber sales have not undergone postharvest inventory, effects of these sales are estimated in order to address cumulative effects under each analysis section. The timber sales listed in *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* under *SCOPE OF THIS EIS* in *CHAPTER I* were considered along with the *SLI* database.

Activities on adjacent lands, such as USFS, DFWP, private, noncommercial, and Trust for Public Lands/The Nature Conservancy, will also be addressed to the extent possible under cumulative effects.

FOREST ECOLOGY AND PAST MANAGEMENT

PAST MANAGEMENT

The first known harvest in Swan River State Forest took place in the early 1900s. All residual signs of the activities indicate that the harvest was very minimal in scope and acreage. Timber harvesting on a larger scale began in and adjacent to the project area during the 1960s. Most of the harvesting in the 1960s were regeneration harvests on 20-acre units and occurred in the flatter areas at the base of the Mission Range. Seedtree and clearcut harvesting between 1970 and 1992 have created 10- to 150-acre openings with dense regeneration. Signs of individual tree-selection harvests, skid trails, and stumps from logging that took place in the era from the 1960s to the 1980s are scattered throughout many of the stands. Several salvage projects have taken place in the project area since the 1990s, with several permits having been completed in the areas immediately within and adjacent to the project area. The Goat Squeezer and Three Creeks Timber Sale projects during 2003 through the spring of 2011 were the latest large timber sales in the project area. According to the *SLI*, the majority of the stands (82.5 percent) in the project area have been entered at some point in the past.

Most harvested stands have regenerated successfully, either naturally or by planting, and are dominated by various combinations of western larch, lodgepole pine, western white pine, and ponderosa pine. Most harvested stands also contain minor components of one or more of the following species: grand fir, subalpine fir, Douglas-fir, western red cedar, and Engelmann spruce.

USFS, former Plum Creek lands, and other privately held lands adjacent to the project area have been harvested with various silvicultural treatments; these lands include Sections 31 and 33,

T24N, R17W; Section 25, T24N, R18W; Sections 3, 5, 7, 9, 11, 14, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, and 35, T23N, R17; and Sections 1, 13, 25, and 31, T23N, R18W. Many of these harvests have created abrupt straight edges that follow ownership boundaries along section lines.

STAND DEVELOPMENT

Natural processes of stand development and disturbance are influenced by environmental conditions and site characteristics, including landform, soil type, aspect, elevation, growing season (climate), and moisture availability. The interaction of these factors determines, in part, the plant species assemblage, productivity, and the disturbance regimes affecting a site.

Most stands typically follow a repeated pattern of development, known as succession, where stand structure and species composition change through time. For example, the development of even-aged stands can be described in 4 stages (*Oliver and Larson, 1996*), beginning with a disturbance that initiates the development of a new stand of trees that colonize the site for several years (stand initiation). Following stand initiation, the new stand will enter a stem-exclusion stage where existing individual trees and species begin to express dominance over other trees and species in terms of height and diameter growth and new trees do not readily establish in the stand. Eventually, understory plants and shrubs will appear underneath the main forest canopy, including tree species tolerant of growing in shaded conditions (understory reinitiation). Following understory reinitiation, the forest eventually reaches a steady-state phase where some overstory trees die and create canopy gaps, allowing trees growing in the understory to advance into the main forest canopy. At any point in stand development, a disturbance, such as wildfire, insects and diseases, windthrow, or human-caused activities, such as timber harvesting, may modify the existing stand's structure and species composition, interrupting the progression of stand development and returning the stand to a previous stage. Disturbance generally creates conditions favorable to shade-intolerant species, such as western larch, and the absence of disturbance generally promotes shade-tolerant species such as grand fir, western red cedar, and western hemlock. As such, shade-intolerant species typically dominate the early stages of stand development; therefore, in the absence of disturbance, shade-tolerant species typically dominate the later stages of stand development.

Many of the stands proposed for harvesting in the project area follow this model of stand development and are in the understory reinitiation and steady-state phases. Proposed treatments would attempt to emulate naturally occurring disturbance patterns and, in most cases, would retain stands in or return stands to earlier stages of succession dominated by shade-intolerant species.

FOREST HABITAT TYPES

Similar sites will often share similar plant communities, succession, and disturbance patterns. Repeated patterns of similar site conditions and plant-species assemblages have been used to develop classifications of forest habitat types (*Pfister et al.* 1977) that describe the potential vegetation communities, patterns of succession (stand development), and potential productivity of similar sites. Forest habitat types do not necessarily describe the current vegetation on a site because they describe the potential vegetation community that could develop and perpetuate

itself on a site in the absence of disturbance. For that reason, the habitat type identified for a given site will not change following disturbance, including timber harvesting.

While minor differences in plant communities and site productivity exist among similar forest habitat types, many share similar naturally occurring disturbance patterns, such as the way fire behaves and affects those habitat types, and, as such, can be arranged into broad groups *(Fischer and Bradley 1987).* In the project area, 75 percent of the area is categorized as belonging to the warm, moist, grand fir, western red cedar, and western hemlock habitat-type group. Without disturbance, stand growing on these habitat types would eventually develop into mixed-conifer forests dominated by shade-tolerant species, such as grand fir, western red cedar, or western hemlock. The moist, low-elevation subalpine habitat-type group occurs on 16 percent of the area, and Douglas-fir habitat types are found on the remaining 9 percent of the area.

The stands proposed for harvesting are included in the warm and moist grand fir, cedar, and hemlock; moist, low-elevation subalpine; and cool, moist Douglas-fir habitat-type groups. Typically, these groups have relatively high timber production, regenerate best with more intensive management treatments that mimic major stand disturbances (such as fire), and provide great opportunities for early seral species. *TABLE III-1 – ACRES TREATED PER HARVEST PRESCRIPTION BY HABITAT-TYPE GROUP* shows the proposed amount of acres being treated within these habitat type groups by harvest prescription.

TABLE III-1 – ACRES TREATED FOR EACH HARVEST PRESCRIPTION BY HABITAT-TYPE GROUP

ACTION ALTERNATIVE	HARVEST PRESCRIPTION	HABITAT-TYPE GROUPS			
		WARM AND MOIST	MOIST, LOW ELEVATION SUBALPINE	COOL, MOIST DOUGLAS-FIR	*TOTALS*
B	Variable Thin	584	67	0	*651*
	Shelterwood	412	135	46	*593*
	Seedtree	720	0	0	*720*
	Totals	*1,716*	*202*	*46*	*1,964**
C	Variable Thin	1,216	125	51	*1,392*
	Shelterwood	232	109	165	*506*
	Seedtree	643	48	0	*691*
	Totals	*2,091*	*282*	*216*	*2,589**

**Total acres differ slightly due to a habitat type not being assigned to the administrative site.*

ELEVATION AND ASPECT

Elevation and aspect interact to influence the moisture and temperature of a stand, and, therefore, the plant species capable of growing there. The project area ranges in elevation from 3,100 to 6,000 feet. A large portion of the project area has a flat to gently rolling topography; consequently, a wide range of sites of both moisture and temperature gradients (from wet to dry and cool to warm) are found in the project area. Cooler, wetter stands typically develop overstories of western white pine, western larch, Douglas-fir, grand fir, western redcedar, Engelmann spruce, lodgepole pine, and subalpine fir, while warmer and dryer sites are likely to have components of ponderosa pine, Douglas-fir, western larch, and lodgepole pine.

FOREST COVERTYPES AND DESIRED FUTURE CONDITIONS

Issue: The proposed activities may affect forest covertypes through species removal or changes in species composition.

EXISTING ENVIRONMENT

Covertypes describe the species composition of forest stands. Covertype representation often varies according to the frequency of disturbances. Some early seral-species-dominated types, such as ponderosa pine, reflect a frequent low-intensity disturbance that helps perpetuate the shade-intolerant ponderosa pine. Other covertypes, such as mixed conifer, are indicative of infrequent and more severe disturbance regimes, and are typically found in the later stages of stand development.

The protocol used to assign covertypes on DNRC-managed forest lands, including Swan River State Forest, is explained in detail in *Forest Management Rules (36.11.401* through *406 ARM).* The methods used to analyze current and desired stand conditions are described below.

This covertype analysis compares historic forest conditions, desired future conditions, and current stand conditions in terms of forest-species composition. Tracking expected changes in the amount of preharvest and postharvest acreage in specific covertypes helps to describe project effects to forest vegetation and track movement toward or away from desired future conditions. Where appropriate, the climatically- and physiographically-defined "*Upper Flathead Section*" (*M333C*) of the larger, vegetation-defined "*Northern Rocky Mountain Forest-Steppe-Coniferous Forest–Alpine Meadow Province*" (*Province M333*) (*Bailey et al. 1994*) was utilized as a reference for the historical conditions in Swan River State Forest and the project area. Historic conditions of age classes and covertypes were quantified by *Losensky (1997*), who used forest inventory data from the 1930s to estimate the historic proportion of age classes by forest covertype for Montana. This provided an estimate of age-class distribution and stand composition prior to Euro/American settlement and the effects of fire suppression, selective logging, cattle and sheep grazing, and the full impact of white pine blister rust.

Current conditions and desired future conditions are defined using DNRC's site-specific *SLI* (*TrustLandsData20110616*). The DNRC site-specific model (*ARM 36.11.405*) was used to determine the characteristics of the desired future conditions and to evaluate potential direct, indirect, and cumulative effects. This model assigns a desired future condition in terms of covertype for each stand identified in the *SLI*. At the administrative unit level, the aggregate acreage of each desired future covertype describes a broad picture of the desired future conditions for that unit. This provides a basis for comparison of current and desired future conditions at both the project and landscape (administrative unit) levels. Field observations and tree data collected during the spring and summer of 2011 were used to verify and further refine descriptions of specific forest stand characteristics in the project area.

The following figures illustrate the proportion of forest occupied by various covertypes at differing scales and time periods. *FIGURE III-1 – PROPORTION OF HISTORIC CONDITIONS (1930s) BY COVERTYPE FOR SWAN RIVER STATE FOREST* shows the historical proportional representation of covertypes for Swan River State Forest. Results within *FIGURE- III-2 – CURRENT COVERTYPE PROPORTIONS FOR SWAN RIVER STATE FOREST*, *FIGURE - III-3 –*

DESIRED FUTURE CONDITON BY COVERTYPE ON SWAN RIVER STATE FOREST, and *TABLE III-2- CURRENT COVERTYPE AND DESIRED FURTURE CONDITIONS FOR SWAN RIVER STATE FOREST AND THE PROJECT AREA* indicate that mixed-conifer stands are currently overrepresented compared to historic data and desired future conditions.

Compared to desired future conditions, the western larch/Douglas-fir and western white pine covertypes are currently underrepresented on Swan River State Forest, but for different reasons. Western larch and Douglas-fir are preferred timber species that were often removed by partial or selective harvest methods that failed to provide suitable conditions for regenerating the species. Additionally, a lack of natural disturbances has prevented regeneration of western larch across much of Swan River State Forest, particularly in the dense old stands common throughout the project area, and has resulted in a shift in dominance from the shade-intolerant species like western larch and Douglas-fir toward the shade-tolerant species like grand fir and western red cedar.

Data for Swan River State Forest indicates that the extent of the western white pine covertype is considerably lower than that which occurred historically. Field reconnaissance through *SLI* data collection has determined that western white pine was more prevalent, percentagewise, than expressed in the historical data. Thus, the desired future condition percentage for western white pine is larger than the historical percentage to reflect this. White pine blister rust has drastically affected western white pine, reducing its representation to less than 10 percent of its historical range *(Fins et al. 2001).* The number of healthy western white pine that occupy the canopy as overstory dominants has been on the decline across its range for several decades despite multiorganization cooperative efforts to restore this species on the landscape. So, while cooperative efforts have produced rust-resistant seed suitable for deployment throughout its range, planting has been unable to keep pace with losses due to blister rust.

FIGURE III-1 – PROPORTION OF HISTORIC CONDITIONS (1930s) BY COVERTYPE FOR SWAN RIVER STATE FOREST

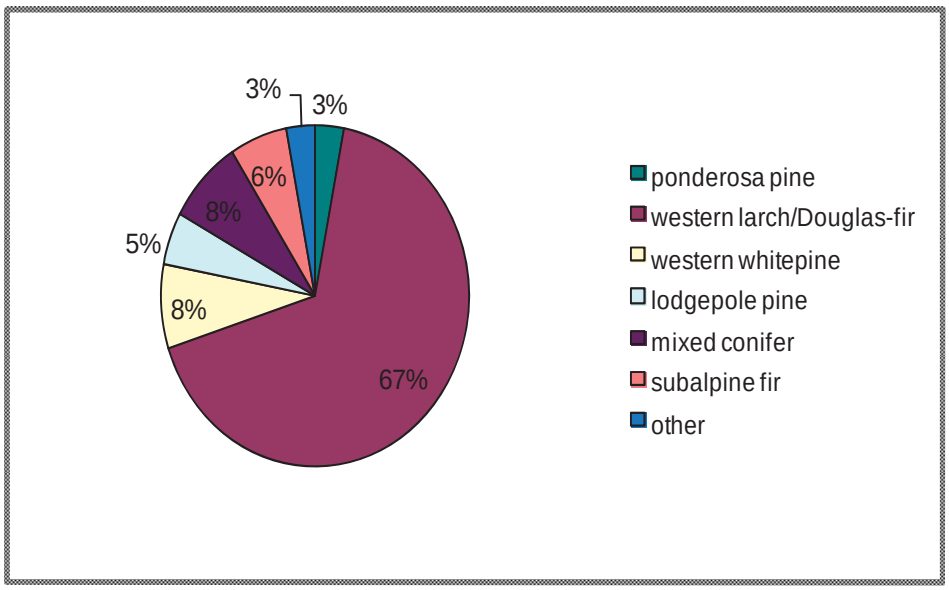


FIGURE III-2 – CURRENT COVERTYPE PROPORTIONS FOR SWAN RIVER STATE FOREST

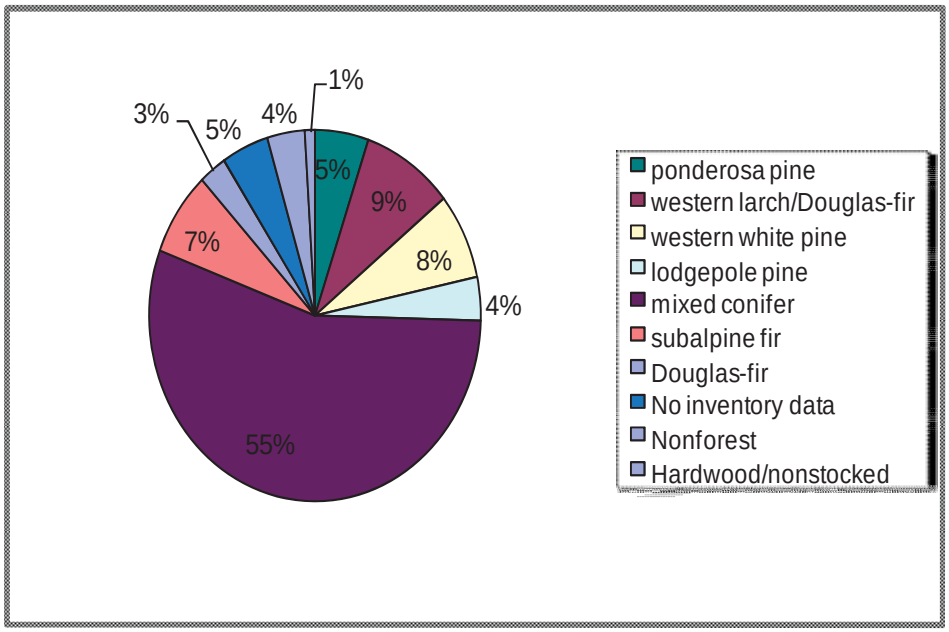


FIGURE III-3 – DESIRED FUTURE CONDITION BY COVERTYPE ON SWAN RIVER STATE FOREST

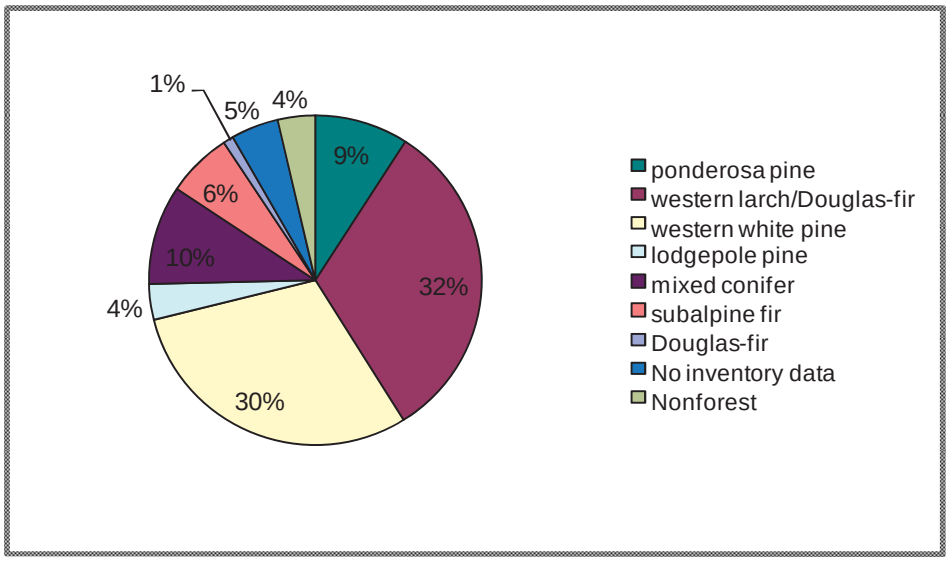


TABLE III-2- CURRENT COVERTYPE AND DESIRED FURTURE CONDITIONS FOR SWAN RIVER STATE FOREST AND THE PROJECT AREA

COVERTYPE	SWAN RIVER STATE FOREST				
	CURRENT (ACRES)	**PERCENT OF TOTAL**	**DESIRED FUTURE CONDITION (ACRES)**	**PERCENT OF TOTAL**	***DIFFERENCE (PERCENT)***
Ponderosa pine	2,174	5.21	3,786	9.08	*3.87*
Douglas-fir	1,131	2.71	425	1.02	*-1.69*
Western larch/ Douglas-fir	3,728	8.94	13,400	32.13	*23.19*
Western white pine	3,154	7.56	12,503	29.98	*22.42*
Lodgepole pine	1,540	3.69	1,428	3.42	*-0.27*
Mixed conifer	23,149	55.51	4,073	9.77	*-45.75*
Subalpine fir	3,083	7.39	2,663	6.39	*-1.01*
Nonforested Non-water	1,516	3.64	1,508	3.62	*-0.02*
Nonstocked	220	0.53	0	0.00	*-0.53*
Hardwoods	91	0.22	0	0.00	*-0.22*
No inventory data	1,914	4.59	1,914	4.59	*0.00*
Totals	*41,700*	*100.00*	*41,700*	*100.00*	
SCOUT LAKE PROJECT AREA					
	CURRENT (ACRES)	**PERCENT OF TOTAL**	**DESIRED FUTURE CONDITION (ACRES)**	**PERCENT OF TOTAL**	***DIFFERENCE (PERCENT)***
Ponderosa pine	1,677	10.76	2,989	19.18	*8.42*
Douglas-fir	347	2.23	208	1.33	*-0.89*
Western larch/ Douglas-fir	1,180	7.57	3,965	25.44	*17.87*
Western white pine	882	5.66	5,479	35.15	*29.49*
Lodgepole pine	863	5.54	769	4.93	*-0.60*
Mixed conifer	9,753	62.58	1,438	9.23	*-53.35*
Subalpine fir	30	0.19	0	0.00	*-0.19*
Nonforested Non-water	738	4.74	738	4.74	*0.00*
Nonstocked	94	0.60	0	0.00	*-0.60*
Hardwoods	22	0.14	0	0.00	*-0.14*
No inventory data	0	0.00	0	0.00	*0.00*
Totals	*15,586*	*100.00*	*15,586*	*100.00*	

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Covertypes***

  The amount of western larch/Douglas-fir and western white pine covertypes would remain lower than *DNRC's* identified desired future conditions amounts (*FIGURE III-2 – CURRENT COVERTYPE PROPORTIONS FOR SWAN RIVER STATE FOREST* and *FIGURE III-3 – DESIRED FUTURE CONDITION BY COVERTYPE ON SWAN RIVER STATE FOREST*). Shade-tolerant species would continue to regenerate under closed-canopied forests. Over time, early seral-dominated covertypes, such as western larch/Douglas-fir and western white pine, would be expected to decrease, and shade-tolerant covertypes, such as mixed conifer, would increase.

  Forest succession, driven by the impacts of forest insects and diseases when fires are being suppressed, would reduce the variability of covertypes. As the forest ages and composition become more homogenous, biodiversity would be reduced.

- ***Direct and Indirect Effects of Action Alternative B to Covertypes***

  This alternative proposes a regeneration harvest using seedtree and shelterwood treatments on approximately 1,313 acres, and variable thinning on approximately 696 acres.

  Treatments on approximately 1,121 acres of the mixed-conifer covertype would result in conversion to the following covertypes: western larch/Douglas-fir, 139 acres; western white pine, 860 acres; ponderosa pine, 76 acres; and Douglas-fir, 45 acres. Approximately 76 acres of the western larch/Douglas-fir covertype would be converted to a western white pine covertype by harvesting shade-tolerant species (grand fir, Engelmann spruce, western red cedar, etc.) and planting various combinations of western larch, ponderosa pine, and blister rust-resistant western white pine. No change in covertype would be expected following harvesting on approximately 503 acres of the mixed conifer, 48 acres of the western white pine, 51 acres of the western larch/Douglas-fir, 120 acres of the lodgepole pine, and 44 acres of the ponderosa pine covertypes. Approximately 46 acres would be treated around a forest administrative site, which is currently classified as a nonforested covertype.

  The proportion of the western larch/Douglas-fir covertype in the project area would increase from the current level of 7.55 to 7.95 percent, the proportion of the western white pine covertype would increase from the current level of 5.64 to 11.62 percent, the proportion of the Douglas-fir covertype would increase from the current level of 2.22 to 2.5 percent, and the proportion of the ponderosa pine covertype would increase from the current level of 10.72 to 11.21 percent due to a combination of harvest prescriptions and planting. The proportion of the mixed-conifer covertype in the project area would decrease from the current level of 62.35 to 55.19 percent (see *TABLE III-3 – COVERTYPE CHANGE BY ACTION ALTERNATIVE FOR THE PROJECT AREA AND SWAN RIVER STATE FOREST*).

TABLE III-3 – COVERTYPE CHANGE BY ACTION ALTERNATIVE FOR THE PROJECT AREA AND SWAN RIVER STATE FOREST

COVERTYPE	ACTION ALTERNATIVES					
	B			C		
	CHANGE IN ACREAGE	CHANGE IN PERCENT		CHANGE IN ACREAGE	CHANGE IN PERCENT	
		PROJECT AREA	SWAN RIVER STATE FOREST		PROJECT AREA	SWAN RIVER STATE FOREST
Ponderosa pine	76	0.49	0.18	36	0.23	0.09
Western larch/Douglas-fir	63	0.40	0.18	126	0.80	0.30
Western white pine	937	5.99	2.24	646	4.13	1.55
Mixed Conifer	-1,121	-7.17	-2.68	-798	-5.10	-1.91
Lodgepole pine	0	0.00	0.00	40	0.26	0.10
Douglas-fir	45	0.29	0.11	-50	-0.32	-0.12

- ***Direct and Indirect Effects of Action Alternative C to Covertypes***

  This alternative proposes regeneration harvests using seedtree, and shelterwood treatments on approximately 1,197 acres and variable thinning on approximately 1,438 acres.

  Treatments on approximately 798 acres of the mixed-conifer cover-type would result in conversion to the following cover-types: western larch/Douglas-fir, 233 acres; western white pine, 539 acres; lodgepole pine, 16 acres; and Douglas-fir, 11 acres. Treatments on approximately 61 acres of the Douglas-fir covertype would result in conversion to the following covertypes: ponderosa pine, 36 acres, and lodgepole pine, 25 acres. Approximately 107 acres of the western larch/Douglas-fir covertype would be converted to the western white pine covertype by harvesting shade-tolerant species (grand fir, Engelmann spruce, western red cedar, etc.) and planting various combinations of western larch, ponderosa pine, and blister rust-resistant western white pine. No change in covertype would be expected following harvesting on approximately 1,077 acres of the mixed-conifer, 103 acres of the western white pine, 143 acres of the western larch/Douglas-fir, 190 acres of the lodgepole pine, 76 acres of the ponderosa pine, and 35 acres of the Douglas-fir covertypes. Approximately 46 acres would be treated around a forest administrative site, which is currently classified as a nonforested covertype.

  The proportion of the western larch/Douglas-fir covertype in the project area would increase from the current level of 7.55 to 8.35 percent, the proportion of the western white pine covertype would increase from the current level of 5.64 to 9.77 percent, the proportion of the lodgepole pine covertype would increase from the current level of 5.85 to 6.10 percent, and the proportion of the ponderosa pine covertype would increase from the current level of 10.72 to 10.95 percent due to a combination of harvesting prescriptions and planting. The proportion of the mixed-conifer covertype in the project area would decrease from the

current level of 53.8 to 47.5 percent (see *TABLE III-3 – COVERTYPE CHANGE BY ACTION ALTERNATIVE FOR THE PROJECT AREA AND SWAN RIVER STATE FOREST*).

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Covertypes***

  The cumulative effects of recent forest management on Swan River State Forest resulted in a trend of increasing early seral covertypes across areas where management occurred. For example planting in selective units on the South Woodward, Goat Squeezer, and Three Creeks timber sale projects increased the western larch/Douglas-fir covertype on Swan River State Forest.

  In addition to the changes in proportions of covertype proposed in the various action alternatives, other timber sale projects have been initiated, but not completed; therefore, their effects are not represented in the *SLI* layers and analysis layers (*TrustLandsData20110616).* Scheduled updates of the *SLI* would capture increased western larch/Douglas-fir and western white pine covertypes on Swan River State Forest.

  The Winter Blowdown, Lucky Logger, Low Wood 2, Swan Burn, South Woodward 28, and Main Wood timber permits removed dead, dying, windthrown, or infected Douglas-fir, grand fir, western white pine, and western larch. The covertypes of these stands would not be affected.

  The White Porcupine Multiple Timber Sales (1, 2, White Donut, White Wood, White Cliffs, White Tailed, White Cedar, and White Bird) have been sold and are in the process of being harvested. Through seedtree, seedtree-with-reserves, shelterwood, shelterwood-with-reserves, and variable thinning treatments, 1,519 acres will be harvested. The posttreatment covertypes of these stands have been incorporated into the current age class and covertype amounts. These treatments will continue the trend of increasing seral covertypes and decreasing late-successional covertypes across areas where management occurred.

  Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to covertype distributions due to previous activities on USFS, as well as privately held ground, including Trust for Public Land property and small, private landholdings adjacent to Swan River State Forest and the project area, have been difficult to interpret due to the scale. The trend typically is late seral species in old stands and a mosaic of early to late seral species in younger or treated stands, the results being dependent on the residual timber, harvest prescription, and postharvest treatments. Development plans on small, private landholdings could result in a decrease in covertypes as forested land is converted to nonforested land.

- ***Cumulative Effects of Action Alternatives B and C to Covertypes***

  The cumulative effects of the action alternatives would be similar to those seen in No-Action Alternative A; however, in general, the result would be a greater increase in early seral covertypes across areas where management occurs.

AGE CLASS

Issue: The proposed activities may affect forest age classes through tree removal.

EXISTING ENVIRONMENT

The distribution of age classes delineates another characteristic important for determining trends on a landscape level. Age-class distributions are tied to covertype representation and disturbance regimes, both of which vary over the landscape in relation to prevailing climatic conditions of temperature and moisture.

Historical stand age-class distributions for Montana were developed by *Losensky (1997).* Although the data was collected at a specific point in time, this data represents the best baseline available for determining how the current age-class distribution differs from historical conditions. Swan Rive State Forest falls within the *Upper Flathead Climatic Section* (*M333C*), and age-class distribution for that area is shown in *TABLE III-4 – HISTORIC, CURRENT, AND POSTHARVEST AGE-CLASS DISTRIBUTIONS FOR SWAN RIVER STATE FOREST.* Inventory data collected in the 1930s at the smaller scale of Swan River State Forest showed that 74 percent of the forest was classified as old stands versus 29 percent for the larger climatic section. The apparent dominance of old stands in Swan River State Forest in the 1930s indicates that Swan River State Forest avoided major disturbances for a considerable time period.

TABLE III-4 – HISTORIC, CURRENT, AND POSTHARVEST AGE-CLASS DISTRIBUTIONS FOR SWAN RIVER STATE FOREST

	M333C (HISTORIC) (PERCENT)	CURRENT		ALTERNATIVE B (POSTHARVEST)		ALTERNATIVE C (POSTHARVEST)	
		ACRES	PERCENT	ACRES	PERCENT	ACRES	PERCENT
No age data[1]	n/a	3,431	8.2	3,431	8.2	3,431	8.2
0 to 39	22	6,102	14.6	7,415	17.8	7,294	17.5
40 to 99	13	8,938	21.4	8,858	21.2	8,828	21.1
100 to 149	22	7,485	17.9	7,231	17.3	7,110	17.1
150 plus[2]	29	5,141	12.3	4,684	11.2	4,581	11.0
Old growth[3]	n/a	10,603	25.4	10,082	24.2	10,457	25.1
Nonstocked	14	-	0.0	-	0.0	-	0.0
Totals	*100*	*41,700*	*100.0*	*41,700*	*100.0*	*41,700*	*100.0*

[1] The no-age category represents land that is nonforest or does not have an age class listed in the SLI.

[2] Losensky's (1997) report for Climatic Section M333C does not include 100 to 149 years, 150-years-plus, and old-growth categories, but instead categorizes mature stands in 2 categories: 100-year "old stands" and "old stands". Ponderosa pine, Douglas-fir, and western larch/Douglas-fir stands greater than 170 years, western white pine and mixed-conifer stands greater than 180 years, and lodgepole pine stands greater than 140 years were classified as "old stands".

[3]Current old-growth stands would be considered a subset of primarily the historical 150 plus age class, with small portions in the historical 100 to 149 age class.

Comparing the current distribution of age classes in the project area, as well as across the entire Swan River State Forest, to the historical data for *Section M333C* demonstrates a reduced proportion in the seedling-sapling (0-to-39-year) age class, excess in the poletimber (40-to-99-year) age class, and an overabundance of mature (100-years-plus) age classes, particularly those older than 150 years (*TABLE III-4 – HISTORIC, CURRENT, AND POSTHARVEST AGE-CLASS*

DISTRIBUTIONS FOR SWAN RIVER STATE FOREST, TABLE III-5 – HISTORIC, CURRENT, AND POSTHARVEST AGE-CLASS DISTRIBUTIONS FOR THE PROJECT AREA). The relatively old age of stands in Swan River State Forest predisposes them to attacks by insects and diseases, as well as an increased risk of stand-replacement fires.

TABLE III-5 – HISTORIC, CURRENT, AND POSTHARVEST AGE-CLASS DISTRIBUTIONS FOR THE PROJECT AREA

AGE CLASS	M333C (HISTORIC) (PERCENT)	CURRENT		ALTERNATIVE B (POSTHARVEST)		ALTERNATIVE C (POSTHARVEST)	
		ACRES	PERCENT	ACRES	PERCENT	ACRES	PERCENT
No age data[1]	n/a	738	4.7	738	4.7	738	4.7
0 to 39	22	2,561	16.4	3,874	24.9	3,750	24.1
40to 99	13	3,170	20.3	3,081	19.8	3,052	19.6
100 to 149	22	3,255	20.9	3,001	19.3	2,888	18.5
150 plus[2]	29	2,320	14.9	1,862	11.9	1,759	11.3
Old growth[3]	n/a	3,542	22.7	3,029	19.4	3,399	21.8
Nonstocked	14	-	0.0	-	0.0	-	0.0
Totals	*100*	*15,586*	*100.0*	*15,586*	*100.0*	*15,586*	*100.0*

[1] The no-age category represents land that is nonforest or does not have an age class listed in the SLI.

[2] Losensky's (1997) report for Climatic Section M333C does not include 100 to 149 year, 150 plus year, and old-growth categories, but instead categorizes mature stands in 2 categories: 100-year "old stands" and "old stands". Ponderosa pine, Douglas-fir, and western larch/Douglas-fir stands greater than 170 years, western white pine and mixed-conifer stands greater than 180 years, and lodgepole pine stands greater than 140 years were classified as "old stands".

[3] Current old-growth stands would be considered a subset of primarily the historical 150-year-plus age class, with small portions in the historical 100 to 149 age class.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Age Classes***

  No immediate change in the proportion of existing age classes is expected unless a large disturbance, such as a wildfire, occurs. Forest succession, driven by the impacts of forest insects and diseases when fires are being suppressed, would reduce the variability of age classes. As the forest ages and its composition become more homogenous, biodiversity would be reduced.

- ***Direct and Indirect Effects of Action Alternative B to Age Classes***

  The proposed seedtree and shelterwood treatments with this alternative would regenerate approximately 1,313 acres, converting these acres to the 0-to-39-year age class. Of this, 521 acres would be converted from the old-growth age class, 458 acres from the 150-year-plus age class, 254 acres from the 100-to-149-year age class, and 80 acres from the 40-to-99-year age class. These treatments and subsequent planting or natural regeneration would increase the proportion of the 0-to-39-year age class on Swan River State Forest by 3.2 percent and in the project area by 8.5 percent, or 1,313 acres. Older age classes (old growth and 150-year-plus) would decrease by 979 acres, or 2.3 percent on Swan River State Forest and 6.3 percent

in the project area (*TABLE III-4 – HISTORIC, CURRENT, AND POSTHARVEST AGE-CLASS DISTRIBUTIONS FOR SWAN RIVER STATE FOREST, TABLE III-5 – HISTORIC, CURRENT, AND POSTHARVEST AGE-CLASS DISTRIBUTIONS FOR THE PROJECT AREA*). The proportion of older-aged stands (150-year-plus and old-growth age classes) on both Swan River State Forest and the project area would still exceed historical levels following harvesting.

The 696 acres proposed for variable thinning would retain pole- to sawtimber-sized trees. About 162 acres would remain in the old-growth age class, 49 acres would remain in the 150-year-plus age class, 159 acres would remain in the 100-to-149-year age class, 244 acres would remain in the 40-to-99-year age class, and 36 acres would retain the 0-to-39-year age class. Approximately 46 acres would be treated around a forest administrative site which, is currently classified as nonforested and, therefore, is not classified in any age class.

- ***Direct and Indirect Effects of Action Alternative C to Age Classes***

The proposed seedtree and shelterwood treatments in this alternative would regenerate approximately 1,192 acres, converting them to the 0-to-39-year age class. Of this, 146 acres would be converted from the old-growth age class, 561 acres from the 150-years-plus age class, 375 acres from the 100-to-149-year age class, and 110 acres from the 40-to-99-year age class. These treatments and subsequent planting or natural regeneration would increase the proportion of the 0-to-39-year age class on Swan River State Forest by 2.9 percent and in the project area by 7.6 percent, or 1,192 acres. Older age classes (old growth and 150-years-plus) would decrease by 707 acres, or 1.7 percent on Swan River State Forest and 4.5 percent in the project area (*TABLE III-4 – HISTORIC, CURRENT, AND POSTHARVEST AGE-CLASS DISTRIBUTIONS FOR SWAN RIVER STATE FOREST, TABLE III-5 – HISTORIC, CURRENT, AND POSTHARVEST AGE-CLASS DISTRIBUTIONS FOR THE PROJECT AREA*). The proportion of older-aged stands (150-years-plus and old-growth age classes) on both Swan River State Forest and the project area would still exceed historical levels following harvesting.

The 1,430 acres proposed for variable thinning would retain pole- to sawtimber-sized trees. About 392 acres would remain in the old-growth age class, 126 acres would remain in the 150-years-plus-year age class, 394 acres would remain in the 100-to-149-year age class, 436 acres would remain in the 40-to-99-year age class, and 36 acres would retain the 0-to-39-year age class. Approximately 46 acres would be treated around a forest administrative site, which is currently classified as nonforested and, therefore, is not classified in any age class.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Age Classes***

The cumulative effects to age-class distributions due to previous forest-management activities on Swan River State Forest are represented in descriptions of the current age-class distribution. Generally speaking, those effects have reduced the proportion of older age classes while increasing the proportion in younger age classes, particularly the 0-to-39-year age class. For example, the South Woodward, Goat Squeezer, and Three Creeks timber sale projects increased the 0-to-39-year age class on Swan River State Forest through timber

harvesting and planting in selected units. This shift in the age-class distribution is expected to provide greater long-term sustainability of forest conditions by moving the age-class distribution toward the historical distribution for *Climatic Section M333C (Upper Flathead).*

In addition to the changes in proportions of age classes proposed in the various action alternatives, other timber sale projects have been initiated, but not completed; therefore, their effects are not represented in the *SLI* and analysis layers (*TrustLandsData20110616).* Scheduled updates of the *SLI* would capture increased acres in the 0-to-39-year age class on Swan River State Forest.

The Winter Blowdown, Lucky Logger, Low Wood 2, Swan Burn, South Woodward 28 (?), and Main Wood timber permits removed dead, dying, windthrown, or infected Douglas-fir, grand fir, western white pine, and western larch. Age class did not change as a result of those actions.

The White Porcupine Multiple Timber Sales (1, 2, White Donut, White Wood, White Cliffs, White Tailed, White Cedar, and White Bird) have been sold and are in the process of being harvested. Through seedtree, shelterwood, and variable thinning treatments, 1,519 acres will be harvested. The posttreatment age classes of these stands have been incorporated into the current age-class amounts. These treatments will continue the trend of increasing the 0-to-39-year age class and decreasing older age classes across areas where management occurs.

Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to age-class distributions due to previous activities on *USFS* as well as privately held ground, which includes Plum Creek property and small, private landholdings adjacent to Swan River State Forest and the project area, have been a reduction in the acres of the older age classes and an increase in the acres of the younger age classes. Based on aerial-photograph interpretation, approximately 50 percent of the acreage appears to consist of stands in the 0-to-39-year age class. Age-class approximations were not possible on the remainder of the ground. Development plans on small, private land could result in a decrease in total age-class distribution as forested land is converted to nonforested land.

- ***Cumulative Effects of Action Alternatives B and C to Age Classes***

  The cumulative effects of the action alternatives would be similar to those seen under No-Action Alternative A; however, the result would be a greater increase in the 0-to-39-year-old age class across areas where even-aged management would occur.

OLD GROWTH

Issue: The proposed activities may affect old-growth amounts and quality through tree removal.

OLD-GROWTH DEFINITION

DNRC defines old growth as stands that meet minimum criteria for number, size, and age of trees per acre for a given combination of covertype and forest habitat-type group. The definitions are adopted from those presented by *Green et al. (1992)*. DNRC's definition has evolved over the years; previous analysis may appear to contradict the analysis presented in this *DEIS* because of that evolution.

HISTORIC ESTIMATES OF OLD GROWTH

Many previous efforts have been made to estimate the historical amounts of old growth in Swan Valley. The following approaches have been used:

- DNRC estimated the quantity of old growth that may have existed historically (*Montana DNRC 2000*). Results suggested that, given the definition used in the analysis, approximately 22 percent of Swan River State Forest represents the expected amount of naturally occurring old growth. That analysis used a more restrictive definition for old growth than DNRC currently uses.
- *FNF Plan Amendment 21 (1998)* estimated that 29 percent of low-elevation forest*s on FNF was old* growth, 8 percent of mid-elevation forest was old growth, and none of the high-elevation forest was old growth, as derived from historic surveys (*Ayers 1898, 1899*). Using various sources of information, the *FNF Amendment 21* also estimated that old growth in FNF *h*ad an historic*al range of variability from* 15 to 60 percent. Using a computer modeling process, *FNF e*stimated that approximately 36 percent of Swan Valley existed as late-seral forest; however, not all late-seral stands would qualify as old growth.
- *Lesica (1996), in an e*ffort to use fire history to estimate the prop*ortions of old-g*rowth forests in Swan Valley, estimated that approximately 52 percent of the area was occupied by stands that were 180 years or older. *Lesica* used stand age as a surrogate for old growth in his mathematically derived estimations.
- Using covertype conditions and historical data from the 1930s (*Losensky 1997*), 29 percent of the forested acres in the *Upper Flathead Climatic Section* were estimated to have historically been occupied by stands 150 years and older and contained a minimum of 4 Mbf/acre (*South Fork Lost Creek FEIS, 1998*).
- *Hart (1989)* indicated that approximately 48 percent of the area represented in the 1930s stand data for the Seeley and Swan valleys had forests with a significant component of trees older than 200 years.

Therefore, using a wide variety of old-growth definitions, the estimates of the historic amount of old growth on Swan River State Forest suggest a range from 15 to 50 percent. The estimates above are primarily age-based estimates that do not consider the other attributes, such as number of snags or coarse woody debris, often deemed necessary to call a stand 'old growth'. The lack of additional old-growth attributes in many of the old-growth definitions results in overestimated amounts of old growth compared to other old-growth definitions that include additional attribute thresholds. For example, only DNRC's estimate has any criteria related to the size and number of large trees per acre, leading one to the conclusion that old growth would necessarily be lower than the other estimates provided because not all old stands, late-seral stands, or modeled stands would have sufficient numbers of large live trees to meet DNRC's old-growth definition.

Estimates presented defined old growth in a variety of ways and none of them represent estimates based on the *Green et al. (1992)* definition that DNRC currently uses; most provide estimates that are higher than they would be if they included additional attribute criteria.

Based on available estimates, the amount of old growth on Swan River State Forest is currently within the historically-occurring range.

RELATIONSHIP TO THE SUSTAINED-YIELD CALCULATION

DNRC's management activities are guided by the philosophy of the *SFLMP*, *Forest Management Rules*, and other relevant rules and laws including the requirement to calculate an annual sustainable yield. As defined in *77-5-221 MCA* and pursuant to *77-5-222* and *223 MCA*, DNRC is required to recalculate the annual sustained yield at least once every 10 years. The sustainable-yield calculation is done to determine the amount of timber that can be sustainably harvested, on an annual basis, from forested state trust lands in accordance with all applicable state and federal laws. The most recent sustainable-yield calculation was approved by the Land Board on October 18, 2004.

The recent sustainable-yield calculation fully incorporated the philosophy of the *SFLMP* and all applicable laws, rules and regulations. Biodiversity, forest health, endangered-species considerations, and desired future conditions are important aspects of state forest land management, including old-growth management. These factors were modeled in the recent sustainable-yield calculation and are reflected in the various constraints applied to the model, which included management constraints in old-growth stands.

The biodiversity and old-growth administrative rules that were incorporated into the sustainable-yield model were developed with public input. The managed old-growth concept means that harvest treatments in old-growth stands contributed to the calculated sustainable yield. For example, maintenance and restoration treatments were allowed to occur periodically in some old-growth stands, while the model also allowed old-growth removal treatments to be applied to other stands. Given the concerns expressed by some of the public regarding old growth, the sustainable-yield model made provisions for tracking old-growth amounts over the planning horizon in order to determine whether landscape-level biodiversity objectives in the *SFLMP* and *ARMs* were met. At the initiation of the model runs, approximately 11 percent of DNRC-managed land met DNRCs old-growth definition. After incorporating DNRCs old-growth management regimes and all relevant constraints into the model, approximately 8 percent of the landscape was intended to be in an old-growth condition at model year 100. The model clearly demonstrates that this is achievable at the current sustained yield of 53.2 MMbf given current management practices, rules, and laws.

ANALYSIS METHODS

Old-Growth Distribution

The analysis of old-growth distribution relies on DNRC's *SLI* and ocular observations in the field. The *SLI* was queried to select stands meeting the age, diameter at breast height (dbh), and large-tree criteria for old growth based on habitat-type groups (see *GLOSSARY* for *DNRC's* old-growth definition). Field surveys were employed to verify the old-growth status of selected stands and determine if additional stands meet the old-growth definition in the project area.

Old-Growth Attributes

Using the *SLI,* attribute levels in the old-growth stands are described and analyzed for preharvest and postharvest conditions. For instance, the *SLI* database contains data on snag numbers. This data was used because the database appeared more consistent than the limited plot data taken in the field.

The diversity of old-growth definitions and the relative importance of old growth as a specific stand condition led DNRC to develop a tool to analyze and understand old growth. This tool indexes attribute levels in stands using DNRC's *SLI* and is called the *Full Old Growth Index (FOGI)*. Index attributes and point assignments are shown in *TABLE III-6 - OLD-GROWTH INDEX ATTRIBUTES AND POINT ASSIGNMENTS.*

The old-growth attributes making up *FOGI* are:

- number of large live trees,
- amount of coarse woody debris,
- number of snags,
- amount of decadence,
- multistoried structures,
- gross volume, and
- crown cover.

Old-growth quality depends on the type of old growth, associated wildlife species being considered, where old growth exists on the landscape, and other factors that do not lend themselves to consistent or meaningful quantification. For the purposes of this analysis, we are using attribute levels (*FOGI*) as an indicator of quality, but are also cognizant that quality is too nebulous a concept for a quantitative analysis. Using the *FOGI* provides a method to consistently describe the attributes of old-growth stands relative to other old-growth stands on state lands. *FOGI* could be construed as providing an indication of old-growth quality, but is more appropriately considered an indication of overall attribute levels. So, while the highest attribute levels may be high quality for some wildlife species and old-growth types (for example, mixed-conifer old growth, which tends to exist in a dense and structurally diverse condition), other species and types are highest quality at relatively lower attribute levels (in particular, the ponderosa pine type, which tends to exist in a more open condition that is less structurally diverse). Therefore, the analysis focuses on quantitative or qualitative assessment of attribute levels rather than relying on the value-laden concept of quality.

TABLE III-6 - OLD-GROWTH INDEX ATTRIBUTES AND POINT ASSIGNMENTS

ATTRIBUTES[1]	0	1	2	3	4	5	6	7
Number of large trees	None		Few		Some		Lots	
Coarse woody debris	None	Few	Some	Lots				
Number of snags	None	Few	Some	Lots				
Decadence	None	Little	Some	Lots				
Structure	Single-storied	Two-storied	Multistoried					
Gross Mbf	Less than 4	4 to 6	7 to 9	10 to 12	13 to 15	16 to 20	21 to 25	26-plus
Crown cover index (percent)	Poor (0 to 39)		Medium (40 to 69)		Well (70-plus)			

[1]*The blank spaces are not applicable; see OLD-GROWTH ATTRIBUTE ASSIGNMENTS at the end of this VEGETATION ANALYSIS for attribute assignments.*

EXISTING ENVIRONMENT, DIRECT, AND INDIRECT EFFECTS

Old-Growth Distribution

Existing Environment

Swan River State Forest currently has 10,603 acres of old growth, which is equal to 25.4 percent of the total acreage (*TABLE III-7 - CURRENT OLD-GROWTH ACRES AND POSTHARVEST ACTION ALTERNATIVE EFFECTS BY FOREST COVERTYPE FOR SWAN RIVER STATE FOREST*). The project area contains 3,541 acres of old growth, which is equal to 22.7 percent of the project area (*TABLE III-8 - CURRENT OLD-GROWTH ACRES AND POSTHARVEST ACTION ALTERNATIVE EFFECTS BY FOREST COVERTYPE FOR THE PROJECT AREA*). Old-growth acreages may change as field surveys are completed and the *SLI* database is updated. For example, the selected Action Alternative B for the White Porcupine Multiple Timber Sale Project left an estimated 11,153 acres of old growth following harvesting. However, updates to DNRC's *SLI* database as well as field verification of old-growth status showed some stands that were thought to be old growth did not meet the requirements of the old-growth definition. The updates reduced the estimated amount of old growth on Swan River State Forest to the 10,603 acres shown in this analysis.

The old-growth definitions used by DNRC are expressed in terms of covertype, thus allowing comparisons to *Losensky's (1997)* historic information for amounts of old-age stands. Mixed conifer, subalpine fir, western larch/Douglas-fir, and western white pine (*TABLE III-7 - CURRENT OLD-GROWTH ACRES AND POSTHARVEST ACTION ALTERNATIVE EFFECTS BY FOREST COVERTYPE FOR SWAN RIVER STATE FOREST*) are currently the 4 dominant old-growth types on Swan River State Forest.

TABLE III-7 - CURRENT OLD-GROWTH ACRES AND POSTHARVEST ACTION ALTERNATIVE EFFECTS BY FOREST COVERTYPE FOR SWAN RIVER STATE FOREST

OLD-GROWTH TYPE	***OLD-GROWTH ACRES***	***POSTHARVEST***	
		ACTION ALTERNATIVE	
		B	***C***
Douglas-fir	38	38	38
Western larch/ Douglas-fir	415	339	415
Western white pine	596	596	596
Mixed conifer	8,172	7,727	8,026
Subalpine fir	1,115	1,115	1,115
Lodgepole pine	23	23	23
Ponderosa pine	244	244	244
Totals	*10,603*	*10,082*	*10,457*

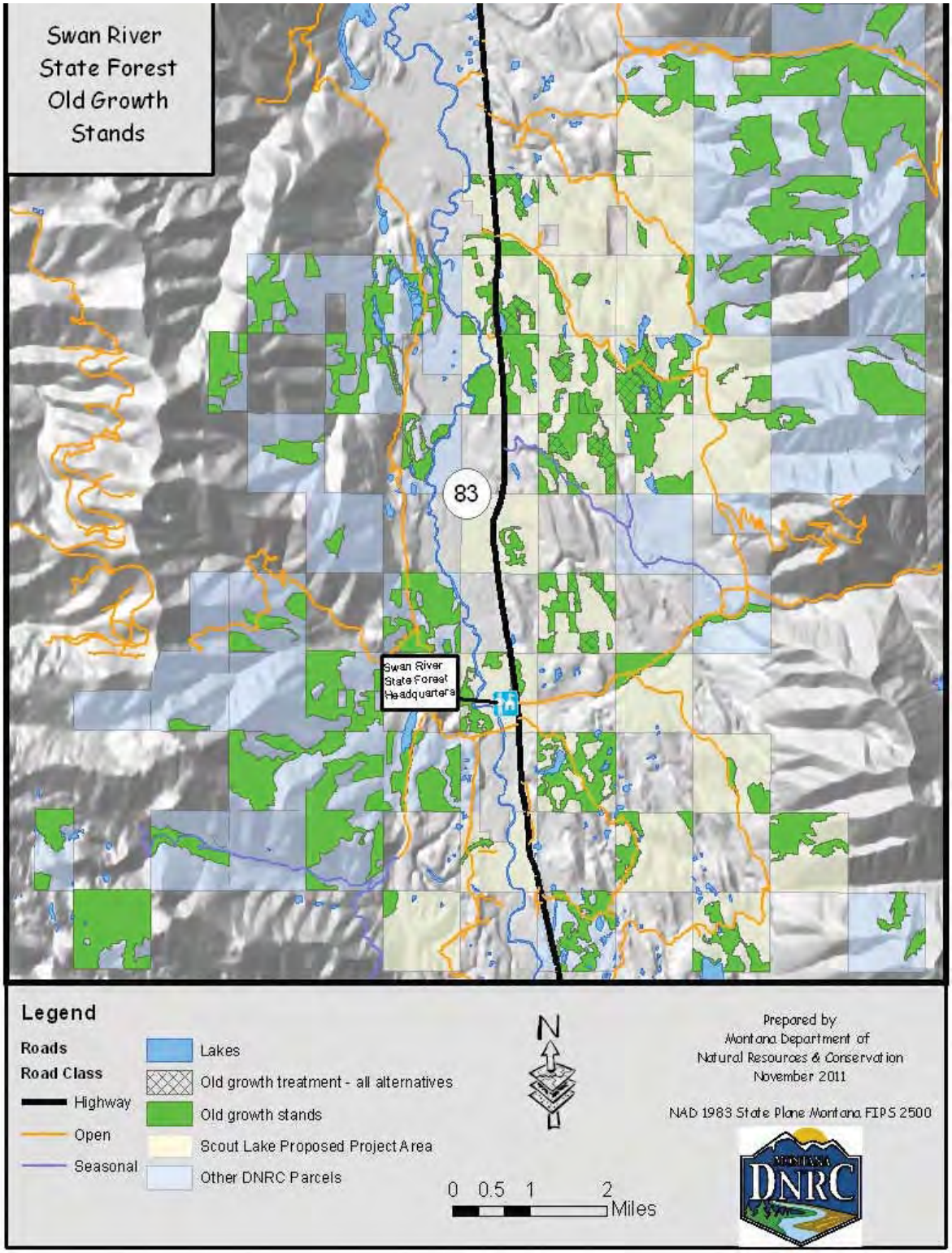
Action Alternative B has 133 acres of mixed-conifer old growth and 30 acres of western larch/Douglas-fir old growth that would be treated, but would retain old-growth status. Action Alternative C has 344 acres of mixed-conifer old growth and 58 acres of western larch/Douglas-fir old growth that would be treated, but would retain old-growth status.

TABLE III-8 - CURRENT OLD-GROWTH ACRES AND POSTHARVEST ACTION ALTERNATIVE EFFECTS BY FOREST COVERTYPE FOR THE PROJECT AREA

OLD-GROWTH TYPE	**OLD-GROWTH ACRES**	**POSTHARVEST**	
		ACTION ALTERNATIVE	
		B	**C**
Douglas-fir	38.4	38.4	38.4
Western larch/ Douglas-fir	170.3	94.0	170.3
Western white pine	1 97.5	197.5	197.5
Mixed conifer	2,929.4	2,484.4	2,783.4
Ponderosa pine	205.9	205.9	205.9
Totals	*3,541.5*	*3,020.2*	*3,395.5*

The current analysis also looks at the old-growth spatial distribution to analyze the effects of a proposed action. *FIGURE III-4 - CURRENT OLD-GROWTH STANDS ON SWAN RIVER STATE FOREST* is a map of old-growth stands in the project area. In addition to old-growth stands in the project area identified by the *SLI*, approximately 1,429 acres of old growth have been field-verified through ocular observation, as well as limited tree boring.

FIGURE III-4 - CURRENT OLD-GROWTH STANDS ON SWAN RIVER STATE FOREST



Environmental Effects to Old-Growth Distribution

- ***Direct and Indirect Effects of No-Action Alternative A to Old-Growth Distribution***

  Initially, the amount of old growth in the project area and on Swan River State Forest would not change. However, mortality and increasing decadence of existing old-growth stands would over time cause some stands to no longer meet the requirements of the old-growth definition, reducing the amount of old-growth acreage. Some stands not currently classified as old growth would, over time, attain sufficient numbers of large live trees that meet the diameter and age requirements to be classified as old growth. The covertypes of old-growth stands would be expected, over time, to shift toward increasing amounts of covertypes dominated by shade-tolerant species, such as mixed conifer, with decreases in covertypes dominated by shade-intolerant species (western larch/Douglas-fir, western white pine, and ponderosa pine). Old-growth stands dominated by shade-tolerant species would be likely to have high attribute levels (high numbers of snags and amount of coarse woody debris, multistoried canopy structure, dense crown cover, and increased decadence), but less longevity on the landscape than old-growth stands dominated by shade-intolerant species.

- ***Direct and Indirect Effects of Action Alternatives B and C to Old-Growth Distribution***

  The main objectives for entering the majority of the old-growth stands are to treat current high- to medium-risk stands or prevent a future high-risk status through removal of insect-infested and disease-infected trees, maintenance of historical covertypes, and removal or reduction of shade-tolerant species. The variable-thin units may be classified as old growth following harvesting; postharvest data collection in particular stands would determine their classification. *TABLE III-9 - OLD-GROWTH ACRES TREATED BY HARVEST PRESCRIPTION AND POSTHARVEST OLD-GROWTH STATUS* shows old-growth acres treated by harvest prescription and their postharvest old-growth status for each alternative. *TABLE III-10 - OLD-GROWTH FOGI ATTRIBUTE CLASSIFICATION CHANGES PREHARVEST AND POSTHARVEST BY ALTERNATIVE* clearly outlines the preharvest and postharvest attributes of each unit proposed for treatment.

TABLE III-9 - OLD-GROWTH ACRES TREATED BY HARVEST PRESCRIPTION AND POSTHARVEST OLD-GROWTH STATUS

	HARVEST PRESCRIPTION			
	SEEDTREE	**SHELTERWOOD**	**VARIABLE THINNING**	***TOTALS***
Action Alternative B				
Old growth postharvest	0	0	162	*162*
Not old growth postharvest	332	189	0	*521*
Total old-growth acres treated	332	189	162	*683*
Action Alternative C				
Old growth postharvest	0	0	392	*392*
Not old growth postharvest	34	112	0	*146*
Total old-growth acres treated	*34*	*112*	*392*	*538*

TABLE III-10 - OLD-GROWTH FOGI ATTRIBUTE CLASSIFICATION CHANGES PREHARVEST AND POSTHARVEST BY ALTERNATIVE

CURRENT STAND NUMBER	OLD-GROWTH TYPE	ALTERNATIVE B HARVEST PRESCRIPTION	ALTERNATIVE C HARVEST PRESCRIPTION	STAND ACRES	PREHARVEST INDEX NUMBER	CURRENT FOGI CLASS	HIGH RISK	EFFECTS BY ACTION ALTERNATIVE					
								B			C		
								INDEX NUMBER	CLASS	OLD-GROWTH POSTHARVEST	INDEX NUMBER CLASS	CLASS	OLD-GROWTH POSTHARVEST
230810	MC	SW	VT	48.7	16	Medium	Yes			No	13	Medium	Yes
230813	MC	ST	VT	27.7	14	Low	Yes			No	12	Low	Yes
230819	MC	VT	VT	37.9	14	Low	Yes	10	Low	Yes	10	Low	Yes
232023	MC		VT	7.8	19	Medium	Yes			Yes	11	Low	Yes
241807	MC	SW	SW	45.1	12	Low	No			No			No
241811	MC	SW	SW	9.7	22	Medium	Yes			No			No
241912	MC	ST		88.1	14	Low	No			No			Yes
242011	MC	ST		16.2	22	High	Yes			No			Yes
242108	MC	ST	ST	19.0	12	Medium	Yes			No			No
242808	MC	VT	VT	82.5	19	High	Yes	13	Medium	Yes	13	Medium	Yes
242821	MC	SW	SW	25.5	18	Medium	Yes			No			No
242823	MC	ST	VT	68.5	17	Medium	Yes			No	11	Low	Yes
242911	MC	VT	VT	12.3	21	High	Yes	10	Low	Yes	10	Low	Yes
242922	WL/DF	ST		48.1	22	High	Yes			No			Yes
242923	MC	ST	ST	14.9	10	Low	No			No			No
243209	WL/DF	SW	VT	28.2	22	High	Yes			No	13	Medium	Yes
243214	MC	SW	SW	32.1	14	Low	No			No			No
243215	WL/DF	VT	VT	29.5	23	High	Yes	16	Medium	Yes	14	Medium	Yes
243217	MC	ST	VT	27.5	16	Medium	Yes			No	11	Low	Yes
243228	MC	ST	VT	21.8	24	High	Yes			No	13	Medium	Yes

Action Alternative B would harvest approximately 683 acres of old growth. Following harvesting operations, 521 acres would no longer meet old-growth criteria, which would reduce the amount of old-growth acres in the project area by 14.7 percent. Following harvesting 162 acres would remain classified as old-growth. The amount of old growth remaining on Swan River State Forest would be 10,082 acres, and the proportion of acreage classified as old growth would be 24.2 percent (*TABLE III-7- CURRENT OLD-GROWTH ACRES AND POSTHARVEST ACTION ALTERNATIVE EFFECTS BY FOREST COVERTYPE FOR SWAN RIVER STATE FOREST*).

Action Alternative C would harvest approximately 538 acres of old growth. Following harvesting operations, 146 acres would no longer meet old-growth criteria, which would reduce the amount of old-growth acres in the project area by 4.1 percent. Following harvesting, 392 acres would remain classified as old growth. The amount of old-growth remaining on Swan River State Forest would be 10,457 acres and the proportion of acreage classified as old growth would be 25.1 percent.

Recognizing that the amounts and distributions of all age classes would shift and change over time, the amount of old growth remaining is within an expected range of natural variation. The postharvest quantities of old growth are also well above the range expected to occur over the long-term as a result of implementing the *SFLMP* and *Forest Management Rules.*

High Risk Old-Growth Stands

Existing Environment

As time passes, various factors influencing stand development may cause stands currently defined as old growth to no longer meet the requirements of the *Green et al. (1992)* old-growth definitions. Such factors include insect and disease outbreaks, drought, competition, etc. These factors can, gradually or suddenly, reduce the number of large, live trees below the minimum described in *Green et al. (1992)*. Stand vigor, insect and disease presence, and current mortality levels as determined by field reconnaissance and *SLI* data, can be used to estimate the risk of falling out of the old-growth status according to *Green et al*. Currently, 2,185 acres, or 70.5 percent, of the old-growth stands in the project area are classified as high risk (see *TABLE III-11 – CURRENT AND POSTHARVEST AMOUNTS OF HIGH-RISK OLD-GROWTH STANDS).*

As shown by *TABLE III-11- CURRENT AND POSTHARVEST AMOUNT OF HIGH-RISK OLD-GROWTH STANDS*, most treatments occurring in old growth address stands with a high risk of losing the old-growth status. Focusing treatments in these stands allows *DNRC* to not only meet its objective of promoting healthy and biologically diverse forest in the project area and Swan River State Forest, but also captures value that would otherwise be lost to mortality. While many of these stands would no longer be classified as old growth following treatment, a high likelihood is that in the near future, even without treatment, these stands would no longer be classified as old growth.

TABLE III-11- CURRENT AND POSTHARVEST AMOUNT OF HIGH-RISK OLD-GROWTH STANDS IN THE PROJECT AREA.

	POSTHARVEST TREATMENT OLD-GROWTH STATUS			
	HIGH RISK OLD GROWTH	**OTHER OLD GROWTH**	**NOT OLD GROWTH**	**TOTALS**
Current and No-Action Alternative A	2,185	1,356	0	3,541
Action Alternative B	1,701	1,319	521	3,541
Action Alternative C	1,730	1,665	146	3,541

Environmental Effects to Old-Growth Risk

- ***Direct and Indirect Effects of No-Action Alternative A to Old-Growth Risk***

  Stands currently classified as high-risk would be expected to remain as high-risk stands and, over time, fall out of old-growth status as large live trees die and fall below the threshold numbers identified by *Green et al (1992)* to be classified as old growth. Other old-growth stands would, over the long-term, see their risk rating increase as the stands age and become more decadent.

- ***Direct and Indirect Effects of Action Alternatives B and C to Old-Growth Risk***

  With Action Alternative B, the amount of high-risk old growth would be reduced by 484 acres through the use of seedtree, shelterwood, or variable thinning treatments. Approximately 1,701 acres would still be classified as high-risk old growth. Approximately 521 acres would no longer be classified as old growth (see *TABLE III-11 – CURRENT AND POSTHARVEST AMOUNTS OF HIGH-RISK OLD-GROWTH STANDS).*

  With Action Alternative C, the amount of high-risk old growth would be reduced by 460 acres through the use of seedtree, shelterwood, or variable thinning treatments. Approximately 1,730 acres would still be classified as high-risk old growth, and 146 acres would no longer be classified as old growth (see *TABLE III-11 – CURRENT AND POSTHARVEST AMOUNTS OF HIGH-RISK OLD-GROWTH STANDS).*

Old-Growth Attributes

The *FOGI* process assigns an index rating to each old-growth attribute that, when summed, indicates its total score, or old-growth index, for the stand. For analysis purposes, these scores can be grouped into low, medium, and high categories. This provides an indication of the condition of the stand in regards to attributes often associated with old growth. These indices do not necessarily indicate old-growth quality, but can be used to compare and classify a collection of older stands across the landscape. The expected variation between covertypes is based on numerous factors, including habitat-type groups, tree species, covertypes, elevations, past-management activities, and proximity to roads. Many of these attributes relate to wildlife habitat and are discussed under *WILDLIFE ANALYSIS*. *TABLE III-12 - FOGI CLASSIFICATION FOR THE PROJECT AREA AND POSTHARVEST AMOUNTS* shows the current amounts of old-growth acres in each of the *FOGI* classifications and the effects of the action

alternatives. See *OLD-GROWTH ATTRIBUTE ASSIGNMENTS* at the end of this *VEGETATION ANALYSIS* for a greater explanation of *TABLE III-6 - OLD-GROWTH INDEX ATTRIBUTES AND POINT ASSIGNMENTS.*

TABLE III-12 - FOGI CLASSIFICATION FOR THE PROJECT AREA AND POSTHARVEST AMOUNTS

FOGI CLASSIFICATION	CURRENT ACRES	ACTION ALTERNATIVE	
		B	C
Low	1,000	971	1,103
Medium	1,713	1,387	1,566
High	828	662	726
Totals	*3,541*	*3,020*	*3,395*

We recognize that our desired management strategy under the *SFLMP* is to retain, in reasonable proportions, stands that contain all the naturally occurring combinations of attributes, including those associated with old-growth stands. Thus, in this section, we display current conditions with regard to attributes often associated with old growth. The attributes displayed are number of large live trees, amounts of coarse woody debris and snags, vigor, crown cover, stand structure, and gross volume per acre.

Large Trees per Acre

Existing environment

TABLE III-13 - CURRENT AND POSTHARVEST AMOUNTS OF LARGE TREES PER ACRE IN OLD-GROWTH STANDS IN THE PROJECT AREA shows the relative abundance of large trees in old-growth stands. As shown, approximately 71 percent of all old-growth stands are in the highest abundance category for numbers of large live trees, with 20.7 percent having 'some', 2.4 percent having 'few', and 5.9 percent having 'none'.

This table also shows the changes in the acreage of stands with large trees on a per-acre basis for each alternative. Some stands would no longer meet the old-growth definition and are not included in postharvest amounts for Action Alternatives B and C. Both action alternatives retain the same acreage with 'lots' of large trees, while Action Alternative C retains more acres with 'some' and 'few' large live trees.

TABLE III-13 - CURRENT AND POSTHARVEST AMOUNTS OF LARGE TREES PER ACRE IN OLD-GROWTH STANDS IN THE PROJECT AREA

LARGE TREES	CURRENT ACRES	ACTION ALTERNATIVE	
		B	C
Lots	2,513	2,352	2,352
Some	733	392	698
Few	86	86	155
None	209	190	190
Totals	*3,541*	*3,020*	*3,395*

Environmental Effects to Large Trees per Acre

- ***Direct and Indirect Effects of No-Action Alternative A to Large Tree Per Acre***

  Initially no change would occur from current conditions in the number of large trees per acre; however, the large-tree component of current old-growth stands is likely to be reduced over time as large shade-intolerant species die and are replaced by smaller shade-tolerant species with a lesser chance of becoming large. Mortality of large trees could cause stands currently classified as old growth to no longer meet the old-growth definition (*Green et al. 1992*)

- ***Direct and Indirect Effects of Action Alternatives B and C to Large Trees Per Acre***

  Large, live trees would be removed if they are dying from insect or disease attacks or to provide openings for regeneration. Seedtree units would retain 6 to 8 trees per acre, with emphasis given to the larger-diameter trees. Shelterwood units would retain 12 to 16 trees per acre, with emphasis given to the larger-diameter trees. Health, vigor, cone production, and other factors would be considered when selecting trees for retention purposes. Variable-thin units would retain a minimum of 35-percent canopy cover, with priority given to the healthier, better-formed individuals in the stand. The seedtree and shelterwood treatments would not retain sufficient large live trees to meet *DNRC's* old-growth definition, while variable thinning harvests are expected to meet the definition (see *TABLE III-12 - CURRENT AND POSTHARVEST AMOUNTS OF LARGE TREES PER ACRE IN OLD-GROWTH STANDS IN THE PROJECT AREA*).

  It should be noted that DNRC's old-growth definition provides an objective numerical threshold for labeling a stand as old growth. Because of this objectivity, some stands may remain as old growth because the threshold defining old growth is still exceeded despite having had some trees harvested. Thus, the apparent anomaly occurs where recently harvested stands could retain sufficient levels of important attributes to remain old growth despite the harvesting that occurred. The definitions also result in the possibility that some acres are shifted from one type of old growth to another because, once again, they would retain sufficient levels of attributes to meet the definition, but shifts in species representation cause a shift in the 'type' of old growth.

  Both action alternatives would retain high proportions of large trees in the 'lots' category.

Amounts of Coarse Woody Debris

Existing environment

Coarse woody debris is measured by the number of pieces present along transect lines through a stand. The pieces are measured for diameter and grouped in ranges such as 6 to 10, 11 to 15, 16 to 20, and so on. The volume or tons per acre of coarse woody debris is also recorded. The *SLI* database contains information on coarse woody debris primarily for older stands on Swan River State Forest. The older stands (100-plus years) show various quantities and sizes of coarse woody debris. Stands with the most pieces and the greatest tons per acre are between 150 to 200 years old, but are not necessarily

old growth. For the project area, the maximum tons per acre are 133.3, the minimum is 0, and the average for the old-growth stands in the project area is 28 tons per acre. Stand data describing the number of pieces per grouped range, number of small pieces, number of large pieces, level of decay, and tons per acre is available in the project file.

TABLE III-14 - CURRENT AND POSTHARVEST LEVELS OF COARSE WOODY DEBRIS IN OLD-GROWTH STANDS IN THE PROJECT AREA shows the relative abundance of down coarse woody debris in old-growth stands. As with the snag numbers, salvage operations are expected to reduce the amount of coarse woody debris in old-growth stands across Swan River State Forest, resulting in a preponderance of stands in the 'some' and 'few' categories.

TABLE III-14 - CURRENT AND POSTHARVEST LEVELS OF COARSE WOODY DEBRIS IN OLD-GROWTH STANDS IN THE PROJECT AREA

COARSE WOODY DEBRIS	CURRENT ACRES	ACTION ALTERNATIVE	
		B	C
Lots	255	255	255
Some	1,052	898	938
Few	2,174	1,807	2,142
None	60	60	60
Totals	*3,541*	*3,020*	*3,395*

Environmental effects to coarse woody debris

- ***Direct and Indirect Effects of No-Action Alternative A to Amounts of Coarse Woody Debris***

  Initially, amounts of coarse woody debris would not be expected to change. Over time and barring large-scale disturbance, increasing decadence of current old-growth stands and mortality of large trees would be expected to increase amounts of coarse woody debris. Existing open roads would continue to provide access to firewood gatherers, potentially reducing the development of snags and coarse woody debris on those sites.

- ***Direct and Indirect Effects of Action Alternatives B and C to Amounts of Coarse Woody Debris***

  Slash would be piled and burned or otherwise treated on site. Stands would retain 10 to 25 tons of coarse woody debris postharvest. The reduction in total acres in the chart reflects the stands' lack of old-growth status postharvest (see *TABLE III-14 - CURRENT AND POSTHARVEST LEVELS OF COARSE WOODY DEBRIS IN OLD-GROWTH STANDS IN THE PROJECT AREA*).

Snags per Acre

Existing environment

TABLE III-15 - CURRENT AND POSTHARVEST AMOUNTS OF SNAGS PER ACRE IN OLD-GROWTH STANDS IN THE PROJECT AREA shows the relative abundance of large snags in old-growth stands. The preponderance of stands has some or few large snags. The 'few' category represents *DNRC's* minimum for snag retention postharvest.

The amount of snags fluctuates across the landscape due to salvage harvesting, which reduces the numbers and continued mortality from insect and disease activities, which increases snag amounts.

TABLE III-15 - CURRENT AND POSTHARVEST AMOUNTS OF SNAGS PER ACRE IN OLD-GROWTH STANDS IN THE PROJECT AREA

SNAGS	CURRENT ACRES	ACTION ALTERNATIVE	
		B	C
Lots	177	51	51
Some	1,572	1,394	1,694
Few	908	802	877
None	884	773	773
Totals	*3,541*	*3,020*	*3,395*

Environmental effects to snags per acre

- ***Direct and Indirect Effects of No-Action Alternative A to Snags per Acre***

  Initially, the amount of snags per acre in current old-growth stands would not change. Over time and barring large-scale disturbances, the amount of snags per acre would increase on most covertypes as climax species mature, decadence increases, and trees die. Mortality of large Douglas-fir, grand fir, western larch, and western white pine trees would increase the snag component of those stands. Existing open roads would continue to provide access to firewood gatherers, potentially reducing the development of snags on those sites.

- ***Direct and Indirect Effects of Action Alternatives B and C to Snags per Acre***

  The minimum snag retention per acre for all units would consist of 2 trees, 21 inches dbh or greater; if no trees that large are present, the next largest trees would be retained. In addition, 2 snag-recruit trees per acre, 21 inches dbh or greater, would be retained. *TABLE III-15 - CURRENT AND POSTHARVEST AMOUNTS OF SNAGS PER ACRE IN OLD-GROWTH STANDS IN THE PROJECT AREA* illustrates the postharvest levels of snags per acre. The change in the percentage of stands with the minimum requirements for retention is minor. Over 99 percent of old-growth stands would still have 2 or more snags per acre. Based on estimates of historical snag numbers (see *WILDLIFE ANALYSIS*), postharvest snag levels well exceed average historical conditions with over double the expected amount of large snags.

Decadence or Stand Vigor of Old Growth

Existing environment

The vigor of old-growth stands is used to indicate relative decadence. Old-growth stands of low vigor are more likely to have more snags and greater amounts of large down woody debris than would be expected with stands of high vigor. The 4 generally recognized vigor classes are:

– *Vigor 1 - Full Vigor* – Forests have an open canopy and growth is optimal. An example of a stand in this class is young, immature, and probably in the seedling or

sapling stage. Currently, no acres of old growth in the project area are at full vigor.

- *Vigor 2 – Good to Average Vigor* – Stand canopies are mostly closed with crown ratios (the vertical height of a tree's crown compared with the total vertical height of the tree) between 33 and 50 percent. Growth rates exceed mortality in these stands. An example of a stand in this class would be young, merchantable sawtimber. Old-growth stands of good to average vigor represent 1,563 acres in the project area.
- *Vigor 3 – Just Below Average to Poor Vigor* – Stand canopies are tightly closed with crown ratios less than 33 percent. Growth and mortality rates are nearly balanced. An example of a stand in this class would be an old stand of merchantable sawtimber. Old-growth stands of just below average to poor vigor occupy 1,916 acres in the project area.
- *Vigor 4 - Poor Vigor* – Stands are similar to the just below average to poor vigor class, but generally are in a decadent condition caused by competing vegetation, insects, diseases, and/or old age. Typically, mortality rates exceed growth rates. Old-growth stands of poor vigor occupy 62 acres in the project area; all are at risk to insects and diseases.

TABLE III-16 - ACRES OF CURRENT AND POSTHARVEST DISTRIBUTION OF VIGOR CLASSIFICATIONS FOR OLD-GROWTH STANDS IN THE PROJECT AREA shows the vigor classes by percentage for old-growth stands.

TABLE III-16 - ACRES OF CURRENT AND POSTHARVEST DISTRIBUTION OF VIGOR CLASSIFICATIONS FOR OLD-GROWTH STANDS IN THE PROJECT AREA

VIGOR	CURRENT ACRES	ACTION ALTERNATIVE	
		B	C
Full	0	0	0
Good to average	1,563	1,322	1,688
Just below average to poor	1,916	1,646	1,655
Poor	62	52	52
Totals	*3,541*	*3,020*	*3,395*

Environmental effects to decadence or stand vigor of old growth

- ***Direct and Indirect Effects of No-Action Alternative A to Decadence or Stand Vigor of Old Growth***

  Initially, stand vigor would remain at current levels; however, over the long-term, existing old growth would continue to age and become more decadent. With increasing decadence, old-growth stands would become more susceptible to insect and disease issues. Increasing decadence and loss of vigor would eventually lead to mortality of large trees that would, over time, cause the stand to no longer meet the defining criteria to be classified as old growth.

- ***Direct and Indirect Effects of Action Alternatives B and C to Decadence or Stand Vigor of Old Growth***

  TABLE III-16 – ACRES OF CURRENT AND POSTHARVEST DISTRIBUTION OF VIGOR CLASSIFICATIONS FOR OLD-GROWTH STANDS IN THE PROJECT AREA illustrates the changes that would take place following harvesting operations.

Stands with good vigor would increase to full vigor; however, these stands fall out of old-growth classification and are not shown. The treated stands would have reduced density and a more-open canopy, which would allow more light in and free up nutrients in the soil for utilization by the residual trees. Postharvest stands still classified as old growth would shift from the *Just below average to poor* or *Poor* to *Good to average* vigor classifications.

Stand Structure of Old Growth

Existing Environment

The structure of forested stands indicates one characteristic often associated with old growth, namely whether or not the stand is in a multistoried condition. The multistoried condition arises when a stand has progressed through succession to the point that trees growing beneath the main forest canopy begin to advance into the overstory. In Montana, this condition most commonly occurs when shade-tolerant species are replacing a shade-intolerant overstory, but can also occur when a stand is already dominated by large, old, shade-tolerant species and, through gap replacement, the regeneration that occurs is also shade-tolerant. In both cases, the time since a major disturbance tends to be long, helping to create many of the attributes important in old growth. *TABLE III-17 - ACRES OF CURRENT AND POSTHARVEST STRUCTURES BY ALTERNATIVE FOR OLD-GROWTH STANDS IN THE PROJECT AREA* displays the current conditions for stand structure of old growth and the postharvest effects of each action alternative. As shown, the vast majority of old-growth stands have multiple canopy levels.

TABLE III-17 - ACRES OF CURRENT AND POSTHARVEST STRUCTURES BY ALTERNATIVE FOR OLD-GROWTH STANDS IN THE PROJECT AREA

STRUCTURE	CURRENT ACRES	ACTION ALTERNATIVE	
		B	C
Single-storied	162	152	152
Two-storied	957	1,018	1,257
Multistoried	2,422	1,850	1,986
Totals	*3,541*	*3,020*	*3,395*

Environmental effects to the stand structure of old growth

- ***Direct and Indirect Effects of No-Action Alternative A to the Stand Structure of Old Growth***

  Initially, no change in stand structure would be expected. Over time and in the absence of disturbance, stands currently classified as single- or two-storied would be expected to develop into multistoried stands.

- ***Direct and Indirect Effects of Action Alternatives B and C to the Stand Structure of Old Growth***

  Stand structures in seedtree and shelterwood units would be converted to single-storied stand structures following harvesting. Stands receiving these treatments would no longer be classified as old growth following harvesting. Variable-thin units would be converted to multistoried or two-storied (in certain areas) stand

structures following harvesting and those stands would remain classified as old growth following harvesting. *TABLE III-17 - ACRES OF CURRENT AND POSTHARVEST STRUCTURES BY ALTERNATIVE FOR OLD-GROWTH STANDS IN THE PROJECT AREA* illustrates the slight changes in structure from multistoried stands to single- or two-storied stands. Also reflected in the figure is the removal of stands that no longer meet the old-growth definition.

Gross Volume per Acre

Existing environment

Another attribute of old-growth stands often deemed important and for which distributions can be quantified and effects assessed is a measure of density, or stocking. In this case, the stand's gross board-foot volume per acre is used (*TABLE III-18 – CURRENT AND POSTHARVEST AMOUNTS OF GROSS VOLUME PER ACRE (MBF) IN OLD-GROWTH STANDS IN THE PROJECT AREA*). Higher volumes indicate more densely stocked stands. One value of this measure is that effects of ingrowth and lack of wildfires are minimized because only trees larger than 9 inches dbh are included. Thus, this becomes another means through which impacts on the character of old-growth stands can be measured. As shown, the board-foot volume ranges are somewhat evenly distributed in old-growth stands across the project area. Approximately 13.6 percent of old-growth stands contain over 26 Mbf per acre, approximately 21.2 percent contain 21 to 25 Mbf per acre, approximately 20.5 percent contain 16 to 20 Mbf per acre, approximately 14.3 percent contain 13 to 15 Mbf per acre, approximately 14.3 percent contain 10 to 12 Mbf per acre, and approximately 16.1 percent contain less than 10 Mbf per acre.

TABLE III-18 –CURRENT AND POSTHARVEST AMOUNTS OF GROSS VOLUME PER ACRE (MBF) IN OLD-GROWTH STANDS IN THE PROJECT AREA

GROSS VOLUME PER ACRE (Mbf)	CURRENT ACRES	ACTION ALTERNATIVE	
		B	C
26 plus	483	323	371
21 to 25	750	639	638
16 to 20	725	671	671
13 to 15	505	381	432
10 to 12	506	544	553
7 to 9	424	276	544
4 to 6	18	56	56
Less than 4	130	130	130
Totals	*3,541*	*3,020*	*3,395*

Environmental effects to gross volume per acre

- ***Direct and Indirect Effects of No-Action Alternative A to Gross Volume per Acre***

  Gross volume per acre would be expected to increase compared to current levels, with stands shifting toward higher volume classes. Over time, increasing decadence and mortality may reduce volume per acre in some stands.

- ***Direct and Indirect Effects of Action Alternatives B and C to Gross Volume per Acre***

  TABLE III–18 – CURRENT AND POSTHARVEST AMOUNTS OF GROSS VOLUME PER ACRE (MBF) IN OLD-GROWTH STANDS IN THE PROJECT AREA illustrates the effects to gross volume per acre following harvesting operations. Old-growth stands with less than 10 Mbf per acre would vary from 15.3 to 21.5 percent of the remaining old growth in the project area. Stands that have 10 to 12 Mbf per acre would vary from 16.3 to 18.0 percent of the project area. Stands that have 13 to 15 Mbf per acre would vary from 12.6 to 12.7 percent of the project area. Stands that have 16 to 20 Mbf per acre would vary from 19.7 to 22.2 percent of the project area. Stands that have 21 to 25 Mbf per acre would vary from 18.8 to 21.2 percent of the project area, and stands that have more than 26 Mbf per acre would vary from 10.7 to 10.9 percent.

Crown Cover

Existing environment

Crown cover refers to the percentage of ground area covered by a vertical projection of the edges of tree crowns to ground level. It is described by 5 categories:

- well stocked (greater than 70 percent),
- medium stocked (40 to 69 percent),
- poorly stocked (less than 39 percent),
- nonstocked, or
- nonforested.

Currently, 2,518 acres (71.1 percent) of the old-growth stands in the project area are well stocked, 1,012 acres (28.6 percent) of the old-growth stands in the project area are medium stocked, and 11 acres (0.3 percent) of the old-growth stands in the project area are poorly stocked. (*TABLE III-19 – ACRES OF CURRENT AND POSTHARVEST CROWN COVER FOR OLD-GROWTH STANDS IN THE PROJECT AREA).*

TABLE III-19 – ACRES OF CURRENT AND POSTHARVEST CROWN COVER FOR OLD-GROWTH STANDS IN THE PROJECT AREA

CROWN COVER	CURRENT ACRES	ALTERNATIVE	
		B	C
Poorly stocked	11	62	176
Medium stocked	1,012	1,108	1,225
Well stocked	2,518	1,850	1,994
Totals	3,541	3,020	3,395

Environmental effects to crown cover

- ***Direct and Indirect Effects of No-Action Alternative A to Crown Cover***

  Crown cover over current old-growth stands would remain at current levels in well-stocked stands, while poorly and medium-stocked stands would be expected to remain at current levels or increase over time, depending on stand conditions. Over time and without large-scale disturbance, increasing decadence and mortality would create gaps in the canopy, temporarily reducing crown cover until shade-tolerant

species grow to fill the gaps. This fluctuating pattern of crown cover would be expected to continue until a disturbance agent, such as fire, affects the stand.

- ***Direct and Indirect Effects of Action Alternatives B and C to Crown Cover***

  Stocking levels in all treated stands would be reduced, and this would be reflected through reduced crown cover percentages. *TABLE III-19 - ACRES OF CURRENT AND POSTHARVEST CROWN COVER FOR OLD-GROWTH STANDS IN THE PROJECT AREA* illustrates the changes in crown cover through harvest treatments. The variable-thin treatment would shift well-stocked stands into the medium-stocked stand category. In these units, stocking levels would decrease to approximately half of current levels, but would retain a minimum of 35-percent crown cover. Seedtree or shelterwood treatments would remove the stands from the old-growth status as reflected in the table. Stocking levels for seedtree units would be approximately 10 percent of current levels and retain less than 40-percent crown cover (these stands would not be old-growth postharvest). Stocking levels for shelterwood units would be approximately 15 percent of current levels and retain less than 40-percent crown cover (these stands would not be old-growth postharvest).

  Both of the action alternatives would harvest timber in or near old-growth stands and create more abrupt stand edges. Some mature stands not yet classified as old growth could be considered old growth in the future. Commercial or variable-thin harvests in these mature stands would increase the diameter growth rates of remaining trees and, in some cases, may hasten the development of old-growth attributes, especially large-diameter trees.

CUMULATIVE EFFECTS TO OLD GROWTH

- ***Cumulative Effects of No-Action Alternative A to Old Growth***

  Current levels of old-growth acres would not change in the short-term. As stands continue to mature and large trees eventually die, some stands may no longer meet the old-growth definition. Ongoing data collection of stands may change the amount of acres classified as old growth. The Swan River State Forest salvage program has completed limited harvesting in old growth on the *High Blow '02, Big Blowdown, Cilly Bug, Rock Squeezer, Red Ridge,* and *Fridge* salvage sales. Most recently salvaged were *Lucky Logger* and *Low Wood 2*, 35 and 30 acres, respectively. The *Three Creeks Timber Sales (1, 2, 3, and Small Lost),* contains old-growth stands and harvesting was completed in March of 2011. *Main Wood 10*, which contains 50 acres of old growth, was harvested in the winter of 2009. Currently, the *White Porcupine Multiple Timber Sales (1, 2, White Donut, White Wood, White Cliffs, White Tailed, White Cedar*, *and White Bird*), contain old-growth stands and harvesting is ongoing; the estimated completion date is March of 2014.

  It should be noted that timber stands, whether harvesting occurs or not, may be reinventoried or reindexed in regard to adjustments of stand boundaries, and a more intensive inventory may change the old-growth status.

Past road construction, timber harvests, wildfires, and general site characteristics have led to the current amount of old-growth characteristics in the entire area. The salvage harvesting would not alter old-growth designation, but would reduce the numbers of large snags and coarse woody debris and, potentially, decrease stand decadence. Future timber sales and thinning projects would likely continue to take place in the analysis area. If additional management projects were proposed, the *MEPA* process would be implemented. The cumulative effects to old-growth amounts and distributions due to previous activities on USFS as well as privately-held ground, including Trust for Public Lands/The Nature Conservancy ownership and small, private landholdings adjacent to Swan River State Forest and the project area, are difficult to quantify because little is known about the total amount of old growth on these ownerships and old-growth stand approximations were not possible by analyzing aerial photographs. Old growth appears to have been retained on some USFS ground. Aerial photography and field observation seem to show that on Trust for Public Lands/The Nature Conservancy ownership, old stands have been retained primarily along creeks and other water features, while younger stands are in place elsewhere. The stands of small, private landowners appear as a mosaic, which results in a variety of age classes and inexact amounts of old growth amongst multiple ownerships.

- ***Cumulative Effects of Action Alternatives B and C to Old Growth***

  The cumulative effects of the action alternatives would be similar to those seen under No-Action Alternative A; however, they would reduce the proportion of old growth on Swan River State Forest by approximately 1.2 (Action Alternative B) or 0.3 (Action Alternative C) percent. Old-growth attribute levels in harvested stands would generally decrease immediately following harvesting, but over time would be expected to increase.

AGE AND COVERTYPE PATCH SIZE

Issue: The proposed activities may affect patch size and shape through tree removal.

AGE PATCHES

Existing Environment

The size of patches of equivalent age is one way to assess effects of management activities to the forested landscape. Age-class patches broadly reflect disturbance in the natural environment and the additional influence of harvesting and associated activities in the managed environment.

Forests change over time. Tracking the changes from historical to current conditions can indicate the effects of management and whether the direction of change is desirable. Assessing historic forest conditions is filled with challenges, such as a lack of actual data or, even when data is available, compatibility with current information. DNRC has maps of an inventory conducted in the 1930s that provide a general baseline for age (and covertype) patches for Swan River State Forest and the project area. The data does not provide for a seamless comparison between historic and current conditions due to differences in mapping procedures, primarily an 8-fold difference in minimum map-unit size (40 acres historically and 5 acres currently). The reduced minimum map-unit size

results in many more patches of a smaller average size, even when applied to the same forest at the same point in time. However, the data does represent the best historic information available; therefore, the data is presented with the caveats mentioned in this paragraph.

This analysis focuses on stand age classes. The oldest age class also encompasses all old-growth stands. However, old growth would represent only a portion of all old-age stands, as not all old stands would meet the large-tree requirements that are part of DNRC's old-growth definition. Reconstructing the historic data to quantify patch characteristics of old growth is not possible, so comparisons between historic and current conditions are not made. An analysis of the current patch characteristics of old growth and the effects of each action alternative are presented under *OLD-GROWTH PATCHES* further on in this analysis.

Historic data indicates that old-stand patches were large in both Swan River State Forest and the project area, with the patches being much larger in Swan River State Forest than for the project area (*TABLE III-20 - HISTORIC AND CURRENT MEAN PATCH SIZES BY AGE CLASS FOR SWAN RIVER STATE FOREST AND THE PROJECT AREA* and *TABLE III-21 - CURRENT AND POSTHARVEST MEAN PATCH SIZES BY AGE CLASS FOR THE PROJECT AREA*). Historically, a single large old-stand patch exceeding 14,000 acres dominated Swan River State Forest (previous DNRC analysis indicates that large stands would be divided into many additional polygons using today's mapping protocols, even in the absence of any harvest-related activities). Other age patches were variable in size between the project level and Swan River State Forest. The expectation is that the project area would naturally have smaller patch size means due to imposing the artificial project area boundary onto some existing patches. On average, current age-class patches are much smaller than historically. Some of the decrease can be attributed to different map-unit minimums, but the data likely reflects a real reduction in mean patch sizes, as harvesting and roads have broken up some previously intact patches.

TABLE III-20 - HISTORIC AND CURRENT MEAN PATCH SIZES BY AGE CLASS FOR SWAN RIVER STATE FOREST AND THE PROJECT AREA

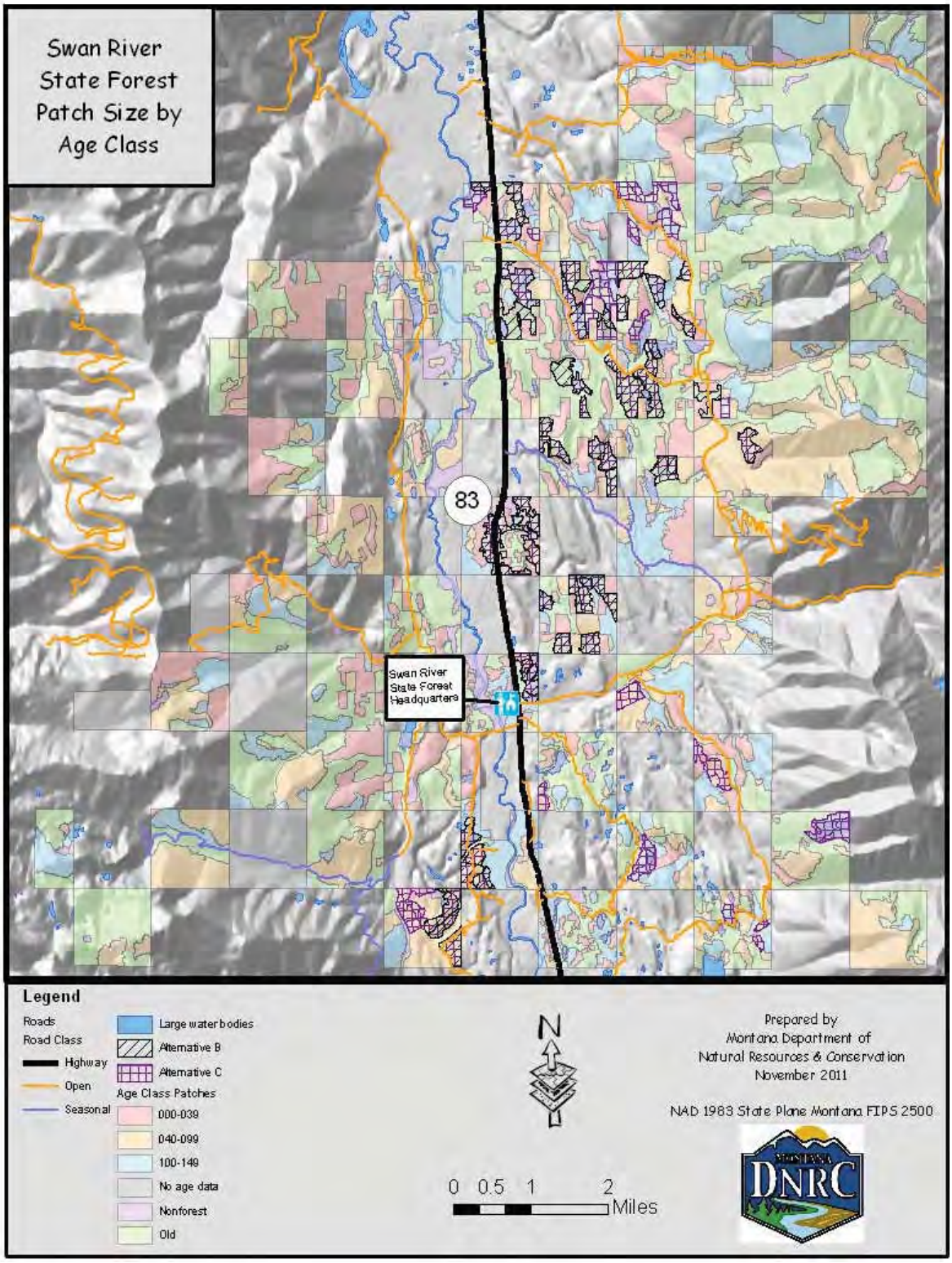
AGE CLASS	SWAN RIVER STATE FOREST (ACRES)		PROJECT AREA (ACRES)	
	HISTORIC	CURRENT	HISTORIC	CURRENT
Nonforest	120.9	22.30	43.17	19.43
0 to 39 years	91.0	32.80	116.33	24.86
40 to 99 years	134.5	55.86	70.78	40.13
100 to old stand	76.4	53.08	116.47	50.08
Old stand	664.8	157.44	711.60	112.72
Overall	280.0	60.74	264.33	46.25
No age data		478.60		

TABLE III-21 – CURRENT AND POSTHARVEST MEAN PATCH SIZES BY AGE CLASS FOR THE PROJECT AREA

AGE CLASS	CURRENT PROJECT AREA (ACRES)	POSTHARVEST ACTION ALTERNATIVES	
		B	C
		(ACRES)	
Nonforest	19.43	19.43	19.43
0 to 39 years	24.86	46.68	38.26
40 to 99 years	40.13	39.00	38.15
100 to old stand	50.08	46.89	45.84
Old stand	112.72	88.94	88.94
Overall	46.25	48.86	46.25

Current old-stand patches are smaller at the scale of the project area and Swan River State Forest than they were historically. Current Swan River State Forest old-stand patches are approximately 23.7 percent of the Swan River State Forest historic mean, and current project area old-stand patches are approximately 15.8 percent of the project area historic mean. At scales of both the project area and Swan River State Forest, the general trend appears to be a current mean patch size of all age classes that is smaller than the historic mean. See *FIGURE III-5 - CURRENT PATCH SIZE AND LOCATION BY AGE CLASS ON SWAN RIVER STATE FOREST* for details.

FIGURE III-5 - CURRENT PATCH SIZE AND LOCATION BY AGE CLASS ON SWAN RIVER STATE FOREST



ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A on Age Patch Size***

  Patch sizes would not be immediately affected. Over time, the forest would tend to homogenize, leading to larger patches of older stands, especially in the absence of significant fires or other disturbance events.

- ***Direct and Indirect Effects of Action Alternatives B and C on Age Patch Size***

  In the project area, the mean old-stand patch size would be reduced to 88.94 acres (a 21.1-percent reduction) with Action Alternatives B and C (*TABLE III-21 - CURRENT AND POSTHARVEST MEAN PATCH SIZES BY AGE CLASS FOR THE PROJECT AREA*). Other age patches would be only marginally affected, except the 0-to-39-year age class, where mean patches would be increased with each action alternative, reflecting the effort to group stand-replacement harvesting near other previously harvested areas.

  Compared to current conditions, project-level effects indicate that Action Alternatives B and C would slightly decrease the mean size of age patches.

Cumulative Effects

- ***Cumulative Effects of All Alternatives on Age Patch Size***

  The current age-class patch condition reflects the effects of natural disturbances and succession and the cumulative effects of previous activities by DNRC that have been completed and mapped. Overall, current age patches for the entire forest and the project area are reduced compared to historic conditions. Cumulative effects of other harvests have been incorporated into the project area. Trust for Public Lands/The Nature Conservancy and other private landowners within the project area have cumulatively increased the overall patch size of younger age classes through active management.

OLD-GROWTH PATCHES

Existing Environment

Old growth represents a subset of the old-stand age class. Old stands must contain a specified number and size of 'large' live trees to meet the old-growth definition; those large trees must also meet or exceed minimum age requirements. This analysis displays current patch-size characteristics of old growth and the effects of each alternative. This analysis does not present a corresponding analysis of historic old-growth patch characteristics because the data does not exist. Although it cannot be verified with observations of historic old-growth patch size, the reduction in patch size of old stands is expected to reflect a similar reduction in patch size of old-growth stands, but the absolute magnitude is unknown.

Currently, the mean patch size of old-growth stands on Swan River State Forest is 91.41 acres (*TABLE III-22 - CURRENT AND POSTHARVEST MEAN PATCH SIZES OF OLD GROWTH ON SWAN RIVER STATE FOREST AND IN THE PROJECT AREA*). In the project area, the mean old-growth patch size is 61.06 acres. Old-growth patches are

about 56 percent of the mean size of old-stand patches. The disparity between patch sizes of old stands and old growth reflects the addition of the large-tree number, size, and age requirements.

TABLE III-22 - CURRENT AND POSTHARVEST MEAN PATCH SIZES OF OLD GROWTH ON SWAN RIVER STATE FOREST AND IN THE PROJECT AREA

SWAN RIVER STATE FOREST ACRES	CURRENT PROJECT AREA ACRES	ACTION ALTERNATIVE ACRES	
		B	C
91.41	61.06	57.15	60.7

Environmental Effects

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A on Old-Growth Patches***

  The patch size of old-growth stands would not be immediately affected. Over time, the effects to the old-growth patch size would be uncertain because the continued development of large live trees within old stands is unpredictable. If existing large live trees remain alive and new large trees develop in old-age stands, the mean patch size of old growth would be expected to increase. Conversely, if existing large live trees continue to die from effects of insects, diseases, and other factors, causing the stand to no longer meet the old-growth requirements specified by *Green et al. (1992),* and new large trees fail to develop because of overly dense stands, the mean patch size of old growth would be expected to decrease.

- ***Direct and Indirect Effects of Action Alternatives B and C on Old-Growth Patches***

  At the project level, mean old-growth patch size would decrease slightly with Action Alternative B or C, by 3.91 and 0.36 acres, respectively. At the cumulative-effects level, mean old-growth patch size would decrease to 90.91 acres under Action Alternative B and increase to 91.76 acres under Action Alternative C. A resulting decrease of 0.5 acres under Action Alternative B and increase of 0.35 acres under Action Alternative C would occur.

Cumulative Effects

- ***Cumulative Effects of All Alternatives on Old-Growth Patches***

  The current old-growth patch condition reflects the effects of natural disturbance and succession and the cumulative effects of previous activities by DNRC that have been completed and mapped. Overall, old-growth patches for Swan River State Forest and the project area are reduced from historic to current conditions. Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to old-growth patch size due to previous activities on USFS as well as on privately held ground, including Trust for Public Land/The Nature Conservancy property and small, private landholdings adjacent to Swan River State Forest and the project area, have been an overall decrease in old-growth patch size through timber management.

COVERTYPE PATCHES

Existing Environment

Historic data suggests mean covertype patch sizes are similar to age patch sizes, in part, due to large patches of old western larch/Douglas-fir, and to a lesser extent, western white pine and lodgepole pine, that dominated the forest and project area. As with mean age-class patch sizes, the differences in mapping protocols and, in particular, a different minimum map-unit size confound direct comparison and drawing clear conclusions. However, a real decrease in mean covertype patch size is expected due to the effects of harvesting and road building. The effects of succession confound the results and are reflected in the increased patch size of shade- tolerant types (mixed conifer and subalpine fir).

Overall, current covertype patches on Swan River State Forest and the project area are about 40 percent the size of the historic mean (*TABLE III-23 - HISTORIC AND CURRENT MEAN PATCH SIZES BY COVERTYPE FOR SWAN RIVER STATE FOREST* and *TABLE III-24 - HISTORIC AND CURRENT MEAN PATCH SIZES BY COVERTYPE FOR THE PROJECT AREA*).

TABLE III-23 - HISTORIC AND CURRENT MEAN PATCH SIZES BY COVERTYPE FOR SWAN RIVER STATE FOREST

COVERTYPE CLASS	HISTORIC ACRES	CURRENT ACRES
Douglas-fir	0.0	53.85
Hardwood	28.5	45.38
Lodgepole pine	94.9	43.99
Mixed conifer	119.3	293.03
Noncommercial	85.2	N/A
Nonforested	32.9	22.30
Nonstocked	0.0	16.89
Ponderosa pine	127.3	31.89
Subalpine fir	170.9	171.26
Water	25.6	
Western larch/Douglas-fir	792.8	44.38
Western white pine	157.9	52.56
Overall	223.4	88.81

TABLE III-24 - HISTORIC AND CURRENT MEAN PATCH SIZES BY COVERTYPE FOR THE PROJECT AREA

COVERTYPE CLASS	HISTORIC ACRES	CURRENT ACRES
Douglas-fir	0.00	49.51
Hardwood	14.56	21.59
Lodgepole pine	102.57	45.44
Mixed conifer	101.76	243.84
Nonforested	18.32	19.43
Nonstocked	0.00	13.51
Ponderosa pine	156.29	30.49
Subalpine fir	0.00	14.85
Western larch/ Douglas-fir	630.11	31.9
Western white pine	322.04	35.26
Overall	219.65	67.47

Environmental Effects

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A on Covertype Patches***

  The covertype patch sizes would not be immediately affected; however, over time, diversity of habitats in terms of covertype patches would likely be reduced through forest succession. The result would be an increase in the mean size of patches dominated by shade-tolerant species as shade-intolerant species are excluded.

- ***Direct and Indirect Effects of Action Alternatives B and C on Covertype Patches***

  Each action alternative would slightly reduce the overall average covertype patch size (*TABLE III-25 - PROJECT AREA POSTHARVEST MEAN PATCH SIZES BY COVERTYPE FOR EACH ALTERNATIVE*). Action Alternative C would reduce the mean patch size the most at a decrease of 6.82 acres, Action Alternative B the least at 4.87 acres. The greatest changes in patch sizes would occur in the mixed-conifer covertype. The mixed-conifer covertype patches would be reduced in size with each action alternative; Action Alternative B the most at 56.17 acres and Action Alternative C the least at 48.99 acres. Western white pine patch size would increase 19.84 and 8.4 acres with Action Alternatives B and C, respectively. Other covertype patch sizes would be affected marginally or not at all by the project.

TABLE III-25 - PROJECT AREA POSTHARVEST MEAN PATCH SIZES BY COVERTYPE FOR EACH ALTERNATIVE

COVERTYPE CLASS	CURRENT (ACRES)	ACTION ALTERNATIVE (ACRES)	
		B	C
Douglas-fir	49.51	43.53	32.96
Hardwood	21.59	21.59	21.59
Lodgepole pine	45.44	45.44	40.74
Mixed conifer	243.84	187.67	194.85
Nonforested	19.43	19.43	19.43
Nonstocked	13.51	13.51	13.51
Ponderosa pine	30.49	31.87	31.14
Subalpine fir	14.85	14.85	14.85
Western larch/ Douglas-fir	31.90	31.87	31.09
Western white pine	35.26	55.10	43.66
Overall	67.47	62.60	60.65

Cumulative Effects

- ***Cumulative Effects of All Alternatives on Covertype Patches***

  The current covertype patch condition reflects previous activities by DNRC and natural disturbances and succession that have been completed and mapped. Overall, covertype patch sizes have been reduced from historic to current conditions. Other ongoing projects that have not been mapped to date would have a slight effect of decreasing patch sizes at the scale of Swan River State Forest. In the project area, cumulative effects of other harvests have been incorporated. To determine the cumulative effects that USFS Trust for Public Lands/The Nature Conservancy, and other private landowners in the project area have had on covertype patches through aerial-photograph interpretation is difficult. Active management of forested lands suggests an increase in early seral species such as western larch and ponderosa pine. However, a lack of aggressive silvicultural practices may result in the retention of a mixed-conifer covertype postharvest.

FRAGMENTATION

Issue: The proposed activities may affect forest fragmentation through tree removal.

EXISTING ENVIRONMENT

Forest fragmentation refers to the breaking up of previously contiguous blocks of forest. Most often, the fragmentation is used in reference to the disruption of large contiguous blocks of mature forest caused by forest-management activities such as road building and timber harvesting. In relation to fragmentation, management activities begin by putting holes in the natural forested landscape (i.e. portions of the forest are removed via harvesting, thus creating patches of nonmature forest within a background matrix of mature forest). As management continues and more harvesting takes place, the open patches created can become connected to other open patches, thus severing the previously existing connections between patches of mature forest. While the

appropriate level of fragmentation for any particular forest is unknown, forests fragmented by management activities generally do not resemble natural forest conditions.

Forest fragmentation was analyzed using aerial photographs of the project area in ArcMap and querying the *SLI*. Aerial photographs provided a visual of past harvesting and current stand appearances such as stocking density and stand boundaries. Queries in the *SLI* and other layers provided information on contiguous areas of stands in the same age class, stocking levels, and stand densities. Alternative effects on the patch size of old-growth stands were also analyzed. Field visits helped to verify this information to establish increases or decreases in a given patch size.

Historically, wildfires burned with varying intensities and return intervals and to different sizes across Swan River State Forest, which interacted with insect and disease activities and blowdown events to create a mosaic of forest covertypes and age classes. Today, forest management is the primary agent influencing fragmentation. Were intense fires to occur during extreme fire seasons, they would influence fragmentation across the landscape, as would insect and disease activities and blowdown events.

The majority of the project area is a matrix, or mosaic, of well-stocked older stands interspersed with younger stands resulting from harvesting activities of past even-aged management; thus, the stands have been fragmented to some degree. Some man-made patches in harvest units range from 4 to 138 acres. However, some areas have not been entered previously and represent a continuous forest of stands uninfluenced by human activities, but of various stocking levels due to past insect infestations. Refer to *CONNECTIVITY ANALYSIS* in *WILDLIFE ANALYSIS* for an assessment of fragmentation effects on closed-canopied forests. Refer to the patch size of age classes, old growth, and covertype in this analysis for additional indications of the effects of forest fragmentation.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Fragmentation***

  Forest fragmentation would not be directly affected by this alternative. Over time, and depending on an unknown future, indirect effects would include a reduction in fragmentation if additional harvesting is not imposed by management and existing patches of nonmature forests grow to maturity. Insects, diseases, or fire, depending on the acreage involved and severity, could result in an increase in fragmentation as well.

- ***Direct and Indirect Effects of Action Alternatives B and C to Fragmentation***

  In the stands designated for regeneration harvesting, the primary effects would be creating a larger area of younger stands with a corresponding reduction in mature forest stands. Stands designated for seedtree or shelterwood harvesting would contribute to the fragmentation of mature forests.

  The units designated for variable thinning would show less fragmentation of the canopy layer. Variable-thin units would be more similar to adjacent mature stands

of timber than would the regeneration harvest units and, therefore, would not contribute to fragmentation. In the case where a variable-thin unit has openings in the canopy, the openings may resemble gaps created by small areas of crown torching that occur during low-intensity fires. However, these instances would not contribute to fragmentation.

Some regeneration harvest units are adjacent to past harvest areas and other proposed units, which would result in an enlargement of the younger age-class patches. The end result would be more of a blended geometric shape of larger regeneration units. The large size of regeneration units would result in larger mature stands in the future, thus, reducing fragmentation. However, future timber harvesting would result in additional fragmentation if existing mature timber patches received a regeneration harvest. The actual net effect on fragmentation would depend on future timber harvesting.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Fragmentation***

  The White Porcupine Multiple Timber Sales (1, 2, White Donut, White Wood, White Cliffs, White Tailed, White Cedar, and White Bird), as well as previous management activities, such as the *South Woodward, Goat Squeezer,* and *Three Creeks* timber sales, have added to the fragmentation of the forest. The stands that primarily contributed to fragmentation are the regeneration units. Units that involve thinning treatments did not provide harsh breaks in the canopy, but a reduced crown cover. The aerial view shows the differences from one unit to the other from the point of stand density, but do not necessarily differ from the point of age class.

  Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to fragmentation due to previous activities on USFS, as well as on privately held ground that includes Trust for Public Lands/The Nature Conservancy property and small, private landholdings adjacent to Swan River State Forest and the project area, have been an overall increase in the size of younger age-class patches through timber management. Development plans on small, private landowners could result in an increase in fragmentation as forest covertypes are converted to nonforested.

- ***Cumulative Effects of Action Alternatives B and C to Fragmentation***

  An overall increase in the patch size of younger age classes and a decrease in the patch size of older age classes would occur where regeneration harvest units are proposed. See the discussion on age classes for acres that would change by alternative.

STAND VIGOR

Issue: The proposed activities may affect the forest stand vigor through tree removal.

EXISTING ENVIRONMENT

Stand vigor, a qualitative assessment of stand health in relation to growth potential, is affected by a variety of factors such as stand age and density, insects, diseases, and weather. Insects and diseases are currently very active in the project area, decreasing vigor, reducing growth, causing mortality, removing stands from the old-growth

classification, and resulting in lost economic value. Elevated populations of Douglas-fir beetles, fir engravers, mistletoe, mountain pine beetles, white pine blister rust, and various heart rots exist throughout the project area. Indian paint fungus is common in grand fir. The majority of tree species show effects from insect infestations and disease infections, causing value to be lost. Also, tree crowns appear sparse, yellowing, and/or fading in many stands, reflecting poor health and slow growth.

The *SLI* identifies stand vigor for each stand on Swan River State Forest in 1 of 4 categories. The 4 categories for vigor classification are:

- full,
- good to average,
- just below average to poor, and
- poor.

The majority of the stands in the project area and those selected for harvesting fall in the *good to average* category (*TABLE III-26 – CURRENT HARVEST UNIT VIGOR CLASSIFICATION (PERCENT) BY ACTION ALTERNATIVE).*

TABLE III-26 – CURRENT HARVEST UNIT VIGOR CLASSIFICATION (PERCENT) BY ACTION ALTERNATIVE

VIGOR	ACTION ALTERNATIVE	
	B	C
Full	3.31	2.53
Good to average	57.80	58.73
Just below average to poor	36.11	36.63
Poor	0.48	0.37
Nonforest	2.29	1.74

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Stand Vigor***

  No immediate change in the proportion of existing stand vigor is expected unless a large disturbance, such as a wildfire, occurs (*TABLE III-26 – CURRENT HARVEST UNIT VIGOR CLASSIFICATION (PERCENT) BY ACTION ALTERNATIVE* and *TABLE III-27 - CURRENT AND POSTHARVEST PROJECT AREA VIGOR)*.

  Forest succession, driven by the impacts of forest insects and diseases when fires are being suppressed, would continue to reduce stand vigor. As the forest ages and composition becomes more homogenous, vigor is expected to decrease.

- ***Direct and Indirect Effects of Action Alternative B to Stand Vigor***

  This alternative proposes regeneration harvests on approximately 1,313 acres using seedtree and shelterwood treatments, and variable thinning on approximately 696 acres.

Postharvest, *full* vigor would increase on approximately 1,313 acres, *good to average* vigor would decrease on approximately 550 acres, *just below average to poor* vigor would decrease on approximately 753 acres, and *poor* vigor would decrease on approximately 10 acres *(TABLE III-27 - CURRENT AND POSTHARVEST PROJECT-AREA VIGOR).*

TABLE III-27 - CURRENT AND POSTHARVEST PROJECT-AREA VIGOR

STAND VIGOR	CURRENT		ACTION ALTERNATIVE			
			B		C	
			POSTHARVEST			
	ACRES	PERCENT	ACRES	PERCENT	ACRES	PERCENT
Full	926.48	5.94	2,239.63	14.37	2,122.86	13.62
Good to average	8,282.73	53.14	7,732.15	49.61	8,094.92	51.94
Just below average to poor	5,473.27	35.12	4,720.51	30.29	4,474.85	28.71
Poor	70.97	0.46	61.24	0.39	61.24	0.39
Nonforested	832.88	5.34	832.81	5.34	832.83	5.34
Totals	*15,586.34*	*100.00*	*15,586.34*	*100.00*	*15,586.34*	*100.00*

- ***Direct and Indirect Effects of Action Alternative C to Stand Vigor***

  This alternative proposes regeneration harvests using seedtree and shelterwood treatments on approximately 1,189 acres and variable thinning on approximately 1,438 acres.

  Postharvest, *full* vigor would increase on approximately 1,196 acres, *good to average* vigor would decrease on approximately 187 acres, *just below average to poor* vigor would decrease on approximately 998.6 acres, and *poor* vigor would decrease on approximately 10 acres *(TABLE III-27 - CURRENT AND POSTHARVEST PROJECT-AREA VIGOR).*

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Stand Vigor***

  Current stand vigor would remain the same across the forest. Over time, stand vigor would be expected to decrease in the absence of disturbance or management. Occurrences of mortality of trees or groups of trees would reduce the stand vigor in localized areas. Limited salvaging may increase the stand vigor in localized areas. Large reductions in stand vigor would occur if a large fire came through the area and salvage harvesting and regeneration or replanting attempts did not follow.

- ***Cumulative Effects of Action Alternatives B and C to Stand Vigor***

  Cumulative effects would result in an increase in vigor in areas where harvesting has occurred and a decrease in vigor in areas where harvesting has not occurred. The trees no longer perform to their highest potential and become susceptible to insects and diseases, etc. Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to stand vigor due to previous activities on USFS as well as privately held ground, which includes Trust for Public Lands/The Nature

Conservancy property and small, private land holdings adjacent to Swan River State Forest and the project area, have typically been similar to those described for Swan River State Forest, above. Vigor typically increases as stands are harvested and regenerate postharvest; vigor typically decreases as a stand ages and remains in an unmanaged state. Exact stand-vigor assessments were not possible due to the lack of field reconnaissance on non-DNRC-managed ground. Development plans on small, private lands could result in a slight decrease in overall stand vigor as land is converted to nonforested.

STAND STRUCTURE

Issue: The proposed activities may affect the forest stand structure through tree removal.

EXISTING ENVIRONMENT

Stand structure indicates a characteristic of stand development and how the stand would continue to develop. The disturbance regime or most recent disturbance event can also be reflected. Stand structure is described by 3 categories that describe the number of distinct canopy layers present in a stand:

Single-storied: One distinct canopy layer is present; this condition is most commonly seen in young stands following disturbance or prior to regeneration establishment in mature stands that have been harvested with regeneration methods such as seedtree cutting.

Two-storied: Two distinct canopy layers are present; this condition is associated with recently harvested or burned stands that have a number of large, fire-resistant trees growing over established or advanced regeneration, or with the understory reinitiation stage of stand development where shade-tolerant trees establish beneath the existing overstory.

Multistoried: At least 3 distinct canopy levels are present; this condition is commonly associated with older stands that have entered the steady state stage of stand development, where understory trees are advancing into the overstory, or in uneven-aged stands. This condition is often indicative of a long period without disturbance.

TABLE III-28 – CURRENT AND POSTHARVEST STAND STRUCTURE (PERCENT) IN THE PROJECT AREA compares the current proportion of stands and the postharvest results by alternative in single-storied, two-storied, and multistoried stands in the project area.

TABLE III-28 – CURRENT AND POSTHARVEST STAND STRUCTURE (PERCENT) IN THE PROJECT AREA

STAND STRUCTURE	CURRENT AMOUNTS	POSTHARVEST ACTION ALTERNATIVE	
		B	C
Single-storied	24.70	27.62	26.61
Two-storied	30.06	36.48	38.65
Multistoried	39.89	30.56	29.40
Nonforested	5.34	5.34	5.34

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Stand Structure***

  No immediate change in the proportion of existing stand structure is expected unless a large disturbance, such as a wildfire, occurs (*TABLE III-28 – CURRENT AND POSTHARVEST UNIT STAND STRUCTURE (PERCENT) IN THE PROJECT AREA*).

  Forest succession, driven by the impacts of insects and diseases when fires are being suppressed, would reduce the variability of stand structure. As the forest ages and composition become more homogenous, so would the stand type.

- ***Direct and Indirect Effects of Action Alternative B to Stand Structure***

  This alternative proposes regeneration harvesting on approximately 1,313 acres using seedtree and shelterwood treatments and variable thinning on approximately 696 acres.

  The single-storied stand structure would increase approximately 453.7 acres; the two-storied stand structure would increase approximately 999.9 acres; and the multistoried stand structure would decrease approximately 1,453.61 acres.

  The proportion of single-storied stand structure in the project area would increase from 24.70 percent currently to 27.62 percent, the proportion of two-storied stand structure would increase from 30.06 to 36.48 percent, and the proportion of multistoried stand structure would decrease from 39.89 to 30.56 percent (*TABLE III-28 - CURRENT AND POSTHARVEST UNIT STAND STRUCTURE (PERCENT) IN THE PROJECT AREA*).

- ***Direct and Indirect Effects of Action Alternative C to Stand Structure***

  This alternative proposes regeneration harvests using seedtree and shelterwood treatments on approximately 1,189 acres and variable thinning on approximately 1,438 acres.

  The single-storied stand structure would increase approximately 296.78 acres; the two-storied stand structure would increase approximately 1,337.98 acres; and the multistoried stand structure would decrease approximately 1,634.68 acres.

  The proportion of single-storied stand structure in the project area would increase from 24.70 percent currently to 26.61 percent, the proportion of two-storied stand structure would increase from 30.06 percent to 38.65 percent, and the proportion of multistoried stand structure would decrease from 39.89 to 29.40 percent (*TABLE III-28 – CURRENT AND POSTHARVEST UNIT STAND STRUCTURE (PERCENT) IN THE PROJECT AREA*).

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Stand Structure***

  The cumulative effects to stand structure distributions due to previous activities on Swan River State Forest are represented in the description of the current condition. Generally speaking, those effects have been to reduce the acres in multistoried stand

structures while increasing the acres in the single-storied stand structure through even-aged management. However, as a whole, the forest contains a mosaic of structures that include single-storied, two-storied, and multistoried conditions.

Although harvesting has changed the proportion of stand-structure distribution, the harvesting methods used emulate the range of disturbances, from stand-replacement fire to mixed severity and light underburns, which have historically occurred in Swan River State Forest. Seedtree harvests have shifted stands to a single-storied stand structure following harvesting, similar to the effects of stand-replacing fire. Shelterwood and variable thinning treatments have left trees in multiple size classes, initially moving stands to a two-storied structure following harvesting that would, over time and in the absence of further harvesting activities (such as the removal of overstory following successful regeneration after shelterwood cutting) or natural disturbance, develop into multistoried conditions. These treatments emulate the effects of mixed- and low-severity fires.

Barring natural disturbance, over time, untreated stands would gradually shift toward heterogeneous, multistoried, or classic uneven-aged stand structures. Treated stands would also gradually shift toward those stand structures through time.

Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to stand structure distributions due to previous activities on USFS, as well as on privately held ground, which includes Trust for Public Lands/The Nature Conservancy property and small, private landholdings adjacent to Swan River State Forest and the project area, have been variable. Actively managed areas tend to resemble a single-storied stand structure of a single age class, or rather, a stand very homogeneous in appearance. Areas that have not been actively managed can appear single-storied to multistoried due to variances in stand conditions and age classes. Exact stand structure assessments were not possible due to lack of field reconnaissance on non-DNRC-managed ground. Development plans on small, private landholdings could result in a decrease in total forested stand structure as ground is converted to nonforested.

- ***Cumulative Effects of Action Alternatives B and C to Stand Structure***

  The cumulative effects of the action alternatives would be similar to those seen in No-Action Alternative A; however, across areas where management would occur, the result would be a greater increase in the single- and two-storied stand structures and, a greater decrease in the multistoried stand structure.

CROWN COVER

Issue: The proposed activities may affect forest crown cover through tree removal.

EXISTING ENVIRONMENT

Crown cover, an estimate of the ratio between tree crown area and ground surface area, is usually expressed in terms of percent and is another measure of stand stocking and density. Categories used to describe crown cover include well-stocked (over 70 percent),

medium-stocked (40 to 69 percent), poorly stocked (less than 39 percent), nonstocked, and nonforested.

The *SLI* database has a rating for overall crown cover and a rating for sawtimber crown cover in the stand. In terms of overall crown cover in the project area, 50.08 percent of stands are well stocked, 33.41 percent are medium stocked, 11.17 percent are poorly stocked, 0.61 percent is nonstocked, and 4.74 percent are nonforested. Sawtimber stocking in the project area shows that 16.08 percent of stands are well stocked, while 37.22 percent of stands are medium stocked. The poorly- stocked sawtimber category consists of 19.54 percent of the project area; the associated stands are typically in poor health or have high quantities of rock and/or brush. Timber in these stands is generally not of good merchantable quality, but in the instance of poor stand health, steps may be taken to address the issue. The nonstocked sawtimber category consists of 22.42 percent of the project area and the associated stands are typically those that have had regeneration harvest treatments in the past. The nonforested category is 4.74 percent.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Crown Cover***

  No-Action Alternative A would not change the crown cover in the short-term. Over time, individuals and groups of trees would be removed from the canopy by insects, diseases, windthrow, or fires and this would result in variable changes to crown cover as canopy gaps are created and gradually filled. Patches of variable size currently exist where the Douglas-fir bark beetles have killed Douglas-fir, white pine blister rust has killed western white pine, or significant windthrow occurred from storms passing through.

  Overall, crown cover and stocking would likely increase over time in the absence of disturbances. Were large fires to occur, overall crown cover would be reduced. Ongoing insect and disease issues would reduce crown cover and sawtimber stocking in some areas prior to understory reinitiation.

- ***Direct and Indirect Effects of Action Alternatives B and C to Crown Cover***

  The reduction in crown cover subsequent to harvest treatments would vary by action alternative and silvicultural prescription. In general, reduced crown cover affects stand growth and development in various ways. First, competition among the crowns of overstory trees is reduced, allowing accelerated volume growth and increased seed production. Second, competition for water and nutrients is reduced, thus allowing trees to be more resistant to both drought and bark beetle attacks. Third, a more diverse and vigorous understory is able to establish. Finally, sunlight is allowed to reach the forest floor, which, along with seedbed preparation, is of particular importance to the successful regeneration of early seral species such as western larch and western white pine. For this analysis, the residual crown cover includes both the overstory and understory tree canopies that remain after harvesting, including both merchantable and submerchantable trees.

In areas with seedtree harvests, the final crown cover would be an average of 10 percent. In areas with shelterwood harvesting, the final crown cover would be an average of 15 percent. In areas with variable-thinning harvests, the final crown cover would be a minimum of 35 percent.

Under Action Alternative B, the project area would have approximately 40.81 percent well-stocked stands, approximately 34.25 percent medium-stocked stands, approximately 19.59 percent poorly-stocked stands, approximately 0.61 percent nonstocked stands, and approximately 4.74 percent nonforested stands (see *TABLE III-29 - PERCENT OF PROJECT AREA CURRENT AND POSTHARVEST CROWN COVER BY ALTERNATIVE*).

Under Action Alternative C, the project area would have approximately 37.61 percent well-stocked stands, approximately 37.55 percent medium-stocked stands, approximately 19.50 percent poorly-stocked stands, approximately 0.61 percent nonstocked stands, and approximately 4.74 percent nonforested stands (see *TABLE III-29 - PERCENT OF PROJECT AREA CURRENT AND POSTHARVEST CROWN COVER BY ALTERNATIVE*).

TABLE III-29 - PERCENT OF PROJECT AREA CURRENT AND POSTHARVEST CROWN COVER BY ALTERNATIVE

CROWN COVER	CURRENT	POSTHARVEST ACTION ALTERNATIVE	
		B	C
Well stocked	50.08	40.81	37.61
Medium stocked	33.41	34.25	37.55
Poorly stocked	11.17	19.59	19.5
Nonstocked	0.61	0.61	0.61
Nonforested	4.74	4.74	4.74

Riparian stands associated with perennial streams, namely Cedar, Goat, In-pa-ah, Perry, Soup, and Cilly creeks, would not be treated or experience reduced crown cover. A 120-foot buffer would be retained where harvesting activities occur adjacent to Class 1 streams. Class 2 streams would retain a 50-foot no-harvest buffer or a 100-foot buffer on slopes greater than 35 percent. Limited harvesting may occur adjacent to Class 3 streams but 40-percent crown cover would be retained.

Crown cover would increase over time as regeneration replaces the harvested units that received seedtree, shelterwood, and variable thinning treatments. Fifteen to 20 years and 5 to 10 years would be needed to develop 70- to 100-percent crown cover in the regeneration and variable thinning harvest units, respectively.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Crown Cover***

  Current crown cover would remain the same across the forest. Over time, crown cover would be expected to increase in the absence of disturbance. Mortality of trees

or groups of trees would reduce the crown cover in localized areas. Large reductions in crown cover would occur if a large fire came through the area.

- ***Cumulative Effects of Action Alternatives B and C to Crown Cover***

  Overall, reductions of crown cover in well-stocked stands would be dispersed across the landscape. Representation of medium-stocked stands would increase following harvesting, as would poorly-stocked stands. As stands regenerate, crown cover would increase. Based on aerial-photograph interpretation on a landscape basis, the cumulative effects to crown cover due to previous activities on USFS, as well as privately-held ground, including Trust for Public Lands/The Nature Conservancy property and small, private landholdings adjacent to Swan River State Forest and the project area, have been similar to those described for Swan River State Forest. These properties are similar in that their stocking level typically increases as stands regenerate postharvest and all entities have created a mosaic of crown cover on the landscape. Exact crown-cover assessments were not possible due to lack of field reconnaissance on non-DNRC-managed ground. Development plans on small, private lands could result in a decrease in crown cover as land is converted to nonforested.

INSECTS AND DISEASES

Issue: The proposed activities may affect forest insect and disease levels through tree removal (both suppressed/stressed and infested/infected).

EXISTING ENVIRONMENT

Planning for the long-term management of forest insects and diseases is an important part of designing project-level timber sales. Various forest species compositions and structures are more vulnerable to certain insects, diseases, windthrow, and wildfires than others (*Byler and Hagle 2000*). Identifying stands with the most vulnerable compositions and structures and developing suitable management plans can help alleviate future problems that may prevent achievement of long-term objectives for forest management.

Insect and disease activities are recorded and mapped annually from aerial flight surveys. New occurrences and the progression of existing pockets, along with approximate acreages and locations, are collected. Field surveys identify areas with insect and disease activities for timber-harvesting opportunities. Maps of several successive years of flight surveys are available at the Swan River State Forest office.

The major forest insects and diseases currently affecting forest productivity include:

Diseases

- Armillaria root disease
- Larch dwarf mistletoe
- White pine blister rust
- Indian paint fungus
- Red-brown butt rot

Insects

- Douglas-fir bark beetle
- Fir engraver
- Mountain pine beetle

➢ ***Armillaria Root Disease***

Armillaria root disease, caused by the fungus *Armillaria ostoyae,* is a common pathogen of conifers in western North America. Stands impacted by Armillaria root disease occur throughout the project area. While Armillaria root disease can affect all conifers, the most susceptible to sever damage are Douglas-fir, grand fir, and subalpine fir. Silvicultural approaches that emphasize early seral species, natural regeneration, and reducing root-to-root pathways between more susceptible species are recommended for stands with Armillaria root disease (*Filip and Goheen 1984; Morrison and Mallett 1996; Morrison et al. 2000; Morrison et al. 2001; Rizzo et al. 1995*).

➢ ***Western Larch Dwarf Mistletoe***

Western larch dwarf mistletoe, caused by *Arceuthobium laricis*, is considered the most important disease of western larch in the *Inland West* (*Beatty et al. 1997*). Dwarf mistletoes are parasitic plants that obtain moisture and nutrients from their hosts, resulting in a reduction in tree vigor, growth, and seed production. Infections on western larch cause branches to form dense clumps of twigs and branches known as 'witches brooms', which are brittle and prone to breakage under snow loads. Mistletoe infection also increases moisture stress in its host, increasing susceptibility to attack by wood borers (*Gibson 2004*).

The incidence and severity of western larch dwarf mistletoe appears to be highly variable across the project area. This variation most likely reflects a complex history of mixed-severity and stand-replacing fires in these forests. Such fires would variously leave both mistletoe-infected and noninfected trees to provide seed for the next generation. Depending on the spatial distribution of infected, seed-bearing trees following fires, western larch regeneration might remain free of infection, have a substantial lag-time prior to infection, or become infected early in development. The earlier a tree becomes infected by dwarf mistletoe, the greater the impacts.

Due to the seeding habit of dwarf mistletoes, spread and intensification are at their worst when an infected overstory exists over the regeneration of the same tree species. Seedtree or shelterwood treatments can still be carried out in stands that have dwarf mistletoe infections in the overstory, but tree selection in such instances needs to discriminate against the most heavily dwarf mistletoe-infected western larch and leave as many noninfected or lightly-infected trees as possible (*Beatty et al. 1997*).

➢ ***White Pine Blister Rust***

Western white pine has declined where it occurred historically on Swan River State Forest. The primary cause is white pine blister rust, a disease caused by the nonnative fungus *Cronartium ribicola,* which can infect and kill western white pine of all ages and sizes.

Some western white pine remain on Swan River State Forest because either they possess natural genetic resistance to the rust or have not been infected. Retention of such trees is encouraged to maintain genetic diversity and promote natural regeneration where possible (*Schwandt and Zack 1996*).

Trees infected by white pine blister rust are more susceptible to attack by insects such as the mountain pine beetle (*Dendroctonus ponderosae*). Management and restoration recommendations for western white pine emphasize planting rust-resistant western white pine seedlings and maintaining western white pine genetic diversity (*Fins et al. 2001*).

- ***Indian Paint Fungus***

Indian paint fungus is a true heartrot that commonly infects true firs and hemlocks. True heartrots are generally confined to the heartwood of trees and produce fruiting bodies or conks on the stems of living trees, causing extensive decay of the heartwood that, over time, increases susceptibility to stem collapse. Large-diameter grand fir with decay caused by Indian paint fungus are important habitat, both while standing and down, for various species of cavity-nesting birds and mammals (*Bull et al. 1997*).

In the project area, Indian paint fungus is well distributed on grand and subalpine firs. Stand exams and reconnaissance surveys reveal a 30- to 40-percent infection rate. Management recommendations to reduce losses from Indian paint fungus include keeping rotation lengths of susceptible species to less than 150 years, early thinning, leaving vigorous residual trees, and avoiding tree damage when conducting silvicultural treatments (*Filip et al. 1983*).

- ***Red-Brown Butt Rot***

Red-brown butt rot is caused by the root-infecting pathogen *Phaeolus schweinitzii*. Any conifer can be a host, but infection is considered of primary importance in Douglas-fir. Red-brown butt rot infects trees via small roots and causes decay in the interior of the roots, which eventually extends into the butt log an average of 8 feet, making such trees susceptible to stem collapse and windthrow. Instead of affecting trees in groups as do root diseases such as Armillaria root disease, red-brown butt rot tends to affect trees on an individual basis (*Hansen and Lewis 1997*). Most damage occurs in stands more than 80 years of age. Management options are limited. Rotations can be shortened to about 90 years in Douglas-fir to minimize loss due to decay, and less-affected host species can be emphasized over Douglas-fir.

Red-brown butt rot is found on individual trees throughout the project area, but is not currently above endemic levels.

- ***Douglas-Fir Bark Beetle***

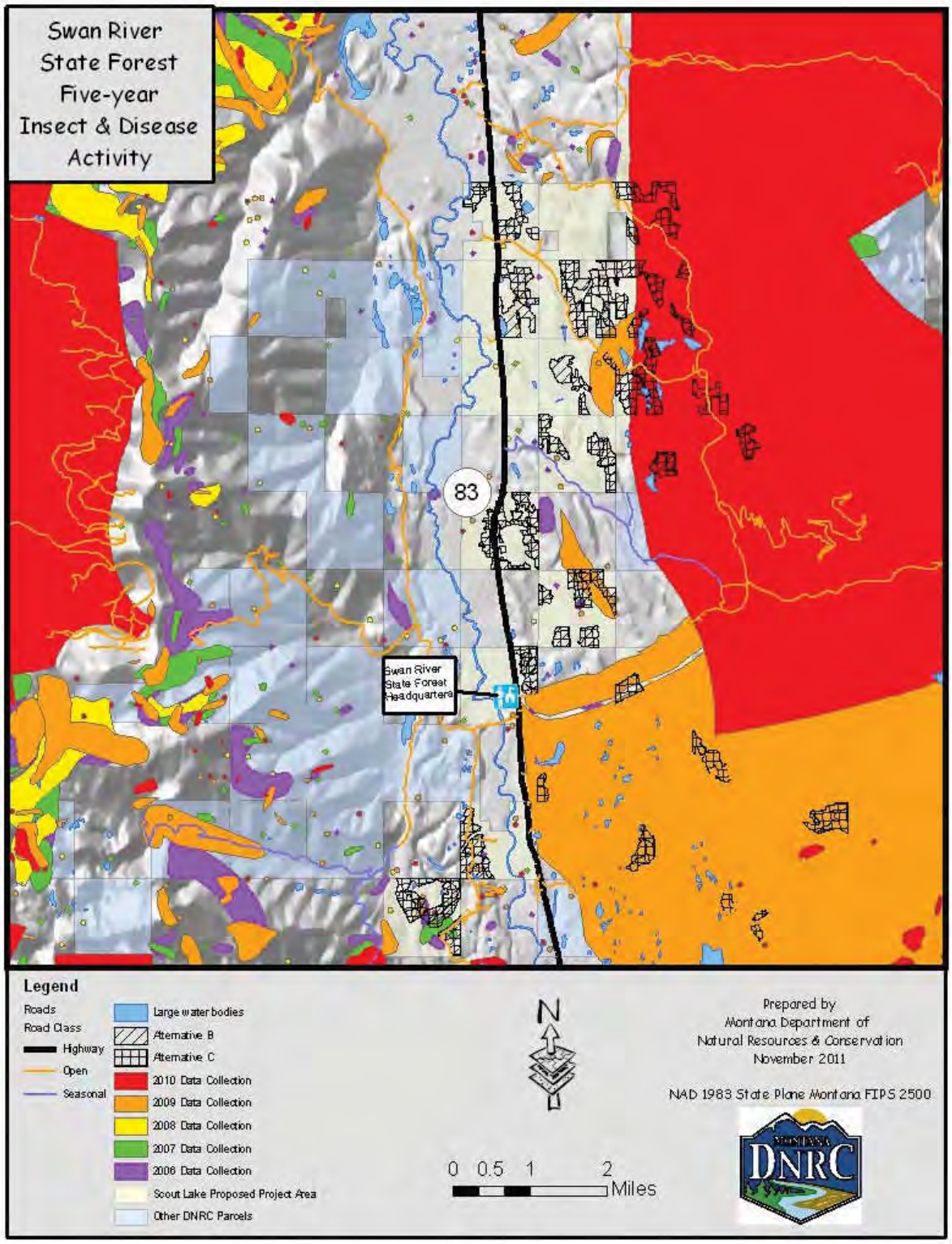
The Douglas-fir bark beetle has been active in recent years across Swan River State Forest. The project area has an elevated incidence of the Douglas-fir bark beetle in areas proposed for harvesting. In general, stands that are at highest risk to attack by the Douglas-fir bark beetle are those with:

- basal areas greater than 250 square feet per acre;
- an average stand age greater than 120 years;
- an average dbh greater than 14 inches; and
- a stand composition greater than 50 percent Douglas-fir (*USDA Forest Service 1999)*.

Management of the Douglas-fir bark beetle should concentrate on the removal of windthrown Douglas-fir and the salvage of newly attacked trees before adult beetles can emerge (*Livingston 1999; Schmitz and Gibson 1996*).

Douglas-fir in most of the proposed harvest areas are at high risk of Douglas-fir bark beetle attack due to age, size, and stocking. Numerous pockets of infestations were located in the analysis area in 2003. Each spring, aerial surveys and light field reconnaissances by *DNRC* foresters were completed to determine the extent of infestations (see *FIGURE III-6 - INSECT ACTIVITY 2007 THROUGH 2010 IN THE VICINITY OF THE PROJECT AREA, ALL ALTERNATIVES*). Beetles were estimated to have caused heavy Douglas-fir mortality on approximately 1,000 acres. The Swan River State Forest timber permit program allowed for the salvage harvesting of approximately 1 MMbf of sawlogs in 2005, 400 Mbf in 2006, and 500 Mbf in 2007.

FIGURE III-6 - INSECT ACTIVITY 2007 THROUGH 2010 IN THE VICINITY OF THE PROJECT AREA, ALL ALTERNATIVES



- ***Fir Engraver***

  The fir engraver, *Scolytus ventralis*, has killed many grand and subalpine firs in the Swan Valley. Its primary host is grand fir (*Ferrell 1986*). Endemic populations of fir engraver beetles are closely associated with root disease or other factors that stress its hosts; they rarely make successful attacks on vigorous grand fir (*Goheen and Hansen 1993*). Silvicultural practices that promote the vigor of grand fir stands (thinning, for example) and promote species less susceptible to root disease can reduce impacts from the fir engraver (*Ferrell 1986*). The fir engraver is present in approximately 15 to 20 percent of the project area; however, most of that area has been previously affected and only small patches in select stands are experiencing current activity.

- ***Mountain pine beetle***

  The mountain pine beetle (*Dendroctonus ponderosae*) is a native North American bark beetle with 4 major hosts, including lodgepole pine, western white pine, and ponderosa pine (*Amman et al. 1989*). A mountain pine beetle attack is characterized by the presence of pitch tubes along the bole of the tree. Mountain pine beetles kill trees by girdling the cambium layer beneath the bark and introducing blue stain fungi that grow into the sapwood, both of which disrupt the flow of water and nutrients through the tree. When its population is above endemic levels, mountain pine beetles can kill extensive stands of trees.

  Numerous areas of mountain pine beetle infestations were located in the analysis area in 2010. Each spring, aerial surveys, as well as light field reconnaissance by DNRC foresters, were completed to determine the extent of the infestations (see *FIGURE III-6 - INSECT ACTIVITY 2007 THROUGH 2010 IN THE VICINITY OF THE PROJECT AREA, ALL ALTERNATIVES*). The beetle was estimated to have caused heavy lodgepole pine mortality on approximately 1,300 acres on Swan River State Forest.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Insects and Diseases***

  Sawlog volume would continue to be lost from the project area due to insect and disease effects, especially from Douglas-fir bark beetles, *Armillaria* root disease, mountain pine beetles, and Indian paint fungus in inaccessible stands with large trees. Salvage logging would continue where stands are accessible without building roads.

  If this alternative were implemented, seral and other shade-intolerant species, such as western larch and Douglas-fir, would continue to be lost from insect infestations and disease infections. The spread of the fir engraver would continue, causing mortality in grand and subalpine firs.

  School trusts may lose long-term revenue due to:

  – increasing mortality rates and sawlog defect that are caused by the ongoing presence of a variety of the aforementioned pathogens;

- reduced growth rates as old-growth stands continue to age and defects increase; and
- the nonregeneration of high-valued species such as western larch and western white pine.

- ***Direct Effects of Action Alternatives B and C to Insects and Diseases***

  Harvest treatments would target those species or individuals affected by insects and diseases, as well as salvage recently killed trees. Douglas-fir currently or recently infested by the Douglas-fir bark beetle, lodgepole pine currently or recently infested by the mountain pine beetle, and western white pine currently or recently infested by the mountain pine beetle would be removed when merchantable value exists. Western larch with moderate to severe infections of dwarf mistletoe would be harvested. Grand fir and subalpine fir would be removed if infected with Indian paint fungus. Western white pine currently infected or recently killed by white pine blister rust would be removed when merchantable value exists. Trees within *Armillaria* root rot pockets would be removed, particularly if conversion to early-seral species is possible. By removing green infected trees, the continued spread of the various insects and diseases would be hampered.

  Harvest treatments would focus on leaving early-seral species, such as western larch, that are more resistant to insect and diseases than shade-tolerant species. Reserve trees left following harvesting would also provide a seed source for natural regeneration.

  Insect and disease problems would be reduced following implementation of either action alternative. Action Alternative B does the most to control rates of spread, economic value loss, and volume loss in the project area. Action Alternative C would have decreased efficacy in treating insect and disease activities.

- ***Direct Effects of Action Alternative B to Insects and Diseases***

  The stands selected for this alternative are slightly more concentrated in the project area and have insect and disease activities occurring at all levels, from low-to-moderate to high levels. Emphasis would be placed on trees (groups or individuals) that are affected by insects or diseases, are at risk of infection, or, if dead, contain merchantable material.

  The majority of the units would be treated with regeneration harvests, but some variable thinning would be applied. Regenerating species would be shade-intolerant species, such as western larch, that are more resistant to many of the infecting agents currently present. This alternative treats the most acres (1,313) with site-intensive management-type treatments to address insect and disease problems in the project area.

- ***Direct Effects of Action Alternative C to Insects and Diseases***

  The stands selected for this alternative are spread throughout the project area and have insect and disease activities occurring at all levels, from low-to-moderate to high levels. Emphasis would be placed on trees (groups or individuals) that are affected by insects or diseases, are at risk of infection, or, if dead, contain

merchantable material. In units utilizing a regeneration harvest, seedtrees would remain scattered throughout to provide a seed source; these seedtrees would primarily be shade-intolerant species, such as western larch, that have a higher tolerance to insects and diseases. This alternative treats 833 acres with moderate and moderate-to-high levels of insect and disease problems in the project area.

- ***Indirect Effects of Action Alternatives B and C to Insects and Diseases***

  Where shelterwood and variable-thin treatments are applied, an indirect effect would be increased vigor and growth rates of the remaining trees due to the availability of light, nutrients, and moisture. Following treatment, the species composition would be more resilient to damage by forest diseases and insects.

  Rust-resistant western white pine, western larch, and, in some cases, ponderosa pine would be planted in units utilizing seedtree harvest treatments. The western white pine seedlings would increase a declining component on Swan River State Forest. The planting of western larch would help reduce the likelihood of future insect and disease problems due to its lower susceptibility to many of the problems being addressed.

  Under Action Alternative B, the newly established stands would be healthier and the overstory would not be laden with insect and disease activities that would infect/infest the seedlings. This alternative would also treat the most acres with site-intensive management treatments to address insect and disease problems, which, in turn, would lead to healthier forest stands in the future.

  Action Alternative C also proposes harvesting insect-infested and disease-infected stands spread throughout the project area. This alternative would not treat as many acres with regeneration harvesting to address insect and disease problems as Action Alternative B, but would have similar effects on the acres that were treated. Overall, this alternative may do less than Action Alternative B to address the insect and disease problems prevalent in the project area.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Insects and Diseases***

  No harvesting of live, dead, dying, or high-risk trees would occur. Some salvage harvesting of insect-infested and disease-infected trees would occur, but at a slower, less-effective rate and not as a result of this analysis or association with this project. Forest stands would maintain dense stocking levels, which contribute to the spread of insects, diseases, and fuel loading, which could lead to high-intensity fires, unnatural forest structures, and overall poor health of the stand.

- ***Cumulative Effects of Action Alternatives B and C to Insects and Diseases***

  Timber-management activities on Swan River State Forest, including those proposed to varying extents under each action alternative, have generally implemented prescriptions that would reduce losses and recover mortality due to stem rots, bark beetles, white pine blister rust, western larch dwarf mistletoe, blowdown, and other causes. Older stands are the most susceptible to many of the identified insect and disease problems in the project area due to lack of vigor, stand age, drought, and

other factors. Stand regeneration treatments that would bring older stands to a 0-to-39-year age class are producing stands with species compositions more resilient to the impacts of forest insects and diseases and more in line with historic forest conditions. Thinning treatments have further reduced the percentage of infected or infested trees.

Activities on USFS as well as on privately-held ground, including Trust for Public Lands/The Nature Conservancy property and small, private landholdings adjacent to Swan River State Forest and the project area, have been mixed. An overall decrease in insects and diseases on formerly owned Plum Creek property may be assumed due to active industrial timber management. Depending on land-management objectives or other mandates, small private landowners or other government agencies may or may not currently employ prescriptions that aim to reduce insect and disease levels on their lands.

FIRE EFFECTS

Issue: The proposed activities may affect forest fire conditions, levels, and hazards through tree removal, increased public access, and/or fuel reduction.

EXISTING ENVIRONMENT

Swan River State Forest Fire History

Swan River State Forest displays a mosaic pattern of age classes and covertypes that have developed due to variations in fire frequency and intensity. In areas that have experienced relatively frequent fires, Douglas-fir, western larch, and ponderosa pine covertypes, with a component of lodgepole pine and western white pine, were produced. As fire frequencies become longer in time, shade-tolerant species (grand fir, subalpine fir, Engelmann spruce, western red cedar) have a better chance to develop. Higher elevation sites in the forest have longer fire frequencies, and the resultant stands are multistoried with a dominant shade-tolerant covertype. Where fire frequencies were short, the stands are open, single-storied, and occasionally two-storied. As fire suppression began, covertypes and fire frequencies were altered. Stands of ponderosa pine, western larch, and/or Douglas-fir have become multistoried with shade-tolerant species. Ponderosa pine-dominated stands that were once open now have a thick understory of Douglas-fir. Fires that do occur are generally kept small and natural fire effects are limited. If a larger scale fire were to start, many acres could be affected due to ladder fuels, heavy fuel accumulation, and other environmental factors.

Swan River State Forest has identified 83 fires that have burned 2,227.63 acres over the last 30 years. On average, 2.8 fires per year occur. Over the last 30 years, 59 lightning fires have burned 75.2 acres, with the largest occurring in 1994 during a dry lightning storm; that fire burned 65 acres in the upper subalpine fir habitat types. Lightning causes approximately 71 percent of all fire starts on Swan River State Forest, and humans cause approximately 29 percent. Human-caused fires are typically started from campfires, debris burning, equipment, or incidents directly related to powerline sparks (*http://mine.mt.gov/f1000/reports.aspx:F1000 Reports*).

In or adjacent to the project area on the east side of Swan River, 49 fires burned 2,202.7 acres over the last 30 years. Lightning caused 34 out of 49, or 69.4 percent of the fires, and burned 2.1 acres *(F1000 reports).*

Past research of fire history in Swan Valley has been conducted. The following summaries describe the fire history and patterns these fires created on the landscape.

Hart (1989) summarized the historical data as follows:

> *Although most of the burns…were of stand-replacement intensity, many less intense fires had also crept over wide areas. The upper (southern) half of Swan valley had been extensively burned, and was blanketed by fallen trees. In this area, fires were moderate, thinning the forest. The lower (northern) Swan also was scarred by fires, but it had a great deal of older mixed forest; species typical of mesic sites were found in this region…*

Antos and Habeck (1981), working mostly in the northern portion of Swan Valley, emphasized the dominance of low-frequency, high-intensity fires (stand-replacement fires) in determining stand patterns:

> *During most summers, the occurrence of frequent rain makes intense fires unlikely; but in some years, dry summers set the stage for large crown fires. Most stands were initiated on large burns… An average frequency of replacement burns of between 100 and 200 years was characteristic… Stands over 300 years old do occur, and repeat burns less than 20 years apart have also occurred. In some forests initiated by replacement burns, ground fires have occurred after stand establishment, with variable effects on the overstory. Very wet sites, such as stream bottoms and lower north slopes, often experience partial burns when located within the perimeter of large replacement burns.*

The analysis of fire history indicates that the lower elevations of Swan Valley were burned frequently; in the drier southern half, the intervals were shorter than on the more moist northern part. Between the years of 1758 and 1905, this portion of the range had fire-free intervals of about 30 years, and the presence of western larch and even-aged lodgepole pine suggests the fires were of higher intensity. The remaining samples are from the southern end and these have a shorter interval of 17 years (*Freedman and Habeck, 1985*).

Historical data indicates that forests in Swan River State Forest and the project area were cooler and moister than the broad scale *Climatic Section* and western Montana averages. Forests were also considerably older with a far higher proportion of western larch/Douglas-fir covertypes than at the broad scale. Although the forests of Swan River State Forest were old, the representation of shade-tolerant covertypes was low, indicating disturbance was frequent or recent enough to prevent widespread covertype conversion through succession.

Fire Groups

The project area is primarily represented by 2 fire groups as classified by *Fischer and Bradley (1987)*. Fire Group 11 is found on warm, moist grand fir, western red cedar, and western hemlock habitat types (75 percent of the project area). Fire Group 9 is found on moist, lower subalpine habitat types (16 percent of the project area). Other fire groups represented in the project area include Fire Group 6 (moist Douglas-fir habitat types)

representing 8 percent and Fire Group 4 (warm, dry Douglas-fir habitat types) representing 1 percent of the project area. *TABLE III-30 – CHARACTERISTICS OF FIRE GROUPS OCCURRING IN THE PROJECT AREA (Fischer and Bradley, 1987)* describes the characteristics of the Fire Groups present in the project area.

TABLE III-30 – CHARACTERISTICS OF FIRE GROUPS OCCURRING IN THE PROJECT AREA (Fischer and Bradley, 1987)

	FIRE GROUP			
	4	**6**	**9**	**11**
Habitat type group	Warm, dry Douglas-fir habitat types	Moist Douglas-fir habitat types	Moist. lower subalpine habitat types	Moist grand fir, western red cedar, and western hemlock habitat types
Percent of project area	1	8	16	75
Fire return interval/severity	Frequent/low	Frequent/low to moderate	Infrequent/mixed (low to high)	Infrequent/mixed (low to high)
Average fuel loading (tons/acre)	11	12	25	25
Postharvest fuel loading (tons/acre)	10 to 25	10 to 25	10 to 25	10 to 25

Stands in both Fire Groups 9 and 11 would typically experience infrequent fires of mixed severity ranging from stand-replacing during droughty conditions to minor ground fires under normal or excessively moist conditions. Fire free intervals typically range from 100 to 200 years between stand-replacing fires, but return intervals of 30 years have also been documented, particularly in the relatively drier grand fir habitat types that have a component of ponderosa pine. These fire groups have predominately moist conditions, which can allow these areas to serve as a fire break for low-intensity ground fires. These sites have high fuel loadings and high plant productivity that, when combined with drought conditions, can lead to severe and widespread fires. The effects of fire on these sites are dependent on severity, but generally create conditions favorable to early-seral, shade-intolerant species by killing shade-tolerant overstory trees and preparing mineral seedbeds for natural regeneration.

Fire Groups 4 and 6 are characterized by frequent, low-severity fires. These sites are drier than those found on Fire Groups 9 and 11, and typically have significant components of ponderosa pine and Douglas-fir. On these sites, frequent, low-severity fire would kill most Douglas-fir and maintain forests dominated by ponderosa pine. A prolonged fire-free interval would allow the establishment and development of Douglas-fir.

Hazards and Risks in the Project Area

The hazards and risks associated with wildfires include a potential loss of timber resources, effects to watersheds, and loss of property. The majority of timber stands being considered for harvesting are in the mature or older age classes in stands that have not burned since pre-European settlement. Fire hazards in these areas range from

above- to near-natural levels with moderate to high accumulations of down and ladder fuels relative to stand densities. Some of the western larch/Douglas-fir stands have a dense understory of grand fir, creating a significant hazard due to its density and structure that increases the risk that a low-intensity ground fire could develop into a stand-replacing crown fire.

Many of the old-growth stands in the project area are relic stands. Stand-replacing fires have not occurred in the area for 200 or more years. As the stands continue to age and mortality occurs from various biotic and abiotic factors, fuels would accumulate. These stands have an in-growth of shade-tolerant trees, which provide ground and ladder fuels, thus increasing their susceptibility to intense fires, especially during times of drought. Accessible stands have had salvage logging and firewood cutting that has reduced the larger-diameter down fuels in the area. The continued encroachment of shade-tolerant trees, accumulations of down woody debris, and mortality increases fire risks.

Increased recreational use in the area is another potential ignition source that may result in a hazardous condition due to fuel accumulation.

Nonindustrial forestland adjacent to the project area has a similar amount of fuel loading. Much of the adjacent *USFS* ownership has not been managed for several years. The resulting stands have a moderate to high risk of stand-replacement wildfires due to continued heavy fuel loadings.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Fire Effects***

  The wildfire hazard would not change substantially in the short term. With continued fuel accumulation from down woody debris, the potential for wildfires increases. Large-scale, stand-replacing fires may be the outcome. Eventually, due to the continuing accumulation of fine fuels, snags, ladder fuels, and deadwood components, the risk of stand-replacement fires would increase.

- ***Direct and Indirect Effects of Action Alternatives B and C to Fire Effects***

  Immediately following timber harvesting, the amount of fine fuels would increase. Hazards would be reduced by scattering slash, cutting limbs and tops to within a maximum height to hasten decomposition, spot-piling by machine in openings created by harvesting, and burning landing piles.

  Seedtree and shelterwood units would be treated by simultaneously piling slash and scarifying soil with an excavator, followed by burning slash piles. Scarification prepares seedbeds for natural regeneration.

  The hazards of destructive wildfires in these stands would be reduced because larger, more fire-resistant species would be left at wider spacing. Grand fir, some Douglas-fir, western red cedar, and subalpine fir, which pose a higher crown-fire hazard because of their low-growing branches and combustible nature, would be removed. This would reduce the potential mortality from low- to moderate-

intensity fires, but would not 'fireproof' the stands from the high-intensity stand-replacing fires brought on by drought and wind.

Seedtree and shelterwood harvest treatments would reduce wildfire hazards. Regeneration harvests, where slash has been treated, but trees are still small, have proven to be fire resistant in many cases. However, contrary conclusions have been put forth wherein timber harvesting is believed to have increased the risk of wildfires, especially in the short-term, where logging slash was not treated. Fire hazards would slowly increase over time as trees reach pole size, crown densities increase, and fuels accumulate.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A on Fire Effects***

  The risk of wildfires would continue to increase as a result of long-term fire suppression.

- ***Cumulative Effects of Action Alternatives B and C on Fire Effects***

  Fuel loadings would be reduced in treated stands, decreasing wildfire risks in these specific areas.

  The White Porcupine Multiple Timber Sales (1, 2, White Donut, White Wood, White Cliffs, White Tailed, White Cedar, and White Bird) have a combination of broadcast burning and excavator piling, with burning to be completed from the fall of 2010 to the fall of 2014. Past and ongoing salvage sales across Swan River State Forest will also have excavator piling and burning associated with slash at the landings. The net cumulative effect would be a reduction in wildfire risks. The differing management techniques of *USFS*, Trust for Public Lands/The Nature Conservancy, and small, private landowners may result in a slight, net cumulative reduction in wildfire risks.

SENSITIVE PLANTS

Issue: The proposed activities may affect sensitive plant populations through ground disturbance.

EXISTING ENVIRONMENT

The *Montana Natural Heritage Program (MNHP)* database (*http://www.nhp.nris.mt.gov*) was searched in May 2003 for plant species and the habitat that would support these plants in the vicinity of Swan River State Forest. Botanists were contracted to perform a site-specific survey for sensitive plants on Swan River State Forest. Results of this search were compared to the location of proposed harvest sites for potential direct and indirect impacts and the need for mitigation measures was assessed.

The majority of sensitive plants and their related habitat features were found in wet meadows, areas that are not normally classified as forest stands or considered for timber harvesting. The survey identified 9 species of special concern existing within a total of 19 separate populations (*Pierce and Barton 2003*); none of these plant populations are in the harvest units.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of All Alternatives to Sensitive Plants***

  No effects are expected because no populations of sensitive plants occur in the harvest units. Typically, these plants are located in such wet areas that activities will not occur within the plant habitat.

Cumulative Effects

- ***Cumulative Effects of All Alternatives to Sensitive Plants***

  If changes occur in the water yield or nutrient level, sensitive plant populations may, in turn, be affected. Given the level of the proposed and active harvesting on Swan River State Forest and other lands in the project area, no measurable changes in water yield or surface water levels are anticipated from any of the proposed action alternatives in Cedar, Goat, In-pa-ah, Perry, Soup, or Cilly creeks. No change in nutrient levels would occur due to mitigation measures designed to prevent erosion and sediment delivery. USFS lands, Trust for Public Lands/The Nature Conservancy property and private, nonindustrial landholdings may have sensitive plant populations on their ownership, and various activities may impact those populations.

NOXIOUS WEEDS

Issue: The proposed activities may affect noxious weed populations and presence through ground disturbance and weed introduction.

EXISTING ENVIRONMENT

Spotted knapweed, yellow hawkweed, orange hawkweed, Canada thistle, oxeye daisy, and common St. John's-wort have become established along road edges in the project area. Swan River State Forest has an ongoing program to reduce the spread and occurrence of noxious weeds.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Noxious Weeds***

  Noxious weed populations would continue as they exist. Weed seed would continue to be introduced by recreational use of the forest and log hauling and other forest-management activities on adjacent ownerships. Swan River State Forest may initiate spot spraying to reduce noxious weed spread along roads under the *FI* program.

- ***Direct and Indirect Effects of All Action Alternatives to Noxious Weeds***

  Logging disturbance would provide opportunities for increased establishment of noxious weeds; log hauling and equipment movement would introduce weed seeds from other sites. The occurrence and spread of existing or new noxious weeds would be reduced by mitigation measures in the form of integrated weed-management techniques. Grass seeding of new and disturbed roads and landings and spot spraying of new infestations would reduce or prevent the establishment of

new weed populations. Contractors would be required to wash and have machinery inspected prior to entering the project area to reduce the introduction of noxious weed seeds. Roadside herbicide spraying would reduce existing populations of noxious weeds. All herbicide applications would follow label directions, avoid introduction of chemicals into riparian systems, and target only the intended species of noxious weeds.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Noxious Weeds***

  Salvage logging on state land and harvesting activities on adjacent lands would continue to provide opportunities for noxious weeds to become established. Current population levels would continue to exist and may increase over time.

- ***Cumulative Effects of All Action Alternatives to Noxious Weeds***

  The action alternatives, together with other management and recreational activities on Swan River State Forest, would provide an opportunity for the transfer of weed seed and increased establishment of noxious weeds. Preventative actions facilitated by the *Lake County Weed Board* and the active weed-management activities performed by Swan River State Forest would reduce the spread and establishment of noxious weeds, as well as the impacts resulting from the replacement of native species. Swan River State Forest would continue to perform weed management through this action depending on funding levels. Trust for Public Lands/The Nature Conservancy works in conjunction with Swan River State Forest to treat noxious weeds; therefore, treatment of noxious weeds could be expected on adjacent parcels under their ownership. Private, nonindustrial landowners may continue to transfer weed seed through vehicle travel and lack of weed management.

VEGETATION ANALYSIS ATTACHMENT 1
OLD-GROWTH ATTRIBUTE ASSIGNMENTS

LARGE LIVE TREES

Listing the number of trees in the (21 inches or greater dbh category), first, and the (17 inches or greater dbh category) second: all possible combinations are shown for each class.

Lots = (11, 11); (11, 3); (11, 6)

Some = (6, 11); (6, 6); (1, 11); (6, 1); (6, 3)

Few = (1, 6); (1, 1); (0, 11); (0, 6); (3, 3); (3, 1)

None = (0, 0); (0, 1)

LARGE COARSE WOODY DEBRIS

DWOODSM = number of small pieces (<16 inches dbh) of coarse woody debris within a 300-foot transect

DWOODLG = number of large pieces (>16 inches dbh) of coarse woody debris within a 300-foot transect

CWDNEW = DWOODSM + (3 * DWOODLG)

Lots = CWDNEW ³ 27

Some = CWDNEW ³ 14 and <27

Few = CWDNEW ³ 3 and <14

None = CWDNEW 0, 1, or 2

SNAGS

Lots = [6 snags at 21 inches or greater dbh] or [11 snags at 15 to 20 inch dbh] possible combinations: listing the 21 inches or greater dbh snag category), first and the (15- to 20-inch dbh snag category), second are (6,0), (6,1), (6, 3), (6,6), (6,11), (11,0), (11,1), (11,6), (11,11), (1,11), or (0,11)

Some = [1 snag at 21 inches or greater dbh] or [6 snags at 15 inches or greater dbh] possible combinations: listing the (21 inches or greater dbh snag category), first and the (15- to 20-inch dbh snag category), second are (3, 3), (3, 6), (1, 0), (1, 1), (1, 6), (1, 3), or (0, 6)

Few = [0 snags at 21 inches or greater dbh] or [1 to 5 snags at 15- to 20-inch dbh] possible combinations: listing the (21 inches or greater dbh snag category), first and the (15- to 20-inch dbh snag category), second are (0, 3) or (0, 1)

None = [0 snags at 21 inches or greater dbh and 0 snags at 15- to 20-inch dbh) possible combinations: listing the (21 inches or greater dbh snag category), first and the (15- to 20-inch dbh snag category), second are (0, 0)

DECADENCE

Lots = Stand mortality likely exceeds growth.

Some = Closed canopy with crown ratios less than 33 percent. Growth and mortality approximately equal.

Little = Canopies mostly closed with crown ratios between 33 and 50 percent. Growth rates exceed mortality.

None = Open canopy and growth is optimal.

HYDROLOGY ANALYSIS

INTRODUCTION

This analysis is designed to disclose the existing condition of the water resources and display the anticipated effects that may result from each alternative of this proposal. Affected watersheds may include Cedar, Cilly, Goat, In-pa-ah/Perry, Soup, South Woodward, and Squeezer creeks, and portions of Swan River. Management responsibility within each watershed varies by owner. Management is generally implemented by DNRC, FNF, DFWP, The Nature Conservancy, and non-industrial private landowners.

The *ENVIRONMENTAL EFFECTS* section discloses the anticipated direct, indirect, and cumulative effects to water resources in the analysis area from the proposed actions. Past, current, and future planned activities on all ownerships in each analysis area have been taken into account for the cumulative-effects analysis.

The primary concerns relating to aquatic resources in the analysis area are potential impacts to water quality from sources or actions outside the channel; however, increases in annual water yield could result in increased in-stream erosion. In order to address these issues, measurement criteria was developed to provide for disclosure of potential impacts and a consistent comparison of alternatives.

ISSUES AND MEASUREMENT CRITERIA

During the initial scoping, issues were identified regarding water quality and water quantity. After reviewing public and internal comments, DNRC developed issue statements regarding the potential effects of the proposed timber-harvesting and road-management activities (*TABLE III-31 – ISSUE STATEMENTS AND MEASUREMENT INDICATORS*).

TABLE III-31 - ISSUE STATEMENTS AND MEASUREMENT INDICATORS

ISSUE STATEMENT	MEASUREMENT INDICATOR
Timber harvesting and road construction has the potential to increase water yield, which, in turn, may affect erosive power, in-stream sediment production, and stream-channel stability.	Annual water-yield increases will serve as measure. Risk of adverse impacts will be based on channel condition, beneficial uses present, and watershed thresholds. A qualitative risk assessment will assess potential impacts of peak flows.
Timber harvesting and road construction may increase sediment delivery into streams/lakes and affect water quality.	Risk assessment using the *Washington Forest Practices Board* methodology for existing and proposed road based sites; erosion risk from the *GEOLOGY AND SOILS ANALYSIS* portion of the EIS coupled with sediment travel distances found in relevant literature.
Timber-harvesting activities may adversely affect water quality by reducing shade and increasing stream temperature.	Changes in riparian canopy due to the project proposal.

These issues can best be evaluated by analyzing the anticipated effects of sediment delivery and water yield on the water quality of streams in the project area and also by evaluating the change in riparian canopy.

ANALYSIS METHOD

Sediment Delivery

The methods applied to the project area to evaluate potential direct, indirect, and cumulative effects include a field review of potential sediment sources from roads including proposed new and temporary roads. Stream crossings and roads near streams were evaluated to determine existing sources of introduced sediment. Data were collected in 2001, 2002, 2007, 2010, and 2011 to quantify sediment delivery from roads using procedures adapted from the *Washington Forest Practices Board* (*Dube*, *Megahan and McCalmon 2004; Callahan 2000*). The potential sediment delivery from stream crossings has been addressed in several projects, including the *Swan Lake Water Quality Protection Plan* and *Total Maximum Daily Load* (*TMDL) (DEQ 2004)*, *Three Creeks Timber Sale Project FEIS (DNRC 2006),* and *White Porcupine Multiple Timber Sale Project FEIS (DNRC 2009).* This analysis will use data from each of these projects as well as field data collected for this project to estimate the potential sediment delivery. The sediment delivery values are estimates based on the *Washington Forest Practices Board* methodologies and are not measured values.

Potential risk of sediment delivery from harvest units will tier to the *GEOLOGY AND SOILS ANALYSIS* in this document. Information from this analysis, specifically risk of erosion, will be considered when potential impact to water quality from sediment delivery is assessed within individual watersheds. In-channel sources of sediment will be addressed qualitatively by discussing the risk of increased in-stream erosion due to annual water-yield increases.

Water Yield

Annual water yield will be disclosed as a cumulative effect in the *EXISTING CONDITIONS* portion of this report because the existing condition is a result of all past harvesting and associated activities. Annual water yield refers to the gross volume of water in a watershed that is contributed to a stream or other surface water feature. In the *ENVIRONMENTAL EFFECTS* portion of this report, water-yield increases as a result of this project will be disclosed as a direct effect. The cumulative water-yield increase for each alternative will be disclosed by watershed analysis area as a cumulative effect.

The annual water-yield increase for watersheds in the project area was estimated using the *Equivalent Clearcut Acres (ECA)* method as outlined in *Forest Hydrology, Part II (Haupt et al, 1976)*. This method does not predict changes in peak flows.

ECA is a function of total area roaded, harvested, or burned; percent of crown removed during harvesting or a wildfire; and the amount of vegetative recovery that has occurred in the harvested or burned areas. As live trees are removed, the water that would have evaporated and transpired either saturates the soil or is translated to runoff. This method also estimates the recovery of these increases as new trees revegetate the site and move toward preharvest water use.

In order to evaluate the potential effects of water-yield increases, a threshold of concern for each watershed was established per *ARM 36.11.423*. Thresholds were established based on evaluating the acceptable risk level, resources value, and watershed sensitivity. Increased annual water yields above the threshold of concern have the potential to result in an increased risk of in-channel erosion and degradation of fisheries habitat.

Changes in peak flow are dependent upon several variables, including precipitation changes, evaporation, transpiration, soil moisture levels, and canopy density changes (*Troendle, McDonald, Luce and Larsen 2010*). These variables combined with unpredictable climate factors, such as wind and storm events, make it very difficult to accurately portray peak-flow increases. Troendle and others concluded that changes in peak flow due to forest management are generally smaller than the annual variability of runoff events. To address peak-flow impacts, a qualitative risk assessment will be applied to each watershed in the project area.

Risk Assessment Criteria

Where risk is assessed in both sediment-delivery and water-yield analyses, the following definitions apply to the level of risk reported:

- *low risk* means that impacts are unlikely to result from proposed activities,
- *moderate risk* means that there is approximately a 50-percent chance of impacts resulting from proposed activities, and
- *high risk* means that impacts are likely to result from proposed activities.

Where levels or degrees of impacts are assessed in this analysis, the following definitions apply to the degree of impacts reported:

- *very low impact* means that impacts from proposed activities are unlikely to be measurable or detectable and are not likely to be detrimental to the water resource;
- *low impact* means that impacts from proposed activities would likely be measurable or detectable, but are not likely to be detrimental to the water resource;
- *moderate impact* means that impacts from proposed activities would likely be measurable or detectable, and may or may not be detrimental to the water resource;
- *high impact* means that impacts from proposed activities would likely be measurable or detectable, and are likely to have detrimental impacts to the water resource.

Stream Temperature and Shading

The basis for the risk assessment for stream-temperature changes will be riparian canopy coverage. The 2009 *National Agriculture Image Program* aerial photography layer will be used as a baseline for the condition of the canopy density within 120 feet of each Class 1 stream in the project-area watersheds. Areas that are visibly affected by development, roads, or timber harvesting will be summed to determine the existing level of impact for each project area watershed. Changes to the baseline due to the alternatives proposed will be considered as direct and indirect impacts. The cumulative-effects evaluation for each alternative will be accomplished by combining the existing condition with the action proposed. A qualitative risk assessment will be applied to address the risk of stream-temperature increases due to reduced shading from each

alternative. For more information on stream-temperature impacts, refer to *FISHERIES ANALYSIS*.

ANALYSIS AREA

Sediment Delivery

The analysis area for direct and indirect effects due to sediment delivery is limited to the harvest units and roads proposed for hauling, including new and temporary roads. This includes upland sources of sediment that could result from this project. The cumulative-effects analysis area for sediment delivery will include all roads in the project area watersheds. In-channel sources of sediment, such as mass-wasting locations or excessive scour and deposition, will be qualitatively discussed for each project watershed with proposed harvest units or road construction.

Water Yield and Cumulative Effects

The annual water-yield project watersheds will be Cilly, Goat, In-pa-ah/Perry, Soup, South Woodward, and Squeezer creeks. This is selected as the appropriate scale of analysis due to the size of the project versus the watershed size and the potential for impacts. All other areas will be discussed qualitatively.

Stream Temperature and Shading

The analysis area for stream temperature and shading will be the area within 120 feet of Class 1 streams in each project area watershed. The rationale for this analysis area can be found it the *FISHERIES ANALYSIS* where riparian function is discussed.

WATER USES AND REGULATORY FRAMEWORK

MONTANA SURFACE WATER-QUALITY STANDARDS

According to *ARM 17.30.608* (*1*)(*b*)(*i*), the Swan River drainage, including tributaries, is classified as B-1. Among other criteria for B-1 waters, no increases are allowed above naturally occurring levels of sediment, and minimal increases over natural turbidity. 'Naturally occurring,' as defined by *ARM 17.30.602* (*19*), includes conditions or materials present during runoff from developed land where all reasonable land, soil, and water-conservation practices (commonly called *BMPs*) have been applied. Reasonable practices include methods, measures, or practices that protect present and reasonably anticipated beneficial uses. These practices include, but are not limited to, structural and nonstructural controls and operation and maintenance procedures. Appropriate practices may be applied before, during, or after completion of activities that could create impacts.

Designated beneficial water uses within the project area include cold-water fisheries, aquatic life support, and recreational use in the streams, wetlands, and lakes in the surrounding area.

WATER-QUALITY-LIMITED WATERBODIES

Goat Creek in the proposed project area is currently listed as a water-quality-limited waterbody in the *2010 Montana 303*(*d*) list; Swan Lake is also currently listed on the *2010 Montana 303(d)* list. Each of the project area watersheds is a tributary to Swan River, which is the primary inflow to Swan Lake. The 303(d) list is compiled by the *DEQ* as

required by *Section 303*(*d*) of the *Federal Clean Water Act* and the *EPA Water Quality Planning and Management Regulations* (*40 CFR, Part 130*). Under these laws, *DEQ* is required to identify waterbodies that do not fully meet water-quality standards, or where beneficial uses are threatened or impaired. These waterbodies are then characterized as 'water quality limited' and are, thus, targeted for *TMDL* development. The *TMDL* process is used to determine the total allowable amount of pollutants in a waterbody of a watershed. Each contributing source is allocated a portion of the allowable limit. These allocations are designed to achieve water-quality standards.

The *Montana Water Quality Act* (*MCA 75-5-701* through *705*) also directs *DEQ* to assess the quality of state waters, ensure that sufficient and credible data exists to support a 303(d) listing, and develop *TMDL* for those waters identified as threatened or impaired. Under the *Montana TMDL Law*, new or expanded nonpoint-source activities affecting a listed waterbody may commence and continue provided they are conducted in accordance with all reasonable land, soil, and water conservation practices. DNRC will comply with the *TMDL Law* and interim guidance developed by *DEQ* through implementation of all reasonable soil and water conservation practices, including *BMPs* and *Forest Management Rules* (*ARM 36.11.401* through *450*).

Swan Lake is currently listed as threatened for aquatic life support and cold-water fisheries; Goat Creek above the confluence with Squeezer Creek is listed for partially supporting aquatic life and cold-water fisheries. The current listed cause of impairment in Swan Lake is sedimentation/siltation; the probable sources include forest roads (road construction and use), highways, roads, bridges, and infrastructure (new construction). The current listed cause of impairment in Goat Creek is total suspended solids; the probable sources include highways, roads, bridges, infrastructure (new construction), and silvicultural harvesting. Through the *Swan Lake Watershed Group* and its associated *Swan Lake Technical Advisory Group*, a water-quality restoration plan was developed for Swan Lake and its tributaries, including Goat Creek, in June 2004. The *Swan Lake Watershed Group* and *Technical Advisory Group* are comprised of local stakeholders and include:

- the Swan Ecosystem Center, Flathead Lake Biological Station at Yellow Bay, and Friends of the Wild Swan;
- landowners, including the *USDA Forest Service*, Montana DNRC, Plum Creek; and
- regulatory agencies, including *DEQ* and the *EPA*.

The *Water Quality Restoration Plan* was approved by *EPA* in August 2004, and activities are ongoing to correct current sources and causes of sediment to Swan Lake and its tributaries. DNRC is an active partner and participant in this process. All proposed activities within the project area would implement activities to alleviate identified sources of sediment and comply fully with all *TMDL* recommendations.

Streamside Management Zone Law (SMZ)

All rules and regulations pertaining to the *SMZ Law* will be followed. An *SMZ* width of 100 feet is required on Class 1 and 2 streams when the slope is greater than 35 percent. An *SMZ* width of 50 feet is required when the slope is less than 35 percent.

Forest Management Rules

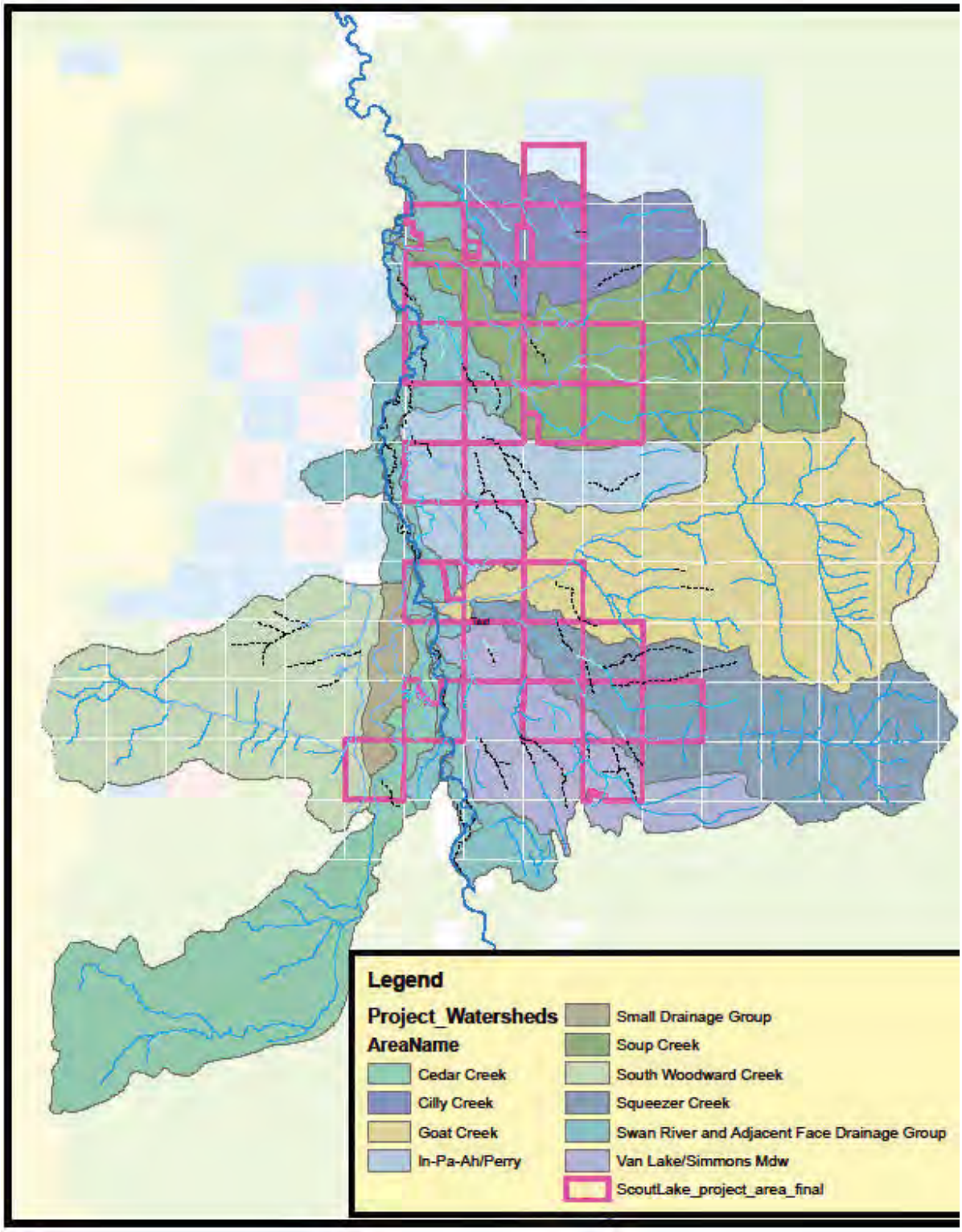
In 2003, DNRC drafted *Administrative Rules for Forest Management*. The portion of those rules applicable to watershed and hydrology resources include *ARM 36.11.422* through *426*. All applicable rules will be implemented if they are relevant to activities proposed with this project. This includes implementing *RMZs* on all Class 1streams to ensure adequate recruitable coarse woody debris is maintained.

EXISTING CONDITION

GENERAL DESCRIPTION

The project watersheds in the proposed project area include Cilly, Cedar, Goat, In-pa-ah/Perry, South Woodward, Soup, and Squeezer creeks. Additionally, lesser defined watersheds, including the area draining Van Lake and face drainages to Swan River, are in the project area. *FIGURE III-7 - PROJECT WATERSHEDS* displays the project watersheds and the project area.

FIGURE III-7 - PROJECT WATERSHEDS



While the majority of the watersheds are on the eastern side of Swan Valley, South Woodward and Cedar creeks are located on the western side. Precipitation for the project area ranges from 20 inches per year at lower elevation to over 70 inches per year at the higher elevations of the Swan and Mission ranges. The flow regime for streams on the western side of Swan Valley is generally less 'flashy', primarily due to a strong groundwater upwelling influence. Streams on the eastern side of the Swan Valley exhibit a flow regime that is generally more indicative of a snowmelt-driven hydrograph with peak flows 5 to 10 times that of base flows.

Ownership and management of the watershed in the project area is mixed between federal, state, and private land managers. *TABLE III-32 - OWNERSHIP/MANAGEMENT OF WATERSHEDS IN THE PROJECT AREA,* below, shows the approximate ownership by watershed. While most of these are watersheds derived from topographic boundaries, the Swan River analysis area is a subset of the entire Swan River watershed. This analysis area was deliberately selected to allow for potential impacts that would not be identifiable at the larger topographic Swan River scale.

TABLE III-32 - OWNERSHIP/MANAGEMENT OF WATERSHEDS IN THE PROJECT AREA

WATERSHED	WATERSHED ACRES	APPROXIMATE OWNERSHIP PERCENTAGE				
		DNRC	USFS	STATE (OTHER)	THE NATURE CONSERVANCY	PRIVATE
Cedar Creek	9,409	6	90	NA	1	3
Cilly Creek	4,634	80	16	NA	NA	4
Goat Creek	13,462	11	63	NA	26	NA
In-Pa-Ah/Perry Creek	5,150	12	49	NA	39	NA
Soup Creek	9,804	76	23	NA	1	NA
South Woodward Creek	9,538	54	21	NA	23	3
Squeezer Creek	9,012	20	50	6	24	NA
Van Lake	5,539	46	23	16	12	3
Swan River analysis area and face drainages	8,777	51	15	NA	19	15

Sediment Delivery

Reviews of in-channel and out-of-channel sediment sources in the project-area watersheds were conducted by DNRC hydrologists and fisheries biologists in 1998, 2000, 2001, 2002, 2007, 2010, and 2011 and also by PBS&J Consulting in association with the development of the *Swan Lake Water Quality Protection Plan* and *TMDL (DEQ 2004).* The potential sediment delivery from stream crossings has been addressed in several projects, including the *Swan Lake Water Quality Protection Plan* and *TMDL*, *Three Creeks Timber Sale Project FEIS (DNRC 2006),* and *White Porcupine Multiple Timber Sale Project FEIS* (DNRC 2009). Additional review and assessment of potential sediment-delivery locations on the proposed haul route was conducted as part of the field review for this project and will be discussed below. These sediment delivery values are estimates based on procedures outlined in *ANALYSIS METHODS* and are not measured values. Estimated potential sediment delivery from road locations in the entire watershed and

along proposed haul routes is summarized in *TABLE III-33 - ESTIMATED POTENTIAL SEDIMENT DELIVERY IN PROJECT WATERSHEDS AND ON PROPOSED HAUL ROUTES,* below. Potential impacts from sediment delivery are discussed in the *FISHERIES ANALYSIS* portion of this document.

TABLE III-33 - ESTIMATED POTENTIAL SEDIMENT DELIVERY IN PROJECT WATERSHEDS AND ON PROPOSED HAUL ROUTES

WATERSHED	ESTIMATED DELIVERY FROM ROAD LOCATIONS ON ALL OWNERSHIPS (TONS/YEAR)	ESTIMATED DELIVERY FROM ROAD LOCATIONS ON A PROPOSED HAUL ROUTES (TONS/YEAR)
Cedar Creek	70.8	34.7
Cilly Creek	2.9	1.5
In-pa-ah/Perry Creek	0	0
Goat Creek	18.8	4.7
Soup Creek	30.0	29.3
South Woodward Creek	19.4	0
Squeezer Creek	1.25	0.9
Swan River face drainages	0.9	0.4
Van Lake	0	0

- ***Cedar Creek***

  Cedar Creek is a low-gradient stream exhibiting characteristics of *Rosgen* B and C channel types (*Rosgen 1996).* Due to the groundwater-influenced flow regime, this stream does not fluctuate greatly from base flow to peak flows. This leads to low potential for bank erosion from higher flows.

  Sediment from out-of-channel sources includes sites on the proposed haul route that contribute an estimated 34.7 tons per year. Most of the delivery is from a small culvert crossing (30.9 tons/year) and a bridge site (3.6 tons/year) due to inadequate surface drainage on roads used year-round for residential access. Two bridges are used for residential access. The lower bridge is relatively new with no direct sediment delivery; however, the upper bridge used for residential access was estimated to contribute sediment due to inadequate surface drainage. This bridge is slated for replacement during the fall of 2011 or summer 2012. Replacement of the bridge would be expected to reduce potential sediment delivery; however, at the time of this analysis, the work has not been completed and, therefore, is not considered.

- ***Cilly Creek***

  Cilly Creek was substantially reviewed as part of the *Three Creeks Timber Sale Project* (*DNRC 2006*) and identified as a Rosgen type 'B' channel in the lower reaches and a *Rosgen* type 'A' (*Rosgen 1996*) channel in the upper reaches. Stream stability is considered good to fair with limited in-stream erosion. The stream was noted as flowing subsurface in several areas during the summer months; however, the majority of the stream has surface flow that supports a fisheries population year-long. A review of the channel in 2011 indicates that the stream may flow for a longer duration after the *Three Creeks Timber Sale*; however, an above-average winter

precipitation likely has influenced the reduced subsurface tendencies. No increase in erosion or channel downcutting was noted in 2010 or 2011.

Sediment from sources outside the channel was reviewed along the proposed haul route during 2011. An estimated 0.4 tons per year of sediment is potentially contributed from 6 stream crossings on the proposed haul route primarily due to surface drainage.

- ***Goat Creek***

Goat Creek is a *Rosgen* type 'B' stream (*Rosgen 1996*) within most of the DNRC-managed lands. The channel was reviewed for stability in 2001, 2010, and 2011. Sediment sources in Goat Creek have been, and remain, few, although a tributary (No Name Creek) to Goat Creek on FNF lands has been observed to contribute sediment due to channel downcutting for unknown reasons. The sediment load from the channel adjustment is currently moving downstream during spring runoff events. Much of the sediment is trapped behind the abundant woody debris and is released as the woody debris decays and adjusts. Additional sediment from a 2011 avalanche is expected to be added to the current sediment load.

Sediment from road sources along the proposed haul route is limited to 4 sites that were estimated to contribute approximately 4.7 tons per year. The largest portion of the estimated annual contribution is attributed to road surface drainage near the bridge over Goat Creek on the Squeezer Loop Road.

- ***In-pa-ah/Perry Creeks***

In-pa-ah Creek (formerly Squaw Creek) exhibits intermittent flow characteristics for much of its distance. The gradient is generally gentle with very little channel confinement. The lack of channel confinement, especially in the lower reach between the Swan Highway (MT Highway 83) and Swan River limits the erosive power of annual flows. Therefore, channel stability is good for this stream. The most common source of sediment for this channel is bank trampling from wildlife and an occasional rootwad from windthrown trees.

No sediment sources from the haul route were noted in this watershed due to the lack of stream crossings and adjacent road construction. Furthermore, most roads in this watershed have well-established grass on the road prism which limits erosion potential on the road tread. No further analysis is necessary for sediment delivery.

- ***Soup Creek***

The main channel of Soup Creek is primarily a *Rosgen* type 'B' channel (*Rosgen 1996*) with cobbly substrate. The lower portions of Soup Creek were observed to have several beaver ponds that trap fine sediment. As the beaver dams decay or are breached, the sediment is released downstream. Bank stability is fair to good in most reaches of Soup Creek, although an unnamed tributary, commonly referred to as the 'North Fork of Soup Creek,' has poor stability in its upper reaches. The reach of this stream immediately adjacent to Cilly Creek Road is on an alluvial fan. Channel adjustments on alluvial fans are common as the material is relatively mobile and deposited in a location where the stream gradient changes. The reach

downstream of the alluvial fan consists of a long series of wetlands. The wetlands serve to filter the water and substantially reduce the sediment-delivery potential to Soup Creek. Occasional field reconnaissance during spring runoff noted no apparent turbidity at the crossing below the alluvial fan.

Potential-sediment delivery locations from out-of-channel sources on the proposed haul route were reviewed in 2010 and 2011. The estimated annual sediment contribution from these sites is approximately 29.3 tons per year. One site in Section 29, T24N, R17W, is estimated to contribute 26.2 tons per year due to inadequate surface drainage. During the sediment-source inventory in 2011, the open-top well casings used for road surface drainage were plugged and resulted in direct sediment delivery to this tributary of Soup Creek.

- ***South Woodward Creek***

  Due to the very limited portion of the project area in the South Woodward Watershed, a limited field review immediately downstream of proposed activities was completed. Conditions were consistent with data from the recent *White Porcupine EIS* (*DNRC 2009).* Due to the stable flow regime, no areas of down cutting or instability were noted. No out-of-channel sediment sources were on the proposed haul route within this watershed. No further analysis is necessary for sediment delivery from road based sources within the South Woodward Creek Watershed.

- ***Squeezer Creek***

  Squeezer Creek is a generally stable, *Rosgen* type 'B' channel (*Rosgen 1996*). The upper reaches of the channel on DNRC-managed land are steep with large boulders. Moss covered substrate is one indicator of a very stable channel in this area with low sediment-transport characteristics.

  No large out-of-channel sediment sources were identified on the proposed haul route in the Squeezer watershed. The combined 4 stream crossings were estimated to contribute approximately 0.9 tons per year due to surface drainage needs.

- ***Van Lake Watershed***

  The Van Lake Watershed is discontinuous in the upper reaches of the watershed and flows through several small meadows as it meanders toward Swan River. Stream channels in this watershed have been classified as non-fish-bearing by the DNRC fisheries biologist.

  No sediment delivery to stream channels was identified during field review in 2001, 2002, or 2011. No further analysis is necessary for sediment delivery from road-based sources.

- ***Swan River and Face Drainages***

  Due to gentle terrain and small tributary areas, streams associated with face drainages along Swan River are typically very stable. As with the In-pa-ah Watershed, the trampling of banks by wildlife, use by recreationists, and wind-thrown trees are the largest sediment sources. These are generally infrequent and small in scale.

Sediment delivery from proposed haul roads within the Swan River Face Drainages is estimated at approximately 0.4 tons per year. This low amount of potential delivery is due to very gentle terrain and robust vegetation on existing roads. No further analysis is necessary for sediment delivery from road-based sources.

Water Yield

According to *ARM 36.11.423*, allowable annual water-yield increase values were set at levels to ensure compliance with all water-quality standards, protect beneficial uses, and exhibit a low degree of risk. Therefore, water-yield thresholds were set at a level that would be unlikely to result in measureable or detectable changes in channel stability.

Aerial photography, past harvest records, and previous analysis data (*DNRC 2003; DNRC 2006; DNRC 2009*) were used to estimate the existing annual water-yield increases due to timber harvesting, road construction, and other human and natural impacts. *TABLE III-34 - EXISTING WATER-YIELD INCREASES AND RECOMMENDED THRESHOLDS*, below, exhibits the existing and allowable water-yield increases for 6 of the watersheds in the project area. The remaining watersheds, which will be discussed qualitatively, include Cedar Creek, Van Lake, and the Swan River Face Drainage.

Cedar Creek and the Swan River Face Drainage are strongly influenced by ground water and show very little evidence of bank erosion from seasonal fluctuations in flow. Aerial-photo (*2009 NAIP* layer) review of the watershed indicates visible harvesting on approximately 25 percent of the watershed. Most of the harvested area is revegated with sapling- and pole-sized trees, indicating reduced water-yield increases from the original timber harvests. This information suggests annual water-yield levels are low. Due to the limited State of Montana ownership and the small amount of proposed harvesting under either action alternative, measurable impacts due to water yield would result in a low risk of very low impacts and will not be further addressed in this document.

The Van Lake Watershed is a discontinuous channel in the upper portions of the watershed. The lower portion of the watershed has several scattered wetlands that dampen the runoff and limit the potential for in-stream erosion. Because of the discontinuous channels and dampened stream velocities, impacts due to existing increases in annual water yield have not been observed. The limited proposed harvesting would result in a low risk of very low impacts due to water-yield increases and will not be further addressed in this document.

TABLE III-34 - EXISTING WATER-YIELD INCREASES AND RECOMMENDED THRESHOLDS

WATERSHED	EXISTING WATER-YIELD PERCENT	ALLOWABLE WATER-YIELD PERCENT	EXISTING ECA	ALLOWABLE ECA
Cilly Creek	7.5	11	755	1,274
Goat Creek	4.5	10	2,019	3,366
In-Pa-Ah/Perry Creeks	8.4	11	1,081	1,416
Soup Creek	2.6	9	813	2,206
South Woodward Creek	7.9	12	1,710	2,758
Squeezer Creek	4.0	10	1,090	2,253

Stream Temperature and Shading

In order to evaluate the potential for increases in stream temperature and decreases in riparian shading, *Geographic Information System (GIS)* was used to evaluate the riparian canopy coverage within 120 feet of class I streams using the *2009 NAIP* coverage from the *Natural Resources Information System*. Areas that exhibited impacts included road corridors, past riparian timber harvest, powerline corridors, and real estate developments such as residences. Class 1 streams were identified by a DNRC water resource specialist during field review. Streams on other ownerships that were not reviewed on the ground were extrapolated from the *National Hydrography Dataset GIS* coverage developed by the *U.S. Geologic Survey*. *TABLE III-35 - RIPARIAN CANOPY COVERAGE BY WATERSHED,* below, displays the acres of riparian vegetation within 120 feet of Class 1 streams, as well as the estimated acres and percentage of reduced canopy coverage by watershed. Although some watersheds exhibit higher levels of riparian canopy impacts, monitoring by the DNRC fisheries biologist suggests existing impacts to stream temperatures are very low to low, except for Soup Creek, which has moderate impacts. (For more information on stream temperature and shading, see *FISHERIES ANALYSIS*)

TABLE III-35 - RIPARIAN CANOPY COVERAGE BY WATERSHED

WATERSHED	ACRES OF RIPARIAN HABITAT	ACRES OF RIPARIAN IMPACTED	PERCENTAGE OF RIPARIAN AREA IMPACTED
Cedar Creek	185	13	7
Cilly Creek	245	6	2
Goat Creek	479	36	8
In-pa-ah/Perry Creeks	197	83	42
Soup Creek	424	59	14
South Woodward Creek	525	160	31
Squeezer Creek	370	4	1
Van Lake	100	12	12

ENVIRONMENTAL EFFECTS

DESCRIPTION OF ALTERNATIVES

- ***No-Action Alternative A***

  No timber harvesting or associated activities would occur under this alternative. Existing activities such as recreational use, individual Christmas tree harvesting, and firewood gathering would continue.

- ***Action Alternative B***

  Approximately 2,010 acres would be harvested; approximately (1) 4.9 miles of new road and 2.5 miles of temporary road would be constructed, (2) 15 miles of road would be reconstructed, and (3) 33 miles of road would be maintained or have minor drainage improvements installed as necessary to protect water quality. All Class 1 streams, fish-bearing or not, would maintain a 120-foot no-harvest buffer (except for approximately 1.1 acres of riparian harvesting for road-construction clearing); Class 2 streams would have a 50-foot no-harvest buffer.

  Existing activities such as recreational use, individual Christmas tree harvesting, and firewood gathering would continue.

- ***Action Alternative C***

  Approximately 2,636 acres would be harvested; approximately (1) 8.2 miles of new road and 3.5 miles of temporary road would be constructed, (2) 20 miles of road would be reconstructed, and (3) 60 miles of road would be maintained or have minor drainage improvements installed as necessary to protect water quality. All Class 1 streams, fish-bearing or not would have a 120-foot no-harvest buffer (except for approximately 1.1 acres of riparian harvesting for road-construction clearing); Class 2 streams would have a 50-foot no-harvest buffer.

  Existing activities such as recreational use, individual Christmas tree harvesting, and firewood gathering would continue.

DIRECT AND INDIRECT EFFECTS

- ***Direct and Indirect Effects of No-Action Alternative A to Water Resources***

  Sediment Delivery

  No-Action Alternative A would have no direct effects to sediment delivery beyond those currently occurring. Existing sources of sediment, both in-channel and out-of-channel would continue to recover or degrade based on natural or preexisting conditions.

  Indirect effects of No-Action Alternative A would be an increased risk of sediment delivery to streams from crossings that do not meet applicable *BMPs*. These sites would continue to pose a moderate risk of moderate impacts from sediment delivery to streams until other funding becames available to repair them.

  Water Yield

  No direct or indirect water-yield increases or peak flow levels would be expected from the implementation of this alternative because timber harvesting would not

occur. Annual water yields would decline over time as existing harvest units revegetate.

Stream Temperature and Shading

No reduction in riparian shading would result from the implementation of this alternative; therefore, changes in stream temperature due to riparian canopy removal as a result of this proposal would not occur.

- ***Direct and Indirect Effects of Action Alternative B to Water Resources***

Sediment Delivery

Research on sediment filtering of buffer strips below harvest units is limited; however, several studies of sediment travel distances below forest roads has occurred (*Belt, O'Laughlin and Merrill 1992*). Research indicates sediment travel distances below roads vary widely (*Swift 1986; Burroughs and King 1989*). The maximum travel distance in a study by *Swift (1986)* was 314 feet, with an average distance of 65 feet. *Burroughs and King (1989)* documented 90 percent of sediment travelled less than 90 feet. *Trimble and Sartze (1957)* indicate the key factors that control sediment movement are slope and the density of barriers or forest floor obstructions. Because the proposed harvest units would maintain a 120-foot buffer on all Class 1 streams (except for 1.1 acres due to road construction) and a 50-foot buffer on all Class 2 streams, and the terrain is gentle near streams, a low risk of low impacts from sediment delivery originating from harvest units would be expected under this alternative for all watersheds.

Out-of-channel sediment sources would be reduced in Cedar Creek, Soup Creek, and the Swan River analysis areas. The long-term reduction would primarily result from the replacement of crossing structures and installation of surface drainage, although a short-term increase would be expected to occur with the installation of new crossing structures. New and temporary roads would not cross streams except for a temporary bridge installation on a tributary to Cedar Creek. The installation of a temporary bridge on new road construction would result in a potential short-term increase in sediment for a tributary to Cedar Creek due to the construction of the bridge approaches. The potential increase estimate based on procedures outlined in *ANALYSIS METHODS* for this crossing would be 0.2 tons per year and would diminish over a 2-year period after removal until vegetation would be fully established.

Replacement of one culvert in the Cedar Creek Drainage with proper *BMPs* would result in a long-term reduction of approximately 28 tons per year of potential sediment contribution. While the replacement would decrease the sediment delivery, the establishment of vegetation on the new fill slope would take a couple of years.

The structure on Soup Creek Road at the North Fork Soup Creek crossing would require replacement and installation of *BMPs* to reduce the potential for sediment delivery. Additional gravel on the road surface would also help to reduce the potential for long-term sediment delivery.

BMP work in the Swan River Face Drainage watershed would include minor work to ensure the drainage ditch does not contribute surface flow to the stream without being filtered, as well as improvements to surface drainage. This would be expected to result in a long-term reduction in potential sediment delivery with no short-term increase in potential sediment delivery.

Until vegetation establishment is adequate, an increased risk of a short-term sediment delivery would result at all of these sites. Mitigation measures, such as slash-filter windrows, a wire-backed silt fence, and quick-cover grass seeding would reduce the risk of sediment delivery until vegetation establishes (approximately 2 growing seasons).

TABLE III-36 - ACTION ALTERNATIVE B POTENTIAL SEDIMENT DELIVERY ON PROPOSED HAUL ROUTE, below, displays the expected long-term reduction in sediment delivery on existing sites and the short-term increase at the new construction of the temporary bridge.

TABLE III-36 - ACTION ALTERNATIVE B POTENTIAL SEDIMENT DELIVERY ON PROPOSED HAUL ROUTE

WATERSHED	EXISTING DELIVERY	REDUCTION	POTENTIAL INCREASE IN SEDIMENT
	TONS PER YEAR		
Cedar Creek	34.7	28	0.2
Cilly Creek	0.4	0	0
Goat Creek	4.7	0	0
In-pa-ah/Perry Creeks	0	0	0
Soup Creek	29.3	22.3	0
South Woodward Creek	0	0	0
Squeezer Creek	0.9	0	0
Van Lake	0	0	0
Swan River and Face Drainages	0.4	0.3	0

Water Yield

Annual water yield would increase in 4 watersheds, although the estimated increase in most of the watersheds, would be less than 1 percent. The proposed increase would have a low risk of very low impacts in all watersheds except for In-pa-ah Creek, meaning that measurable impacts such as increased-instream erosion or channel instability would not likely result. In-pa-ah Creek would be expected to have a low risk of low impacts, which indicates measureable results without adverse or detrimental impacts. *TABLE III-37 - ACTION ALTERNATIVE B ANNUAL WATER-YIELD AND ECA INCREASES,* below, exhibits the direct annual water-yield increase and ECA increase for each watershed. In addition to the annual water-yield increases listed in TABLE WR6, an estimated 87 ECA would be generated in Cedar Creek and 271 *ECA* in the Swan River analysis area, including the Swan River Face Drainage.

Due to the small scale of harvest in relation to the watershed sizes, a low risk of very low impacts would be expected from this alternative.

TABLE III-37 - ACTION ALTERNATIVE B ANNUAL WATER YIELD AND ECA INCREASES

WATERSHED	PROPOSED WATER YIELD PERCENT	PROPOSED ECA INCREASE	ALLOWABLE ECA
Cilly Creek	0.8	157	1,274
Goat Creek	<0.1	5	3,366
In-Pa-Ah/Perry Creeks	2.1	382	1,416
Soup Creek	0.7	520	2,206
South Woodward Creek	0	0	2,758
Squeezer Creek	0	0	2,253

Peak flow volume and duration may be elevated and the timing of peak flows may be slightly earlier as a result of the proposed harvesting activities. These changes have a low risk of low impacts to the stream channels in each of the watersheds listed above.

Stream Temperature and Shading

Approximately 1.1 acres of riparian harvesting would occur in the Cedar Creek watershed for road construction. This low level of change in riparian canopy would be expected to have a low risk of a very low impact to stream shading and stream temperature increases.

- ***Direct and Indirect Effects of Action Alternative C to Water Resources***

Sediment Delivery

Research on sediment filtering of buffer strips below harvest units is limited; however, several studies of sediment travel distances below forest roads has occurred (*Belt, O'Laughlin and Merrill 1992*). Research indicates distances sediment travels below roads vary widely (*Swift 1986; Burroughs and King 1989*). The maximum travel distance in a study by *Swift (1986)* was 314 feet, with an average distance of 65 feet. *Burroughs and King (1989)* documented 90 percent of sediment travelled less than 90 feet. *Trimble and Sartze (1957)* indicate the key factors that control sediment movement are slope and the density of barriers or forest-floor obstructions. Because the proposed harvest units would maintain a 120-foot buffer on all Class 1 streams (except for 1.1 acres due to road construction) and a 50-foot buffer on all Class 2 streams, and the terrain is gentle near stream, a low risk of low impacts from sediment delivery originating from harvest units would be expected under this alternative for all watersheds.

Out-of-channel sediment sources would be reduced in Cedar, Cilly, Goat, and Soup creeks and the Swan River analysis area. The reductions would primarily be due to the replacement of crossing structures and installation of surface drainage, although a short-term increase would be expected to occur with new installations of crossing structures. New and temporary roads would not cross streams except for a temporary bridge installation on a tributary to Cedar Creek. The installation of a temporary bridge would result in a potential short-term increase in sediment for a tributary to Cedar Creek due to the construction of bridge approaches. The potential increase estimate based on procedures outlined in *ANALYSIS METHODS* for this

crossing would be 0.2 tons per year and would diminish over a 2-year period after removal until vegetation would be fully established.

Replacement of one culvert in the Cedar Creek drainage with proper *BMPs* would result in a long-term reduction of approximately 28 tons per year of potential sediment contribution. While the replacement would decrease the potential sediment delivery, establishment of vegetation on the new fill slope would take a couple of years.

The structure on Soup Creek Road at the North Fork Soup Creek crossing would require replacement and installation of *BMPs* to reduce the potential for delivery. Additional gravel on the road surface would also help to reduce the potential for long-term sediment delivery.

BMP work in the Swan River Face Drainage watershed would include minor work to ensure the drainage ditch does not contribute surface flow to the stream without being filtered, as well as improvements to surface drainage. This would be expected to result in a long-term reduction in potential sediment delivery with no short-term increase in potential sediment delivery.

Surface drainage above the bridge over Goat Creek on Squeezer Loop Road would reduce long-term sediment by approximately 2.2 tons per year. No increase in short-term sediment delivery would be expected at this location because the work would not be directly connected to the stream. Instead, the work would simply reconstruct a partially functioning drain dip to divert runoff into existing vegetation.

Minor *BMP* work in the Cilly Creek watershed would reduce potential sediment delivery by improving surface drainage. Again, no additional short-term sediment delivery would be expected from this action.

Until vegetation establishment is adequate, an increased risk of a short-term sediment delivery would result. Mitigation measures, such as slash-filter windrows, a wire-backed silt fence, and quick-cover grass seeding would reduce the risk of sediment delivery until vegetation establishes (approximately 2-growing seasons). The installation of a temporary bridge would result in a potential increase in sediment for a tributary to Cedar Creek. *TABLE III-38 - ACTION ALTERNATIVE C POTENTIAL SEDIMENT DELIVERY ON PROPOSED HAUL ROUTE*, below, displays the expected reduction in sediment delivery for all watersheds.

TABLE III-38 - ACTION ALTERNATIVE C POTENTIAL SEDIMENT DELIVERY ON PROPOSED HAUL ROUTE

WATERSHED	EXISTING DELIVERY	REDUCTION	POTENTIAL INCREASE IN SEDIMENT
	TONS PER YEAR		
Cedar Creek	34.7	28	.2
Cilly Creek	0.4	<.01	0
Goat Creek	4.7	2.2	0
In-pa-ah/Perry Creeks	0	0	0
Soup Creek	29.3	22.3	0
South Woodward Creek	0	0	0
Squeezer Creek	0.9	0	0
Van Lake	0	0	0
Swan River and Face Drainages	0.4	0.3	0

Water Yield

Annual water yield would increase in 6 watersheds, although most of the estimated increase in most of the watersheds would be less than 1 percent. The proposed increase would have a low risk of very low impacts in watersheds expecting less than a 1 percent increase, meaning that measurable impacts such as increased in-stream erosion or channel instability would not likely result. In-pa-ah and Cilly creeks would have an annual water-yield increase of over 1 percent. This would result in a low risk of low of low impacts, which indicates that the increase could be measureable, but would not be expected to have adverse impacts. *TABLE III-39 - ACTION ALTERNATIVE C ANNUAL WATER-YIELD AND ECA INCREASES,* below, exhibits the direct annual water-yield increase and the ECA increase for each watershed.

In addition to the annual water-yield increases listed in TABLE WR8, an estimated 87 ECA would be generated in Cedar Creek, 184 *ECA* in the Swan River analysis area (including the Swan River Face Drainage) and 73 *ECA* in the Van Lake analysis area. Due to the small scale of harvesting in relation to the watershed sizes, a low risk of very low impacts would be expected from this alternative.

TABLE III-39 - ACTION ALTERNATIVE C ANNUAL WATER-YIELD AND ECA INCREASES

WATERSHED	PROPOSED WATER YIELD PERCENT	PROPOSED ECA INCREASE	ALLOWABLE ECA
Cilly Creek	2.1	393	1,274
Goat Creek	greater than 0.1	42.8	3,366
In-Pa-Ah/Perry Creeks	1.7	292	1,416
Soup Creek	0.6	402	2,206
South Woodward Creek	greater than 0.1	8	2,758
Squeezer Creek	0.4	100	2,253

Peak flow volume and duration may be elevated, and the timing of peak flows may be slightly earlier as a result of the proposed harvesting activities. These changes

have a low risk of low impacts to the stream channels in each of the watersheds listed above.

Stream Temperature and Shading

Approximately 1.1 acres of riparian harvesting would occur in the Cedar Creek watershed for road clearing. The low level of change in riparian canopy would be expected to have a low risk of a very low impact to stream shading and stream temperature increases.

CUMULATIVE EFFECTS

- ***Cumulative Effects of No-Action Alternative A to Hydrology***

The cumulative effects would be very similar to those described in the existing conditions portion of this analysis. All existing sources of sediment would continue to recover or degrade as dictated by natural and preexisting conditions until a source of funding becames available to repair them. The exception is the Cedar Creek bridge replacement, which is currently under contract to be finished in late 2011 or the summer of 2012.

Sediment Delivery

No changes in sediment delivery would result from the implementation of this alternative. However, a reduction of approximately 2.5 tons per year would result from the replacement of the Cedar Creek Bridge which is currently under contract to be completed in fall of 2011 or the summer of 2012. *TABLE III-40 - CUMULATIVE POTENTIAL SEDIMENT DELIVERY FOR NO-ACTION ALTERANTIVE A*, below, displays the cumulative potential sediment delivery from road locations in the project watersheds. The sediment-delivery values are estimates based upon the *Washington Forest Practice Board* methodologies and are not measured values.

TABLE III-40 - CUMULATIVE POTENTIAL SEDIMENT DELIVERY FOR NO-ACTION ALTERNATIVE A

WATERSHED	ESTIMATED DELIVERY FROM ROAD LOCATIONS ON ALL OWNERSHIPS (TONS PER YEAR)
Cedar Creek	68.3
Cilly Creek	2.9
In pa ah/Perry Creeks	0
Goat Creek	18.8
Soup Creek	30.0
South Woodward Creek	19.4
Squeezer Creek	1.25
Swan River Face Drainages	0.9
Van Lake	0

Water Yield

No timber harvesting would occur; therefore, a low risk of very low impacts would be expected from increases in annual water yield or peak flow in all watersheds. Over time, the existing water-yield increases would be reduced as vegetation continues to establish and grow. *TABLE III-41 - NO-ACTION ALTERNATIVE A*

CUMULATIVE ANNUAL WATER-YIELD AND ECA INCREASES, below, displays the cumulative water yield increases and ECA for each watershed.

TABLE III-41 - NO-ACTION ALTERNATIVE A CUMULATIVE ANNUAL WATER-YIELD AND ECA INCREASES

WATERSHED	CUMULATIVE WATER YIELD PERCENT	ALLOWABLE WATER YIELD PERCENT	CUMULATIVE ECA	ALLOWABLE ECA
Cilly Creek	7.5	11	755	1,274
Goat Creek	4.5	10	2,019	3,366
In-Pa-Ah/Perry CreekS	8.4	11	1,081	1,416
Soup Creek	2.6	9	813	2,206
South Woodward Creek	7.9	12	1,718	2,758
Squeezer Creek	4.0	10	1,090	2,253

Stream Temperature and Shading

No change in riparian shading or stream temperature would be expected as a result of this alternative. Existing reductions in stream shading would lessen over time as vegetation establishes and grows.

Cumulative Effects Summary

Because no additional impacts would occur under this alternative, the cumulative impacts would be similar to the existing condition, with all watersheds remaining within the recommended thresholds for annual water-yield increases. Potential long-term sediment delivery would be slightly reduced (2.5 tons per year) due to the replacement of the Cedar Creek Bridge. An increase in potential short-term sediment delivery to Cedar Creek would result from the bridge replacement until vegetation reestablishes at the site. Until vegetation is reestablished, mitigation measures such as slash-filter windrows, a wire-backed silt fence, and quick-cover grass seeding would reduce the risk of cumulative sediment delivery until vegetation establishes (approximately 2-growing seasons). Due to the limited actions under this alternative, a low risk of low cumulative impacts to water quality and a low risk of very low cumulative impacts to water quantity would be expected.

- ***Cumulative Effects of Action Alternative B to Hydrology***

Sediment Delivery

Because the proposed harvest units would maintain a 120-foot buffer on all Class 1 streams (except for 1.1 acres on Cedar Creek due to road construction) and a 50-foot buffer on all Class 2 streams, and the terrain is gentle near streams, a low risk of low impacts from sediment delivery originating from harvest units would be expected under this alternative for all watersheds. Therefore, a low risk of increasing the sediment to streams from harvest units would result.

Out-of-channel sediment sources would be reduced in Cedar and Soup creeks and the Swan River analysis area. This includes the replacement of a temporary bridge across Cedar Creek that is currently being used by local residents. The new bridge will be replaced in the fall of 2011 or 2012 and result in a long-term sediment delivery reduction potential of approximately 2.5 tons per year. This, coupled with

the sediment reduction discussed in the direct/indirect effects section, would result in a reduction of approximately 50.6 tons per year on all ownerships in all project watersheds. Stream-crossing installations and replacements would result in a high risk of moderate short-term impacts due to short-term increases in potential sediment delivery. As discussed earlier, mitigation measures such as slash-filter windrows, a wire-backed silt fence, and quick-cover grass seeding would reduce the risk of sediment delivery until vegetation reestablishes at each site.

TABLE III-42 - ACTION ALTERNATIVE B CUMULATIVE POTENTIAL SEDIMENT DELIVERY, below, displays the expected cumulative reduction in potential sediment delivery from all ownerships in the project watersheds.

TABLE III-42 - ACTION ALTERNATIVE B CUMULATIVE POTENTIAL SEDIMENT DELIVERY

WATERSHED	EXISTING DELIVERY ON ALL OWNERSHIPS	REDUCTION	POTENTIAL INCREASE IN SEDIMENT	POST PROJECT ESTIMATE OF LONG-TERM SEDIMENT DELIVERY ON ALL OWNERSHIPS
	TONS PER YEAR			
Cedar Creek	70.8	28	0.2 (short-term)	42.8
Cilly Creek	2.9	0	0	2.9
Goat Creek	18.8	0	0	18.8
In-pa-ah/Perry Creeks	0	0	0	0
Soup Creek	30	22.3	0	7.7
South Woodward Creek	19.4	0	0	19.4
Squeezer Creek	1.25	0	0	1.25
Van Lake	0	0	0	0
Swan River and Face Drainages	0.9	0.3	0	0.1

Water Yield

While all watersheds would remain below the recommended threshold for the cumulative annual water yield (see *TABLE III-43 - ACTION ALTERNATIVE B CUMULATIVE ANNUAL WATER-YIELD AND ECA INCREASES*), ECA increases would be slightly above the recommended threshold in In-pa-ah Creek. Due to the characteristics of this stream, the topography of the watershed, and the flow regime discussed in the existing condition, this would result in a low risk of low impacts to water quality. In other words, while a measurable increase in water yield may result, detrimental effects to water quality would not likely occur.

TABLE III-43 - ACTION ALTERNATIVE B CUMULATIVE ANNUAL WATER-YIELD AND ECA INCREASES

WATERSHED	CUMULATIVE WATER YIELD PERCENT	ALLOWABLE WATER YIELD PERCENT	PROPOSED ECA INCREASE	ALLOWABLE ECA
Cilly Creek	8.3	11	912	1,274
Goat Creek	4.5	10	2,024	3,366
In-Pa-Ah/Perry Creeks	10.5	11	1,463	1,416
Soup Creek	3.3	9	1,333	2,206
South Woodward Creek	7.9	12	0	2,758
Squeezer Creek	4.0	10	0	2,253

Peak flow volume and duration may be elevated and the timing of peak flows may be slightly earlier as a result of the proposed harvesting activities. These changes have a low risk of low impacts to the stream channels in each of the watersheds listed above.

Stream Temperature and Shading

Stream shading in the project area would be reduced by approximately 1.1 acres over the entire project area watersheds due to right-of-way clearing for road construction. Cumulative changes to the existing riparian canopy would be very minor (see *TABLE III-44 - ACTION ALTERANTIVE B CUMULATIVE RIPARIAN CANOPY COVERAGE BY WATERSHED*). This minor reduction would result in a low risk of very low impacts to stream temperature.

TABLE III-44 - ACTION ALTERNATIVE B CUMULATIVE RIPARIAN CANOPY COVERAGE BY WATERSHED

WATERSHED	ACRES OF RIPARIAN HABITAT	ACRES OF RIPARIAN IMPACTED	PERCENTAGE OF RIPARIAN AREA IMPACTED
Cedar Creek	185	13	7
Cilly Creek	245	7	3
Goat Creek	479	36	8
In-pa-ah/Perry Creeks	197	83	42
Soup Creek	424	59	14
South Woodward Creek	525	160	31
Squeezer Creek	370	4	1
Van Lake	100	12	12

Cumulative Effects Summary

Because the annual water-yield increase would remain below the recommended annual water-yield threshold on all watersheds and the *ECA* increase would slightly be above the recommended level, in stream erosion would not be expected to increase measurably in any watershed. Potential sediment sources associated with road locations would be reduced by an estimated 50.6 tons per year and stream temperature would not be expected to increase due to a reduction in riparian canopy. Therefore, water quality would be maintained with a low risk of low impacts.

- ***Cumulative Effects of Action Alternative C to Hydrology***

Sediment Delivery

Because the proposed harvest units would maintain a 120-foot buffer on all Class 1 streams (except for 1.1 acres on Cedar Creek due to road construction) and a 50-foot buffer on all Class 2 streams, and the terrain is gentle near streams, a low risk of low impacts from sediment delivery originating from harvest units would be expected under this alternative for all watersheds. Therefore, a low risk of increasing the sediment to streams from harvest units would result.

Out-of-channel sediment sources would be reduced in Cedar, Goat, and Soup creeks and the Swan River analysis area. The reduction would primarily be due to the replacement of crossing structures and installation of surface drainage. This includes the replacement of a bridge across Cedar Creek that is currently being used by local residents. The new bridge will be replaced in the fall of 2011 or 2012 and result in a long-term sediment delivery reduction potential of approximately 2.5 tons per year. This coupled with the sediment reduction discussed in the direct/indirect effects section, would result in a reduction of approximately 52.8 tons per year across all project area watersheds.

Stream-crossing installations and replacements would result in a high risk of moderate short-term impacts due to short-term increases in potential sediment delivery. This would result because of vegetation removal and placement of fill material associated with crossing-structure installation. As discussed earlier, mitigation measures such as slash-filter windrows, a wire-backed silt fence, and quick-cover grass seeding would reduce the risk of sediment delivery until vegetation reestablishes at each site. *TABLE III-45 - ACTION ALTERNATIVE C CUMULATIVE POTENTIAL SEDIMENT DELIVERY,* below, displays the expected reduction in long-term potential sediment delivery.

TABLE III-45 - ACTION ALTERNATIVE C CUMULATIVE POTENTIAL SEDIMENT DELIVERY

WATERSHED	EXISTING DELIVERY ON ALL OWNERSHIPS	REDUCTION	POTENTIAL INCREASE IN SEDIMENT	POST PROJECT ESTIMATE OF LONG-TERM SEDIMENT DELIVERY ON ALL OWNERSHIPS
	TONS PER YEAR			
Cedar Creek	70.8	28	0.2(short-term)	42.8
Cilly Creek	2.9	<0.01	0	2.9
Goat Creek	18.8	2.2	0	16.6
In-pa-ah/Perry Creeks	0	0	0	0
Soup Creek	30	22.3	0	7.7
South Woodward Creek	19.4	0	0	19.4
Squeezer Creek	1.25	0	0	1.25
Van Lake	0	0	0	0
Swan River and Face Drainages	0.9	0.3	0	0.6

Water Yield

All watersheds would remain below the recommended threshold for the cumulative annual water-yield and ECA increases would also remain below the recommended threshold yield (see *TABLE III-46 - ACTION ALTERNATIVE C CUMULATIVE ANNUAL WATER-YIELD AND ECA INCREASES*). This would result in a low risk of low impacts to water quality. In other words, while a measurable increase in water yield may result, detrimental effects to water quality would not likely occur.

TABLE III-46 - ACTION ALTERNATIVE C CUMULATIVE ANNUAL WATER-YIELD AND ECA INCREASES

WATERSHED	CUMULATIVE WATER YIELD PERCENT	ALLOWABLE WATER YIELD PERCENT	PROPOSED ECA INCREASE	ALLOWABLE ECA
Cilly Creek	9.6	11	1,148	1,274
Goat Creek	4.5	10	2,062	3,366
In-pa-ah/Perry Creeks	10.1	11	1,373	1,416
Soup Creek	3.2	9	1,215	2,206
South Woodward Creek	7.9	12	1,726	2,758
Squeezer Creek	4.4	10	1,190	2,253

Peak flow volume and duration may be elevated, and the timing of peak flows may be slightly earlier as a result of the proposed harvesting activities. These changes have a low risk of low impacts to the stream channels in each of the watersheds listed above.

Stream Temperature and Shading

Stream shading in the project area would be reduced by approximately 1.1 acres over the entire project-area watersheds due to right-of-way clearing for road

construction. Cumulative changes to the existing riparian canopy would be very minor (*TABLE III-47 - ACTION ALTERNATIVE C CUMULATIVE RIPARIAN CANOPY COVERAGE BY WATERSHED*). This minor reduction would result in a low risk of very low impacts to stream temperature and would not be expected to result in measureable cumulative impacts on stream temperature.

TABLE III-47 - ACTION ALTERNATIVE C CUMULATIVE RIPARIAN CANOPY COVERAGE BY WATERSHED

WATERSHED	ACRES OF RIPARIAN HABITAT	ACRES OF RIPARIAN IMPACTED	PERCENTAGE OF RIPARIAN AREA IMPACTED
Cedar Creek	185	13	7
Cilly Creek	245	7	3
Goat Creek	479	36	8
In-pa-ah/Perry Creeks	197	83	42
Soup Creek	424	59	14
South Woodward Creek	525	160	31
Squeezer Creek	370	4	1
Van Lake	100	12	12

Cumulative Effects Summary

Because (1) annual water yields would remain below the recommended threshold, (2) sediment from sources outside of the channel would be reduced by approximately 52.8 tons per year across all project-area watersheds, and (3) the proposed reduction in riparian canopy would not be expected to result in a measurable increase in stream temperature, a low risk of low cumulative impacts to water quality would result from this alternative.

FISHERIES ANAYLYSIS

INTRODUCTION

The purpose of this analysis is to assess potential impacts to fisheries resources in the project area (see *CHAPTER I– PURPOSE AND NEED*) as a result of implementing any one of the project alternatives.

The project area lies entirely within the Swan River drainage (*5th code HUC 17010211030*). Up to 2,635 acres of the total harvest area; 8.2 miles of new, permanent road construction; and 3.5 miles of temporary road construction are proposed in the project area.

Native cold-water fish species in the project area include:

- bull trout,
- westslope cutthroat trout,
- slimy sculpin,
- largescale sucker,
- longnose sucker,
- longnose dace,
- mountain whitefish,
- northern pike minnow,
- peamouth, and
- redside shiner.

The 3 nonnative species known to persist within the specific project area are:

- eastern brook trout,
- rainbow trout, and
- kokanee.

The remainder of this introduction will focus on a brief review of the life history and ecology of bull trout and westslope cutthroat trout since these species will be the primary focus of the following effects analysis (see *ANALYSIS METHODS*).

Both bull trout and westslope cutthroat trout exhibit resident, fluvial, and adfluvial life forms. Resident life forms spend their juvenile and adult life in natal or nearby low-order tributaries. Fluvial and adfluvial life forms generally leave their natal streams within 1 to 3 years of emergence (*Shepard et al 1984, Fraley and Shepard 1989*) to mature in downstream river and lake systems, respectively, and then return again to headwater or upstream reaches to spawn. Fluvial and adfluvial life forms of bull trout and westslope cutthroat trout are typically larger than resident fish, and bull trout have been observed returning to upstream reaches during successive or alternating years to spawn (*Fraley and Shepard 1989*). Overall, the life forms and stages of bull trout and westslope cutthroat trout have evolved to exist in sympatry (*Nakano et al 1992, Pratt 1984, Shepard et al 1984*).

Fluvial and adfluvial bull trout generally mature at ages 5 to 6 years, begin upstream spawning migrations in April, and spawn between September and October in response

to a temperature regime decline below 9 to 10 degrees Celsius (*Fraley and Shepard 1989*). Spawning adult bull trout are known to construct redds in close association with upwelling groundwater and proximity to overhanging or instream cover (*Fraley and Shepard 1989*). Naturally occurring stream temperature regimes and substrate compositions having low levels of fine material are closely related to bull trout embryo and juvenile survival (*MBTSG 1998, Weaver and Fraley 1991, Pratt 1984*).

Bull trout have been found inhabiting streams with wetted widths as low as 1.0 meters and gradients as high as 15.6 percent (*Rich et al 2003*), while observed average measures have ranged from 3.1 to 12.4 meters for wetted width and 1.6 to 5.6 percent for stream gradient (*Dunham and Chandler 2001, Rich et al 2003*). Bull trout appear to prefer average maximum seasonal stream temperatures ranging from approximately 14.0 to 16.0 degrees Celsius (*Rieman and Chandler 1999, Sauter et al 2001, Gamett 2002, Rich et al 2003*).

Resident westslope cutthroat trout have been observed maturing at ages 3 to 5 years (*Downs et al 1997*), and all life forms are known to spawn during May through June (*Shepard et al 1984*). Naturally occurring stream temperature regimes and substrate compositions having low levels of fine material are closely related to westslope cutthroat trout embryo and juvenile survival (*Pratt 1984*).

Westslope cutthroat trout were found throughout the watersheds of their historic range, including small, first-order, headwater stream reaches (*Behnke 1992, McIntyre and Rieman 1995*). A summary of scientific literature on westslope cutthroat trout (*McIntyre and Rieman 1995*) indicates the subspecies prefers stream temperatures less than 16 degrees Celsius and can be found in streams with gradients up to 27 percent.

RELEVANT AGREEMENTS, LAWS, PLANS, RULES, AND REGULATIONS

The *USFWS* has listed bull trout as 'threatened' under the *Endangered Species Act*. Both bull trout and westslope cutthroat trout are listed as *S2 Montana Animal Species of Concern*. Species classified as S2 are considered to be at risk due to very limited and/or potentially declining population numbers, range, and/or habitat, making the species vulnerable to global extinction or extirpation in the state (*DFWP, MNHP,* and *Montana Chapter American Fisheries Society Rankings*). DNRC has also identified bull trout and westslope cutthroat trout as sensitive species (*ARM 36.11.436*).

DNRC is a cooperator and signatory to the following relevant agreements: *Restoration Plan for Bull Trout in the Clark Fork River Basin and the Kootenai River Basin, Montana (2000)*, *Memorandum of Understanding (2005) for the Swan Valley Bull Trout Work Group*, and *Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout and Yellowstone Cutthroat Trout in Montana (2007)*. All 3 agreements contain land management conservation strategies or action items utilized by DNRC as decisionmaking tools.

Goat Creek (upstream of the Squeezer Creek confluence) is the only waterbody contained within the fisheries analysis areas that is individually identified on the *2010 Montana 303(d)* list as an impaired stream. A *TMDL* analysis completed for Swan Lake includes Swan River and its tributaries. Suspended solids that may be a result of forest management activities have been identified as a potential cause of impairment in Goat

Creek. For more information on known and potential water quality impairments, please see the *HYDROLOGY ANALYSIS*.

Swan River and all waterbodies contained in the fisheries analysis areas are classified as B-1 in the *Montana Surface Water Quality Standards (ARM 17.30.608[b][i])*. The B-1 classification is for multiple beneficial-use waters, including the growth and propagation of cold-water fisheries and associated aquatic life. Among other criteria for B-1 waters, a 1-degree Fahrenheit maximum increase above naturally occurring water temperature is allowed within the range of 32 to 66 degrees Fahrenheit (0 to 18.9 degrees Celsius), and no increases are allowed above naturally occurring concentrations of sediment or suspended sediment that will harm or prove detrimental to fish or wildlife. In regard to sediment, naturally occurring includes conditions or materials present from runoff or percolation from developed land where all reasonable land, soil, and water conservation practices have been applied (*ARM 17.30.603[19]*). Reasonable practices include methods, measures, or practices that protect present and reasonably anticipated beneficial uses (*ARM 17.30.603[24]*). The State has adopted *BMPs* through its *Nonpoint Source Management Plan* as the principle means of controlling nonpoint source pollution from silvicultural activities (*Thomas et al 1990*).

Fisheries-specific forest management *ARMs* (*36.11.425* and *36.11.427*), the *SMZ Law* and rules, and other site-specific prescriptions would be implemented as part of any action alternative.

ISSUES AND MEASUREMENT CRITERIA

Fifteen detailed written concerns and issues regarding fisheries resources were raised through public participation during the scoping process. These concerns and issues are contained in a separate document (*issues_scoping_draft.xls*) that can be found in the project file. Each detailed concern and issue is identified and followed with a statement describing how the concern or issue will be addressed by this analysis.

The broad issues raised both internally and through public comment during the scoping process are that the proposed actions may adversely affect fisheries populations and fisheries habitat features, including flow regime (or annual stream flow characteristics), sediment, channel forms, riparian condition, large woody debris, stream temperature, macroinvertebrate richness and connectivity, in fish-bearing streams in the project area. The following brief rationales describe why these broad issues are important fisheries resource concerns:

- Population – provides the status and distribution of fish species in the project area.
- Flow regime – affects species migration, spawning, and embryo survival and is a direct contributor to the function of other features such as: sediment transport, channel forms, stream temperature, and macroinvertebrate richness.
- Sediment – is a major habitat feature affecting fish embryo survival, the quality and quantity of channel form features, and macroinvertebrate richness.
- Channel forms – describe the quantities of various fish habitat types.
- Riparian condition – is the primary terrestrial feature affecting large woody debris and stream shading, which indirectly affects both channel form features and stream temperature.

- Large woody debris (LWD) – is a major contributor to the quality and quantity of channel form features.
- Stream temperature – directly affects the survivability, metabolism, dynamics, and distribution of fish species.
- Macroinvertebrate richness – is an indicator of water quality, nutrients, and stream productivity.
- Connectivity – describes the potential for fish to migrate within and between available habitats.

Depending on the type and extent of the proposed actions, these issues will (or will not) be addressed separately for each analysis area under the *EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS* sections.

Issue variables, normal effect mechanisms, potential effect mechanisms, and measurement criteria establish the foundation of analysis for each of the broad fisheries issues. These 4 descriptors are described in *TABLE III-48 – ISSUE VARIABLES, NORMAL EFFECT MECHANISMS, POTENTIAL EFFECT MECHANISM, AND MEASUREMENT CRITERIA* for each of the broad fisheries issues. The broad issues include those variables that have potentially measurable or detectable criteria and are expected to support the development of meaningful effects analyses.

For the purposes of this analysis, issue variables are the primary factors that contribute to a broad environmental issue. Normal effect mechanisms describe the typical physical or biological processes that determine how issue variables are expressed in the environment. Potential effect mechanisms describe the processes through which the proposed actions may affect normal effect mechanisms and, consequently, issue variables.

TABLE III-48 - ISSUE VARIABLES, NORMAL EFFECT MECHANISM, POTENTIAL EFFECT MECHANISM, AND MEASUREMENT CRITERIA

ISSUE	VARIABLE	NORMAL EFFECT MECHANISM	POTENTIAL ACTION EFFECT MECHANISM	MEASUREMENT CRITERIA
Population	Species presence or absence	Historic range of native species, range of nonnative species, species status	Species introduction, suppression, or removal	Species presence or absence, species density and trend
	Genetics	Species migration, species isolation	Species introduction, suppression, or removal	Pure genetics, genetic introgression, or hybridization
Flow regime	Gross annual flow volume	Precipitation + equivalent clearcut area (ECA)[1] + watershed area + elevation + climate	Increase in ECA[1]	Annual water yield[2]
	Peak seasonal flow volume	Precipitation + ECA[1] + watershed area + elevation + climate	Increase in ECA[1]	Peak seasonal flow volume
	Peak seasonal flow time	Precipitation + ECA[1] + watershed area + elevation + climate	Increase in ECA[1]	Peak seasonal flow time
	Peak seasonal flow duration	Precipitation + ECA[1] + watershed area + elevation + climate	Increase in ECA[1]	Peak seasonal flow duration
Sediment	Fine sediment	**Flow regime** + sediment budget	Sedimentation from: 1) road-stream crossing structure, 2) adjacent roads, 3) RMZ disturbance	Percent fine sediment
	Embeddedness (*Sylte and Fischenich 2002*)	**Flow regime** + sediment budget	Sedimentation from: 1) road-stream crossing structure, 2) adjacent roads, 3) RMZ disturbance	Substrate score (*Weaver and Fraley 1991 citing others*)
	Surface substrate size-class distribution	**Flow regime** + sediment budget	Sedimentation from: 1) road-stream crossing structure, 2) adjacent roads, 3) RMZ disturbance	Relative percent of size classes per *Rosgen* channel type (*Rosgen 1996*)
Channel forms	Channel type	**Flow regime** + **sediment** + stream gradient + stream confinement	Change in **flow regime** and/or **sediment**	*Rosgen* (1996), *Montgomery* and *Buffington* channel types (*Montgomery and Buffington 1997*)
	Fast/slow fish habitat frequency	**Flow regime** + **sediment** + **LWD** + stream gradient + stream confinement	Change in **flow regime**, **sediment**, and/or **LWD** (if applicable)	Percent of slow habitats per stream reach
	Fast/slow fish habitat volume	**Flow regime** + **sediment** + **LWD** + stream gradient + stream confinement	Change in **flow regime**, **sediment**, and/or **LWD** (if applicable)	Total volume of slow habitats per stream reach
	Channel bank stability (*Overton et al 1997 citing others*)	**Flow regime** + **sediment** + stream gradient + stream confinement	Change in **flow regime** and/or **sediment**	Percent of stable channel bank per stream reach

ISSUE	VARIABLE	NORMAL EFFECT MECHANISM	POTENTIAL ACTION EFFECT MECHANISM	MEASUREMENT CRITERIA
Riparian condition	Riparian stand characteristics	Precipitation + physiographic location + elevation + soils/geology	RMZ timber harvest	Average trees per acre, average quadratic mean diameter, average basal area per acre, average height of site index trees at 100 years
	Riparian habitat type (climax)	Precipitation + physiographic location + elevation + soils/geology	RMZ timber harvest	Riparian habitat type (climax)
	Riparian habitat type (regional functionality)	Precipitation + physiographic location + elevation + soils/geology	RMZ timber harvest	Riparian habitat type (regional functionality)
	Rate of riparian tree blowdown	Precipitation + physiographic location + elevation + soils/geology + wind events	RMZ timber harvest	Average rate of riparian tree blowdown
	Stream shading	Precipitation + physiographic location + elevation + soils/geology	RMZ timber harvest	Average angular canopy density for July and August
LWD	In-stream LWD frequency	**Riparian condition**	RMZ timber harvest	In-stream LWD frequency per 1,000 linear stream feet
Stream temperature	In-stream temperature rate of change	**Flow regime** + **channel forms** + **riparian condition**	Change in **flow regime** and/or **channel forms**, RMZ timber harvest	Change in mean weekly maximum temperature per stream reach
Macro-invertebrate richness	*DEQ* macroinvertebrate indexes (MMI[3], RIVPACS[4])	**Flow regime** + **sediment** + **riparian condition** + nutrients	Change in **flow regime** and/or **sediment**, RMZ timber harvest	MMI[3] index, RIVPACS[4] index, DEQ impairment class
	Historic macroinvertebrate index (MVFP[5])	**Flow regime** + **sediment** + **riparian condition** + nutrients	Change in **flow regime** and/or **sediment**, RMZ timber harvest	MVFP[5] index, MVFP[5] impairment class
Connectivity	Accessible habitat (adult fish)	Natural migration barriers, road-stream crossing structure	Road-stream crossing structure installation or removal	Miles of accessible habitat (adult fish)
	Accessible habitat (juvenile fish)	Natural migration barriers, road-stream crossing structure	Road-stream crossing structure installation or removal	Miles of accessible habitat (juvenile fish)

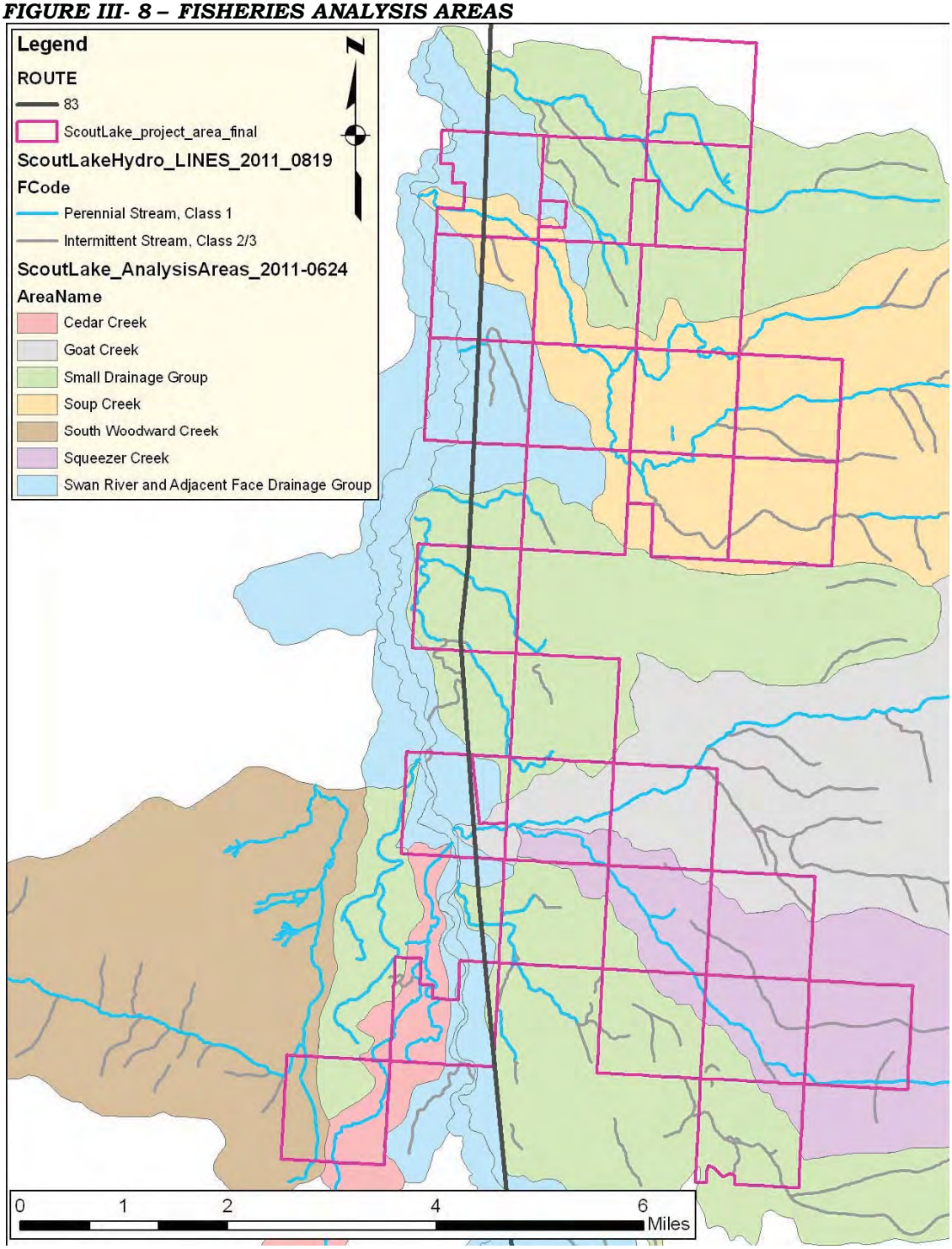
[1] *'Equivalent Clearcut Area' (ECA): see HYDROLOGY ANALYSIS.*
[2] *'Gross Annual Flow Volume' = 'Annual Water Yield': see HYDROLOGY ANALYSIS.*
[3] *Multimetric macroinvertebrate index (MMI) (Jessup et al 2006).*
[4] *Predictive macroinvertebrate model (RIVPACS) (Hawkins 2005, Feldman 2006).*
[5] *Historic macroinvertebrate index (MVFP) (Bollman 1998, MDEQ 2005).*

FISHERIES RESOURCE ANALYSIS AREAS

In order to evaluate the existing environment and potential environmental effects to fisheries resources in the project area, 7 different analysis areas that contain distinct fisheries distributions were identified (see *FIGURE III-8 – FISHERIES ANALYSIS AREAS*). The analysis areas were chosen because they include (1) the watersheds or reaches of known or potential fish-bearing streams or lakes and (2) the proposed harvest units and/or associated roads that could have foreseeable measurable or detectable impacts to those fish-bearing streams or lakes. The analysis areas of contributing area watersheds are delineated using *6th Code HUC* scale or smaller watershed boundaries.

The fisheries analysis areas generally coincide with the analysis areas used in the *HYDROLOGY ANALYSIS* in this document.

FIGURE III- 8 – FISHERIES ANALYSIS AREAS



ANALYSIS METHODS

The environmental analysis contained in this document will focus primarily on the populations and habitat variables affecting bull trout and westslope cutthroat trout, as these 2 native species are the primary focus of fisheries-related comments developed for the project as a result of public and internal scoping. Furthermore, bull trout and westslope cutthroat trout are also the focus of many sensitive species listings and interagency agreements (see *RELEVANT AGREEMENTS, LAWS, PLANS, RULES, AND REGULATIONS* at the beginning of this document), which indicates these 2 species have high intrinsic ecological and social value. The other 8 native species identified as inhabiting some portion of the project area are not identified as endangered, threatened, or sensitive species (*MNHP 2011*). Although those 8 other native species are an integral component of the aquatic ecosystem in the project area, any foreseeable issues or concerns regarding these species' populations or habitat variables can be adequately addressed through an effects analysis for bull trout and westslope cutthroat trout. Eastern brook trout, rainbow trout, and kokanee are nonnative and, to a large degree, invasive species that are not a component of the region's historical biodiversity, but any foreseeable issues or concerns regarding these species populations or habitat variables can also be adequately addressed through an effects analysis of relevant fisheries resources related to bull trout and westslope cutthroat trout.

The existing environment and (if possible) the ranges of existing conditions of bull trout and westslope cutthroat trout populations and habitat variables will be described in *EXISTING ENVIRONMENT – ALL FISHERIES RESOURCE ANALYSIS AREAS* in this analysis. The analysis methods for evaluating existing conditions are detailed in *SCOUT LAKE FISHERIES ANALYSIS – METHODS FOR EVALUATING EXISTING CONDITIONS (EXISTING ENVIRONMENT)*, which can be found in the project file. The potential environmental impacts of the proposed actions to bull trout and westslope cutthroat trout populations and habitat variables will be described in *ENVIRONMENTAL EFFECTS – ALL FISHERIES RESOURCE ANALYSIS AREAS* in this analysis. The analysis methods for evaluating potential environmental impacts are detailed in *SCOUT LAKE FISHERIES ANALYSIS – METHODS FOR EVALUATING ENVIRONMENTAL IMPACTS (ENVIRONMENTAL EFFECTS)*, which can be found in the project file.

Depending on the type and extent of the proposed actions, issues will (or will not) be carried through the analysis methods in each analysis area. The analysis methods detailed in *SCOUT LAKE FISHERIES ANALYSIS – METHODS FOR EVALUATING EXISTING CONDITIONS (EXISTING ENVIRONMENT)* and *SCOUT LAKE FISHERIES ANALYSIS – METHODS FOR EVALUATING ENVIRONMENTAL IMPACTS (ENVIRONMENTAL EFFECTS)* include the general methodologies considered for analysis throughout the project area; however, the actual relevance and degree of fisheries-resource information that is assessed in each analysis area is a function of the scope and type of the proposed actions in each analysis area.

Throughout the *EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS* section, the risk of a particular impact to fisheries resources is described. In terms of the risk that an impact may occur, a low risk of an impact means that the impact is unlikely

to occur. A moderate risk of an impact means that the impact may or may not (50/50) occur. A high risk of an impact means that the impact is likely to occur.

A very low impact means that the impact is unlikely to be detectable or measurable, and the impact is not likely to be detrimental to the resource. A low impact means that the impact is likely to be detectable or measurable, but the impact is not likely to be detrimental to the resource. A moderate impact means that the impact is likely to be detectable or measurable, and the impact is likely to be moderately detrimental to the resource. A high impact means that the impact is likely to be detectable or measurable, and the impact is likely to be highly detrimental to the resource.

Cumulative impacts are those collective impacts on the human environment (e.g. fisheries resources) of the proposed action when considered in conjunction with other past, present, and future actions related to the proposed action by location or generic type (*75-1-220, MCA*). The potential cumulative impacts to fisheries in the analysis areas are determined by assessing the collective anticipated direct and indirect impacts, other related existing actions, and foreseeable future actions affecting the fish-bearing streams.

Existing road density and road-stream crossing density are other variables that have been indirectly correlated to native fisheries population trends across large regional areas (*Quigley and Arbelbide 1997*). The mechanisms through which road density and road-stream crossing density affect native fisheries populations include sedimentation, fishing access, poaching, recreational access, timber harvest access, and grazing and agriculture (*Quigley and Arbelbide 1997, Baxter et al 1999*). As road density and road-stream crossing density are, therefore, very broad surrogates of multiple potential actions, these variables are tools to describe potential cumulative effects to fisheries. In the absence of site-specific fisheries data to describe the existing conditions of the project area, road density and road-stream crossing density could be considered simple, viable measures of potential cumulative effects. However, the level of detailed, project-specific fisheries population and habitat data to be utilized throughout this fisheries analysis is expected to provide a much more accurate and precise baseline for the cumulative effects analysis of fisheries in the project area. Therefore, road density and road-stream crossing density will not be used as a measure of potential cumulative effects in this analysis.

EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS

The existing environmental assessment for each analysis area includes: affected fish species, potential actions that may affect fisheries resources, fisheries resources (issues and variables) that may be affected by potential actions (*TABLE III-48 – ISSUE VARIABLES, NORMAL EFFECT MECHANISMS, POTENTIAL EFFECT MECHANISM AND MEASUREMENT CRITERIA*), existing conditions of potentially affected fisheries resources (see *SCOUT LAKE FISHERIES ANALYSIS – METHODS FOR EVALUATING EXISTING CONDITIONS [EXISTING ENVIRONMENT]*), and other existing information needed for the assessment of cumulative effects.

The environmental effects assessment for each analysis area includes: analysis of potential impacts to affected fisheries resources (see *SCOUT LAKE FISHERIES ANALYSIS – METHODS FOR EVALUATING ENVIRONMENTAL IMPACTS*

[ENVIRONMENTAL EFFECTS]), comparison of potential impacts to existing conditions, and cumulative effects assessment of anticipated collective impacts. The effects assessment for each analysis area will be conducted for all alternatives.

ALL FISHERIES RESOURCE-ANALYSIS AREAS

The proposed actions affecting fisheries resources in the analysis areas (Cedar and Goat creeks, Small Drainage Group, Soup, South Woodward, and Squeezer creeks, and Swan River and Adjacent Face Drainage Group) include:

- use of forest road haul routes for timber and equipment transportation,
- existing, permanent forest road surface maintenance and reconstruction,
- new, permanent forest road construction
- temporary forest road construction and reclamation,
- upland harvest, and
- streamside riparian area harvest.

The primary point-source mechanisms through which fisheries resources are affected by the proposed actions are sediment delivery to fish habitats at 29 existing and 2 proposed, new road-stream crossings (see *FIGURES III-9* - through *III-12*) and the modification of habitat connectivity at one road-stream crossing. The primary nonpoint-source mechanisms through which fisheries resources are affected by the proposed actions are (1) modifications of flow regime from upland harvest, (2) sediment delivery from streamside riparian area harvest, and (3) effects to LWD and stream temperature from riparian harvest. For analysis in this DEIS, population, flow regime, sediment, channel forms, riparian conditions, LWD, stream temperature, macroinvertebrate richness, and connectivity are the measurable or detectable fisheries resources expected to be potentially affected by the proposed actions.

FIGURE III-9 – FISHERIES ANALYSIS AREA DETAIL 1

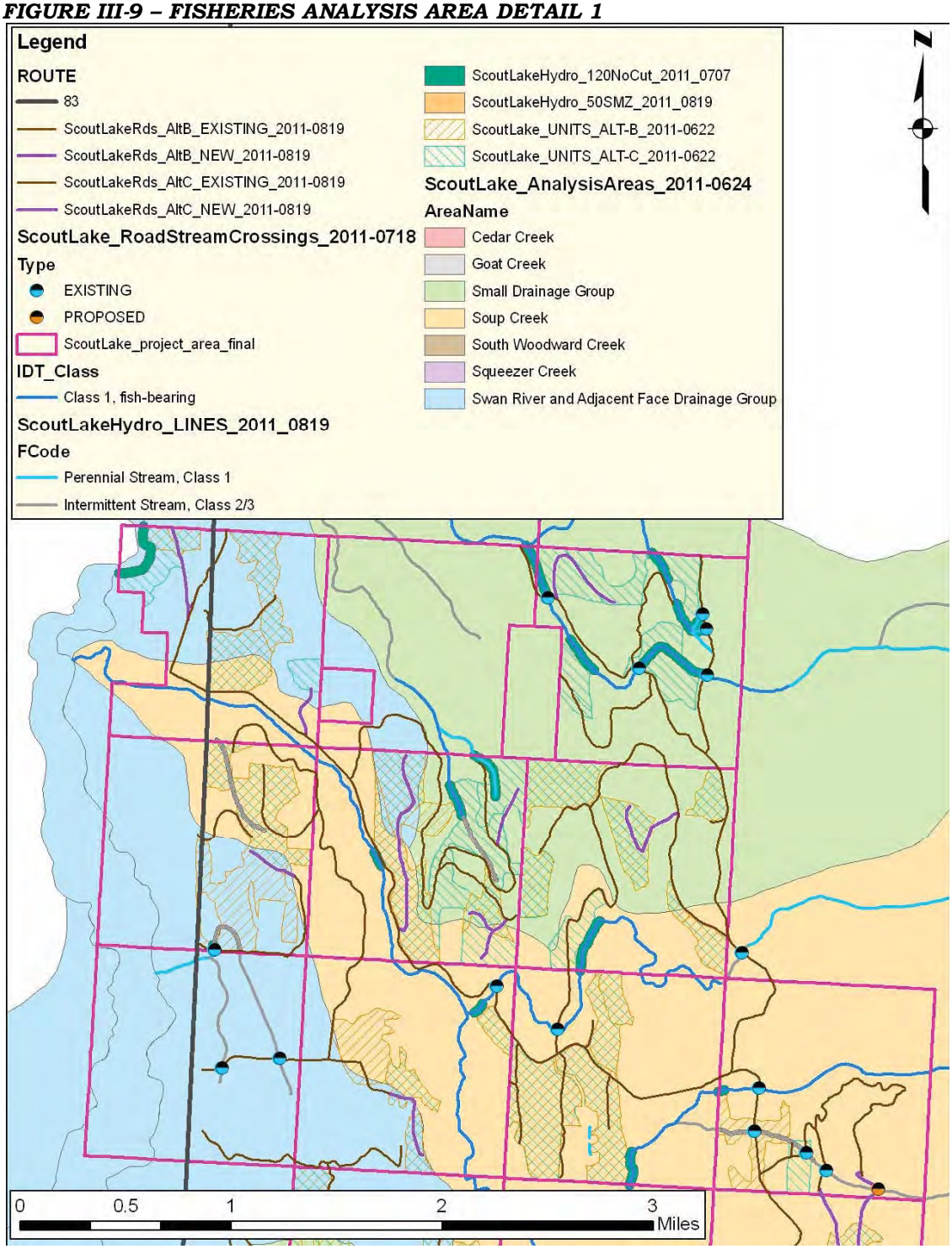


FIGURE III-10 – FISHERIES ANALYSIS AREA DETAIL 2

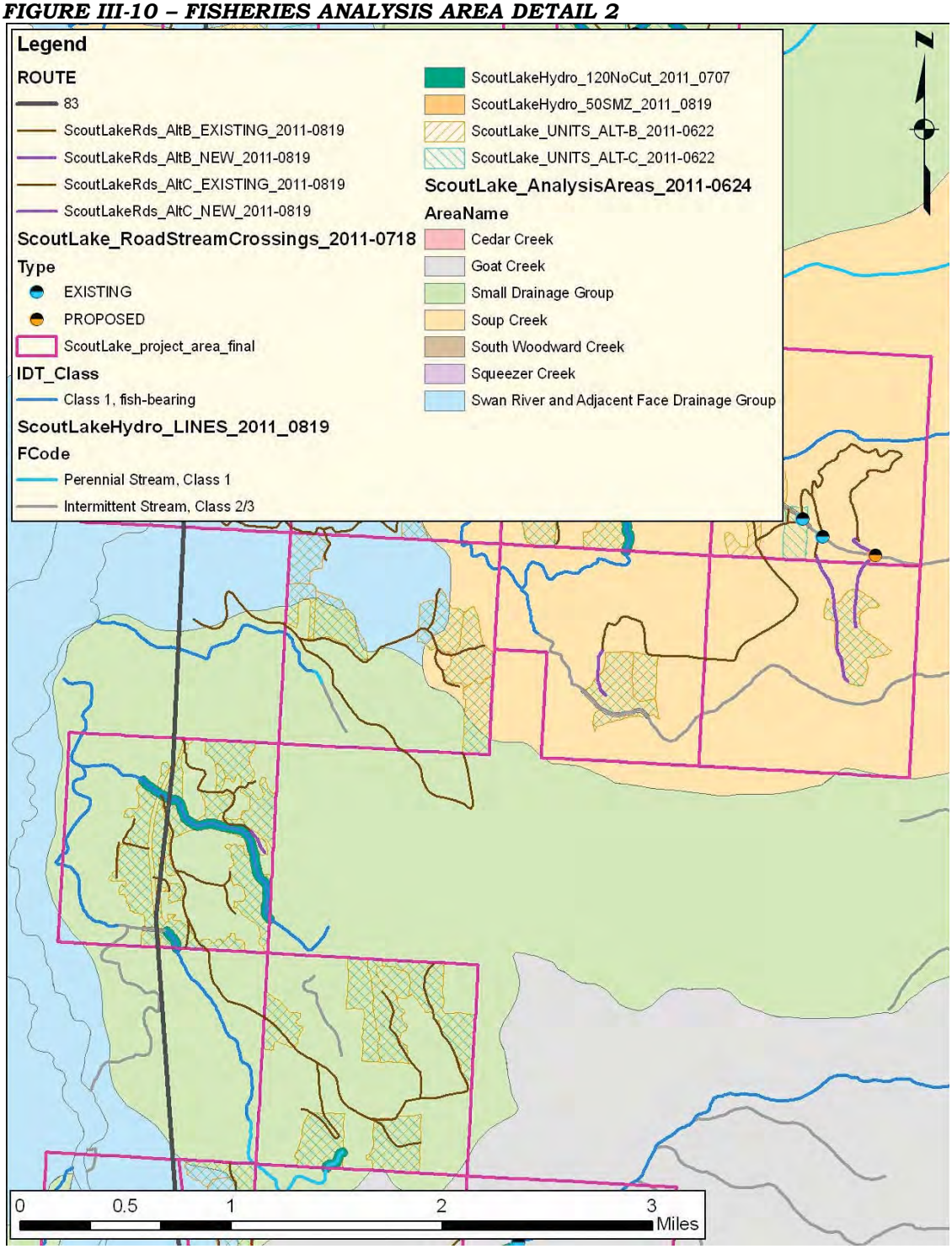


FIGURE III-11 – FISHERIES ANALYSIS AREA DETAIL 3

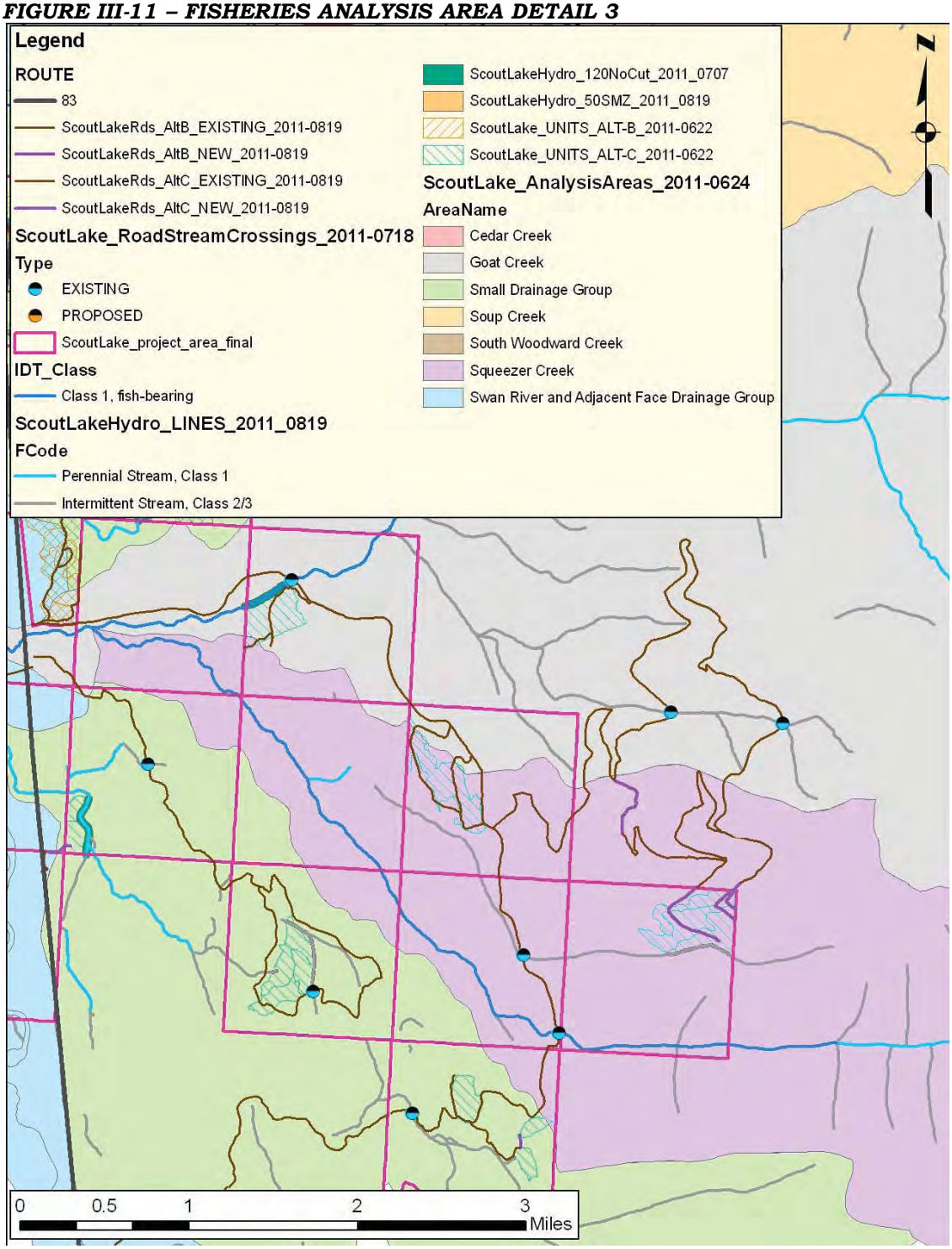
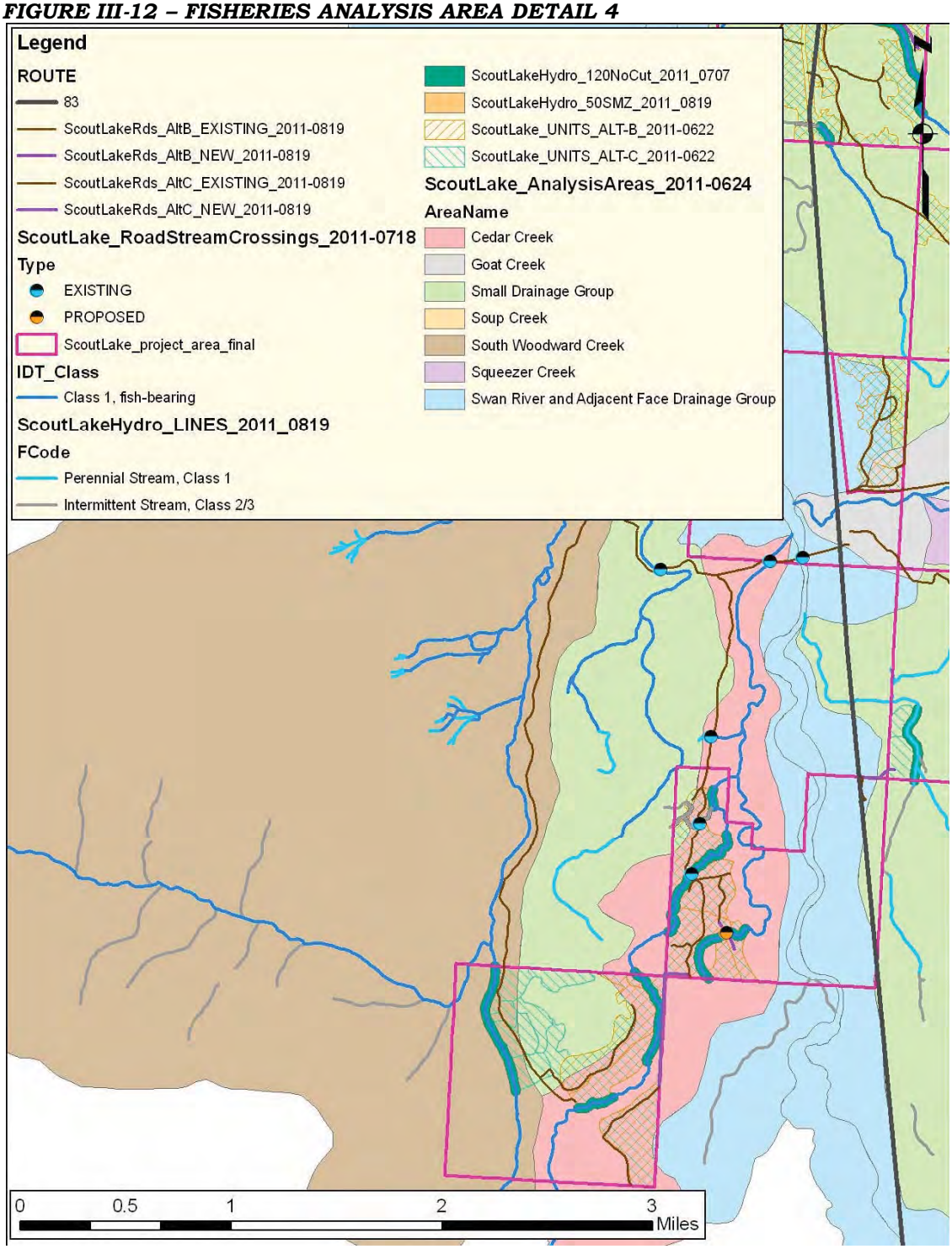


FIGURE III-12 – FISHERIES ANALYSIS AREA DETAIL 4



Existing Environment – All Fisheries Resource Analysis Areas

The assessment of existing conditions within the analysis areas includes information from past surveys and ongoing monitoring by both DNRC and DFWP. Site-specific information is also provided by field reviews of the project area during 2010 and 2011 by a DNRC fish biologist.

Affected fish species in the analysis areas are identified in *TABLE III-49 – AFFECTED FISH SPECIES*. Data supporting species presence and absence in the analysis areas are from *MFISH 2011* and DNRC fisheries surveys during 2003 through 2011.

TABLE III-49 – AFFECTED FISH SPECIES

			ANALYSIS AREA						
			Cedar Creek	Goat Creek	Small Drainage Group	Soup Creek	South Woodward Creek	Squeezer Creek	Swan River and Adjacent Face Drainage Group
SPECIES	native	bull trout	X	X	X[1]	X	X	X	X
		westslope cutthroat trout	X	X	X	X	X	X	X
		slimy sculpin				X			X
		largescale sucker				X			X
		longnose sucker	X						X
		longnose dace				X			X
		mountain whitefish				X			X
		northern pike minnow							X
		peamouth							X
		redside shiner							X
	non-native or introduced	eastern brook trout	X	X	X	X	X	X	X
		rainbow trout	X	X		X			X
		kokanee							X

[1] Species currently not distributed within affected portion of analysis area; affected portion of analysis area is likely within species' historic distribution.

Total fisheries densities within all analysis areas are stable, and no foreseeable impacts to total fisheries density are anticipated in the foreseeable future. However, field surveys during the past 8 years and collaborative studies involving other agencies suggest that populations of native bull trout and westslope cutthroat trout within all of the analysis areas are generally declining, and populations of nonnative eastern brook trout and rainbow trout are generally increasing. Bull trout are generally declining due to competitive displacement of rearing fish by eastern brook trout, predation of subadult

fish in Swan Lake by lake trout and to a lesser degree, hybridization with eastern brook trout. Westslope cutthroat trout are declining primarily due to competitive displacement by eastern brook trout and hybridization with rainbow trout. Within each analysis area, both bull trout and westslope cutthroat trout currently occupy only a fraction of the habitats that likely were historically occupied. As a result of the adverse effects of invasive nonnative fish species, the existing impacts to native fisheries populations within each analysis area range from moderate to high.

The analysis of hydrologic data includes the assessment of water yield; the existing conditions of this variable can be found in the *HYDROLOGY ANALYSIS*. The existing average increases in water yield are discussed both quantitatively and qualitatively in the *HYDROLOGY ANALYSIS*. The existing increases in water yield range from 2.6 percent to 8.4 percent in the Goat Creek, Small Drainage Group, Soup Creek, South Woodward Creek and Squeezer Creek analysis areas. The existing increases in the Cedar Creek, Swan River, and Adjacent Face Drainage Group analysis areas are negligible. Although these increases are likely within the range of natural variability, inputs to the analysis of existing conditions primarily consider past forest crown removal through timber harvest; therefore, these increases represent negligible to low existing impacts for all analysis areas. The variables of existing seasonal peak flow volume, timing, and duration are expected to be within the range of natural variability (see *HYDROLOGY ANALYSIS*).

Quantitative data of percent fine sediment (*McNeil core*) and embeddedness (substrate score) have been measured annually in most analysis areas within reaches important to native fisheries spawning and rearing (see *TABLE III-50 – EXISTING SEDIMENT CONDITIONS: MCNEIL CORE AND SUBSTRATE SCORE*). When available, these measures provide a level of information that is more comprehensive than surface substrate size-class distribution (below) and tends to be a better indicator of conditions in an entire analysis area. The analysis areas of Goat, Soup, and Squeezer creeks have all had one or more years during the monitoring period with annual percent fine sediment measures (*McNeil core*) exceeding 35 percent, which may indicate a condition that threatens embryo survival (*FBC 1991*). While the analysis areas for Goat, Squeezer, and South Woodward creeks do not have long-term average measurements of percent fine sediment over 35 percent, the Soup Creek Analysis Area exhibits an overall average value of 36.1 percent during the monitoring period. The 4 analysis areas with records of substrate score have also had one or more years during the monitoring period with embeddedness ratings less than 10, which may also indicate a condition that threatens embryo survival (*FBC 1991*). The analysis areas of South Woodward and Squeezer creeks retained an average substrate score that is less than 10 through the monitoring period.

TABLE III-50 – EXISTING SEDIMENT CONDITIONS: MCNEIL CORE AND SUBSTRATE SCORE.

	ANALYSIS AREA						
	Cedar Creek	Goat Creek	Small Drainage Group	Soup Creek	South Woodward Creek	Squeezer Creek	Swan River and Adjacent Face Drainage Group
Percent fine sediment (McNeil core): survey years[1]	ND	1987 - 2009	ND	1993 - 2009	1996 - 2009	1994 - 2009	ND
Percent fine sediment (McNeil core): average[1]	ND	29.6%	ND	36.1%	29.2%	27.4%	ND
Percent fine sediment (McNeil core): range[1]	ND	24.8% - 37.3%	ND	33.9% - 39.7%	24.9% - 34.1%	23.6% - 35.8%	ND
Substrate score: survey years[1]	ND	1988 - 2009	ND	1992 - 2009	1997 - 2009	1988 - 2009	ND
Substrate score: average[1]	ND	11.0	ND	10.1	9.8	9.5	ND
Substrate score: range[1]	ND	9.5 - 11.7	ND	9.0 - 10.9	9.0 - 11.2	9.0 - 10.3	ND

ND = No [direct measure] data

[1] T. Weaver, DFWP Kalispell

Within other analysis areas that do not have *McNeil core* or substrate score records, existing surface substrate size-class distributions are either directly measured or estimated at potentially affected reaches. Surveys of potentially affected reaches in Cedar Creek (*Koopal 2002*) indicate that the existing proportions of fine surface sediments are lower than the average expected amounts (*Rosgen 1996*). Quantitative data of surface substrate size-class distributions are not available for the Small Drainage Group or Swan River and Adjacent Face Drainage Group analysis areas, although field reviews during 2010 and 2011 by a DNRC fish biologist and hydrologist indicate a normal distribution of substrate size classes are likely in stream reaches adjacent to potentially affected areas.

In addition to the total estimated annual sedimentation from all existing roads in the analysis areas, the estimated annual sedimentation from all existing roads proposed for use under the action alternatives is described (see *HYDROLOGY ANALYSIS* and *TABLE III-51 – EXISTING ROAD-STREAM CROSSINGS AND ASSOCIATED ANNUAL SEDIMENTATION*). This type of baseline information can be used to compare the potential effects of the proposed actions due to the use of a portion of the roads within each analysis area. The Goat Creek, Small Drainage Group, Squeezer Creek and Swan River and Adjacent Face Drainage Group analysis areas have average estimated sedimentation rates ranging from 0.1 to 1.6 tons per year per road-stream crossing proposed for use. These rates are relatively low compared to the Cedar Creek and Soup

Creek analysis areas, which have average estimated sedimentation rates of 8.7 and 4.2 tons per year per road-stream crossing proposed for use, respectively.

TABLE III-51 – EXISTING ROAD-STREAM CROSSINGS AND ASSOCIATED ANNUAL SEDIMENTATION

	ANALYSIS AREA						
	Cedar Creek	Goat Creek	Small Drainage Group	Soup Creek	South Woodward Creek	Squeezer Creek	Swan River and Adjacent Face Drainage Group
Maximum number of existing road-stream crossings proposed for use	4	3	9	7	0	2	4
Estimated annual sedimentation from existing road-stream crossings proposed for use (above) (tons)	34.7	4.7	</=1.5	29.3	-	0.9	0.4
Estimated annual sedimentation from all existing road-stream crossings (tons)	70.8	18.8	</=2.9	30.0	19.4	1.3	0.9

The existing conditions of sediment variables in the analysis areas consider the suite of available assessment tools described above. Based on these survey results, low existing impacts to sediment are likely in all of the analysis areas, except in the Cedar Creek and Soup Creek watersheds. In the Cedar Creek and Soup Creek analysis areas moderate existing impacts to sediment variables are likely.

Fisheries resources associated with riparian variables in the analysis areas are not expected to be markedly affected by the proposed actions, which is due to the anticipated implementation of a 120-foot no-harvest zone adjacent to all fish-bearing and non-fish-bearing perennial streams. Consequently, the assessment of this variable will be qualitative and non-site-specific. Riparian conditions within the current analysis areas are highly variable, but recent riparian surveys of existing conditions throughout the Swan River State Forest can be used to characterize the general conditions within the current analysis areas:

- average trees per acre = 836 (range: 100 to 2,580),
- average quadratic mean diameter (inches) = 8.3 (range: 2.8 to 16.8),
- average basal area (square feet) per acre = 291.3 (range: 55.8 to 904.8), and
- average height (feet) of site index trees at 100 years = 74 (range: 33 to 127).

The general width of the functional riparian areas (*Hansen et al 1995*) ranges from 30 to 110 feet. Observed rates of riparian vegetation blowdown appear normal. Measures of angular canopy density for the month of July indicate an average stream shading of 75 percent (range: 48 to 97 percent); measures for the month of August indicate an average of 82 percent (range: 56 to 100 percent).

The predominant riparian stand types within the analysis areas include various grand fir, Engelmann spruce, and western red cedar series. Although these are typically the dominant species during late seral and climax stages, other species such as subalpine fir, Douglas-fir, western larch, and Sitka alder are also components of the overstory (*Hansen et al 1995*). The riparian landtypes as they relate to associated geology and soils include NL2A, SL2B, and SL3B characteristics (*Sirucek and Bachurski 1995*), and they primarily occur adjacent to B and C channel types with stream gradients ranging from 1 to 12 percent. The NL2A riparian landtype generally occurs at sites with deep, weakly developed, very gravelly sandy loams or very gravelly loams. The SL2B and SL3B riparian landtypes tend to be somewhat poorly drained sites with deep, weakly developed, gravely or bouldery, sandy loams or loams.

The historic harvest of large trees within riparian areas has occurred throughout all of the analysis areas. Although this practice has been widespread, the intensity of this harvest is infrequent or low and has not occurred in riparian areas for an estimated 30 years or more. The *HYDROLOGY ANALYSIS* includes an assessment of potentially affected existing riparian areas adjacent to fish-bearing and non-fish-bearing streams. This analysis suggests the South Woodward Creek and Small Drainage Group analysis areas may have up to 31 percent and 42 percent, respectively, of total riparian area exhibiting existing harvest impacts; all other analysis areas likely exhibit minor levels of existing harvest in riparian areas. A review of other recent DNRC environmental assessments having similar analysis areas (*DNRC 2003, DNRC 2006*, and *DNRC 2009*) suggests these observations in the *HYDROLOGY ANALYSIS* are consistent with other past survey results of riparian conditions. Low existing impacts to riparian function are likely occurring in all of the analysis areas, except in the South Woodward Creek and Small Drainage Group analysis areas. In the South Woodward Creek and Small Drainage Group analysis areas a moderate existing impact to riparian function is likely.

LWD is a function of riparian conditions and will be discussed qualitatively in this environmental assessment. A review of other recent DNRC environmental assessments having similar analysis areas (*DNRC 2003, DNRC 2006,* and *DNRC 2009*) suggests the baseline conditions, and foreseeable effects of proposed past actions, of LWD have existing potential impacts ranging from negligible to low across all analysis areas. However, considering the description of existing riparian conditions (above) and the previously assessed existing conditions, very low to low existing impacts to LWD are likely occurring in all of the analysis areas, except in the South Woodward Creek and Small Drainage Group analysis areas. In the South Woodward Creek and Small Drainage Group analysis areas a moderate existing impact to LWD is likely.

The existing conditions of channel forms are primarily a function of flow regime, sedimentation, and riparian variables. A review of other recent DNRC environmental assessments having similar analysis areas (*DNRC 2003, DNRC 2006,* and *DNRC 2009*) did not find the existing conditions of channel forms, or the foreseeable effects of proposed past actions, to be impacted, or otherwise outside the range of expected variability, except in the Cedar Creek Analysis Area. Considering the description of these 3 variables (above) and the previously assessed existing conditions, very low to low existing impacts to channel forms are likely occurring in all of the analysis areas,

except in the Cedar Creek, Soup Creek, South Woodward Creek and Small Drainage Group analysis areas. In the Cedar Creek, Soup Creek, South Woodward Creek, and Small Drainage Group analysis areas a low to moderate existing impact to channel forms is likely.

Stream temperature is primarily a function of flow regimes, channel forms, and riparian conditions and will be discussed qualitatively in this *DEIS*. A review of other recent DNRC environmental assessments having similar analysis areas (*DNRC 2003, DNRC 2006*, and *DNRC 2009*) did not find the existing conditions of stream temperature, or the foreseeable effects of proposed past actions, to be impacted or otherwise outside of the range of expected variability, except in the Soup Creek and Swan River and Adjacent Face Drainage Group analysis areas. The results of past assessments indicating elevated peak seasonal stream temperatures in the lower reaches of Soup Creek (*DNRC 2006*) are consistent with those found in *DNRC Stream Temperature Monitoring Reports* (*DNRC 2010*). Considering the description of the 3 contributing variables (above) and the previously assessed existing conditions, negligible to low existing impacts to stream temperature are likely occurring in all of the analysis areas, except in the Soup Creek and Swan River and Adjacent Face Drainage Group analysis areas. In the Soup Creek and Swan River and Adjacent Face Drainage Group analysis areas a moderate existing impact to stream temperature is likely.

Macroinvertebrate richness is primarily function of flow regime, sedimentation, and riparian variables. Quantitative analyses of macroinvertebrate samples are only available for South Woodward Creek and Soup Creek analysis areas. In the *White Porcupine EIS (DNRC 2009)*, the South Woodward Creek Analysis Area is described as 'unimpaired'. Sampling from Soup Creek (*Bollman 2007*) also suggests an 'unimpaired' condition in terms of modeled species richness indices; however, a closer analysis of the presence and absence of certain taxa may indicate elevated fine sediments in the stream. No conditions were observed in any of the other analysis areas during 2010 and 2011 field surveys that may indicate a range of macroinvertebrate richness not consistent with stream morphologies. Considering the descriptions of related variables and quantitative sampling results, very low to low existing impacts to macroinvertebrates are likely occurring in all of the analysis areas, except in the Soup Creek Analysis Area. In the Soup Creek Analysis Area, a low to moderate existing impact to macroinvertebrates is likely.

DNRC surveys indicate fish passage is impaired at 17 different road-stream crossing sites in 3 of the analysis areas (*DNRC 2011*): 8 sites occur in the Small Drainage Group Analysis Area, 2 sites occur in the Soup Creek Analysis Area, and 7 sites occur in the South Woodward Creek Analysis Area. All of the sites prevent passage of one or more life stages at some point during base to bankfull flows. With the exception of 2 sites in the South Woodward Creek Analysis Area, all of the sites occur in streams where native fish species have been completely displaced by nonnative fish. Two sites in the South Woodward Creek Analysis Area occur in reaches that support native westslope cutthroat trout; however, at this point in time, these 2 sites are complete fish passage barriers that inadvertently provide a positive effect to this native species by preventing invasion of eastern brook trout. No existing impacts to the connectivity of native

fisheries occurs in any of the analysis areas, while moderate impacts to the connectivity of nonnative fisheries occurs in the Small Drainage Group, Soup Creek, and South Woodward Creek analysis areas.

Other past and present factors affecting all of the analysis areas include those actions described in *CHAPTER I – PURPOSE AND NEED* under *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS*, riparian and upland harvest by other landowners, timber and equipment hauling by other landowners, and other public, open road-stream crossing sites. These other factors, in conjunction with the area-specific existing conditions assessed above, contribute an existing moderate to high collective impact to all analysis areas. The moderate to high existing collective impact to fisheries is primarily a result of the adverse effects of nonnative fish populations on native fisheries. Although other contributing factors currently affect fisheries resources, such as sedimentation, past riparian harvest, stream temperature and connectivity, the population dynamics between native and nonnative fisheries has had the most profound existing effect on fisheries resources, as a whole, throughout all of the analysis areas.

ENVIRONMENTAL EFFECTS – ALL FISHERIES RESOURCE ANALYSIS AREAS

- ***Direct and Indirect Effects of No-Action Alternative A on All Analysis Areas***

  No direct or indirect impacts would occur to affected fish species or affected fisheries resources beyond those described in *EXISTING ENVIRONMENT*.

- ***Direct and Indirect Effects Common to Action Alternatives B and C on All Analysis Areas***

  As a result of implementing Action Alternatives B or C, no direct or indirect impacts to fisheries populations (including species presence or absence and genetics) are expected to occur in any of the analysis areas. The adverse effects of nonnative fisheries on native fisheries would continue to occur at the same levels as described under *EXISTING ENVIRONMENT*.

  A 120-foot wide, no-harvest zone would be implemented along all fish-bearing and non-fish-bearing Class 1 streams in all analysis areas, except the Cedar Creek Analysis Area (see below). Class 1 streams include all connected stream reaches that are perennial or have surface flow for at least 6 months per year. As a result of the proposed action, riparian stand characteristics adjacent to all perennially connected and most intermittent streams are not expected to be affected. Due to hydrologic and soil features associated with the riparian habitat types found throughout the analysis areas, the rate of riparian tree blowdown may increase (*Hansen et al 1995*, *Sirucek and Bachurski 1995*). Scientific literature reviews (*Belt et al 1992, McGreer 1994, Castelle and Johnson 2000*) suggest a no-harvest zone of this extent is expected to greatly reduce potential upland harvest effects to in-stream shading.

  Considering riparian stand characteristics along all fish-bearing and non-fish-bearing Class 1 streams in all analysis areas, except the Cedar Creek Analysis Area (see below), and the implementation of a 120-foot wide, no-harvest zone, potential impacts to LWD are expected to be greatly reduced; this assessment is based on similar observations from other related studies (*Murphy and Koski 1989*, *McDade et al 1990*, *Robinson and Beschta 1990*, *Van Sickle and Gregory 1990*).

A 50-foot wide, no-harvest zone would also be implemented along all Class 2 streams in all analysis areas. Class 2 streams are non-fish-bearing and include all disconnected perennial streams and connected streams that have surface flow for less than 6 months per year. This no-harvest application of the *SMZ Law* is expected to greatly reduce potential effects to riparian functions and LWD in Class 2 streams throughout all analysis areas.

In the Cedar Creek Analysis Area, a total of 1.1 acres of riparian-area harvest would occur adjacent to 2 fish-bearing, Class 1 streams. Harvest would occur on 1.0 acres adjacent to approximately 1,050 feet of mainstem Cedar Creek, which supports native bull trout and westslope cutthroat trout; however, the riparian area harvest associated with this action would not occur within 50 feet of mainstem Cedar Creek. Harvest would occur on 0.1 acres adjacent to a tributary to Cedar Creek, which supports eastern brook trout. An overall low risk of low impacts to riparian function and LWD is expected in the Cedar Creek Analysis Area, but a low risk of very low impacts to these 2 variables is expected in all other analysis areas.

One road-stream crossing of an unnamed tributary to Soup Creek would be reconstructed as part of both action alternatives. The unnamed tributary supports nonnative eastern brook trout both upstream and downstream of the existing road-stream crossing site. The reconstructed road-stream crossing site would provide full levels of fish passage, but would not have a measurable effect on the population of the eastern brook trout within the Soup Creek Analysis Area; however, this action is expected to have minor positive impacts to the variable of connectivity in the analysis area.

- ***Direct and Indirect Effects of Action Alternative B on All Analysis Areas***

The introduction to *EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS* describes a series of general proposed actions potentially affecting fisheries resources in the analysis areas. *TABLE III-52 – ACTION ALTERNATIVE B: DETAIL OF POTENTIAL EFFECT MECHANISMS* describes in more detail the specific proposed actions in Action Alternative B that may affect fisheries resources in the different analysis areas. These proposed actions and associated resources will frame the assessment of environmental effects in each analysis area. The primary point-source mechanism through which fisheries resources are affected by the proposed actions is sediment delivery to fish habitats at road-stream crossings. The primary nonpoint-source mechanisms through which fisheries resources are affected by the proposed actions are (1) modifications of flow regime from upland harvest and (2) sediment delivery from riparian harvest.

TABLE III-52 – ACTION ALTERNATIVE B: DETAIL OF POTENTIAL EFFECT MECHANISMS

		ANALYSIS AREA						
		Cedar Creek	Goat Creek	Small Drainage Group	Soup Creek	South Woodward Creek	Squeezer Creek	Swan River and Adjacent Face Drainage Group
Action Alternative B	Percent existing increase in annual water yield (from a fully forested condition)[1]	**N**	**4.5**	**<8.4**	**2.6**	**7.9**	**4.0**	**N**
	Percent new increase in annual water yield (from a fully forested condition)[1]	**N**	**4.6**	**<10.5**	**3.3**	**7.9**	**4.0**	**N**
	Miles of existing forest road used (within 300 feet of all streams)	**1.3**	**0.2**	**2.0**	**3.9**	**1.4**	**-**	**0.7**
	Miles of new forest road constructed (within 300 feet of all streams)	**0.5**	**-**	**0.2**	**0.3**	**-**	**-**	**-**
	Number of existing road-stream crossings used	**4**	**-**	**1**	**7**	**-**	**-**	**4**
	Number of new road-stream crossings constructed	**1**	**-**	**-**	**1**	**-**	**-**	**-**
	Acres of riparian zone[2] harvest adjacent to fish-bearing and non-fish-bearing perennial streams	**1.1**	**-**	**-**	**-**	**-**	**-**	**-**
	Acres of riparian zone[3] harvest adjacent to non-fish-bearing intermittent streams	**-**	**-**	**1.2**	**4.3**	**-**	**-**	**-**

[1] Estimated values from HYDROLOGY ANALYSIS
[2] Areas within 120 feet of all Class 1 or perennial streams
[3] Areas within 50 feet of all Class 3 intermittent streams
N = negligible

The *HYDROLOGY ANALYSIS* describes estimated increases in water yield ranging from 0.0 to 2.1 percent as a result of implementing Action Alternative B. A low risk of very low impacts to this variable is expected in the fisheries resource analysis areas. A low risk of low impacts to peak seasonal flow volume, flow time, and flow duration are expected (see *HYDROLOGY ANALYSIS*).

The erosion of forest road surfaces and the potential delivery of fine material to stream channels are a function of the application and effectiveness of forestry *BMPs*,

including road design, road traffic, road surface composition, and road maintenance. Through the implementation of project-specific *BMPs* and road maintenance, the *HYDROLOGY ANALYSIS* indicates the following estimated reductions in sediment delivery from project area roads if Action Alternative B is selected: 80 percent in the Cedar Creek Analysis Area, 76 percent in the Soup Creek Analysis Area, 75 percent in the Swan River and Adjacent Face Drainage Group Analysis Area, and no reductions in the other analysis areas. New road construction in 3 of the analysis areas would occur near water resources (0.2 to 0.5 miles of new road within 300 feet of streams and 2 new road-stream crossing sites). The reconstruction of road-stream crossing structures on unnamed tributaries to Soup and Cedar creeks will cause short-term delivery (high risk of moderate short-term impacts); however, long-term risks of impacts to sediment at all sites are expected to be low.

Increased truck traffic can also accelerate the mobilization and erosion of roadbed material at road-stream crossings (*Reid and Dunne 1984, Bilby et al 1989, Coker et al 1993, Luce and Black 2001*). However, through the implementation of project-specific *BMPs* and road maintenance, the applicable road-stream crossing sites would be expected to deliver most mobilized sediment away from the stream and road prism and filter eroded material through roadside vegetation. These actions are expected to substantially offset the risk of increased sedimentation due to the anticipated levels of project-specific vehicle traffic; however, a moderate risk of low short-term and long-term impacts to sediment is still expected from truck traffic.

A 50 to 100-foot equipment exclusion zone would be implemented along all fish-bearing and non-fish-bearing Class 1 streams, which is expected to greatly reduce potential sediment delivery from ground disturbances related to upland harvest (*Davies and Nelson 1994*, *Castelle and Johnson 2000*, *Parker 2005*, *Rashin et al 2006*). A 50-foot equipment exclusion zone would be implemented along all non-fish-bearing Class 2 and 3 streams, although minor amounts of riparian harvest would occur adjacent to Class 3 streams in the Small Drainage Group and Soup Creek analysis areas. Class 3 streams include intermittent reaches that rarely contribute surface flow to another stream. Application of the *SMZ Law* is expected to reduce potential sediment delivery from ground disturbances adjacent to perennially disconnected and intermittent, non-fish-bearing streams in the analysis area.

The primary considerations for impacts to sediment include: (1) a positive impact due to the implementation of project-specific *BMPs* and road maintenance, (2) a moderate risk of low short-term and long-term fine sediment delivery impacts from increased project-specific traffic and new road construction, and (3) a high risk of moderate short-term impacts from two road-stream crossing structure replacements and 1 temporary bridge installation. A net high risk of moderate impacts is expected in the short-term only in the Soup and Cedar creek analysis areas, and a moderate risk of low sediment impacts to fisheries resources in all analysis areas is expected in the short-term and long-term.

Potential impacts to channel forms from the proposed actions are expected to be primarily a function of (long-term) changes in flow regime and sediment. As a

result, a low to moderate risk of low impacts to channel forms is expected in all analysis areas.

The minor levels of streamside riparian harvest adjacent to Class 3 streams in the Small Drainage Group (1.2 acres) and Soup Creek (4.3 acres) analysis areas is expected to have a low risk of low impacts to overall riparian conditions in those areas.

Peak seasonal stream temperatures in all analysis areas may increase very slightly due to potential effects to flow regime and sediment. Implementation of a 120-foot wide, no-harvest zone along all fish-bearing and non-fish-bearing Class 1 streams is expected to greatly reduce potential effects to stream temperature (*Beschta et al 1987*, *Brosofske et al 1997*, *Wilkerson et al 2006*). Application of a 50-foot wide, no-harvest zone along all Class 2 streams and the *SMZ Law* along all Class 3 streams is expected to reduce potential effects to stream temperature in these stream reaches in all of the analysis areas. A low risk of low impacts is expected to stream temperatures in all analysis areas.

Macroinvertebrate richness may decrease slightly due to the potential effects to flow regime and sediment (*Herlihy et al 2005*, *VanDusen et al 2005*). Implementation of a 120-foot wide, no-harvest zone along all fish-bearing and non-fish-bearing Class 1 streams is expected to reduce potential positive or adverse effects to macroinvertebrate richness as a result of potential changes to riparian condition (*Newbold et al 1980*, *Carlson et al 1990*, *Moldenke and Ver Linden 2007*). A low risk of low impacts is expected to macroinvertebrate richness in all analysis areas.

- ***Direct and Indirect Effects of Action Alternative C on All Analysis Areas***

The introduction to *EXISTING ENVIRONMENT AND ENVIRONMENTAL EFFECTS* describes a series of general proposed actions potentially affecting fisheries resources in the analysis areas. *TABLE III-53 – ACTION ALTERNATIVE C: DETAIL OF POTENTIAL EFFECT MECHANISMS* describes in more detail the specific proposed actions in Action Alternative C that may affect fisheries resources in the different analysis areas. These proposed actions and associated resources will frame the assessment of environmental effects in each analysis area. The primary point-source mechanism through which fisheries resources are affected by the proposed actions is sediment delivery to fish habitats at road-stream crossings. The primary nonpoint-source mechanisms through which fisheries resources are affected by the proposed actions are (1) modifications of flow regime from upland harvest and (2) sediment delivery from riparian harvest.

TABLE III-53 – ALTERNATIVE C: DETAIL OF POTENTIAL EFFECT MECHANISMS

		ANALYSIS AREA						
		Cedar Creek	Goat Creek	Small Drainage Group	Soup Creek	South Woodward Creek	Squeezer Creek	Swan River and Adjacent Face Drainage Group
Action Alternative C	Percent existing increase in annual water yield (from a fully forested condition) [1]	**N**	**4.5**	**<8.4**	**2.6**	**7.9**	**4.0**	**N**
	Percent new increase in annual water yield (from a fully forested condition) [1]	**N**	**4.6**	**<10.5**	**3.2**	**8.0**	**4.4**	**N**
	Miles of existing forest road used (within 300 feet of all streams)	**1.3**	**1.7**	**6.2**	**4.0**	**1.4**	**0.5**	**0.7**
	Miles of new forest road constructed (within 300 feet of all streams)	**0.5**	**-**	**0.3**	**0.3**	**-**	**0.1**	**-**
	Number of existing road-stream crossings used	**4**	**3**	**9**	**7**	**-**	**2**	**4**
	Number of new road-stream crossings constructed	**1**	**-**	**-**	**1**	**-**	**-**	**-**
	Acres of riparian zone [2] harvest adjacent to fish-bearing and non-fish-bearing perennial streams	**1.1**	**-**	**-**	**-**	**-**	**-**	**-**
	Acres of riparian zone [3] harvest adjacent to non-fish-bearing intermittent streams	**-**	**-**	**-**	**1.7**	**-**	**-**	**-**

[1] Estimated values from HYDROLOGY ANALYSIS

[2] Areas within 120 feet of all Class 1 or perennial streams

[3] Areas within 50 feet of all Class 3 intermittent streams

N = negligible

The *HYDROLOGY ANALYSIS* describes estimated increases in water yield ranging from 0.0 to 2.1 percent as a result of implementing Action Alternative C. A low risk of very low impacts to this variable is expected in the fisheries resource analysis areas. A low risk of low impacts to peak seasonal flow volume, flow time, and flow duration are expected (see *HYDROLOGY ANALYSIS*).

The erosion of forest road surfaces and the potential delivery of fine material to stream channels are a function of the application of forestry *BMPs*, including road

design, road traffic, road surface composition, and road maintenance. Through the implementation of project-specific *BMPs* and road maintenance, the *HYDROLOGY ANALYSIS* indicates the following estimated reductions in sediment delivery from project area roads if Action Alternative C is selected: 80 percent in the Cedar Creek Analysis Area, 76 percent in the Soup Creek Analysis Area, 75 percent in the Swan River and Adjacent Face Drainage Group Analysis Area, 47 percent in the Goat Creek Analysis Area, up to 3 percent in the Small Drainage Group Analysis Area, and no reductions in the remaining analysis areas. New road construction in 4 of the analysis areas would occur near water resources (0.1 to 0.5 miles of new road within 300 feet of streams and 2 new road-stream crossing sites). The reconstruction of road-stream crossing structures on unnamed tributaries to Soup and Cedar creeks will cause short-term delivery (high risk of moderate short-term impacts); however, long-term risks of impacts to sediment at all sites are expected to be low.

The potential effects to sediment from increased truck traffic and equipment operation outside *SMZ* areas are expected to be the same as those described under Action Alternative B.

The primary considerations for impacts to sediment include: (1) a positive impact due to the implementation of project-specific *BMPs* and road maintenance, (2) a moderate risk of low short-term and long-term fine sediment delivery impacts from increased project-specific traffic and new road construction, and (3) a high risk of moderate short-term impacts from two road-stream crossing structure replacements and one temporary bridge installation. A net high risk of moderate impacts is expected in the short-term only in the Soup and Cedar creek analysis areas, and a moderate risk of low sediment impacts to fisheries resources in all analysis areas is expected in the short-term and long-term.

Potential impacts to channel forms are expected to be primarily a function of (long-term) changes in flow regime and sediment. As a result, a low to moderate risk of low impacts is expected to channel forms in all analysis areas.

The minor levels of riparian harvest adjacent to Class 3 streams (1.7 acres) in the Soup Creek Analysis Area is expected to have a low risk of low impacts to overall riparian conditions in that area.

The potential effects to stream temperature and macroinvertebrate richness are expected to be the same as those described under Action Alternative B.

- ***Cumulative Effects of No-Action Alternative A on All Analysis Areas***

The other related past and present factors and site-specific existing conditions described in *EXISTING ENVIRONMENT* would continue to occur. Other future, related actions include those described in *CHAPTER I - PURPOSE AND NEED* under *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS*. These related actions include moderate levels of timber harvest and associated road use on private lands and the potential conversion of forest timberlands to residential use; these actions are expected to have a moderate risk of low impacts to fisheries resources. Considering all of these impacts collectively, a

moderate risk of moderate to high cumulative impacts is expected to occur. Although the anticipated moderate to high cumulative effect is a function of all potentially related impacts, the elevated cumulative effect in the analysis areas is primarily due to adverse impacts from nonnative fish species.

- ***Cumulative Effects of Action Alternatives B and C on All Analysis Areas***

  Using the cumulative effects described for No-Action Alternative A as a baseline, the anticipated collective direct and indirect effects due to implementing Action Alternatives B or C are expected to contribute a moderate risk of additional low impacts to fisheries resources. Consequently, a moderate risk of moderate to high cumulative impacts to fisheries resources is expected in all analysis areas, which is fundamentally the cumulative effect to fisheries resources described for No-Action Alternative A. Although the anticipated moderate cumulative effect is a function of all potentially related impacts, the elevated cumulative effect in the analysis areas is primarily due to adverse impacts from nonnative fish species.

WILDLIFE ANALYSIS

INTRODUCTION

This analysis discloses the existing condition of potentially affected wildlife resources and displays the anticipated effects that may result from each proposed alternative. Anticipated direct and indirect effects were analyzed in the project area, and cumulative effects were analyzed at expanded scales that were defined and described for each resource category. Past and current activities on all ownerships in each analysis area, as well as future agency actions, were taken into account in each analysis addressing cumulative effects.

ISSUES AND MEASUREMENT CRITERIA

Wildlife-related issues were identified through public and internal scoping and are listed in *TABLE I–1 – ISSUES STUDIED IN DETAIL* (*CHAPTER I*). The issues carried forward in this analysis are reiterated at the beginning of each applicable subsection. Differing measurement criteria were used to evaluate the effects of the alternatives, depending on the resource or habitat analyzed. Measurement criteria typically are the quantifiable metrics selected for use to describe the scope and scale of effects to a particular target species, habitat, or habitat parameter. The criteria used for evaluations are described under *ANALYSIS AREA* and *ANALYSIS METHODS* under each issue topic.

ANALYSIS AREAS

For this analysis, existing conditions and environmental effects are assessed at 2 different scales. The first is 'Project Area' (see *PROJECT AREA MAP* located before *CHAPTER I- PURPOSE AND NEED).* The proposed project area comprises 15,586 acres and is primarily on the east side of the Swan River State Forest; of this area, DNRC is proposing timber harvesting on approximately 2,010 acres (13 percent) (Action Alternative B) or 2,636 acres (17 percent) (Action Alternative C). Elevations range from 3,200 to 6,100 feet, with the majority of included lands occurring at 3,200 to 4,000 feet. The project area encompasses portions of 7 tributaries to Swan River: Cilly, Soup, Cedar, Napa, In-pa-ah, Goat, and Squeezer creeks. The project area is situated within portions of 4 grizzly bear management unit subunits (South Fork Lost Soup, Goat Creek, Lion Creek, and Porcupine-Woodward).

The second scale includes the project area and broader areas of surrounding lands identified for assessing cumulative effects. The 2 cumulative effects analysis areas most commonly used throughout this wildlife analysis include the Swan River State Forest (including non-DNRC checkerboard lands, 65,682 acres) (see *MAP W-1*), and the land area consisting of the 4 combined aforementioned grizzly bear subunits (124,199 acres). Land ownership for these 2 areas is quantified below in *TABLE III-54 - ACREAGES AND PERCENTAGES OF LANDS BY OWNERSHIP* and *TABLE III-55 - ACREAGES AND PERCENTAGES OF LANDS BY OWNERSHIP WITHIN 4 GRIZZLY BEAR SUBUNITS.* Existing conditions and effects of alternatives are discussed quantitatively in terms of the conditions and effects to the various resources on DNRC lands in the Swan River State Forest. While DNRC does not have adequate data to quantitatively discuss

conditions on other ownerships the analysis area (primarily The Nature Conservancy and USFS), we acknowledge that management actions on these other lands can have ecological effects to resources on DNRC lands. Thus, these effects will be discussed qualitatively.

Note, that within the 65,682-acre cumulative effects analysis area, a wildfire started on a DNRC parcel (Section 1, T24N, R17W) and burned approximately 500 acres of DNRC lands. This acreage equates to about 0.8 percent of the cumulative effects analysis area. The potential effects of this fire to wildlife habitat and habitat attributes will be qualitatively considered in this analysis. However, at the time of this writing, quantifiable inventory data were not available for inclusion into the tabular information presented in this analysis. The burn occurred outside of lands in the project area and would generally have a minimal additional effect or influence on affected habitats or landscape-scale considerations, such as habitat connectivity and linkage, when considered at the 65,682-acre cumulative effects analysis area scale.

Within the 65,682-acre cumulative effects analysis area, some future logging could occur on lands currently owned by The Nature Conservancy in conjunction with their 10-year *Fiber Supply Agreement* with Plum Creek. However, currently, no activity is planned in the near term (*M. Mantas, TNC, pers. comm. 8/24/11*). Any Nature Conservancy lands that may be transferred into DNRC ownership would not be available for logging for the purpose of fulfilling the 10-year *Fiber Supply Agreement*. No USFS projects are planned or in progress in the 65,682-acre cumulative effects analysis area (*J. Dunham, USFS, pers. comm. 9/14/2011*).

TABLE III-54 - ACREAGES AND PERCENTAGES OF LANDS BY OWNERSHIP. *Acreages and percentages of lands by ownership in the Swan River State Forest cumulative effects analysis area.*

LANDOWNERS	ACRES (PERCENT)
USFS	5,208 (7.9)
State DNRC	41,700 (63.3)
State DFWP	2,222 (3.4)
The Nature Conservancy/Plum Creek	14,803 (22.5)
Other agency/private	1,929 (2.9)
Totals	*65,862 (100.0)*

TABLE III-55 - ACREAGES AND PERCENTAGES OF LANDS BY OWNERSHIP WITHIN 4 GRIZZLY BEAR SUBUNITS *containing lands within the Scout Lake Multiple Timber Sale project area.*

LANDOWNERS	SOUTH FORK LOST SOUP	GOAT CREEK	LION CREEK	PORCUPINE WOODWARD	*TOTAL ACRES (PERCENT OF OWNERSHIP)*
	ACRES (PERCENT OF SUBUNIT)				
USFS	11,041.1 (36.9)	13,323.5 (48.3)	23,059.0 (79.4)	15,428.2 (41.0)	*62,851.8 (50.6)*
State DNRC	18,284.7 (61.2)	6,009.2 (21.8)	3,071.1 (10.6)	14,153.9 (37.6)	*41,518.9 (33.4)*
State DFWP	40.9 (0.1)	790.7 (2.9)	1,390.8 (4.8)	0 (0.0)	*2,222.5 (1.8)*
The Nature Conservancy/Plum Creek	86.7 (0.3)	7,479.0 (27.1)	600.4 (2.1)	6,174.9 (16.4)	*14,341.0 (11.5)*
Other agency/private	430.0 (1.4)	0 (0.0)	925.9 (3.2)	1,909.0 (5.0)	*3,264.9 (2.6)*
Totals	*29,883.4 (24.1)*	*27,602.4 (22.2)*	*29,047.2 (23.4)*	*37,666.2 (30.3)*	*124,199.2 (100.0)*

ANALYSIS METHODS

DNRC manages for biodiversity by utilizing both 'coarse' and 'fine' filter approaches to forest management. The coarse filter approach promotes an appropriate mix of stand structures and compositions on state lands (*ARM 36.11.404*). Appropriate stand structures are based on ecological characteristics (e.g., landtype, habitat type, disturbance regime, unique characteristics). The coarse filter approach assumes that if landscape patterns and processes are maintained similar to those endemic species evolved with, the full complement of species will persist and biodiversity will be maintained. DNRC cannot assure that the coarse filter approach will adequately address the full range of biodiversity; therefore, DNRC also employs a 'fine filter' approach for threatened, endangered, and sensitive species (*ARM 36.11.406*). The fine filter approach focuses on habitat requirements of several specific species. Species addressed under the fine filter are typically rare, particularly susceptible to forest management activities, and/or may be habitat specialists requiring narrower ranges of habitat conditions.

For each issue, existing habitat conditions are described and compared to the anticipated effects of the proposed alternatives to describe the foreseeable effects to potentially affected wildlife species. To assess existing conditions in the project area and surrounding landscape, a variety of techniques were used. Field visits, scientific literature, *SLI* data, aerial photographs, *MNHP* data, and consultations with other professionals provided information for the following discussion and effects analysis. Current vegetative cover layers used for this analysis provided the primary means to evaluate cumulative effects associated with past projects on DNRC ownership and neighboring lands. See *CHAPTER I - PURPOSE AND NEED* for a comprehensive listing of past DNRC projects involving vegetation management on the Swan River State

Forest. Where applicable, specific methodologies were applied and are discussed under the relevant issue topic. Species were dismissed from further analysis if suitable habitat did not exist in the project area, or if the habitat would not be modified by any alternative.

RELEVANT AGREEMENTS, LAWS, PLANS, RULES, AND REGULATIONS

Various legal documents dictate criteria for management of terrestrial wildlife and their habitats on state lands. These include the DNRC *Forest Management Rules (ARMs)*, *SVGBCA*, *Endangered Species Act*, *Migratory Bird Treaty Act*, and *Bald and Golden Eagle Protection Act*. The *Forest Management Rules* provide the primary regulatory foundation for DNRC management activities and incorporate requirements from a number of different relevant plans and policies applicable to wildlife habitat management in Montana.

COARSE FILTER WILDLIFE ANALYSIS

COVERTYPE

Issue: The proposed activities could result in changes in the distribution of different covertypes on the landscape, which could affect wildlife.

Introduction

Differing forest covertypes can provide important habitat attributes for some species of wildlife. While some species are relatively unaffected by covertype differences (eg. coyote), others can be found in greater abundance in specific covertypes, particularly during different seasons. Preferences by some animals for certain covertypes may reflect a direct relationship between the wildlife species and the vegetation (e.g. the animal may prefer to forage or nest on a certain tree species), but often the relationship results from the preference for particular characteristics associated with the covertype. For example, drier covertypes, such as ponderosa pine, are typically associated with a more-open, grassy understory that may provide important foraging areas for wintering ungulates or open hunting areas for species such as the flammulated owl (*McCallum 1994*). In contrast, subalpine fir and spruce forests typically support a dense understory structure that is favored by snowshoe hares and Canada lynx (*Hodges 2000, Squires et al. 2010*). To provide an appropriate diversity of covertypes to support a host of different wildlife species, DNRC attempts to manage for a diversity of covertypes in proportions similar to what was historically present on the Swan River State Forest (*ARM 36.11.405*).

Analysis Area and Methods

For this analysis, the percentage of the project area in each major covertype was assessed using *SLI* data (see *COVERTYPE* and *AGE CLASSES* in *VEGETATION ANALYSIS*). To assess the direct and indirect effects of the proposed activities, the change in covertype acres by alternative was evaluated. Cumulative effects to covertypes were assessed at the scale of the 65,682-acre Swan River State Forest cumulative effects analysis area (see *MAP W-1*). Primary measurement criteria are the changes in acres of each covertype that would be expected under each alternative being considered in the project.

Existing Environment

On DNRC lands in the Swan River State Forest, covertype distributions are skewed from those that would have been expected around the turn of the century (*Losensky 1997*) (see *COVERTYPE* and *AGE CLASS* tables in *VEGETATION ANALYSIS*). At the forest-wide

scale, mixed-conifer covertypes are overrepresented by 46 percent, while western larch/Douglas-fir and western white pine covertypes are underrepresented by 23 and 22 percent, respectively. Covertype distributions currently found in the project area are similarly skewed away from historic proportions. On lands in the project area, mixed-conifer covertypes are overrepresented by 53 percent, while western larch/Douglas-fir and western white pine covertypes are underrepresented at 18 and 29 percent, respectively. These conditions likely lead to increased habitat availability and quality for species that use dense stands that include a variety of shade-tolerant and shade-intolerant tree species, while providing fewer habitats for those species that use the more-open stands dominated by shade-intolerant tree species.

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Covertypes***

  In the near term, minimal effects or change in covertypes would be expected. However, over the next several decades shade-intolerant trees would continue to die and be replaced by shade-tolerant species, which would lead to an increasing deviation from historic covertype proportions. Over time, this could lead to a reduction in habitat for species associated with covertypes dominated by shade-intolerant tree species. For example, shade-intolerant western larch are preferred trees for nesting pileated woodpeckers in Swan Valley (*McClelland and McClelland 1999*). Conversely, species that are associated with shade-tolerant habitat types would benefit from an increased amount of habitat. Therefore, the effects of this alternative could result in localized adverse effects to wildlife species that are closely associated with shade-intolerant covertypes and could impede the goal of maintaining a diversity of endemic species.

- ***Direct and Indirect Effects of Action Alternatives B and C to Covertypes***

  Action Alternatives B and C would involve covertype conversions on 1,121 and 848 acres in the project area, respectively. The majority of these stands are currently mixed-conifer covertypes that would be converted to a western white pine covertype, which would help ensure their presence on the landscape. Also, under both action alternatives, lesser increases ranging from 36 to 126 acres would occur in the western larch/Douglas-fir, ponderosa pine, Douglas-fir, and lodgepole pine covertypes (see covertype analysis in the *VEGETATION ANALYSIS* section). Increases in these types would vary slightly by alternative. Either action alternative would promote shifts in the proportions of shade-intolerant covertypes slightly closer to historic conditions on lands in the project area, potentially improving and maintaining habitat quality for species associated with the shade-intolerant covertypes once the stands regenerate. Thus, the effects of the action alternatives would be positive for wildlife species associated with shade-intolerant covertypes and for the goal of maintaining a diversity of species. Conversely, habitat quality would be degraded for species that use forest cover types dominated by shade-tolerant tree species.

- ***Cumulative Effects of No-Action Alternative A to Covertypes***

  Under No-Action Alternative A, no changes in covertype would occur and mixed-conifer covertypes would remain disproportionately high on DNRC lands on the Swan River State Forest, potentially resulting in lower quality, less-sustainable habitat conditions for wildlife species associated with the shade-intolerant covertypes. Over time and in the absence of severe natural disturbances, gradual cumulative increases in the proportion of shade-tolerant covertypes would occur on DNRC lands on the Swan River State Forest, further decreasing habitat quality for wildlife species that use shade-intolerant types or a variety of habitat types. Such cumulative shifts could be additive to similar changes that could occur on neighboring DFWP- managed lands, The Nature Conservancy, and USFS lands in the absence of natural disturbances.

- ***Cumulative Effects of Action Alternatives B and C to Covertypes***

  Forest management activities that have occurred over the last several decades within the 65,682-acre Swan River State Forest cumulative effects analysis area have contributed to a cumulative increasing trend in the abundance of seral forest covertypes. Anticipated shifts in covertype abundance associated with any of the action alternatives would be additive to past actions that have occurred in the cumulative effects analysis area, including those recently managed as corporate timberlands. Future projects planned by DNRC (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I- PURPOSE AND NEED*) would likely be planned in a manner that would continue to address skewed covertype proportions in order to promote appropriate covertype representations as directed by DNRC's *Forest Management Rules*. USFS has no plans in the foreseeable future to manage timber in the cumulative effects analysis area; thus, no change would be expected in the proportions of covertypes associated with vegetation management on USFS lands (*J. Dunham, USFS, pers. comm. 9/14/2011*). Within the 65,682-acre cumulative effects analysis area, some future logging could occur on lands currently owned by The Nature Conservancy in conjunction with their 10-year *Fiber Supply Agreement* with Plum Creek, which could promote the regeneration of shade-intolerant tree species. However, currently, no activities are planned in the near term (*M. Mantas, TNC, pers. comm. 8/24/11*). Efforts by DNRC to plant rust-resistant western white pine aims to counteract the effects of blister rust, which is decreasing the abundance of this covertype. In general, wildlife species that evolved under historic disturbance regimes would benefit from the additional cumulative changes in covertype distributions to a similar degree under either action alternative. However, these benefits would generally be realized in the longer term due to the necessary conversion of older-aged stands to younger-aged stands in order to successfully make the species covertype conversions. Thus, the cumulative effects would tend to be positive for species that use shade-intolerant covertypes at the possible expense of those that use shade-intolerant types.

AGE CLASS

Issue: The proposed activities could alter the representation of stand age classes on the landscape, which could adversely affect wildlife.

Introduction

Differing ages of forest stands can provide a variety of habitats and structures for wildlife. Some terrestrial animal species, such as the ruffed grouse, are commonly associated with early successional forest conditions (*Dessecker and McAuley 2001*), while some species, such as pine marten and fisher, are associated with mature stands (*Buskirk and Ruggiero 1994, Powell and Zielinski 1994*). Other species, such as the snowshoe hare, can be found in younger stands of regenerating trees, as well as mature forest stands with dense structure, but are not typically found in midsuccessional stands with open forest understory vegetation (*Hodges 2000*).

Analysis Area and Methods

To provide an appropriate diversity of forest stands to support wildlife species indigenous to Montana, DNRC considers historic proportions and distributions of age classes (*ARM 36.11.404*). For this analysis, stands on the Swan River State Forest were categorized as 0 to 39 years, 40 to 99 years, 100 to 149 years, and old stands 150 years and greater (see *COVERTYPE* and *AGE CLASSES* in *VEGETATION ANALYSIS*). The anticipated shift in acres of each age class associated with the proposed harvesting under each alternative was used to assess the potential effects to wildlife. Changes to the project area by alternative are considered in *DIRECT AND INDIRECT EFFECTS*; cumulative effects were analyzed at the scale of the 65,682-acre Swan River State Forest cumulative effects analysis area to provide consistency with the discussion in *VEGETATION ANALYSIS*.

Existing Environment

In the project area, stands in the 100-year and older age classes currently comprise approximately 58 percent of the forest, whereas the 0 to 39 year old stands and 40 to 99year old stands comprise 16 and 21percent, respectively. Compared to the reported historic data for the climatic section (*M333C, Losensky 1997*), stands currently in the 0 to 39 year age class are slightly underrepresented by 6 percent, and stands in the 40 to 99-year age class are slightly overrepresented by 8 percent. Stands on the project area in the 100 to 149 year age class are consistent with historic climatic section estimates at 21 percent, whereas old forests greater than 149 years comprise 36 percent of the age class distribution and are overrepresented by 7 percent (see *COVERTYPE* and *AGE CLASSES* in *VEGETATION ANALYSIS*). On DNRC lands across the Swan River State Forest cumulative effects analysis area, similar trends exist in which stands over 100 years old are the most abundant, while young stands are least abundant. Older stands are also abundant on USFS lands, while young stands less than 50 years old are abundant on previously owned Plum Creek lands. The prevalence of older stands likely reflects a lack of disturbance over the last century or more, which is consistent with the history of fire suppression in the area. When comparing averages of historical climatic sections with existing conditions on DNRC lands, habitat for species that use very young stands is slightly lower, whereas habitat remains relatively abundant for those species that use mature forested stands at the scales of both the project area and Swan River State Forest. At each of the 3 scales, considered (i.e., 1) project area, 2) Swan River State Forest cumulative effects analysis area, and 3) climatic section), all of the age classes are represented relatively well with none of the existing classes representing less than 15

percent, which suggests that diverse habitat conditions currently exist on both the project area and cumulative effects analysis area.

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Age Class***

  In the short term, no effects to age class would be expected. Over time and in the absence of natural disturbances, the proportions of older to younger stands would become greater. These conditions would lead to an increasing deviation from historic distributions of age classes, potentially promoting a reduction in the level of available habitat over time for species associated with young forest conditions.

- ***Direct and Indirect Effects of Action Alternatives B and C to Age Class***

  Action Alternatives B and C would involve regeneration harvests that would convert older-aged stands to the youngest age class across 1,233 or 1,087 acres, respectively. Under both alternatives, older stands (100-years-plus) would continue to comprise over half of the project area. Proposed reductions in habitat could cause adverse effects for 30 to 50 years to wildlife species that prefer mature forest conditions, while wildlife species that use meadows and early successional forests would benefit from an increase in habitat availability for up to approximately 30 years.

- ***Cumulative Effects of No-Action Alternative A to Age Class***

  Under this alternative, no logging of forest stands would occur; thus, no cumulative effects to age class distributions in the cumulative effectscumulative effect analysis area would be expected. Over the long term (i.e., several decades) as forest stands age and succession continues, adverse effects to wildlife species associated with younger age classes could occur and positive effects to wildlife associated with older age classes would be likely. The degree that such effects would occur would likely be closely related to the scale and magnitude of the changes over time.

- ***Cumulative Effects of Action Alternatives B and C to Age Class***

  Recent forest management activities on the Swan River State Forest have resulted in a trend of increasing amounts of younger forest age classes. This trend is gradually moving forest stands in the cumulative effects analysis area toward historic proportions found within the climatic section during the early 1900s (*Losensky 1997*) (see *COVERTYPE AND AGE CLASSES* in *VEGETATION ANALYSIS*). Both action alternatives would increase the proportion of younger age classes, while decreasing the proportion of existing mature to old stands. These effects would be additive to actions by other landowners in the cumulative effects analysis area that have, or could in the future, changed the proportions of age classes in the area. No USFS projects are planned or in progress that would alter forest age classes within the 65,682-acre cumulative effects analysis area (*J. Dunham, USFS, pers. comm. 9/14/2011*). Within the 65,682-acre cumulative effects analysis area, some future logging could occur on lands currently owned by The Nature Conservancy in conjunction with their 10-year *Fiber Supply Agreement* with Plum Creek. However, currently, no activities are planned in the near term (*M. Mantas, TNC, pers. comm. 8/24/11*). Past timber sales by Plum Creek and small, private landowners have increased the

acreage of stands in the younger age classes in the cumulative effects analysis area, providing more habitat for wildlife species associated with younger stands on these areas. Therefore, the cumulative effects to wildlife species would be slightly negative to species associated with older forest stands, but positive for species that use younger age classes. In time, as historic proportions of age classes were restored, habitat proportions would more closely reflect the proportions under which wildlife in western Montana evolved, resulting in potential benefits to biodiversity.

OLD GROWTH

Issue: The proposed activities could affect wildlife species associated with old-growth forests by reducing the acreage of available habitat and increasing fragmentation.

Introduction

Old-growth forests are an important component of biological diversity. They are old forest stands that typically have large old trees, abundant snags and downed logs, and multiple canopy layers, which are not found in young forests. These attributes provide structures used by a diversity of wildlife species. The diversity of species and the complexity of interactions between them can be different than in earlier successional stages (*Warren 1990*). On nearby lands on the FNF, approximately 31 wildlife species associated with old-growth forests have been documented (*Warren 1998*).

When considering the effects of forest management on species associated with old-growth forests, evaluating changes in the amount of old-growth habitats is important, as well as the size and spatial juxtaposition of these habitats. Smaller patches may be unsuitable for wildlife species with large home ranges. Additionally, small, less-mobile species may be at greater risk of local extinction in small patches/habitat islands. Of the 48 oldgrowth associated species occurring in the Northern Rockies, about 60 percent are thought to require stands larger than 80 acres (*Harger 1978*).

Analysis Area and Methods

Old-growth forest patches were identified as described under *OLD GROWTH* in *VEGETATION ANALYSIS.* Patch sizes and shapes were assessed using *ArcGIS 9.3*. Changes in the total acres of old growth, as well as the number of patches greater than 80 acres, were assessed in the project area. To provide consistency with the *VEGETATION ANALYSIS*, cumulative effects to associated wildlife species were analyzed across DNRC lands (i.e., 41,700 acres) comprising the Swan River State Forest. Additional qualitative analysis was done considering neighboring ownerships within the larger 65,682-acre Swan River State Forest cumulative effects analysis area. Effects to wildlife were evaluated in terms of the total amount of old-growth habitat and the abundance of large patches greater than 80 acres that would be retained under each alternative.

Existing Environment

Currently, the project area has 3,542 acres of old growth, which represents approximately 23 percent of the project area; the 10,603 acres of old growth across the 41,700 acres of DNRC lands on the entire Swan River State Forest represents 25 percent of that area. Across much of the Swan River State Forest, periodic reductions of some

attributes, such as large trees, snags, and downed logs, occurred during past timber sales and salvage logging. Thus, habitat quality has been reduced in some areas for some wildlife species associated with structurally diverse forest conditions. Decreases in the acreage of old growth, reductions in average patch size, simplification of patch shapes, and loss of connectivity between stands of old growth have occurred due to past management, and have been exacerbated in Swan Valley where ownership is mixed. Old-growth stands in the project area average 60 acres, and 9 of 52 existing total patches are larger than 80 acres (*TABLE III-56 – NUMBER OF OLD-GROWTH PATCHES AND PATCH SIZES*). The average existing patch size of old-growth stands on the project area is 202 acres. Many of the old-growth patches in the project area share some, if not all, of their boundaries with mature, dense forests. In these cases, the effective patch size for old-growth associated species is likely larger than for patches surrounded by younger-aged forest stands. Stands in the mature and old-age categories in the project area currently represent greater than 50 percent of the forested acres (see *VEGETATION ANALYSIS* for further details). Presently on the Swan River State Forest, an abundance of mixed-conifer covertypes and shortages of western white pine, ponderosa pine, and western larch/Douglas-fir covertypes also exist. Thus, wildlife species that are typically associated with old growth in covertypes comprised of seral tree species that are underrepresented have likely suffered from lower habitat quality, while those associated with old growth in the overrepresented covertypes have likely benefited from a greater abundance of high-quality habitat.

TABLE III-56 - NUMBER OF OLD GROWTH PATCHES AND PATCH SIZES.
Number of patches and patch sizes of old-growth forests in the project area and DNRC parcels within the cumulative effects analysis area (Swan River State Forest).

	ALTERNATIVE		
	NO-ACTION	**ACTION**	
	A	**B**	**C**
Project Area			
Number of old-growth patches	52	46	49
Average patch size (acres)	60	57	61
Number of large patches greater than 80 acres	9	10	9
Maximum patch size	352	332	348
Minimum patch size	5	5	6
Average size for large patches	202	151	193
Swan River State Forest			
Number of old-growth patches	114	108	111
Average size (acres)	83	83	84
Number of large patches greater than 80 acres	34	35	34
Maximum patch size	973	973	973
Minimum patch size	4	4	4
Average size for large patches	212	197	210

In the cumulative effects analysis area, the various landowners have had differing approaches to the management of old growth, which has affected its abundance and

spatial distribution. The current and past amounts of old growth in the cumulative effects analysis area are difficult to quantify because little is known as to the potential amounts of old growth on other ownerships, and approximations of older age classes were not possible with aerial-photograph analysis. In general, USFS has retained much of the old growth acreages on its lands in the Swan River State Forest cumulative effects analysis area, whereas, Plum Creek has extensively harvested old growth during the last several decades. Old stands have been retained primarily along creeks and other water features; however, the exact amount of old stands present on other ownerships is unknown.

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Old Growth***

  No changes to the amounts, quality, or spatial arrangement of old growth would occur under this alternative. Thus, old-growth-associated wildlife species would not be affected.

- ***Direct and Indirect Effects of Action Alternative B to Old Growth***

  Under Action Alternative B, of the 3,542 acres of old-growth forest in the project area, 502 acres would be removed (3 percent of the project area; 14 percent of the existing old growth in the project area), resulting in 3,040 acres (20 percent) of old-growth forest remaining in the 15,586-acre project area. An additional 162 acres of old growth would be retained, but would be harvested in a manner that would maintain sufficient large old trees and other structural attributes to remain as old growth. Logging would alter the existing attributes on all of the acres of old growth treated and potentially affect some old-growth-associated species using those stands, particularly those preferring dense forest stands. Remaining old-growth patches would range from 5 to 332 acres in size; 10 patches greater than 80 acres would remain (*TABLE III-56 – NUMBER OF OLD-GROWTH PATCHES AND PATCH SIZES*). However, the average patch size of old-growth stands on the project area would be reduced from 202 acres to 151 acres (25-percent reduction). Thus, because: 1) the total amount of old growth would be reduced on the project area by 14 percent, 2) the number of large patches would slightly increase, 3) the average large patch size would decrease by 25 percent, 4) 162 acres would be treated using old growth maintenance or restoration treatments to maintain and perpetuate old growth attributes, and 5) stands in the mature and old forest age categories in the project area would continue to represent 50 percent of the forested acres (see *VEGETATION ANALYSIS* for further details), -- a low level of adverse direct and indirect effects to wildlife associated with old-growth forests would be expected under Action Alternative B as a result of reduced availability of habitat with high attribute levels and slight increases in old growth fragmentation habitat parameters, such as reduced overall average patch size and reduced average size of large patches (*TABLE III-56 – NUMBER OF OLD GROWTH PATCHES AND PATCH SIZES*).

- ***Direct and Indirect Effects of Action Alternative C to Old Growth***

  Under Action Alternative C, of the 3,542 acres of old-growth forest in the project area, 150 acres would be removed (1 percent of the project area; or 4 percent of existing old growth in the project area), resulting in 3,392 acres of old-growth forest remaining (22 percent of the 15,586-acre project area). An additional 402 acres of old

growth would be retained, but would be harvested in a manner that would maintain sufficient large old trees and other structural attributes to remain old growth. Logging would alter the existing attributes on all of the acres of old growth treated and potentially affect some old-growth-associated species using those stands, particularly those preferring dense forest stands. Remaining old-growth patches would range from 6 to 348 acres in size; 9 patches greater than 80 acres would remain (*TABLE III-56 – NUMBER OF OLD GROWTH PATCHES AND PATCH SIZES*). However, the average patch size of old-growth stands on the project area would be reduced from 202 acres to 193 acres (5 percent reduction). Thus, because: 1) the total amount of old growth would be reduced on the project area by 1 percent, 2) the number of large patches would slightly increase, 3) the average large patch size would decrease by 5 percent, 4) 402 acres would be treated using old-growth maintenance or restoration treatments to maintain and perpetuate old-growth attributes, and 5) stands in the mature and old forest age categories in the project area would continue to represent 51 percent of the forested acres (see *VEGETATION ANALYSIS* for further details), -- a low level of adverse direct and indirect effects to wildlife associated with old growth forests would also be expected under Action Alternative C as a result of reduced availability of habitat with high attribute levels and slight increases in old growth fragmentation habitat parameters, such as reduced average size of large patches (*TABLE III-56 – NUMBER OF OLD-GROWTH PATCHES AND PATCH SIZES*).

- ***Cumulative Effects of No-Action Alternative A to Old Growth***

  Under No-Action Alternative A, the project would not affect any old-growth forest. Therefore, existing stands of old growth would remain in their current state and no cumulative effects to old-growth associated wildlife species would be anticipated.

- ***Cumulative Effects to Old Growth Common to Action Alternative B***

  Under Action Alternative B, of the 10,603 total acres of old-growth forest across the Swan River State Forest, 502 acres would be removed (5 percent of the total old-growth amount), resulting in 10,101 acres of old-growth forest remaining (24 percent of the 41,700-acre Swan River State Forest). An additional 162 acres of old growth would be retained, but would be harvested in a manner that would maintain sufficient large old trees and other structural attributes to remain old growth. Logging would alter the existing attributes on all of the acres of old growth treated and potentially affect some old-growth-associated species using those stands, particularly those preferring dense forest stands. Effects to old-growth and associated wildlife species that would be likely under this alternative would be in addition to those that have occurred in Swan Valley over the last several decades on DNRC lands (see *CHAPTER I- PURPOSE AND NEED* for a comprehensive listing of past DNRC projects), intermingled private industrial forest lands, and neighboring USFS lands. Remaining old-growth patches would range from 4 to 973 acres in size; 35 patches greater than 80 acres would remain across the forest (*TABLE III-56 – NUMBER OF OLD-GROWTH PATCHES AND PATCH SIZES*). However, the average patch size of large old-growth stands on the Swan River State Forest would be reduced from 212 acres to 197 acres (8 percent reduction). Thus, because: 1) the total amount of old growth would be reduced on the Swan River State Forest area by 5 percent, 2) the number of large patches would remain essentially the same, 3) the

average large patch size would decrease by 8 percent, 4) 162 acres would be treated using old-growth maintenance or restoration treatments to maintain and perpetuate old- growth attributes, and 5) stands in the mature and old-forest age categories on Swan River State Forest would continue to represent approximately 53 percent of the forested acres (see *VEGETATION ANALYSIS* for further details), -- a low level of adverse cumulative effects to wildlife associated with old growth forests would be expected under Action Alternative B as a result of reduced availability of habitat with high attribute levels and slight increases in old growth fragmentation habitat parameters, such as reduced average size of large patches (*TABLE III-56 – NUMBER OF OLD GROWTH PATCHES AND PATCH SIZES*).

- ***Cumulative Effects to Old Growth Common to Action Alternative C***

  Under Action Alternative C, of the 10,603 total acres of old-growth forest across the Swan River State Forest, 150 acres would be removed (1 percent of the total old-growth amount), resulting in 10,453 acres of old-growth forest remaining (25 percent of the 41,700-acre Swan River State Forest). An additional 402 acres of old growth would be retained, but would be harvested in a manner that would maintain sufficient large old trees and other structural attributes to remain old growth. Logging would alter the existing attributes on all of the acres of old growth treated and potentially affect some old-growth associated species using those stands, particularly those preferring dense forest stands. As with Action Alternative B, effects to old-growth and associated wildlife species that would be likely under this alternative would be in addition to those that have occurred in Swan Valley over the last several decades on DNRC lands (see *CHAPTER I- PURPOSE AND NEED* for a comprehensive listing of past DNRC projects), intermingled private industrial forest lands, and neighboring USFS lands. Remaining old-growth patches under Action Alternative C would also range from 4 to 973 acres in size; and 34 patches greater than 80 acres would remain across the forest (*TABLE III-56 – NUMBER OF OLD-GROWTH PATCHES AND PATCH SIZES*). However, the average patch size of large old-growth stands on Swan River State Forest would be reduced slightly from 212 acres to 210 acres (less than a 1-percent reduction). Thus, because: 1) the total amount of old growth would be reduced on the Swan River State Forest area by 5 percent, 2) the number of large patches would remain essentially the same, 3) the average large patch size would decrease by 8 percent, 4) 162 acres would be treated using old-growth maintenance or restoration treatments to maintain and perpetuate old- growth attributes, and 5) stands in the mature and old-forest age categories on Swan River State Forest would continue to represent approximately 53 percent of the forested acres (see *VEGETATION ANALYSIS* for further details), -- a low level of adverse cumulative effects to wildlife associated with old growth forests would be expected under Action Alternative B as a result of reduced availability of habitat with high attribute levels and slight increases in old growth fragmentation habitat parameters, such as reduced average size of large patches (*TABLE III-56 – NUMBER OF OLD GROWTH PATCHES AND PATCH SIZES*).

HABITAT CONNECTIVITY AND FRAGMENTATION

Issue - The proposed activities could result in alteration of the connectivity, patch size, and amount of forest edge associated with forested habitat, which could reduce habitat quality and inhibit wildlife use and movements.

Introduction

Connectivity of forest cover between adjacent patches is important for promoting movements of species that are hesitant to cross nonforested expanses. Effective corridors tend to be those that are relatively wide, unfragmented, diverse, and associated with riparian areas (*Fischer and Fischenich 2000*). Width of the travel corridor tends to determine the efficacy of the corridor for individual species. In general, a wider corridor would be more effective and provide for more species than a narrower one. Narrow corridors can provide some measure of habitat connectivity, particularly for small mammals and some amphibians. Narrow corridors, however, can also serve as funnels that increase predator efficiency and reduce survival of individual prey species that may inhabit the corridor (*Groom et al. 1999*). To be considered as a functional upland corridor under *ARM 36.11.403(20)(b)*, forest patches at least 300 feet wide with a minimum of 40 percent total stand canopy closure are required. Forest patches meeting these requirements are assumed to provide adequate connectivity for medium-sized carnivores that inhabit the project area, such as fishers (*Jones 1991*) and Canada lynx (*Squires et al. 2010*). Riparian areas and ridges often play an important role in providing connective corridors across a landscape. In Swan Valley, riparian areas provide connectivity between the valley bottom habitats and those found at mid to upper elevations.

Habitat fragmentation refers to the landscape-level process in which a specific habitat is progressively subdivided into smaller and more isolated patches (*McGarigal and Cushman 2002*). Historically, wildfires were a primary disturbance factor that shaped the forests of western Montana (*Fischer and Bradley 1987, Arno et al. 1995, Losensky 1997*). Thus, substantial portions of forested landscapes were fragmented naturally (*Gruell 1983, Hart 1994*), and many species native to Montana that use forested habitats evolved under conditions where substantial amounts of available habitat occurred in relatively small, isolated patches. However, human management of landscapes, especially those in which ownership is mixed, can increase the presence of small forest patches.

Timber harvesting can decrease patch size and change the shape and amount of fragmentation among patches of dense forest. Landscape-level management that can mitigate the effects to wildlife species while still harvesting timber includes principles such as; limiting the creation of small habitat islands where interior forest-associated species may suffer localized extinctions of small subpopulations; treating and retaining fewer larger patches rather than many small ones; and reducing edge (boundary between habitats perceived by an organism to be different from one another) to reduce effects of nest parasitism and elevated levels of predation on some species associated with edge habitat, since large patches tend to have less edge per unit area than small patches.

The ecological effects that are of most concern or risk regarding this project are the potential to create small ineffective patches or an increase in edge habitats that subsequently harm species associated with interior forest. Thus, this discussion will focus on the sizes of patches of moderate to dense forest habitat and the amount of edge between dense forest and much younger forest or nonforest patches.

Analysis Area and Methods

Connective forest was identified on DNRC lands using current *SLI* data to identify the location and quantify potential changes to pole and sawtimber stands with moderate to closed canopies (40 to 100 percent canopy closure) that were also greater than 300 feet wide. Stands meeting these requirements were assumed to provide conditions that would facilitate use and movement of wildlife species in the area. Changes to existing conditions that would occur under each alternative were assessed by removing stands proposed for treatment in such a manner that forest canopy would be likely to decrease below 40 percent after harvesting. Effects to wildlife species were assessed by evaluating amounts of connective forest removed by treatment type, quantifying the change in average patch size, and by summing and comparing the amounts of forest edge associated with forest patches located in the 15,586-acre project area. *GIS* analysis using *ARCGIS 9.3* was used to calculate stand polygon areas and perimeter distances to estimate average patch size and forest edge, respectively. To assess existing conditions and changes in patch characteristics across the 65,682-acre cumulative effects analysis area, *USDA USFS VMap 2009 data*, and *National Agriculture Imagery Program (NAIP)* aerial imagery were used. The same technical methods described above for direct and indirect effects were also used to assess the potential for cumulative effects.

Existing Environment

In the project area, a relatively high level of forest connectivity exists. Currently, 8,665 acres (56 percent) of the project area provides habitat that would facilitate movement for forest-dwelling species (*TABLE III-57 - CONNECTIVITY*). Very few of these acres occur as isolated patches and connectivity throughout the major drainages and across DNRC lands on the Swan River State Forest is relatively intact (*FIGURE III-13 - ALTERNATIVE A - HABITAT CONNECTIVITY MAP*). Average patch size on the project area is 232 acres and the existing level of forest edge associated with existing habitat patches is approximately 216 miles (*TABLE III-58 - PATCH CHARACTERISTICS*). Within the cumulative effects analysis area, approximately 32,227 acres (48.9 percent) provide habitat that would facilitate the movement of forest-associated wildlife species (*TABLE III-57 - CONNECTIVITY*). Average patch size in the 65,682-acre cumulative effects analysis area across all ownerships is approximately 409 acres, and the existing level of forest edge is approximately 621 miles (*TABLE III-59 – CUMULATIVE EFFECTS PATCH CHARACTERISTICS*).

Throughout the project area and cumulative effects analysis area, connectivity has been diminished in places due largely to the scattered ownership patterns where private industrial timberlands are interspersed with DNRC and USFS lands (*FIGURE III-13 – NO-ACTION ALTERNATIVE A - HABITAT CONNECTIVITY MAP*). Forest connectivity is often broken in areas where large harvest units were intensively logged during the last several decades by the various landowners in the valley. Along the major streams in the project area and cumulative effects analysis area, several gaps occur where forest cover is reduced to less than 300 feet. Some of the breaks are associated with natural openings (wet meadows, brush fields, and avalanche chutes); however, most are the result of past logging. In most cases, these openings contain at least some horizontal

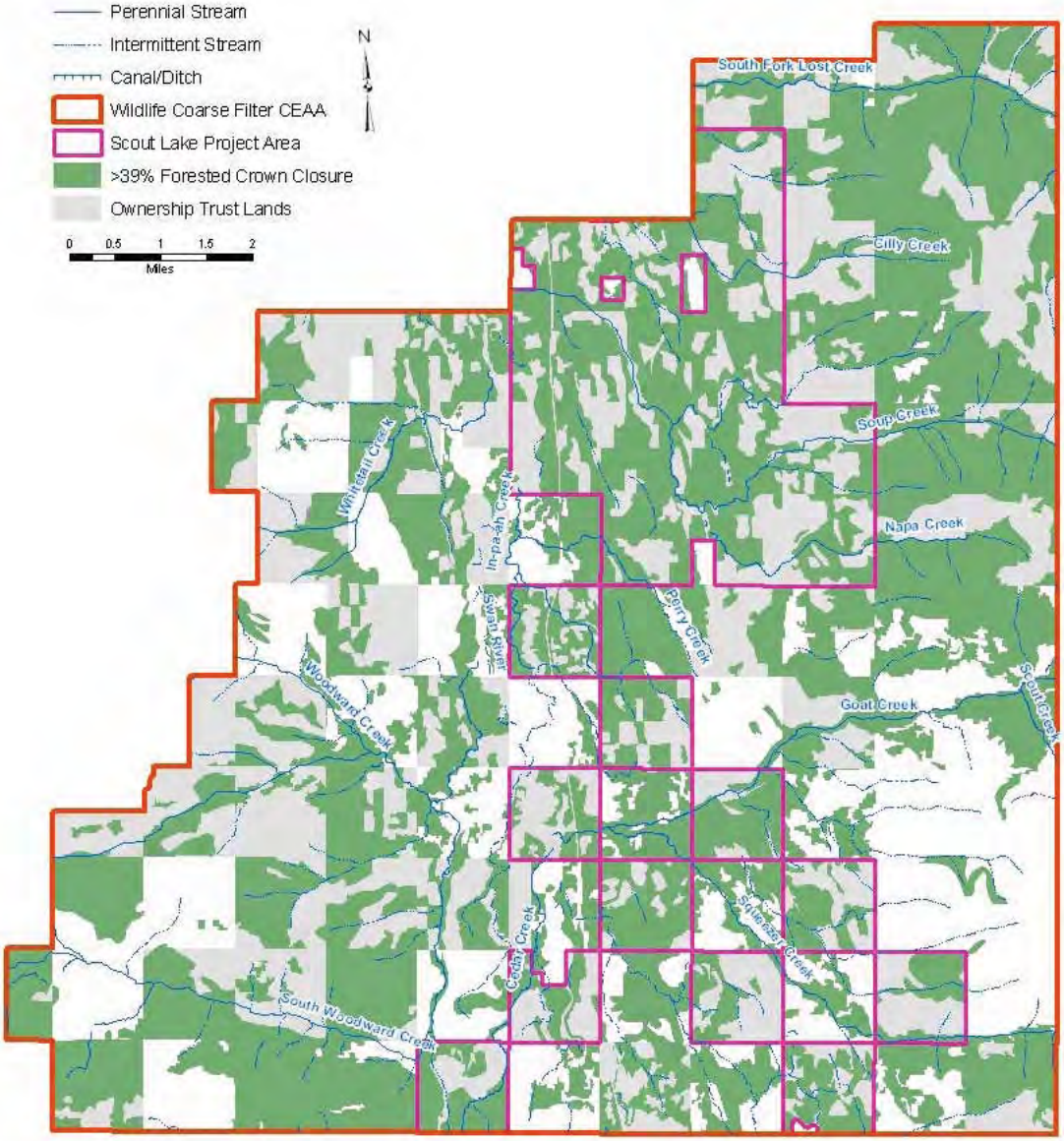
cover from shrubs or regenerating trees, thereby providing some structure usable by some species of wildlife.

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Habitat Connectivity and Fragmentation***

  Under this alternative, no changes from existing conditions regarding forest connectivity or habitat fragmentation would be expected as no harvesting or changes in habitat attributes would occur. Thus, no direct or indirect effects to wildlife associated with reduced habitat quality or alteration of habitat use or their movements would be anticipated.

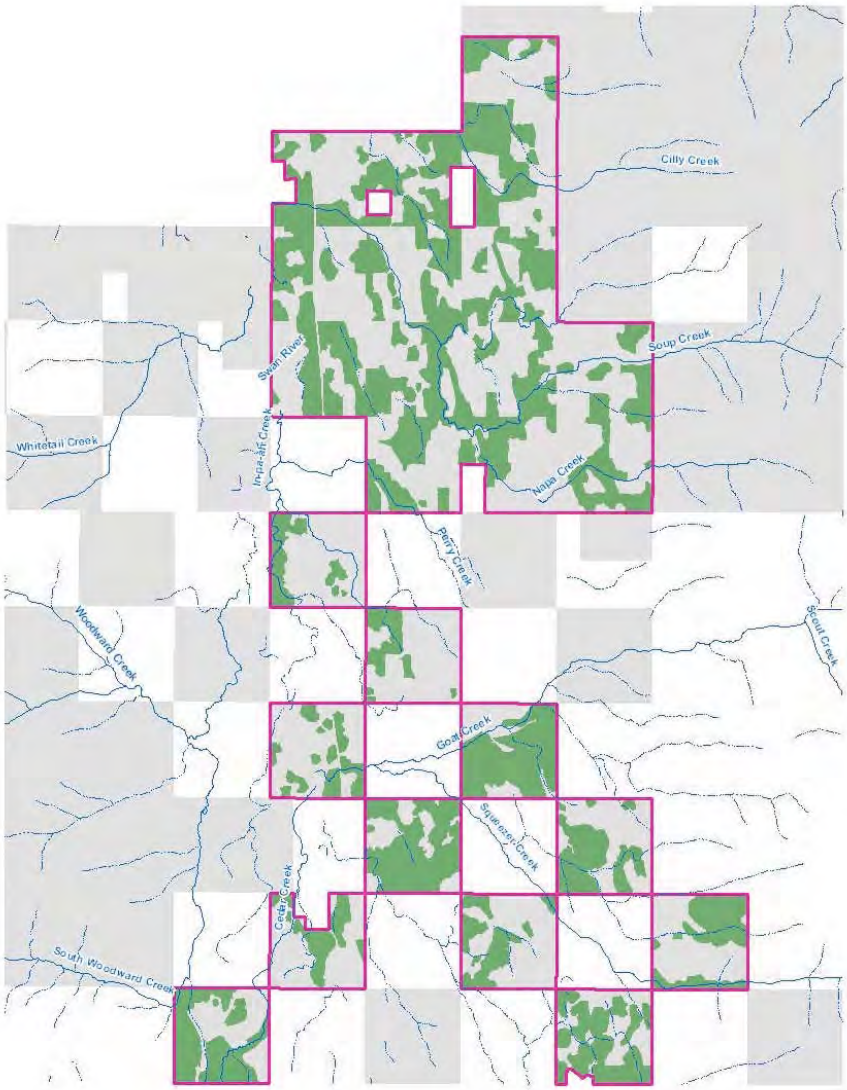
FIGURE III-13 – NO-ACTION ALTERNATIVE A HABITAT CONNECTIVITY MAP *.*
Existing patches of forest cover that would provide habitat connectivity for wildlife species in the project area and cumulative effects analysis area. Noncover areas on DNRC lands are shaded gray.



- ***Direct and Indirect Effects of Action Alternative B to Habitat Connectivity and Fragmentation***

  Under Action Alternative B, habitat connectivity associated with riparian areas would not be appreciably altered as ample levels of cover would be retained along riparian areas and *SMZs* in areas where harvesting would occur. However, tree density would generally be reduced below the threshold defined for this analysis on 1,676 acres of upland mature forest. This alternative would result in a 19.3-percent reduction of connective forest on the project area (*TABLE III-57 - CONNECTIVITY*). Following logging, 6,896 acres (44 percent of the project area) of forest patches meeting the minimum connective patch criteria would be retained (*TABLE III-57 - CONNECTIVITY*). Also, average patch size of moderate to dense forest would be approximately 166 acres, which would represent a 28 percent decrease from the existing average patch size of 232 acres; however, forest edge would be reduced by 17 miles (8 percent) from existing levels (*TABLE III-58 - PATCH CHARACTERISTICS*). Reductions in forest edge can be beneficial for interior species sensitive to highly fragmented habitat conditions in areas where edge is abundant (*Hilty et al. 2006:126*). Following logging, forest patches on the project area would continue to have variable tree density and would continue to provide a mosaic of habitat conditions, and moderate to dense patches of mature forest cover would generally remain abundant and connected (*FIGURE III-14 – ACTION ALTERNATIVE B - HABITAT CONNECTIVITY MAP*). Tree density in harvested patches would be reduced, which would improve habitat quality for species that prefer open forest conditions, but would reduce security and habitat quality for species that benefit from larger expanses of mature forest cover and interior forest conditions. Anticipated changes in the amount of moderate to dense forest and reduced patch sizes would be expected to inhibit movements of interior forest species in some localized areas in the project area. Thus, given that: 1) connectivity would be maintained along the major drainages and riparian areas, 2) the amount of connective forest would be reduced by 1,676 acres, 3) average patch size would be reduced by 28 percent from existing levels, and 4) forest edge would be reduced by 8 percent from the existing amount, a low to moderate degree of adverse effects to interior wildlife species would be anticipated. These anticipated effects would be associated reductions in habitat quality, increased potential for inhibited habitat use, and potential for impeded movements across the project area associated with reduced levels of cover, smaller patch sizes, and patch fragmentation in some localized areas.

FIGURE III-14 – ACTION ALTERNATIVE B HABITAT CONNECTIVITY MAP. *Patches of forest cover (green) that would provide habitat connectivity for wildlife species in the project area following implementation of Action Alternative B. Noncover areas on DNRC lands in the project area are shaded gray.*



- ***Direct and Indirect Effects of Action Alternative C to Habitat Connectivity and Fragmentation***

  Under Action Alternative C, habitat connectivity associated with riparian areas would not be appreciable altered as ample levels of cover would be retained along riparian areas and *SMZs* in areas where harvesting would occur. However, tree density would generally be reduced below the threshold defined for this analysis on 2,216 acres of upland mature forest. This alternative would result in a 25.6-percent reduction of connective forest on the project area (*TABLE III-57 - CONNECTIVITY*). Following logging, 6,352 acres (41 percent of the project area) of forest patches meeting the minimum connective-patch criteria would be retained (*TABLE III-57 - CONNECTIVITY*). Also, average patch size of moderate to dense forest would be

approximately 119 acres, which would represent a 49-percent decrease from the existing average patch size of 232 acres. However, similar to Action Alternative B, forest edge would also be reduced by 17 miles (8 percent) from existing levels (*TABLE III-58 - PATCH CHARACTERISTICS*), which would be beneficial for interior species sensitive to highly fragmented habitat conditions in areas where edge is abundant (*Hilty et al. 2006:126*). Following logging, forest patches on the project area would continue to have variable tree density and would continue to provide a mosaic of habitat conditions, and moderate to dense patches of mature forest cover would generally remain abundant and connected (*FIGURE III-15 – ACTION ALTERNATIVE C -- HABITAT CONNECTIVITY MAP*). Tree density in harvested patches would be reduced, which would improve habitat quality for species that prefer open forest conditions, but would reduce security and habitat quality for species that benefit from larger expanses of mature forest cover and interior forest conditions. Anticipated changes in the amount of moderate to dense forest and reduced patch sizes would be expected to inhibit movements of interior forest species in some localized areas in the project area, and to a greater extent than Action Alternative B (*TABLE III-58 - PATCH CHARACTERISTICS*). Thus, given that: 1) connectivity would be maintained along the major drainages and riparian areas, 2) the amount of connective forest would be reduced by 2,216 acres, 3) average patch size would be reduced by 49 percent from existing levels, and 4) that forest edge would be reduced by 8 percent from the existing amount, moderate adverse effects to interior wildlife species would be anticipated. These anticipated effects would be associated reductions in habitat quality, increased potential for inhibited habitat use, and the potential for impeded movements across the project area associated with reduced levels of cover, smaller patch sizes, and patch fragmentation in some localized areas.

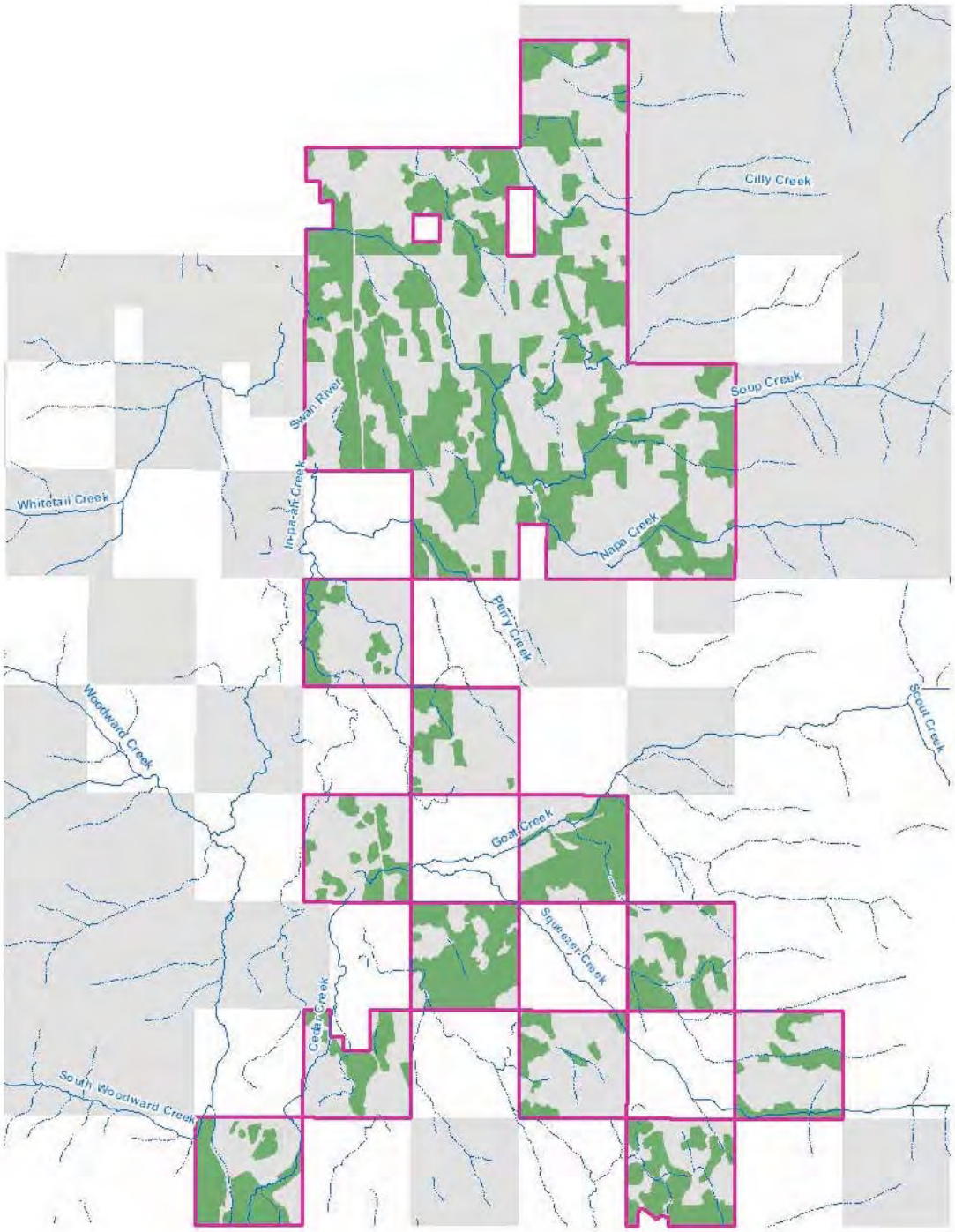
TABLE III-57 - CONNECTIVITY. *Effects to connective forest habitats in the project area and cumulative effects analysis area as a result of each alternative on the DNRC Scout Lake Multiple Timber Sale Project. Connective forest is defined as areas of sawtimber or pole-sized forests with at least 40-percent canopy and at least 300-feet wide that would facilitate movement of forest dwelling wildlife species.*

PARAMETERS	ALTERNATIVE		
	NO ACTION	ACTION	
	A	B	C
Acres of connective forest removed	0	1,676	2,216
Percent reduction in connective forest on the project area	0	19.3	25.6
Acres of connective forest remaining on the project area	8,665	6,896	6,352
Percent of project area remaining as connective forest	56	44	41
Percent reduction in connective forest on the cumulative effects analysis area	0	5.2	6.9
Acres of connective forest remaining on the cumulative effects analysis area	32,227	30,458	29,912
Percent of cumulative effects analysis area remaining as connective forest	48.9	46.2	45.4

TABLE III-58 - PATCH CHARACTERISTICS. *Patch size of dense forest habitat and miles of forest/nonforest edge in the 15,586-acre Scout Lake Multiple Timber Sale Project Area.*

PROJECT AREA	**ALTERNATIVE**		
	NO ACTION	**ACTION**	
	A	**B**	**C**
Average patch size (acres)	232	166	119
Percent decrease in average patch size	0	28	49
Miles of edge	216	199	199
Percent change in edge habitat	0	8	8

FIGURE III-15 - ALTERNATIVE C - HABITAT CONNECTIVITY MAP. *Patches of forest cover (green) that would provide habitat connectivity for wildlife species in the project area following implementation of Action Alternative C. Noncover areas on DNRC lands in the project area are shaded gray.*



- ***Cumulative Effects of No-Action Alternative A to Habitat Connectivity and Fragmentation***

  Under No-Action Alternative A, no changes from existing conditions regarding forest connectivity or habitat fragmentation would be expected as no harvesting or changes in habitat attributes would occur. Thus, no cumulative effects to wildlife associated with reduced habitat quality or alteration of habitat use or their movements would be anticipated.

- ***Cumulative Effects to Habitat Connectivity and Fragmentation Common to Both Action Alternatives B and C***

  Forest management activities that have occurred over the last several decades in the 65,682-acre Swan River State Forest cumulative effects analysis area have contributed to a cumulative increasing trend in the presence of small, forest patches observable today (*FIGURE III-13 – NO-ACTION ALTERNATIVE A*). Anticipated reductions in dense cover and patch size associated with this action alternative would be additive to past DNRC actions that have occurred in the cumulative effects analysis area (see *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* in *CHAPTER I – PURPOSE AND NEED*), including those recently managed as corporate timberlands. USFS has no plans in the foreseeable future to manage timber in the cumulative effects analysis area; thus, no expected change would occur in forest patch characteristics associated with vegetation management on FNF-managed lands (*J. Dunham, USFS, pers. comm. 9/14/2011*). Within the 65,682-acre cumulative effects analysis area, some future logging could occur on lands currently owned by The Nature Conservancy in conjunction with their 10-year *Fiber Supply Agreement* with Plum Creek, which could promote the regeneration of shade-intolerant tree species. However, currently, no activity is planned in the near term (*M. Mantas, TNC, pers. comm. 8/24/11*).

- ***Cumulative Effects of Action Alternative B to Habitat Connectivity and Fragmentation***

  Under Action Alternative B, habitat connectivity associated with riparian areas would not be appreciable altered as ample levels of cover would be retained along riparian areas and *SMZs* in areas where harvesting would occur. However, tree density would generally be reduced below the threshold defined for this analysis on 1,676 acres of upland mature forest. Implementation of this alternative would result in a 5.2-percent reduction of connective forest on the 65,682-acre cumulative effects analysis area (*TABLE III-57 - CONNECTIVITY*). Following logging, 30,458 acres (46.2 percent of the cumulative effects analysis area) of forest patches meeting the minimum connective-patch criteria would be retained (*TABLE III-57 - CONNECTIVITY*). Also, average patch size of moderate to dense forest would be approximately 354 acres across all ownerships, which would represent a 13-percent decrease from the existing average patch size of 409 acres; however, forest edge would be reduced by 9 miles (1.4 percent) from existing levels (*TABLE III-59 - CUMULATIVE-EFFECT PATCH CHARACTERISTICS*). Reductions in forest edge can be beneficial for interior species sensitive to highly fragmented habitat conditions in areas where edge is abundant (*Hilty et al. 2006:126*). Following logging, forest patches in the cumulative effects analysis area would continue to have variable tree density and provide a mosaic of habitat conditions, and moderate to

dense patches of mature forest cover would generally remain abundant and connected. Tree density in harvested patches would be reduced, which would improve habitat quality for species that prefer open forest conditions, but would reduce security and habitat quality for species that benefit from larger expanses of mature forest cover and interior forest conditions. Anticipated changes in the amount of moderate to dense forest and reduced patch sizes would be expected to minimally inhibit movements of interior forest species in some localized areas in the cumulative effects analysis area. Thus, given that: 1) connectivity would be maintained along the major drainages and riparian areas, 2) the amount of connective forest would be reduced by 1,676 acres, 3) average patch size would be reduced by 13.6 percent in the cumulative effects analysis area from existing levels, and 4) forest edge would be reduced by 1.4 percent from the existing amount, a low degree of adverse effects to interior wildlife species would be anticipated. These anticipated effects would be associated reductions in habitat quality, increased potential for inhibited habitat use, and potential for impeded movements across the cumulative effects analysis area associated with reduced levels of cover, smaller patch sizes, and patch fragmentation in some localized areas.

- ***Cumulative Effects of Action Alternative C to Habitat Connectivity and Fragmentation***

  Under Action Alternative C, habitat connectivity associated with riparian areas would not be appreciable altered as ample levels of cover would be retained along riparian areas and *SMZs* in areas where harvesting would occur. However, tree density would generally be reduced below the threshold defined for this analysis on 2,216 acres of upland mature forest. Implementation of this alternative would result in a 6.9-percent reduction of connective forest on the 65,682-acre cumulative effects analysis area (*TABLE III-57 - CONNECTIVITY*). Following logging, 29,912 acres (45.4 percent of the cumulative effects analysis area) of forest patches meeting the minimum connective-patch criteria would be retained (*TABLE III-57 - CONNECTIVITY*). Also, average patch size of moderate to dense forest would be approximately 310 acres across all ownerships, which would represent a 24.3-percent decrease from the existing average patch size of 409 acres; however, forest edge would be reduced by 5 miles (0.8 percent) from existing levels (*TABLE III-59 - CUMULATIVE EFFECTS PATCH CHARACTERISTICS*). Following logging, forest patches in the cumulative effects analysis area would continue to have variable tree density and provide a mosaic of habitat conditions, and moderate to dense patches of mature forest cover would generally remain abundant and connected. Tree density in harvested patches would be reduced, which would improve habitat quality for species that prefer open forest conditions, but would reduce security and habitat quality for species that benefit from larger expanses of mature forest cover and interior forest conditions. Anticipated changes in the amount of moderate to dense forest and reduced patch sizes would be expected to minimally inhibit movements of interior forest species in some localized areas in the cumulative effects analysis area. Thus, given that: 1) connectivity would be maintained along the major drainages and riparian areas, 2) the amount of connective forest would be reduced by 2,216 acres, 3) average patch size would be reduced by 24.3 percent in the

cumulative effects analysis area from existing levels, and 4) forest edge would be reduced by 0.8 percent from the existing amount, a low degree of adverse cumulative effects to interior wildlife species would be anticipated. These anticipated effects would be associated reductions in habitat quality, increased potential for inhibited habitat use, and potential for impeded movements across the cumulative effects analysis area associated with reduced levels of cover, smaller patch sizes, and patch fragmentation in some localized areas.

TABLE III-59 - CUMULATIVE EFFECTS PATCH CHARACTERISTICS. *Patch size of dense forest habitat and miles of forest/nonforest edge on the 65,682-acre Swan River State Forest Cumulative effects Analysis Area.*

	ALTERNATIVE								
	A – NO ACTION			**B**			**C**		
	DNRC	NON-DNRC	ALL OWNERSHIP	DNRC	NON-DNRC	ALL OWNERSHIP	DNRC	NON-DNRC	ALL OWNERSHIP
Average patch size (acres)	264.0	105.4	409.3	241.9	105.4	353.5	208.5	105.4	309.7
Percent decrease in average patch size	0%	0%	0%	8.4%	0%	13.6%	21.0%	0%	24.3%
Miles of edge	453.6	248.8	621.3	433.1	248.8	612.4	433.5	248.8	616.3
Percent change in edge habitat	0%	0%	0%	4.5%	0%	1.4%	4.4%	0%	0.8%

LINKAGE

Issue - The proposed activities could increase open road densities, increase human developments, and reduce forested cover, which could adversely affect linkage habitat for wildlife.

Introduction

Linkage zones are defined as "the area between larger blocks of habitat where animals can live at certain seasons and where they can find the security they need to successfully move between these larger habitat blocks" (*Servheen et al. 2003*). Linkage zones differ from corridors in that the area is not just used for travel. Areas appropriate for linkage zones can occur at different spatial scales, particularly when considering the species of concern. For example, a linkage zone for a stream-breeding salamander may be the upland habitat between 2 first-order streams, whereas the linkage zone for a grizzly bear may be the large valley bottom between 2 mountain ranges. Increased linkage potential is found in areas with lower road densities, low densities of human-developed sites, higher vegetative hiding cover, and abundant riparian areas (*Servheen et al. 2003*). In this analysis, linkage is discussed in terms of factors that would allow linkage for a variety of small, medium, and large wide-ranging terrestrial wildlife species, including grizzly bears.

Analysis Area and Methods

Three measurement criteria were used to assess existing and predicted future-linkage potential under each alternative: 1) open-road densities (calculated using moving-windows methods *Ake 1994*), 2) a qualitative assessment of human development, and 3) vegetative hiding cover (as defined in the DNRC *SVGBCA* cover model [*DNRC 2006*]; see *GRIZZLY BEAR*, for further analysis). Because the abundance of riparian areas would not change with any of the alternatives, and because all alternatives include measures to provide protection for riparian areas, they were not included as a measurement criterion in this analysis. Direct and indirect effects were considered in the project area. Because large terrestrial species were used as focal species for determining the effects of the proposed project to linkage, the 65,682-acre Swan River State Forest cumulative effects analysis area and the grizzly bear management unit subunits were used to analyze cumulative effects of the proposed alternatives. The cumulative effects analysis area provides linkage between the Mission Mountains to the west and the Swan Valley bottom to the east.

Existing Environment

The majority of the project area lies within the northerly-most grizzly bear linkage zone defined in the *SVGBCA*. Thus, special protective measures to limit disturbance in spring are in place for that area. In general, lands in the project area currently contribute to high-quality linkage habitat, as open-road amounts in the project area are relatively low (2.4 linear miles), and one primary area of human development exists (the Swan River State Forest headquarters and associated buildings), which presents few hindrances to linkage. The project area also contains 8,801 acres of hiding cover (56 percent of the project area), and riparian areas are abundant and heavily vegetated.

In the cumulative effects analysis area, linkage values are also high, though some existing features reduce linkage potential. Highway 83, a narrow two-lane road with a 70 mph speed limit bisects both the project area and cumulative effects analysis area; this highway affects linkage potential as some species may be hesitant to cross a busy roadway and forest openings. Vehicle-related wildlife mortalities associated with Highway 83 in Swan Valley are common (particularly white-tailed deer). The percentages of the 5 grizzly bear subunits that make up the cumulative effects analysis area that exceed an open-road density of more than 1 mile per square mile across all ownerships are: Goat Creek, 23 percent; Lion Creek, 19 percent; Piper Creek, 19 percent; Porcupine-Woodward, 28 percent; and South Fork Lost Soup, 25 percent (*SVGBCA Monitoring Team 2011*). Although open roads can degrade linkage value, the open-road densities in the cumulative effects analysis area are relatively low. Human development is relatively low in the cumulative effects analysis area, and most scattered homes and other buildings are located within 0.5 miles of Highway 83. Riparian areas are also abundant in the cumulative effects analysis area and are protected in accordance with the *SVGBCA* and other state and federal regulations. Vegetative hiding cover is also regulated by the *SVGBCA* and must remain at 40 percent or more in each grizzly bear subunit on cooperators' lands. Cover amounts have been influenced by logging over the last several decades on state, The Nature Conservancy/Plum Creek, and USFS lands. However, in the aforementioned grizzly bear subunits, existing cover percentages range

from 40 to 98 percent, with an overall average of 67.4 percent across the 5 subunits described above that contain DNRC lands. Thus, both the project area and the cumulative effects analysis area currently provide desirable linkage attributes for a variety of small, medium, and large wide-ranging wildlife species.

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Linkage***

  Under this alternative, no forest management activities would occur on DNRC lands and road densities would not change. No changes in human development would occur in the project area, and forest vegetation would not be affected. Thus, no effects to important linkage attributes, or wildlife linkage habitat would be expected.

- ***Direct and Indirect Effects of Action Alternatives B and C to Linkage***

  Under either action alternative, open-road densities would not increase in the project area. However, 4.9 or 8.2 miles of permanent restricted roads would be built in the project area with Action Alternative B or C, respectively. Under Action Alternative B, 2.5 miles of additional temporary road would be constructed and used, and under Action Alternative C, 3.5 miles of temporary road would be included. Use of restricted roads would be expected to increase with both the administrative and commercial uses associated with both proposed action alternatives. Under Action Alternative B, 55.4 total miles of restricted roads would be accessed and used, whereas under Action Alternative C, use of 92.7 total miles of restricted roads would be required. Most of this use and associated activity would occur within the 3-year operating window for the Goat Creek grizzly bear subunit or in the winter months. No additional human development would occur under either action alternative; thus, no additional effects to linkage associated with development would be anticipated. Harvesting under these alternatives would have minimal effects to cover associated with riparian areas as protective measures would be implemented that would retain 120-foot no-cut zones along Class 1 streams and 50-foot no-cut zones along Class 2 streams (see *FISHER* in this *WILDLIFE ANALYSIS* for further details). Cover would be reduced on 1,538 acres (Action Alternative B) or 2,088 acres (Action Alternative C), depending on which alternative is selected (see *GRIZZLY BEAR* in this *WILDLIFE ANALYSIS* for further details), which could deter movement or habitat use for species that prefer dense cover. However, 46 percent of the project area under Action Alternative B or 43 percent under Action Alternative C would still retain hiding cover following harvesting. Thus, because: 1) open-road densities would not increase, but road usage would temporarily increase for 3 to 4 years, 2) no additional human dwellings would be developed under this proposal, and 3) hiding cover would decrease by 9.9 (Action Alternative B) to 13.2 percent (Action Alternative C), moderate short-term and minor long-term negative effects to linkage habitat would be expected under either of the action alternatives considered.

- ***Cumulative Effects of No-Action Alternative A to Linkage***

  Under this alternative, no forest management activities would occur on DNRC lands, and no further changes would occur in road densities, human developments, or forest cover in the cumulative effects analysis area. Forest vegetation in riparian

areas would also not be affected. Thus, no cumulative effects to wildlife linkage habitat would be expected.

- ***Cumulative Effects to Linkage Common to Action Alternatives B and C***

  Under either action alternative, open-road densities would not increase in the cumulative effects analysis area. However, 4.9 or 8.2 miles of permanent restricted roads would be constructed with Action Alternative B or C, respectively. Under Action Alternative B, 2.5 miles of additional temporary road would be constructed and used, and under Action Alternative C, 3.5 miles of temporary road would be included. Use of restricted roads would be expected to increase with both administrative and commercial uses associated with both of the proposed action alternatives. Under Action Alternative B, 55.4 total miles of restricted roads would be accessed and used in the cumulative effects analysis area, whereas under Action Alternative C, use of 92.7 total miles of restricted roads would be required. Most of this use and associated activity would occur in the 3-year operating window for the Goat Creek Grizzly Bear Subunit or during winter months. No additional human development would occur under either action alternative; thus, no additional cumulative effects to linkage associated with development would be anticipated. Harvesting under these alternatives would have minimal effects to cover associated with riparian areas as protective measures would be implemented that would retain 120-foot no-cut zones along Class 1 streams and 50-foot no-cut zones along Class 2 streams (see *FISHER* in this *WILDLIFE ANALYSIS* for further details). Cover would be reduced on 1,538 acres (Action Alternative B) or 2,088 acres (Action Alternative C), depending on which alternative is selected (see *GRIZZLY BEAR* in this *WILDLIFE ANALYSIS* for further details), which could deter movement or habitat use for species that prefer dense cover. However, 46.7 percent of the cumulative effects analysis area under Action Alternative B or 45.9 percent under Action Alternative C would still retain hiding cover following harvesting. Thus, because: 1) open-road densities would not increase, but road usage would temporarily increase for 3 to 4 years, 2) no additional human dwellings would be developed under this proposal, and 3) hiding cover would decrease by 2.3 percent (Action Alternative B) to 3.2 percent (Action Alternative C), low short-term and minor long-term negative cumulative effects to linkage habitat would be expected under either of the action alternatives considered.

SNAGS AND COARSE WOODY DEBRIS

Issue - The proposed activities could reduce the abundance and alter the distribution of snags and coarse woody debris, which could adversely affect species closely associated with these habitat attributes.

Introduction

Snags and defective trees (partially dead, spike top, broken top etc.) are used by a wide variety of wildlife species for nesting, denning, roosting, feeding, and cover. The quantity, quality, and distribution of snags affect the presence and population size of many of these species. Snags provide foraging sites for insectivorous species and sites for nesting and roosting birds and animals. Primary excavators of nest cavities (i.e.

woodpeckers) create holes and nest sites for secondary cavity users, which include many other birds and mammals. Snags and defective trees can also provide nesting sites for cavity-using species where cavities are formed by broken tops and fallen limbs. Without trees and snags that provide for cavities or substrate for cavity excavation, primary and secondary cavity species would not be able to survive and/or reproduce. Primary risk factors for snags and large defective trees include loss to legal and illegal firewood cutting, prescribed burning, removal for wood fiber, purposeful felling for human safety during timber harvesting operations, and incidental loss during logging due to equipment operation and yarding activities. Given various tree mortality agents, it can take at least 40 years to grow a small tree capable of becoming a small snag, whereas it often takes 100 to several hundred years to grow large trees capable of becoming large snags.

Coarse woody debris provides structural diversity and promotes biological diversity by providing habitat for many wildlife species. Many small mammals require coarse woody debris to survive. In turn, these species distribute fungi that are beneficial for seedling establishment and tree growth (*Graham et al. 1994*). Additionally, coarse woody debris can provide feeding substrates for species such as pileated woodpeckers and black bears, as logs will often host high densities of insects (*Aney and McClelland 1985*). Forest carnivores such as pine marten and Canada lynx rely on coarse woody debris to provide resting and denning habitat (*Patton and Escano 1990, Squires et al. 2008*). Loss or removal of coarse woody debris through logging and other forest management activities could reduce habitat quality and availability for species that rely on this important habitat attribute.

Analysis Area and Methods

For this analysis, DNRC *SLI* data and DNRC road inventory information was used to quantify the forested stand acreage existing greater than 200 feet from open roads that had not been harvested during the last 100 years. These areas were used as a surrogate indicator of habitat likely to possess the greatest densities of naturally occurring snags and coarse woody debris in the local area. Information regarding the size, species, and density of snags was also gathered by both qualitative assessments during site visits and quantitative assessments using data collected from 88 fixed one-sixth-acre plots randomly distributed across the project area. Covertypes were sampled differentially with the percentage of plots falling in covertypes as follows: 76 percent in mixed conifer; 9 percent in western larch/Douglas-fir; 7 percent in lodgepole pine; 6 percent in western white pine; and 2 percent in ponderosa pine and Douglas-fir types. Snags were grouped into 3 size classes: 1) 8 to 15 inches dbh, 2) 15 to 21 inches dbh, and 3) more than 21 inches dbh. These 3 size classes of snags are emphasized in this analysis because they represent mature trees that require the longest time to produce and offer habitat substrate for a large breadth of wildlife species. Findings of *Harris (1999)* were used as an approximation of historical snag abundance for the purpose of numerical comparison. Direct and indirect effects of all alternatives on snag abundance were assessed in the project area by qualitatively considering potential changes in snag

densities and their relative distribution given common potential attrition factors for snags.

Coarse woody debris was assessed qualitatively on site visits to the stands considered in this project and in neighboring stands via visual assessments in the field. During site visits, quantitative information was obtained by sampling 88, 100-foot transects to estimate relative amounts of existing coarse woody debris. Direct and indirect effects of all alternatives to coarse woody debris amounts and distribution were assessed qualitatively in the project area by considering the most likely attrition factors that would be present under the proposed alternatives. Results obtained from DNRC woody debris monitoring projects conducted during the last 10 years were also considered in this assessment (*DNRC 2005, DNRC 2010*).

Quantified acres of unlogged lands were used to assess cumulative effects considering all DNRC lands on the Swan River State Forest only because of limitations on data availability for other ownerships. Quantitative and qualitative assessments of cumulative effects were also considered at the broader scale of the 65,682-acre cumulative effects analysis area incorporating *USDA USFS VMap 2009* data and *NAIP* aerial imagery. The 65,682-acre scale was selected for analysis because this area encompasses lands owned and managed by other neighboring land-management entities, and the area is large enough to support a broad diversity of species in a local, definable area. For this analysis, forested stands greater than 200 feet from open roads that had not been harvested during the last 100 years were also used as a surrogate indicator of areas likely to possess the greatest densities of naturally occurring snags and coarse woody debris in the local area. Acreages of such areas likely to provide quality snag habitat that would remain unaffected following implementation of each alternative were calculated and are presented below in the cumulative effects subsection. Results from plot data collected for this project supported this approach for analyzing cumulative effects.

Existing Environment

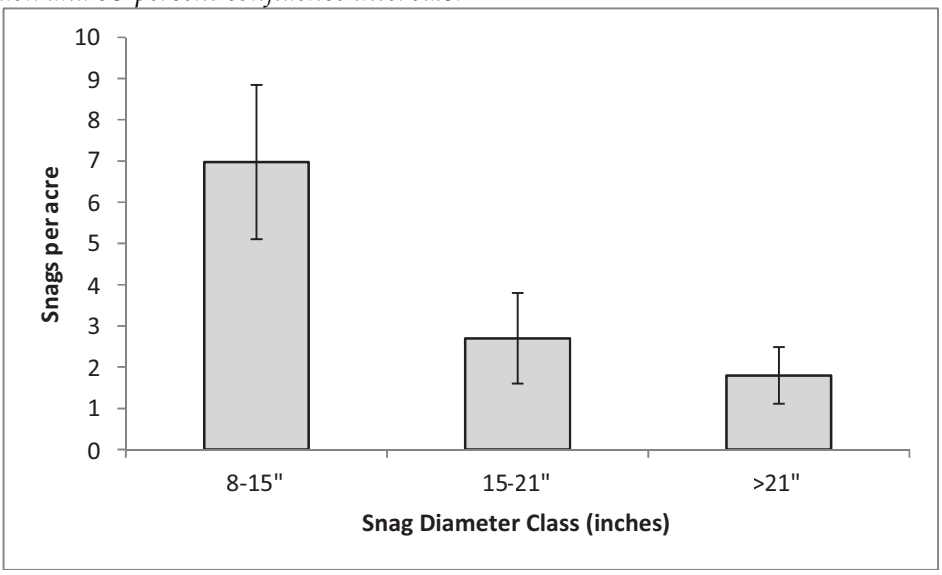
Approximate average densities for the 3 snag classes sampled on the project area ranged from 7 small, 3 medium, to 2 large snags per acre, with an overall average total of about 12 snags per acre (*FIGURE III-16 - SNAG ABUNDANCE BY SIZE*). For an approximate historical reference, *Harris (1999)* found similar snag densities on uncut plots for 3 similar size classes within the warm/moist/mixed fire regimes, and the cool/stand-replacing fire regimes (*Harris 1999:10*).

Older stands in the project area may have higher snag densities than were historically present. Younger stands are most likely below the historical snag densities, as younger stands historically would have had snags created by fire or insects/diseases that would remain after the disturbance. Snag densities in stands that have been harvested in the last century are lower than in unharvested stands (based on visual estimates and *SLI* data), as the practice of leaving snags and snag recruits (particularly large ones) was not a common practice throughout much of the last century. Snag densities are also reduced near open roads where snags are often cut for firewood. Thus, approximately 8,797

acres (56 percent) of the project area have received timber harvest treatments during the last 100 years and likely have snag densities lower than historically occurring levels or close to open roads. Conversely, approximately 6,789 acres of forest not logged during the last 100 years likely possess snag densities similar to those expected historically (*TABLE III-60 - SNAGS AND COARSE WOODY DEBRIS*).

The practice of leaving coarse woody debris was highly variable in the past and was often avoided on DNRC lands until the last 15 years, as a clean forest floor was thought to be healthy and more aesthetically desirable. The practice of leaving coarse woody debris after logging has become more common, and coarse woody debris has been identified as being important for maintaining nutrients on logged sites, healthy soil structure, and important habitat attributes for wildlife (*Graham et al. 1994*). Monitoring on DNRC lands conducted during the last 10 years has indicated that higher densities of coarse woody debris typically exist after logging than prior to logging. However, the quantity of large pieces (greater than 15 inches diameter) that are good for wildlife habitat are scarce (*DNRC 2010*). Thus, throughout the project area and the subunit, the amount of coarse woody debris in areas that have been harvested in the last century or are near roads could have varying densities of coarse woody debris, but are unlikely to have an abundance of larger logs. Results for coarse woody debris data collected along 88 transects (100 feet long) on the project area indicated that existing amounts range from 0 to 77 tons per acre and average about 16 tons per acre overall. Results from the majority of transects ranged from about 2 tons per acre to 28 tons per acre. About 72 percent of the downed logs sampled were decayed and about 28 percent were recently fallen, solid logs indicating that much of the material had been lying on the ground for a number of years. Variability in the number of logs found on each plot indicated that the distribution of downed material was widespread in stands, but was generally somewhat clumped, which is common in coniferous forest types in western Montana. As with snags, approximately 6,789 acres of the forest not logged during the last 100 years likely possess densities of downed logs and fallen material similar to those expected historically (*TABLE III-60 -SNAGS AND COARSE WOODY DEBRIS*).

FIGURE III-16 – SNAG ABUNDANCE BY SIZE. *Average snag densities by diameter class from 88 sampling plots distributed in the cumulative effects analysis area. Bars represent mean dbh and 95-percent confidence intervals.*



Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Snags and Coarse Woody Debris***

  Under this alternative, no short-term changes would occur in the abundance or distribution of snags or coarse woody debris associated with forest-management activities. Thus, no short-term effects would be anticipated. Over time, snags and downed logs would likely increase and be well distributed across the project area as a result of aging forest conditions and the natural attrition of live trees. Such expected increases would improve the availability of these habitat attributes over time for associated wildlife species that depend on them in the project area.

TABLE III-60 - SNAGS AND COARSE WOODY DEBRIS. *Acres of DNRC lands in the Scout Lake Multiple Timber Sale Project Area and across all DNRC lands in the cumulative effects analysis area that are likely to possess high densities of snags and coarse woody debris. Criteria for selection included lands not harvested during the last century and that occurred more than 200 feet from open roads.*

HABITAT PARAMETER	ALTERNATIVE		
	NO-ACTION	ACTION	
	A	B	C
Acres with abundant snags and coarse woody debris in project area (percent of project area)	6,789 (43.6)	5,337 (34.2)	4,949 (31.7)
Acres with abundant snags and coarse woody debris in the cumulative effects analysis area includes only DNRC lands on the Swan River State Forest (percent of cumulative effects analysis area)	17,579 (42.2)	16,127 (38.7)	15,739 (37.7)

- ***Direct and Indirect Effects of Action Alternatives B and C to Snags and Coarse Woody Debris***

  In all units proposed under the action alternatives, snag densities would be decreased across 2,010 acres (Action Alternative B) to 2,636 acres (Action Alternative C) from the current average of 12 snags per acre to a minimum average of 2 large snags per acre. While a greater overall number of acres would be harvested under Action Alternative C, approximately 1,439 acres (55 percent of the proposed harvest) would be treated using partial harvest treatments that would be expected to retain more trees and snags than Action Alternative B. Under Action Alternative B, approximately 696 acres would be partially harvested (35 percent of the proposed harvest). Under both alternatives, the greatest expected attrition factor would likely be the removal of snags due to human-safety factors while accessing and harvesting green trees. Also, some very recently insect-killed trees such as lodgepole pine may be taken for their commercial value, which could influence existing snag densities in mature forest stands proposed for harvesting. The effects to wildlife species that utilize snag resources would primarily be related to a decrease in the amount and distribution of smaller-sized snags across the harvest units, equating to reduced availability of structures used for feeding and nesting. A minimum of 2 large (21 inches or larger) snags and 2 snag recruits (21 inches or larger live trees) per acre would be retained in all harvest units *(ARM 36.11.411*), with preference given to the shade-intolerant species, such as western larch and ponderosa pine, as these typically provide habitat for longer periods of time than do the faster-decaying shade-tolerant species. If adequate densities of snags are lacking preharvest, snags of the largest available size would be retained. Lower resulting densities of retained large snags and live trees would be expected, but those remaining would continue to provide substrates for feeding and nesting in the near term, and they would contribute to structural diversity over time as treated stands continue to mature and undergo changes brought about by ongoing forest succession. Following logging, 5,337 acres (Action Alternative B) and 4,949 acres (Action Alternative C) of mature stands likely to possess high densities of snags and coarse woody debris would remain in the project area (*TABLE III-60 - SNAGS AND COARSE WOODY DEBRIS*) at densities likely to approximate those obtained in estimates from preharvest sample plots (*FIGURE III-16 - SNAG ABUNDANCE BY SIZE*). These identified acres would be expected to continue to provide ample quality habitat for a variety of wildlife species in the project area. The density of snags (primarily smaller ones) could be reduced by as much as 83 percent on some sites proposed for treatment (10 snags of the overall average of 12 could potentially be removed). However, the distribution of large snags would not change appreciably because retention requirements would be applied in all proposed harvest units. The distribution of small snags would be weighted to those areas that have experienced little recent or historical logging activity. No additional open roads would be constructed under either action alternative, thus, any potential associated snag loss due to illegal firewood cutting would not be expected.

In all harvest units proposed under the action alternatives, coarse woody debris material could be affected. Changes in amounts and distribution would likely occur across 2,010 acres (Action Alternative B) or 2,636 acres (Action Alternative C) from existing levels. However, the amounts following logging could likely be slightly greater than existing levels, and contract requirements to retain 10 to 25 tons of woody material per acre would be in place under either action alternative to ensure material is retained. Much of the material would likely consist of pieces of existing logs, cull boles, limbs, and tops with relatively few intact large trees retained. Retained material would also be required to be relatively well distributed across harvest units and could simply not be retained in large piles. An additional mitigation measure applicable to both alternatives would emphasize retention of larger logs greater than 15 inches diameter in harvest units following logging. Coarse woody debris retained in stands following harvesting would provide quality habitat attributes for a number of species. However, habitat quality on affected harvest units in the project area could be degraded for those species that require an abundance of larger logs (*DNRC 2010*). The remaining acres of unharvested forests not near open roads would continue to provide habitat for species that utilize large pieces of coarse woody debris. Although the different alternatives would affect different acreages throughout the project area, 34.2 percent (Action Alternative B) to 31.7 percent (Action Alternative C) of the project area would be expected to retain relatively high densities of high-quality woody debris created naturally, including logs, whole trees, and large limbs (*TABLE III-60 - SNAGS AND COARSE WOODY DEBRIS*). Therefore, some habitat may be removed or the quality reduced for species that rely on coarse woody debris, but the overall effects would cause low risk to wildlife species in the project area as 10 to 25 tons per acre of coarse woody debris would be left on harvest units, and an appreciable number of acres with high densities of coarse woody debris would not be harvested (*TABLE III-60 - SNAGS AND COARSE WOODY DEBRIS*).

- Thus, considering that: 1) snag densities would be decreased across 2,010 acres (Action Alternative B) or 2,636 acres (Action Alternative C) from existing levels; 2) a diversity and greater abundance of snags and downed logs would remain on 5,337 acres (Action Alternative B) to 4,949 acres (Action Alternative C) of unharvested sites; 3) high quality snags and recruitment trees (4 or more per acre) would be retained in all proposed harvest units; 4) relatively high densities of high-quality woody debris created naturally would be retained across 34.2 percent (Action Alternative B) to 31.7 percent (Action Alternative C) of the project area; 5) no new open roads would be constructed that could otherwise increase the potential for illegal firewood removal; and 6) coarse woody material would likely be retained in similar to greater amounts within proposed harvest units under both action alternatives, and logs greater than 15 inches diameter would be emphasized for retention; overall effects to wildlife species closely associated with snags and downed woody material would be relatively low in the project area. Species most likely to be adversely affected would be those species that use, and sometimes prefer, smaller snags for feeding and nesting (eg. smaller primary and secondary

cavity-nesting bird species), as greater amounts of smaller snags would likely be lost or removed across proposed harvest units.

- ***Cumulative Effects of No-Action Alternative A to Snags and Coarse Woody Debris***

  Under this alternative, no short-term cumulative changes in the abundance or distribution of snags or coarse woody debris would be associated with forest-management activities. Thus, no short-term cumulative effects would be anticipated. Over time, snags and downed logs would likely increase and be well distributed across the project area as a result of aging forest conditions and the natural attrition of live trees. Such expected increases would improve the availability of these habitat attributes over time for associated wildlife species that depend on them within the cumulative effects analysis area.

- ***Cumulative Effects to Snags and Coarse Woody Debris Common to Action Alternatives B and C***

  In all units proposed under the action alternatives, snag densities would be decreased across 2,010 acres (Action Alternative B) to 2,636 acres (Action Alternative C) from the current average of 12 snags per acre to a minimum average of 2 large snags per acre in the project area, which would result in a cumulative reduction of snags and high-quality habitat within the 65,682-acre cumulative effects analysis area. While a greater overall number of acres would be harvested under Action Alternative C, approximately 1,439 acres (55 percent of the proposed harvest) would be treated using partial harvest treatments that would be expected to retain more trees and snags than Action Alternative B. Under Action Alternative B, approximately 696 acres would be partially harvested (35 percent of the proposed harvest). Such reductions would be in addition to effects related to similar projects on DNRC lands and neighboring ownerships over the last several decades.

  No USFS projects are planned or are in progress that would alter snags or coarse woody debris on neighboring lands in the cumulative effects analysis area (*J. Dunham, USFS, pers. comm. 9/14/2011*). However, some future logging could occur on neighboring lands currently owned by The Nature Conservancy in conjunction with their 10-year *Fiber Supply Agreement* with Plum Creek. Currently no known activities are planned in the near term (*M. Mantas, TNC, pers. comm. 8/24/11*). Future harvesting on The Nature Conservancy lands in the cumulative effects analysis area could further reduce snags and coarse woody debris, though the effects would likely be fairly minimal as most of these lands have been harvested in the last several decades and already have low snag densities. Also, firewood gathering would be expected to continue at roughly current levels for the foreseeable future.

  The effects of either action alternative to wildlife species that utilize snag resources would primarily be related to a cumulative decrease in the amount and distribution of smaller-sized snags across the harvest units, equating to reduced availability of structures used for feeding and nesting. A minimum of 2 large (21 inches or larger) snags and 2 snag recruits (21 inches or larger live trees) per acre would be retained in all harvest units, with preference given to the shade-intolerant species, such as

western larch and ponderosa pine. Also, no snags or recruitment trees would be harvested or removed within any of the 120- or 50-foot no-cut buffers associated with Class 1 and Class 2 streams in the project area. Lower resulting densities of retained large snags and live trees would be expected, but those remaining would continue to provide substrates for feeding and nesting in the near term, and they would contribute to structural diversity over time as treated stands continue to mature and undergo changes brought about by ongoing forest succession.

In the 65,682-acre cumulative effects analysis area, past harvesting detectable on air photos has occurred on approximately 51 percent (derived from *TABLE III-57 - CONNECTIVITY*) of stands in this area during the last few decades, likely resulting in lower densities of snags (particularly large ones), and possibly coarse woody debris. Following proposed logging, 16,127 acres (Action Alternative B) or 15,739 acres (Action Alternative C) of mature stands would likely continue to possess high densities of snags and coarse woody debris on DNRC lands in the cumulative effects analysis area (*TABLE III-60 - SNAGS AND COARSE WOODY DEBRIS*). Snag densities on these acres would likely remain similar to those obtained in estimates from preharvest sample plots (*FIGURE III-16 - SNAG ABUNDANCE BY SIZE*). These identified acres would be expected to continue to provide ample quality habitat for a variety of wildlife species in the cumulative effects analysis area. The distribution of small snags in the cumulative effects analysis area would continue to be weighted to those areas that have experienced little recent or historical logging activity. No additional open roads would be constructed under either action alternative; thus, any potential associated cumulative snag loss due to illegal firewood cutting would not be expected. Over time, snag densities would continue to increase on nonharvested DNRC lands, USFS lands, and lands managed by DFWP.

In all harvest units proposed under the action alternatives, coarse woody debris material could be affected. Changes in amounts and distribution would likely occur across 2,010 acres (Action Alternative B) or 2,636 acres (Action Alternative C) from existing levels. However, amounts following logging likely would be slightly greater than existing levels, and contract requirements to retain 10 to 25 tons of woody material per acre would be in place under either action alternative to ensure material is retained; thus, little cumulative change would be anticipated. Much of the material would likely consist of pieces of existing logs, cull boles, limbs, and tops with relatively few intact large trees retained. Retained material would also be required to be relatively well distributed across harvest units and could simply not be retained in large piles. An additional mitigation measure applicable to both alternatives would emphasize the retention of larger logs greater than 15 inches diameter in harvest units following logging, which would mitigate potential cumulative reductions in larger material that is more difficult to acquire on managed sites. Coarse woody debris retained in stands following harvesting would provide quality habitat attributes for a number of species. However, habitat quality on affected harvest units could be degraded for those species that require an abundance

of larger logs (*DNRC 2010*). The remaining acres of unharvested forests not near open roads would continue to provide habitat for species that utilize large pieces of coarse woody debris. Under the action alternatives, quality habitat throughout the cumulative effects analysis area , 38.7 percent (Action Alternative B) or 37.7 percent (Action Alternative C) of the 65,682-acre area would be expected to retain relatively high densities of high-quality woody debris created naturally, including logs, whole trees, and large limbs (*TABLE III-60 - SNAGS AND COARSE WOODY DEBRIS*). Therefore, some habitat may be removed or the quality reduced for species that rely on coarse woody debris, but the overall cumulative effects would cause low risk to wildlife species in the cumulative effects analysis area as 10 to 25 tons per acre of coarse woody debris would be left on harvest units, and an appreciable number of acres with high densities of coarse woody debris would not be harvested (*TABLE III-60 - SNAGS AND COARSE WOODY DEBRIS*).

Thus, considering that: 1) snag densities would be decreased across 2,010 acres (Action Alternative B) or 2,636 acres (Action Alternative C) from existing levels; 2) a diversity and greater abundance of snags and downed logs would remain on 16,127 acres (Action Alternative B) or 15,739 acres (Action Alternative C) of unharvested sites on DNRC-managed lands in the 65,682-acre cumulative effects analysis area; 3) high quality snags and recruitment trees (4 or more per acre) would be retained in all proposed harvest units; 4) relatively high densities of high-quality woody debris created naturally would be retained across 38.7 percent (Action Alternative B) or 37.7 percent (Action Alternative C) of all 41,700 acres of DNRC lands in the cumulative effects analysis area; 5) no new open roads would be constructed that could otherwise increase the potential for illegal firewood removal; and 6) coarse woody material would likely be retained in similar to greater amounts in the proposed harvest units under both action alternatives, and logs greater than 15 inches diameter would be emphasized for retention; overall cumulative effects to wildlife species closely associated with snags and downed woody material would be minor in the cumulative effects analysis area. Species most likely to be adversely affected would be those species that use, and sometimes prefer, smaller snags for feeding and nesting (eg. smaller primary and secondary cavity-nesting bird species), as greater amounts of smaller snags would likely be lost or removed across proposed harvest units. No appreciable differences in cumulative effects between either of the proposed action alternatives would be expected.

FINE FILTER ANALYSIS

In the fine filter analysis, individual species of concern are evaluated. These species include wildlife species listed as threatened or endangered under the *Endangered Species Act of 1973*, species listed as sensitive by DNRC, and species managed as big game by DFWP. *TABLE III-61 – FINE FILTE*R summarizes how each of the species considered was included in the following analysis, or was removed from further analysis because either suitable habitat does not occur in the project area or because proposed activities would not affect their required habitat components.

TABLE III-61 – FINE FILTER. *Status and determination basis for species considered in the fine filter analysis for this proposed project.*

SPECIES/HABITAT	DETERMINATION – BASIS
THREATENED AND ENDANGERED SPECIES	
Grizzly bear Habitat: Recovery areas, security from human activity.	The project area occurs in the Porcupine-Woodward, Goat Creek, Lion Creek, and South Fork Lost Soup grizzly bear subunits of the Northern Continental Divide Ecosystem. Thus, grizzly bears will be further analyzed in this document.
Canada lynx Habitat: Subalpine fir habitat types, dense sapling, old forest, deep snow zone.	Potential Canada lynx habitats occur in the project area. Thus, Canada lynx will be further analyzed in this document.
SENSITIVE SPECIES	
Bald eagle Habitat: Late-successional forest more than 1 mile from open water.	The project area includes the Van Lake bald eagle nest and a portion of the nest area, primary use area, and home range associated with that territory. Thus, bald eagles will be further analyzed in this document.
Black-backed woodpecker Habitat: Mature to old burned or beetle-infested forest.	No recently (less than 5 years) burned areas or massive, widespread insect outbreaks are in the project area. Thus, no direct, indirect, or cumulative effects to black-backed woodpeckers would be expected to occur as a result of any alternative, and this species will not be discussed further in this document.
Coeur d'Alene salamander Habitat: Waterfall spray zones, talus near cascading streams.	No moist talus or streamside talus habitat occurs in the project area. Thus, no direct, indirect, or cumulative effects to Coeur d'Alene salamanders would be expected to occur as a result of any alternative, and this species will not be discussed further in this document.
Columbian sharp-tailed grouse Habitat: Grassland, shrubland, riparian, agriculture.	No suitable grassland communities occur in the project area. Thus, no direct, indirect or cumulative effects to Columbian sharp-tailed grouse would be expected to occur as a result of any alternative, and this species will not be discussed further in this document.
Common loon Habitat: Cold mountain lakes, nests in emergent vegetation.	Although loons have successfully reproduced on Van Lake, which is partially in the project area, no proposed activities would occur within 0.5 miles of the lakeshore. Thus, no direct, indirect, or cumulative effects to common loons would be expected to occur as a result of any alternative, and this species will not be discussed further in this document.
Fisher Habitat: Riparian and dense mature to old forest less than 6,000 feet in elevation.	Potential fisher habitats occur in the project area. Thus, fisher will be further analyzed in this document.

Flammulated owl Habitat: Late-successional ponderosa pine and Douglas-fir forest.	Potentially suitable dry ponderosa pine and Douglas-fir habitats occur in the project area. Thus, flammulated owls will be further analyzed in this document.
Gray Wolf Habitat: Ample big game populations, security from human activities.	Several different wolf packs (Cilly, Condon, and Squeezer) have been in the vicinity of the project area in the recent past. Thus, gray wolves will be further analyzed in this document.
Harlequin duck Habitat: White-water streams, boulder and cobble substrates.	No suitable high-gradient stream or river habitats occur in the project area. No direct, indirect, or cumulative effects to harlequin ducks would be expected to occur as a result of any alternative, and this species will not be discussed further in this document.
Northern bog lemming Habitat: Sphagnum meadows, bogs, fens with thick moss mats.	No suitable sphagnum bogs or fens occur in the project area. Thus, no direct, indirect or cumulative effects to northern bog lemmings would be expected to occur as a result of any alternative, and this species will not be discussed further in this document.
Peregrine falcon Habitat: Cliff features near open foraging areas and/or wetlands.	No suitable cliffs/rock outcrops occur in the project area or within 1 mile of the project area. Thus, no direct, indirect, or cumulative effects to peregrine falcons would be anticipated as a result of any alternative, and this species will not be discussed further in this document.
Pileated woodpecker Habitat: Late-successional ponderosa pine and larch-fir forest.	Mature western larch/Douglas-fir and mixed-conifer habitats exist in the project area. Thus, pileated woodpeckers will be further analyzed in this document.
Townsend's big-eared bat Habitat: Caves, caverns, old mines.	No suitable caves or mine tunnels are known to occur in the project area. Thus, no direct, indirect, or cumulative effects to Townsend's big-eared bats would be anticipated as a result of any alternative, and this species will not be discussed further in this document.
BIG GAME SPECIES	
Big game winter range.	Big game winter range is present in the project area. Thus, big game winter range will be further analyzed in this document.
Elk security habitat.	Elk security habitat is present in the project area. Thus, elk security will be further analyzed in this document.

THREATENED AND ENDANGERED SPECIES

- ***Grizzly Bear***

Issues

Hiding cover

The proposed activities could result in a reduction of hiding cover that is important for grizzly bears, which could result in: 1) increased displacement of grizzly bears, 2) avoidance of otherwise suitable habitat, and/or 3) increased risk of bear-human conflicts.

Open-road density

The proposed activities could result in an increase in the density of roads, which could result in increased displacement of grizzly bears and increased risk of bear-human conflicts.

Security habitat

The proposed activities could result in a decrease in secure areas for grizzly bears, which could result in increased displacement of grizzly bears and risk of bear-human conflicts.

Introduction

Grizzly bears are native generalist omnivores that use a diversity of habitats found in western Montana and are currently listed as 'threatened' under the Endangered Species Act. Preferred grizzly bear habitats are meadows, riparian zones, avalanche chutes, subalpine forests, and big game winter ranges, all of which provide seasonal food sources. In the project area, primary habitat components include meadows, riparian areas, and big game winter ranges. Primary threats to grizzly bears are related to human-bear conflicts, habituation to unnatural foods near high-risk areas, and long-term habitat loss associated with human development (Mace and Waller 1997). Forest management activities may affect grizzly bears by altering cover and/or by increasing human access into secure areas by creating roads (Mace et al. 1997). These actions could lead to the displacement of grizzly bears from preferred areas and/or result in an increased risk of human-caused mortality by bringing humans and bears closer together and/or making bears more detectable, which can increase their risk of being shot illegally. Displacing bears from preferred areas may increase their energetic costs, which may in turn lower their ability to survive and/or reproduce successfully.

In the Swan Valley, DNRC, USFS, Plum Creek, and USFWS collaborated to cooperatively manage grizzly bear habitat, linkage, and human access under the SVGBCA (SVGBCA 1997). Under this agreement, a rotation of active and inactive subunits was devised. The rotation schedule allows for active subunits where harvesting activities might displace grizzly bears and inactive subunits where commercial activities are prohibited to provide undisturbed habitat for bears. These rotations currently occur on a 3-year-active and 6-year-inactive basis. The Goat Creek Grizzly Bear Subunit of the Bunker Bear Management Unit (BMU) is scheduled to become active during the 2012 through 2014 period. Meanwhile, the

active period for the South Fork Lost Soup subunit of the BMU is scheduled for 2015 through 2017 and the Lion Creek subunit of the Bunker BMU, as well as, the Porcupine-Woodward subunit of the Mission Range North BMU are scheduled to be active in 2018 through 2020.

When a subunit is active, harvesting activities would not occur during the spring period (April 1 through June 15) in spring habitat (areas in designated linkage zones below 5,200 feet). After the spring period, harvesting activities and associated road use can occur unrestricted in the active subunit. However, any restricted road used for commercial activities would require restriction of public use through the placement of signs while harvesting activities are occurring, and the placement of a barrier across the road when harvesting activities are not occurring (weekends, nights, inactive periods, etc.). Other stipulations under the *SVGBCA* include:

- retaining a minimum of 40 percent of each subunit in grizzly bear hiding cover,
- managing open-road densities across all ownerships so that no more than 33 percent of any subunit exceeds an open-road density of 1 mile per square mile,
- tracking total road densities and amounts of secure habitat (i.e., security core),
- retaining a 100-foot visual buffer between open roads and the even-aged harvest units,
- utilizing uneven-aged management in the riparian zones,
- laying out harvest units so that no point is greater than 600 feet to cover, and
- restricting contractors from carrying firearms while on duty.

Analysis Area

Direct and indirect effects were analyzed for activities conducted in the project area. Cumulative effects were analyzed on each of the subunits that include portions of the project area, including Goat Creek, Lion Creek, Porcupine Woodward, and South Fork Lost Soup grizzly bear subunits. Each of these subunits approximates the home range size of a female grizzly bear. Additionally, analyses required by the *SVGBCA* are reported at the grizzly bear management subunit scale.

Analysis Methods

Hiding Cover

To assess hiding cover, DNRC's *SLI* data was used to map stands that would serve as hiding cover and be consistent with the definition of 'Cover' contained in the *SVGBCA* (*DNRC 2006*). Under the *SVGBCA*, each subunit must contain 'Cover' on a minimum of 40 percent of all lands in the subunit. Factors considered in the analysis include the amount of hiding cover available.

Open Road Density

A moving-windows analysis (*Ake 1994*) was conducted to determine open-road densities in the Goat Creek, Lion Creek, Porcupine-Woodward, and South Fork Lost Soup grizzly bear subunits. Results included areas that exceeded an open-road density of 1 mile per square mile. Factors considered in the analysis include the percentage of the area with open-road densities greater than 1 mile per square mile.

Security Habitat

Secure habitats are areas that are free of motorized human access. Specifically, secure habitats need to be greater than 0.3 miles (500 meters) from any open, restricted, or high-use roads and trails and meet a minimum size of 2,500 acres. A moving-windows analysis (*Ake 1994*) was conducted to determine areas that provide secure habitats and areas that exceed a total road density of 2 miles per square mile. Open and gated roads were buffered by 1,640 feet (500 meters), and the resultant area was removed from the subunit to obtain the amount of potential secure habitat in the cumulative effects analysis area.

The presence and maintenance of restricted roads produces a long-term potential for additional disturbance to grizzly bears and increased risk of human-caused mortality when compared to areas without road access. Since even restricted roads pose a risk to grizzly bears, total road-density estimates were used as a surrogate for that amount of the area potentially receiving more motorized and nonmotorized use. Spring habitats in the identified linkage zone receive additional consideration under the *SVGBCA* in an effort to provide connectivity while creating relatively undisturbed areas in the spring. Factors considered in the analysis include amount of available security habitat, amount of the area with a total road density greater than 2 miles per square mile, and amount of habitats affected in a grizzly bear linkage zone that extends across a broad northerly portion of the Swan River State Forest, hereafter termed the Swan River State Forest Linkage Zone.

Existing Environment

Hiding Cover

Past timber harvesting in Swan Valley on all ownerships have resulted in an obvious patchwork comprised of variously-shaped, multiaged forest stands that exist at differing stages of successional development. Hiding cover exists on 56 percent of the DNRC lands in the project area. Presently, hiding cover is fairly abundant in each of the subunits *(TABLE III-62 –EXISTING SVGBCA HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA).*

Some of the ongoing and recently completed salvage/sanitation/timber-harvesting activities have altered hiding cover (i.e. *Lucky Logger, Low Wood, White Porcupine Multiple Timber Sale Project*), while others (*Winter Blowdown, Swan Burn Salvage*) have not altered hiding cover due to the nature of the salvaged material. The precommercial thinning projects could alter approximately 228 acres of hiding cover. No other DNRC projects that would alter grizzly bear hiding cover are proposed in any of the subunits. In the Lion Creek cumulative effects analysis area, ongoing activities on USFS lands associated with the *Lion Creek Mountain Pine Beetle Project* are reducing grizzly bear hiding cover; no other activities are occurring on USFS lands in the Goat Creek, Porcupine Woodward, or South Fork Lost Soup cumulative effects analysis areas (*J. Dunham, USFS, personal communication September 14, 2011*). Within the individual cumulative effects analysis areas, some future logging could occur on lands currently owned by The Nature Conservancy in conjunction with their 10-year *Fiber Supply Agreement* with Plum Creek. However, currently, no

activity is planned in the near term (*M. Mantas, TNC, personal communication August 24, 2011*).

Open Road Density

Extensive road systems that have been required over the years to facilitate intensive logging are also evident in the valley. These road systems now provide a number of access routes into otherwise remote areas. Presently, the project area has roughly 2.4 miles of open roads. At the larger scale, the individual cumulative effects analysis areas have open-road density greater than 1 mile per square mile on between 19 and 28 percent of their individual areas *(TABLE III-62 –EXISTING SVGBCA HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREAS).*

No other proposed or ongoing DNRC projects that would alter open-road densities are occurring in any of the cumulative effects analysis areas. In the Lion Creek cumulative effects analysis area, ongoing activities on USFS lands associated with the *Lion Creek Mountain Pine Beetle Project* are not altering open-road densities; no other activities are occurring on USFS lands in the Goat Creek, Porcupine Woodward, or South Fork Lost Soup cumulative effects analysis areas (*J. Dunham, USFS, personal communication September 14, 2011*). Within the individual cumulative effects analysis areas, some future logging could occur on lands currently owned by The Nature Conservancy in conjunction with their 10-year *Fiber Supply Agreement* with Plum Creek. However, currently, no activity is planned in the near term (*M. Mantas, TNC, personal communication August 24, 2011*).

Security Habitat

Security habitat currently exists on approximately 4.6 percent of the project area, much of which is included in larger blocks of security habitats that extend beyond the project-area boundary. The individual cumulative effects analysis areas have between 15 and 42 percent in security habitats (*TABLE III-62 –EXISTING SVGBCA HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREAS).* Although the *SVGBCA* does not contain standards for security habitats or total-road densities on DNRC and Plum Creek lands, it requires the cooperators to annually report these values by subunit. On the DNRC portions, between 62.5 and 94.7 percent of the individual cumulative effects analysis areas exceed 2 miles per square mile of total road density. Additionally, seasonally secure habitats are provided for grizzly bears by limiting all management activities during the spring period in identified linkage zones below 5,200 feet of elevation. Approximately 8,002 acres (51.3 percent) of the project area exist in the Swan River State Forest Linkage Zone. Past harvesting in the area in the last 30 years has modified roughly 6,728 acres of the 45,989 acres (14.6 percent) in this linkage zone.

Ongoing salvage/sanitation projects are not altering security habitats or total road densities, but some have altered cover attributes in spring habitats in the linkage zone in the cumulative effects analysis areas. Ongoing timber harvesting associated with the *White Porcupine Multiple Timber Sale Project* is altering security habitat, total road densities, and spring habitats in linkage zones in the Porcupine Woodward cumulative effects analysis area. Ongoing precommercial thinning would have

minimal effects on spring habitats in the linkage zone as thinning treatments typically retain enough saplings following completion to provide adequate hiding-cover attributes. No other DNRC projects are proposed in the cumulative effects analysis areas that would alter grizzly bear security habitats, total road densities, or spring habitats in the linkage zone. In the Lion Creek cumulative effects analysis area, ongoing activities on USFS lands associated with the *Lion Creek Mountain Pine Beetle Project* is not affecting grizzly bear security habitats or total road densities, but is altering spring habitats in the linkage zone; no other activities are occurring on USFS lands in the Goat Creek, Porcupine Woodward, or South Fork Lost Soup cumulative effects analysis areas (*J. Dunham, USFS, personal communication September 14, 2011*). Within the individual cumulative effects analysis areas, some future logging could occur on lands currently owned by The Nature Conservancy in conjunction with their 10-year Fiber Supply Agreement with Plum Creek. However, currently, no activity is planned in the near term (*M. Mantas, TNC, personal communication August 24, 2011).*

TABLE III-62 – EXISTING SVGBCA HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA. *Open-road density, security habitat, and hiding cover by land ownership within each of the 4 grizzly bear subunits included in the project area and at the entire subunit level where appropriate. Adapted from SVGBCA Monitoring Team, 2011.*

	Open Route Density				Security Habitat				Hiding Cover		
	Entire Subunit	TNC/ PCTC*	DNRC	USFS	Entire Subunit	TNC/ PCTC*	DNRC	USFS	TNC/ PCTC*	DNRC	USFS
Goat Creek	23	26	43	13	42	4	11	82	52	60	67
Lion Creek	19	13	38	15	41	0	3	49	58	55	69
Porcupine Woodward	28	36	36	17	15	0	16	32	66	75	83
South Fork Lost Soup	25	15	30	18	40	0	35	59	40	71	75

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Grizzly Bears***

Hiding Cover

No vegetation modification would occur in the project area; therefore, no changes to existing hiding cover would be anticipated. Thus, no direct and indirect effects to grizzly bear hiding cover or associated impacts to bears involving displacement, avoidance of habitat, or increased risk of bear-human conflicts would be anticipated.

Open Road Density

No changes to the open-road status, open-road densities, or risk of grizzly bear displacement or bear-human conflicts caused by vehicular noise or human access would occur. Thus, no direct and indirect effects to open-road densities or, subsequently, grizzly bears in the project area would be anticipated.

Security Habitat

No alteration of habitat attributes or increased human presence would occur. No changes to total road densities or spring grizzly bear habitats in linkage zones

would occur. Therefore, no changes in grizzly bear security habitats, increased displacement, or human-caused mortality risk in the project area would be expected under this alternative.

- ***Direct and Indirect Effects of Action Alternatives B and C to Grizzly Bears***

Hiding Cover

The proposed harvesting would remove 1,538 to 2,088 acres of hiding cover from the existing 8,801 acres of hiding cover in the project area, with the greatest reduction in hiding cover occurring with Action Alternative C (*TABLE III-63 - PROJECT AREA GRIZZLY BEAR HABITAT PARAMETERS*). To reduce the avoidance of harvest units and provide some security, the seedtree and shelterwood harvest units would be laid out to ensure that no point of the unit exceeds 600 feet to cover, and visual screening would be retained in a 100-foot strip between the harvest units and open roads. Proposed road construction adjacent to Cedar Creek would alter cover in that riparian area; however, this area is outside of the linkage zone, and the road construction was designed to minimize riparian habitat loss. Thus, minor adverse direct and indirect effects to hiding cover that would affect grizzly bears in the project area would be anticipated since: 1) hiding cover would be reduced across a portion of the project area, but considerable hiding cover would remain in the project area (6,713 to 7,263 acres remaining), and 2) *SVGBCA* mitigations to ensure that no point in a proposed regeneration unit is more than 600 feet to cover and that a minimum of 40 percent of DNRC's-managed lands meet the definitions for hiding cover would provide some cover-related benefits for bears in the project area.

Open Road Density

Under either action alternative, no new open roads would be constructed. However, proposed harvesting activities could result in short-term displacement effects, while the construction of new restricted roads could result in both short- and long-term displacement effects. Under both action alternatives, between 4.9 and 8.2 miles of new permanent restricted roads would be constructed, adding to the existing 102 miles in the project area, with the greatest amounts constructed under Action Alternative C (*TABLE III-63 – PROJECT AREA GRIZZLY BEAR HABITAT PARAMETERS*). As all newly constructed roads would be managed as restricted, the amount of open roads or open-road densities would not change (*TABLE III-63 – PROJECT AREA GRIZZLY BEAR HABITAT PARAMETERS*). All newly constructed roads would be behind existing closure devices to allow for administrative and commercial uses. Thus, since open-road densities would not change, no direct and indirect effects associated with open-road densities would be anticipated that would affect grizzly bears in the project area for the foreseeable future.

Security Habitat

Although, no changes in open roads would be anticipated, reductions in security habitats on 195 or 239 acres (1.3 percent or 1.6 percent) would be anticipated in

the project area, with the greater reduction being associated with Action Alternative C (*TABLE III-63 – PROJECT AREA GRIZZLY BEAR HABITAT PARAMETERS)*. Alterations of vegetation in proposed units could make grizzly bears more visible; however, maintaining new and existing roads as restricted, incorporating 600-feet to cover requirements, maintaining visual screening along open roads, and prohibiting contractors from carrying firearms while on duty would minimize the risk of human-caused mortality. An increase in total road densities and disturbance levels associated with commercial timber harvesting would be anticipated, with the greater increase associated with Action Alternative C (*TABLE III-63 - PROJECT AREA GRIZZLY BEAR HABITAT PARAMETERS*). Harvesting would alter 1,512 to 1,518 acres of spring habitats in the linkage zone. Between 58.8 and 58.9 percent of the proposed units (1,182 to 1,553 acres) could only be harvested during the grizzly bear denning period (November 16 through March 31). This seasonal restriction would limit the potential for disturbance to grizzly bears during the spring period when they are more susceptible to disturbance and during the remainder of the nondenning period (April 1 through November 15). Proposed harvesting would alter spring habitats in the linkage zone on 1,512 to 1,518 acres. Action Alternative C, with the larger reduction in security habitat, more new road construction, and similar amounts of spring habitat in linkage zone affected, coupled with greater removal of hiding cover (see *WILDLIFE ANALYSIS - GRIZZLY BEAR - HIDING COVER* section), would be expected to have slightly more effects to grizzly bears than Action Alternative B. Collectively, minor adverse direct and indirect effects to grizzly bear security habitats and subsequent displacement-related effects would be anticipated in the project area since: 1) security habitat would be reduced by 1.3 to 1.6 percent; 2) total road densities would increase slightly in the project area with the addition of 4.9 to 8.2 miles of new, restricted roads; 3) some increases in disturbance caused by commercial harvesting could occur during the nondenning period for 3 years, but the majority of proposed activities would occur during the denning period when activities would not disturb grizzly bears; and 4) spring habitats within the linkage zone would be altered across 1,512 to 1,518 acres.

TABLE III-63 – PROJECT AREA GRIZZLY BEAR HABITAT PARAMETERS. *Proposed amounts of hiding cover removed as well as hiding cover retained; linear miles of permanent road, miles of open and restricted road construction; resultant miles of open and restricted roads expected under each alternative; and acres of spring habitats altered in the linkage zone in the project area.*

PARAMETER	ALTERNATIVES		
	NO ACTION	ACTION	
	A	B	C
Acres of hiding cover removed	0	1,538	2,088
Acres of hiding cover retained in the project area after implementation of each alternative (percent reduction)	8,801 (0)	7,263 (17.5)	6,713 (23.7)
Linear miles of new permanent, restricted road constructed	0	4.9	8.2
Linear miles of permanent restricted road (percent increase)	102 (0)	107 (4.9)	110.2 (8.0)
Miles of new permanent open road constructed	0	0	0
Miles of permanent open road (percent increase)	2.4 (0)	2.4 (0)	2.4 (0)
Acres of security habitat in the project area after implementation of each alternative (percent of project are providing security habitats)	710 (4.6)	515 (3.3)	471 (3.0)
Acres of spring habitats in the linkage zone modified (percent of unit acreages occurring in the linkage zone)	0 (0)	1,518 (75.6)	1,512 (57.4)
Acres of spring habitats in the linkage zone in the project area that would not be altered (percent reduction)	8,003 (0)	6,485 (19.0)	6,490 (18.9)

- ***Cumulative Effects of No-Action Alternative A to Grizzly Bears***

  Hiding Cover

  No vegetation modification would occur; therefore, no changes to existing hiding cover would be anticipated in any of the cumulative effects analysis areas *(TABLE III-64- GRIZZLY BEAR HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA)*. Vegetation in the project area and cumulative effects analysis areas that are providing hiding cover would be expected to continue providing this attribute for the foreseeable future. Thus, no further cumulative effects to hiding cover or associated impacts to bears involving displacement, avoidance of habitat, or increased risk of bear-human conflicts would be anticipated that would affect grizzly bears in any of the cumulative effects analysis area since: 1) no further changes in hiding cover would be expected on DNRC lands under this alternative; and 2) considerable amounts of the cumulative effects analysis area are providing hiding cover.

  Open Road Density

  No changes to open roads or open-road densities would be anticipated. On DNRC lands, the 30.1 to 44.9 percent of the individual cumulative effects analysis

areas with an open-road density greater than 1 mile per square mile would not change *(TABLE III-64 - GRIZZLY BEAR HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA)*. Thus, no further cumulative effects to open-road densities would be anticipated that would affect grizzly bears in the cumulative effects analysis areas for the foreseeable future.

Security Habitat

No changes to open roads, grizzly bear security habitats, total road densities, amount of spring habitats altered in the linkage zone, or increased potential for displacement or bear-human conflicts would be anticipated. No changes would be anticipated to the 3.2 to 33.8 percent of DNRC lands in the cumulative effects analysis areas that are currently providing security habitats. Likewise, the amount of the individual cumulative effects analysis areas with a total road density exceeding 2 miles per square mile would not change. No further changes to any spring habitats in the linkage zone would occur. Thus, no further cumulative effects would be anticipated to security habitats that would affect grizzly bears in the cumulative effects analysis area for the foreseeable future since: 1) security habitats would not change; 2) total road densities would not change; and 3) spring habitats in the linkage zone would not be affected.

- ***Cumulative Effects to Grizzly Bears Common to Action Alternatives B and C***

Hiding Cover

Proposed activities would reduce the amount of hiding cover in the individual cumulative effects analysis areas by up to 8.4 to 12.7 percent *(TABLE III-64 - GRIZZLY BEAR HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA)*. Proposed road construction would alter hiding cover in the riparian area adjacent to Cedar Creek; however, this area is outside of the linkage zone and the proposed road construction would be designed to minimize riparian habitat loss. Vegetation elsewhere in the project area and cumulative effects analysis areas that is providing hiding cover would be expected to continue providing this attribute for the foreseeable future. Ongoing harvesting and thinning on DNRC lands as well lands in other ownerships would continue altering grizzly bear hiding cover. Thus, reductions in hiding cover associated with these alternatives would be additive to ongoing and recently completed projects that would alter, or have altered, grizzly bear hiding cover. Reductions in hiding cover associated with timber harvesting and thinning are short-lived (10 to 20 years) and recovery of hiding cover in the general vicinity is fairly rapid. Under the *SVGBCA*, all cooperators are required to maintain a minimum of 40-percent hiding cover on their individual lands. The proposed harvesting would reduce the amount of hiding cover on DNRC lands in the individual cumulative effects analysis areas from between 55.2 and 68.1 percent to between 48.0 and 62.7 percent (*TABLE III-64 - GRIZZLY BEAR HABITAT PARAMETERS - CUMULATIVE EFFECTS ANALYSIS AREA).* Similarly, the amount of hiding cover across all ownerships in the individual cumulative effects analysis areas would be reduced from between 61.4 and 72.3 percent to between 58.6 and 72.1 percent (*TABLE III-64 - GRIZZLY BEAR HABITAT PARAMETERS - CUMULATIVE EFFECTS ANALYSIS*

AREA), all of which would exceed the 40-percent minimum threshold required in the *SVGBCA*. Collectively, Action Alternative C would alter more hiding cover; therefore, a slightly lower degree of effect would be anticipated with Action Alternative B. Thus, minor adverse cumulative effects to hiding cover that would influence grizzly bear displacement, avoidance of habitat, or increased risk of bear-human conflicts in the cumulative effects analysis areas would be anticipated since: 1) hiding cover would be reduced by a measurable level on DNRC lands; but 2) adequate hiding cover would persist on all ownerships and across the cumulative effects analysis areas at levels exceeding the 40-percent requirement of the *SVGBCA*.

Open-Road Density

No changes in open-road amounts or open-road densities would be anticipated. No ongoing or proposed salvage/sanitation or precommercial thinning on DNRC lands would alter open-road densities. Any activities that could occur on other ownerships in the cumulative effects analysis areas could alter total road densities, but changes to open roads would not be expected. The 30.1 to 44.9 percent of the individual cumulative effects analysis areas on DNRC lands with an open-road density greater than 1 mile per square mile would not change. Thus, no further cumulative effects involving open-road densities or, subsequently, grizzly bears would be anticipated in the cumulative effects analysis areas for the foreseeable future.

Security Habitat

No changes to open roads or the associated potential for human-caused mortality would be anticipated. Minor reductions in security habitats would further reduce existing amounts in the individual cumulative effects analysis areas from 3.2 to 33.8 percent to between 3.2 to 32.5 percent, with the slightly larger reductions being associated with Action Alternative C. Proposed road construction would increase total road density ranges in affected subunits from existing levels of 62.5 to 94.7 percent (Action Alternative A) to 63.3 to 95.5 percent (range for both Action Alternatives B and C), with a slightly larger increase associated with Action Alternative C (*TABLE III-64– GRIZZLY BEAR HABITAT PARAMETERS - CUMULATIVE EFFECTS ANALYSIS AREA*). Under both action alternatives, total road densities would be affected most in the Lion Creek and South Fork Lost Soup subunits. Use of the restricted roads in the Goat Creek and, potentially, South Fork Lost Soup cumulative effects analysis areas would increase substantially during the 3-year active period and then revert to levels similar to current levels for another inactive period. No changes to the use levels on the restricted roads in the other cumulative effects analysis areas (58.8 to 58.9 percent of the proposed units) would be anticipated since those subunits would be harvested during the denning period. Proposed harvesting would not alter spring habitats in the linkage zone in the Porcupine Woodward and Lion Creek cumulative effects analysis areas, but could alter spring habitats in the linkage zone in the Goat Creek (479 acres) and South Fork Lost Soup (1,032 to 1,038 acres) cumulative effects analysis areas (*TABLE III-64 – GRIZZLY BEAR*

HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA). All alternatives would be in compliance with the *SVGBCA*. Collectively, the increases in total road density, accessibility of existing roads that would be reconstructed, and the decrease in secure habitat could result in increased disturbance of grizzly bears via nonmotorized dispersed recreation, administrative activities (including motorized), salvage harvests during inactive periods, and commercial forest management activities during active periods. The increases in total road density and decreases in secure habitat could result in increased risks of avoidance of suitable habitat and bear-human conflicts. However, stipulations placed on contractors and DNRC personnel that restrict carrying firearms reduce the risk of additional mortality associated with administrative use. The availability of newly constructed roads, as well as the improvements made to 48 to 80 miles of existing roads, could increase nonmotorized use in the cumulative effects analysis areas, with proportionally more being associated with Action Alternative C (*TABLE III-64 - GRIZZLY BEAR HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA*). However, this nonmotorized use would not be expected to increase substantially; therefore, the risk to bears associated with nonmotorized use would be minor.

Reductions in habitat quality and quantity would be additive to losses associated with past harvesting on all ownerships in each of the cumulative effects analysis areas as well as ongoing harvesting on DNRC lands associated with the *White Porcupine Multiple Timber Sale Project*. Additionally, reductions of forest cover in spring habitats would be additive to the recent activities on DNRC lands as well as the ongoing reductions in the linkage zone associated with the USFS *Lion Creek Mountain Pine Beetle Project*. An increase in grizzly bear disturbance levels associated with the proposed activities would be additive to any existing disturbance mechanisms in the individual cumulative effects analysis areas. However, only the Goat Creek Subunit would be active under either action alternative, limiting potential disturbance to grizzly bears from the *SVGBCA* cooperators, with the exception of ongoing recreational use of the areas and other permitted activities (including road maintenance, limited salvage harvesting, etc.). All alternatives would fully meet the stipulations in the *SVGBCA*. Action Alternative C, with the larger reduction in security habitat, more new restricted road construction, and similar amounts of spring habitat in the linkage zone affected, coupled with greater removal of hiding cover (see the *HIDING COVER* section under *GRIZZLY BEAR* in this *WILDLIFE ANALYSIS*), would be expected to have proportionally more effects to grizzly bears than Action Alternative B. Thus, low to moderate adverse cumulative effects to security for grizzly bears would be anticipated in the cumulative effects analysis areas since: 1) little or no appreciable physical changes in existing amounts of security habitat would be anticipated; 2) total road densities in the individual cumulative effects analysis areas would increase by 0 to 0.9 percent; 3) increased disturbance caused by commercial harvesting would occur for 3 years during the nondenning period; however, 58.8 to 58.9 percent of the proposed activities would occur during the denning period when disturbance would not likely affect grizzly bears; 4) forest

vegetation in spring habitat within the linkage zone would be altered on up to 12.5 percent of the individual cumulative effects analysis areas; and 5) *SVGBCA* mitigations would further reduce risks to grizzly bear security.

TABLE III-64 – GRIZZLY BEAR HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA. *Anticipated changes to open-road densities, hiding cover, restricted roads, total road densities, security habitats, and spring habitats in the linkage zone under each alternative.*

PARAMETER	SUBUNITS	ALTERNATIVES		
		A-No Action	B	C
Percent of the area on DNRC-managed lands with an open-road density greater than 1 mile per square mile.	Goat Creek	44.9	44.9	44.9
	Lion Creek	32.3	32.3	32.3
	Porcupine Woodward	33.7	33.7	33.7
	South Fork Lost Soup	30.1	30.1	30.1
Percent of the area under all *SVGBCA* cooperator-managed lands with an open-road density greater than 1 mile per square mile[1]	Goat Creek	23	23	23
	Lion Creek	19	19	19
	Porcupine Woodward	28	28	28
	South Fork Lost Soup	25	25	25
Percent of hiding cover retained on DNRC-managed lands (percent of subunit changed)	Goat Creek	60.7 (0)	52.3 (8.4)	48.0 (12.7)
	Lion Creek	55.2 (0)	55.2 (0)	52.4 (2.8)
	Porcupine Woodward	62.0 (0)	61.5 (0.5)	61.5 (0.5)
	South Fork Lost Soup	68.1 (0)	62.7 (5.4)	61.5 (6.6)
Percent of hiding cover anticipated to exist on all ownerships [1] (percent of subunit changed)	Goat Creek	61.4 (0)	59.5 (1.9)	58.6 (2.8)
	Lion Creek	67.2 (0)	67.2 (0)	66.8 (0.4)
	Porcupine Woodward	72.3 (0)	72.1 (0.2)	72.1 (0.2)
	South Fork Lost Soup	70.6 (0)	67.2 (3.4)	66.5 (4.1)
Linear miles of restricted roads	Goat Creek	130.6	130.7	131.9
	Lion Creek	67.5	67.5	67.7
	Porcupine Woodward	214.3	215.1	215.1
	South Fork Lost Soup	96.1	100.0	101.5
Percent of the area with a total-road density greater than 2 miles per square mile	Goat Creek	90.3	90.3	90.3
	Lion Creek	94.7	95.4	95.5
	Porcupine Woodward	90.6	90.7	90.7
	South Fork Lost Soup	62.5	63.3	63.4
Percent of security habitat on DNRC-managed lands remaining after implementation of each alternative	Goat Creek	8.9	8.9	8.9
	Lion Creek	3.2	3.2	3.2
	Porcupine Woodward	10.2	10.2	10.2
	South Fork Lost Soup	33.8	32.7	32.5
Altered acres of spring habitats in linkage zone	Goat Creek	0	479	479
	Lion Creek	0	0	0
	Porcupine Woodward	0	0	0
	South Fork Lost Soup	0	1,038	1,032
Acres of spring habitats in linkage zone that would not be altered on all ownerships (percent reduction)	Goat Creek	10,132 (0)	9,653 (4.7)	9,653 (4.7)
	Lion Creek	8,425 (0)	8,425 (0)	8,425 (0)
	Porcupine Woodward	9,980 (0)	9,980 (0)	9,980 (0)
	South Fork Lost Soup	8,317 (0)	7,279 (12.5)	7,285 (12.4)

[1] *Open road densities and amount of hiding cover for lands managed by USFS and TNC/PCTC were adapted from the SVGBCA Monitoring Team Report (2011).*

- **Canada Lynx**

Issue

The proposed activities could result in the alteration of Canada lynx foraging habitat, denning habitat, and suitable habitat, rendering it unsuitable for supporting lynx.

Introduction

Canada lynx are listed as 'threatened' under the *Endangered Species Act*. Currently, no recovery plan exists for Canada lynx, but a draft recovery plan outline has been written (*USFWS 2005*) and is being further developed and considered by USFWS. Additionally, critical habitat has been designated by USFWS, which includes portions of the Swan River State Forest.

Canada lynx are associated with subalpine fir forests, generally between 4,000 to 7,000 feet in elevation in western Montana (*Ruediger et al. 2000*). The proposed project area ranges from approximately 3,120 to 6, 080 feet in elevation and on DNRCd state ownership is dominated by Douglas-fir/western larch with appreciable acreage in mixed conifers, Engelmann spruce, and lodgepole pine. Lynx habitat in western Montana consists primarily of stands that provide habitat for snowshoe hares, either dense, young coniferous stands or dense, mature forested stands. Lynx habitat also includes mature subalpine fir types with abundant coarse woody debris for denning and cover for kittens, and densely forested cover for travel and security. These conditions are found in a variety of climax vegetation habitat types, particularly within the subalpine fir series (*Pfister et al. 1977*). Historically, high intensity, stand-replacing fires of long fire intervals (150 to 300 years) occurred in continuous dense forests of lodgepole pine, subalpine fir, and Engelmann spruce. These fires created extensive even-aged patches of regenerating forest intermixed with old stands that maintained a mosaic of snowshoe hare and lynx habitat.

Analysis Area

Direct and indirect effects were analyzed for activities conducted in the project area. Cumulative effects were analyzed on the Goat Creek, the Lion Creek, Porcupine-Woodward, and the South Fork Lost Soup grizzly bear subunits (per *ARM 36.11.435 [7][a]* and *[b]*). Each of these analysis areas approximates the home range size of a lynx (*Ruediger et al. 2000*). More information regarding these cumulative effects analysis areas can be found under *GRIZZLY BEAR* in this analysis.

Analysis Methods

To assess lynx habitat, DNRC *SLI* data were used to map specific habitat classes used by lynx (*DNRC 2008*). Lynx habitat (*ARM 36.11.403[40*]) was assigned to a stand if the *SLI* data indicated habitat types (*Pfister et al. 1977*) that are consistent with those reportedly used by lynx (*Ruediger et al. 2000*). Other parameters (stand age, canopy cover, and amount of coarse woody debris) were used in modeling the availability of the following 5 specific lynx habitat elements:

1) denning,
2) young foraging,

3) mature foraging,
4) forested travel/other habitat, and
5) temporary non-lynx habitats.

Denning habitat provides important vegetative and woody structure needed to provide denning sites and security for juvenile lynx, while foraging habitat is critical for the survival of both adult and juvenile lynx. 'Forested travel/other habitat' is a general habitat category that provides for secondary prey items and contains modest levels of forest structure usable by lynx. Temporary non-lynx habitat consists of nonforest and open forested stands that are not expected to be used appreciably by lynx until adequate horizontal cover reestablishes. Additionally, habitats on other ownerships in the cumulative effects analysis areas were evaluated using aerial photographs and USDA remotely-sensed data. Factors considered in the analysis include landscape connectivity and the amount of the cumulative effects analysis area in denning, foraging, and unsuitable habitats.

Existing Environment

Approximately 7,931 acres of lynx habitat occur (*TABLE III-65 – LYNX HABITATS*) in the 15,591-acre project area. Much of this habitat was identified as forested travel/other and mature foraging habitats, with lesser amounts of denning and temporarily not available habitats. Connectivity of forested habitats in the project area is relatively intact (see the *CONNECTIVITY* section in this *WILDLIFE ANALYSIS*).

Mature foraging and forested travel/other suitable habitats dominate the Goat Creek, Lion Creek, and South Fork Lost Soup cumulative effects analysis areas; meanwhile the Porcupine Woodward cumulative effects analysis area is dominated by forested travel/other habitats and denning habitats (*TABLE III-65 – CANADA LYNX HABITATS*). The distribution of the various lynx habitat elements on DNRC lands is the result, primarily, of past timber harvesting and the lack of recent wildfires. Forest management practices over the past 40 to 60 years produced the current levels of temporary unsuitable and young foraging habitats. Stands that were precommercially thinned on DNRC lands would be considered forested travel/other habitat and not young foraging habitat in accordance with the DNRC lynx-mapping protocol. Timber harvesting conducted over 15 years ago has likely recovered to the point of providing forested travel/other habitat. Although it appears limited, young foraging habitats exist on DNRC lands in the cumulative effects analysis areas. Some younger stands classified as forested travel/other habitats contain dense thickets with low-growing canopies with high horizontal cover and may support snowshoe hares. In addition, the lack of fire, including the effects of fire suppression, led to the development and maintenance of mature foraging, forested travel/other, and denning habitats. *ARM 36.11.435 (7)(a)* and *(b)* require a minimum of 5 and 10 percent of the lynx habitats in each grizzly bear management subunit to be in denning and foraging habitats, respectively. Currently, each of the subunits used as cumulative effects analysis areas exceed the minimum thresholds for both foraging and denning habitat requirements (*TABLE III-65 – CANADA LYNX HABITATS*).

In the cumulative effects analysis areas, the recently-completed DNRC *Winter Blowdown Salvage Project* in the Porcupine Woodward Subunit affected 32 acres of lynx habitats, which were mostly forested travel/other habitats and the Section 28 Salvage Project in the Porcupine Woodward Subunit salvaged through approximately 80 acres of forested travel/other habitats, but those habitats would continue to serve in that capacity for lynx following logging activities. Meanwhile, recently-completed activities associated with the DNRC's *Low Wood 2 Salvage Permit* converted 40 acres of mature foraging habitats to forested travel/other habitats in the Porcupine Woodward Subunit. The recently completed *Lucky Logger Salvage Permit* in the same subunit converted 33 acres of denning habitat and 26 acres of forested travel/other habitats to temporary non-lynx habitats. The *White Porcupine Multiple Timber Sale Project* converted denning, mature foraging, and forested travel/other habitats to temporary non-lynx habitats (401, 430, and 404 acres, respectively) and forested travel/other habitats (0, 126, and 0 acres, respectively) in the Porcupine Woodward Subunit. The recently completed *Three Creek Timber Sale Project* removed denning habitat (163 acres), mature foraging habitats (288 acres), and forested travel/other habitats (97 acres) in the South Fork Lost Soup Subunit. Meanwhile, precommercial thinning projects in the Porcupine Woodward Subunit are converting 145 acres of forested travel/other habitats to temporary non-lynx habitats, while activities on another 88 acres of temporary non-lynx habitats would not alter the current level of temporary non-lynx habitats. Based on interpretation of aerial photographs and USDA remotely-sensed data for the individual cumulative effects analysis areas, considerable acreage (6,228 to 15,222 acres) is providing forested habitats with greater than 40-percent canopy closure that could support lynx habitats in each of the subunits (*TABLE III-66 – CUMULATIVE EFFECTS ANALYSIS AREA NON-DNRC CANADA LYNX HABITATS*). The remaining acres (5,316 to 12,287 acres) are comprised of younger stands, poorly stocked stands, sparsely vegetated stands, and natural openings (*TABLE III-66 – CUMULATIVE EFFECTS ANALYSIS AREA NON-DNRC CANADA LYNX HABITATS*). A portion of these sparsely stocked stands, younger stands, and natural openings likely provide some level of foraging habitat for lynx. Connectivity across the cumulative effects analysis areas is fairly intact, but has been diminished in places by past harvesting and road construction. In the Lion Creek cumulative effects analysis area, ongoing activities on USFS lands associated with the *Lion Creek Mountain Pine Beetle Project* are not expected to alter lynx foraging or denning habitats and would be expected to maintain a suitable matrix of forested habitats suitable for lynx travel and a variety of lynx prey. No other activities are occurring on USFS lands in the Goat Creek, Porcupine Woodward, or South Fork Lost Soup cumulative effects analysis areas (*J. Dunham, USFS, personal communication September 14, 2011*). Within the individual cumulative effects analysis areas, some future logging could occur on lands currently owned by The Nature Conservancy in conjunction with their 10-year *Fiber Supply Agreement* with Plum Creek. However, currently, activity is not planned in the near term (*M. Mantas, TNC, personal communication August 24, 2011*).

Specific lynx use of the cumulative effects analysis areas is unknown. One set of tracks has been documented in the Swan River State Forest in the past (*A. Lieberg,*

Northwest Connections, personal communication, October 26. 2011). This evidence indicates that lynx use is not prevalent; however, lynx could be using, or at least traveling through on occasion, portions of the cumulative effects analysis areas. However, modeling indicates that lynx habitat is available in ample proportions.

TABLE III-65 – CANADA LYNX HABITATS*. Existing acres and percentages of lynx habitat elements on DNRC lands in the project area and 4 grizzly bear subunits included for evaluating cumulative effects.*

HABITAT ELEMENTS	PROJECT AREA ACRES (PERCENT)	GOAT CREEK ACRES (PERCENT)	LION CREEK ACRES (PERCENT)	PORCUPINE WOODWARD ACRES (PERCENT)	SOUTH FORK LOST SOUP ACRES (PERCENT)
Denning	1,084 (13.7)	75 (9.3)	0 (0.0)	3,021 (30.6)	3,273 (22.8)
Mature Foraging	2,275 (28.7)	202 (25.1)	29 (12.2)	2,173 (22.0)	3,626 (25.3)
Forested Travel/Other	3,264 (41.2)	427 (53.1)	208 (87.8)	3,978 (40.3)	5,108 (35.6)
Temporary Non-Suitable	1,308 (16.5)	100 (12.4)	0 (0.0)	692 (7.0)	2,320 (16.2)
Young Foraging	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	17 (0.1)
Grand Total Lynx Habitats	*7,931 (100)*	*804 (100)*	*237 (100)*	*9,864 (100)*	*14,344 (100)*
Permanently Unsuitable	7,660 (-)	5,204 (-)	2,833 (-)	2,385 (-)	3,939 (-)
Total Acres	*15,591 (-)*	*6,008 (-)*	*3,070 (-)*	*12,249 (-)*	*18,284 (-)*

TABLE III-66 – CUMULATIVE EFFECTS ANALYSIS AREA NON-DNRC LYNX HABITATS. *Existing acres of potential lynx habitat elements on non-DNRC lands in the cumulative effects analysis area based on aerial-photograph interpretation and USDA remotely-sensed data.*

HABITAT	GOAT CREEK ACRES	LION CREEK ACRES	PORCUPINE WOODWARD ACRES	SOUTH FORK LOST SOUP ACRES	TOTAL ACRES
Mature foraging/denning/ forested travel/other	11,560	13,557	15,222	6,228	46,568
Temporary non-suitable	9,980	12,287	10,107	5,316	37,690
Grand total potential lynx habitats	*21,541*	*25,843*	*25,329*	*11,545*	*84,258*
Permanently unsuitable	53	133	98	55	338
Total acres	*21,593*	*25,977*	*25,427*	*11,599*	*84,596*

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Canada Lynx***

  In the short-term, no changes in lynx habitat elements would be expected in the project area. In the longer term, barring major natural disturbance, natural succession would advance several classes forward, generally improving several classes of lynx habitats; however, the further reduction in young foraging habitats would be expected in the absence of new regenerating stands to replace the limited, existing stands succeeding beyond young foraging habitat. When this occurs, habitat quality for snowshoe hares could decline, thereby reducing the availability of prey for lynx. Mature foraging and denning habitats would be expected to remain at similar levels or increase in the future as shade-tolerant trees develop in the understory and coarse woody debris accumulates through time due to natural events. Forested travel/other habitats would be expected to increase in the future as temporary non-lynx habitats and young foraging habitats mature into this habitat element. Therefore, in the short-term, no effects to lynx would be expected. In the longer term, without disturbance, young foraging opportunities in the project area would decrease. Landscape connectivity would not be altered in the near-term and may improve in the long-term. Thus, minor beneficial direct and indirect effects to lynx habitats would be expected to occur in the project area since: 1) adequate denning habitats would persist; 2) sufficient mature foraging habitats would exist; 3) young foraging habitats would continue to develop in the next 10 to 20 years in the project area; 4) longer-term availability of young foraging habitats would likely decline without disturbance; 5) limited amounts of lynx habitats would be in the temporary non-lynx habitat category, meaning most of the lynx habitats would be in a usable state for lynx; and 6) landscape connectivity would not be altered in the short-term and would improve as stands continue to grow and mature over the long-term (greater than 10 years).

- ***Direct and Indirect Effects of Action Alternatives B and C to Canada Lynx***

  Both proposed action alternatives would alter lynx habitats in the project area. Under both action alternatives, proposed harvesting would reduce canopy cover and horizontal cover, which would convert available lynx habitat elements into temporary non-lynx habitats (*TABLE III-67 – CHANGES IN CANADA LYNX HABITATS*). While maintaining a suitable mix of lynx habitats (*TABLE III-68 - PROJECT AREA CANADA LYNX HABITAT CHANGES*), a range of approximately 1,122 to 1,393 acres of lynx habitats would be converted to temporary non-lynx habitats under the action alternatives, increasing the overall amount of the project area in temporary non-lynx habitats to 30.6 or 34.1 percent. Portions of those units proposed to receive variable-thin-type treatments could meet the definition of forested travel/other habitats following treatment should retention levels be slightly heavier, but for the purposes of this analysis all proposed units would move into the temporary non-lynx habitat category following proposed treatments. Retention of patches of advanced regeneration of shade-tolerant trees would be required where feasible, which would break-up site distances, provide horizontal cover, and provide forest structural attributes preferred by snowshoe hares and lynx. Continued

maturation of younger-aged stands in the project area would gradually move these stands away from temporary non-habitat and into other classes of suitable lynx habitats. However, the younger-aged stands created with the proposed harvesting could provide young foraging habitats further into the future as tree seedlings and shrubs recover and begin providing habitats for snowshoe hares. It could take up to 10 years for seedlings to provide snowshoe hare habitat. In all proposed units, 10 to 25 tons of coarse woody debris would be retained (emphasizing retention of downed logs 15-inch dbh and larger) to provide some horizontal cover and security structure for lynx. In the short term, lynx would likely avoid proposed harvest units that would be converted to temporary non-lynx habitat. Forest connectivity around the openings created with these alternatives would be largely maintained through riparian buffers and other forested habitats in the project area that would not be harvested. However, overall connectivity would be reduced to varying levels (see the *CONNECTIVITY* section in this *WILDLIFE ANALYSIS*). Given that more denning habitat is reduced, a moderate and reasonably similar amount of foraging habitat is removed, more acres of lynx habitats are converted to temporary non-lynx habitats, and the larger effect on landscape connectivity would be expected under Action Alternative C, proportionally more effects to Canada lynx would be anticipated under this alternative compared to Action Alternative B. Collectively, minor adverse direct and indirect effects to lynx habitats would be expected to affect Canada lynx in the project area since: 1) adequate denning habitats would persist under both action alternatives; 2) sufficient mature foraging would exist under both action alternatives; 3) young foraging habitats would continue developing in the next 20 to 50 years in the project area; 4) moderate amounts of lynx habitats would be in the temporary non-lynx habitat category, meaning much of the available lynx habitats would be in a usable state for lynx; and 5) moderate levels of landscape connectivity would persist despite overall reductions in landscape connectivity.

TABLE III-67 – CHANGES IN CANADA LYNX HABITATS. *Acreage changes in lynx habitat elements following implementation of the alternatives considered.*

CHANGES TO LYNX HABITATS	ALTERNATIVES		
	A - NO ACTION	B	C
Denning habitat converted to temporary non-lynx habitat	0	107	226
Mature foraging habitat converted to temporary non-lynx habitat	0	839	789
Other habitat converted to temporary non-lynx habitat	0	176	378
Temporary non-lynx habitats modified	0	0	15
Total increase in temporary non-lynx habitat	*0*	*1,122*	*1,393*

TABLE III-68 - PROJECT AREA CANADA LYNX HABITAT CHANGES. *Acres and proportions of lynx habitat elements on DNRC lands in the project area following implementation of each alternative.*

LYNX HABITAT ELEMENT	ACRES OF LYNX HABITAT ELEMENTS FOLLOWING EACH ALTERNATIVE (PERCENT OF TOTAL LYNX HABITAT)		
	A - NO ACTION	B	C
Denning	1,084 (13.7)	977 (12.3)	858 (10.8)
Mature foraging	2,275 (28.7)	1,436 (18.1)	1,486 (18.7)
Other	3,264 (41.2)	3,088 (39.0)	2,886 (36.4)
Temporary non-lynx habitat	1,308 (15.5)	2,430 (30.6)	2,701 (34.1)
Young foraging	0 (0.0)	0 (0.0)	0 (0.0)
Total acres lynx habitat	*7,931*	*7,931*	*7,931*

- ***Cumulative Effects of No-Action Alternative A to Canada Lynx***

  No appreciable change in lynx habitats would occur under this alternative except the continued maturation of stands. Ongoing and recently completed projects on DNRC lands would continue altering lynx habitats. Across all ownerships, continued stand maturation, in the absence of other disturbance, would move temporary non-lynx habitat towards young foraging habitat or forested travel/other habitat. This includes some of the 0 to 2,320 acres of temporary non-lynx habitats on DNRC lands in the cumulative effects analysis areas (*TABLE III-65 – CANADA LYNX HABITATS*), as well as a portion of the 5,316 to 12,287 acres of younger or sparsely vegetated stands identified on other ownerships in the cumulative effects analysis areas (*TABLE III-66 – CUMULATIVE EFFECTS ANALYSIS AREA NON-DNRC LYNX HABITATS*). A slight increase in young foraging habitats in each of the cumulative effects analysis areas would be possible in the near-term as stands that were harvested in the last 10 to 15 years regenerate tall, dense saplings. Since the amount of developing young foraging habitat would be expected to exceed the amount of young foraging habitat that would mature into forested travel/other habitat, snowshoe hare prey availability would be expected to potentially increase in the next 10 to 20 years. Gradually, however, as these young foraging stands continue maturing out of the young-foraging category and into forested travel/other habitats, habitat quality for snowshoe hares could decline, thereby reducing the availability of prey for lynx in the long-term.

  Mature foraging and denning habitats would be expected to increase in the future as shade-tolerant trees develop in the understory, coarse woody debris accumulates through time due to natural events, and, in general, stands continue maturing out of young foraging and forested travel/other habitats. This would include the 208 to 5,108 acres identified on DNRC lands in the cumulative effects analysis areas (*TABLE III-65 – CANADA LYNX HABITATS*) and likely a portion of the 6,228 to

15,222 acres in forested stands on other ownerships in the cumulative effects analysis areas (*TABLE III-66 – CUMULATIVE EFFECTS ANALYSIS AREA NON-DNRC LYNX HABITATS*). Therefore, in the short-term, negligible negative effects to lynx would be expected. In the longer-term, without disturbance, young foraging opportunities could decrease as stands mature towards mature foraging, denning, and forested travel/other habitats. The no-action alternative would be expected to result in a low risk of reducing the ability of lynx to survive and reproduce in the area. Landscape connectivity would not be further altered in the cumulative effects analysis area. Thus, minor beneficial cumulative effects to lynx habitats would be expected to affect Canada lynx in the cumulative effects analysis area since: 1) adequate denning habitats would persist; 2) sufficient mature foraging habitats would exist; 3) young foraging habitats would continue developing in the near term across the cumulative effects analysis area; 4) longer-term availability of young foraging habitats would likely decline without disturbance; 5) limited amounts of lynx habitats would exist in the temporary non-lynx habitat category meaning most of the lynx habitats would be in a usable state for lynx; and 6) landscape connectivity would persist and develop further.

- ***Cumulative Effects to Canada Lynx Common to Action Alternatives B and C***

Each action alternative alters the amounts and proportions of lynx habitat elements in the individual cumulative effects analysis areas. Denning habitat would be reduced on 107 to 226 acres (all in the South Fork Lost Soup Subunit), with the larger reduction associated with Action Alternative C (*TABLE III-67 –CHANGES IN CANADA LYNX HABITATS*); however, following implementation of either alternative, enough lynx denning habitat would be retained on DNRC lands to satisfy DNRC's commitment (*ARM 36.11.435*) of retaining 5 percent of Canada lynx habitat in the denning-habitat element (*TABLE III-69 - CANADA LYNX HABITATS – CUMULATIVE EFFECTS ANALYSIS AREA*). Similarly, both action alternatives would reduce the amount of mature foraging habitats in the Goat Creek (29 acres) and South Fork Lost Soup (743 to 810 acres) subunits, with additional mature foraging habitats (18 acres) being removed with Action Alternative C in the Porcupine Woodward Subunit. Following the implementation of any alternative, adequate foraging habitats would exist (*TABLE III-69 - CANADA LYNX HABITATS - CUMMULATIVE-EFFECTS ANALYSIS AREA*) to meet DNRC's commitment of retaining 10 percent lynx habitat in mature foraging or young foraging habitats as required under *ARM 36.11.435*. Anticipated reductions in denning and mature foraging habitats would be additive to past losses from timber harvesting as well as any ongoing activities that are altering those habitats. In addition to the denning and mature foraging habitats that exist on DNRC lands, denning and mature foraging habitats likely to occur in some similar, but unknown proportions of the 6,228 to 15,222 acres in forested stands on other ownerships in the cumulative effects analysis areas (*TABLE III-66 – CUMULATIVE EFFECTS ANALYSIS AREA NON-DNRC LYNX HABITATS*), thereby likely adding to the amount of denning and mature foraging habitats available. Additionally, some young foraging habitats could exist on some similar, but also unknown portion of the 5,316 to 12,287 acres of

younger forest (given they have adequate horizontal cover) of adjacent USFS and The Nature Conservancy lands. Public firewood harvesting could reduce denning and foraging structure, primarily along open roads.

In the short-term, 1,122 to 1,393 acres of available lynx habitats would be converted into temporary non-lynx habitat on DNRC lands in the individual cumulative effects analysis areas, which would be largely concentrated in the South Fork Lost Soup cumulative effects analysis area, with lesser amounts in the Goat Creek cumulative effects analysis area (both action alternatives) and Porcupine Woodward cumulative effects analysis area (Action Alternative C only), with the greatest increase being associated with Action Alternative C; *TABLE III-69 CANADA LYNX HABITATS – CUMMULATIVE-EFFECTS ANALYSIS AREA*). These anticipated increases in temporary non-lynx habitats would be additive to past losses of lynx habitats due to timber harvesting, as well as any ongoing modifications in the cumulative effects analysis areas. In 10 to 20 years, any acres converted to temporary non-lynx habitats with this project, as well as any conversions on other ownership, would be expected to regenerate into young foraging habitat or forested travel/other habitat. Regenerating stands can provide high-quality snowshoe hare habitat until the branches of the trees no longer provide horizontal cover at the ground or snow level, which is expected to occur in 10 to 30 years following the successful regeneration of young trees. Some portion of the existing 0 to 2,320 acres of temporary non-lynx habitats in the cumulative effects analysis areas would likely be converted to young foraging or forested travel/other habitats in the near future (5 to 15 years), thereby offsetting, to a degree, some of the loss of habitat under these alternatives. Regardless of the natural conversion of existing temporary non-lynx habitat to usable habitat, each alternative, in combination with other activities in the cumulative effects analysis areas, would be expected to retain enough usable habitats for lynx to successfully inhabit each of the individual cumulative effects analysis areas under either action alternative.

In conclusion, proposed harvesting would alter 1,122 to 1,393 acres of lynx habitats, with the greatest amount modified under Action Alternative C. However, adequate amounts of denning and foraging habitats would be retained in each of the cumulative effects analysis areas to meet DNRC's lynx commitments. In 10 to 20 years, both action alternatives could result in increased young foraging habitats that could provide increased snowshoe prey availability for an additional 10 to 30 years. Collectively, both action alternatives would be expected to result in a low risk of reducing the ability of a lynx to survive and reproduce in the area in the short-term (10 to 20 years) and could benefit lynx in 10 to 20 years by increasing foraging habitat as the harvested stands regenerate and provide snowshoe hare habitat. Landscape connectivity would be further reduced to varying degrees with both action alternatives, but moderate levels of landscape connectivity would persist that would facilitate lynx movements in the individual cumulative effects analysis areas. Given that more denning habitat is reduced, a moderate and reasonably similar amount of foraging habitat is removed, more acres of lynx habitats are converted to temporary non-lynx habitats, and the larger effect on landscape connectivity would

be expected under Action Alternative C, proportionally more effects to Canada lynx would be anticipated under this alternative compared to Action Alternative B. Overall, minor adverse cumulative effects to Canada lynx habitats would be expected in the cumulative effects analysis area since: 1) adequate denning habitats would persist under all alternatives where it exists; 2) sufficient mature foraging habitats would exist under all alternatives in each of the cumulative effects analysis areas; 3) young foraging habitats would continue developing for the next 20 to 50 years across the cumulative effects analysis areas; 4) limited amounts of lynx habitats would be in the temporary non-lynx habitat category (less than 30 percent), meaning that most of the lynx habitats would be in a usable state for lynx; and 5) reductions in landscape connectivity would not prevent lynx movements.

TABLE III-69 - CANADA LYNX HABITATS – CUMMULATIVE-EFFECTS ANALYSIS AREA.
Acres and proportions of lynx habitat elements on DNRC-managed lands in the cumulative effects analysis areas following implementation of each alternative.

LYNX HABITAT ELEMENT	CUMULATIVE EFFECTS ANALYSIS AREAS	ACRES (AND PERCENT) OF LYNX HABITAT ELEMENTS FOLLOWING EACH ALTERNATIVE		
		A-NO ACTION	B	C
Denning	Goat Creek	75 (9.3)	75 (9.3)	75 (9.3)
	Lion Creek	0 (0)	0 (0)	0 (0)
	Porcupine Woodward	3,021 (30.6)	3,021 (30.6)	3,021 (30.6)
	South Fork Lost Soup	3,273 (22.8)	3,166 (22.1)	3,047 (21.2)
Mature Foraging	Goat Creek	202 (25.1)	173 (21.5)	173 (21.5)
	Lion Creek	29 (12.2)	29 (12.2)	29 (12.2)
	Porcupine Woodward	2,173 (22.0)	2,173 (22.0)	2,155 (21.8)
	South Fork Lost Soup	3,626 (25.3)	2,816 (19.6)	2,883 (20.1)
Other	Goat Creek	427 (53.1)	427 (53.1)	402 (50.0)
	Lion Creek	208 (87.8)	208 (87.8)	208 (87.8)
	Porcupine Woodward	3,978 (40.3)	3,978 (40.3)	3,916 (40.0)
	South Fork Lost Soup	5,108 (35.6)	4,932 (34.4)	4,816 (33.6)
Temporary Non-Lynx Habitat	Goat Creek	100 (12.4)	129 (16.0)	154 (19.2)
	Lion Creek	0 (0)	0 (0)	0 (0)
	Porcupine Woodward	692 (7.0)	692 (7.0)	772 (7.8)
	South Fork Lost Soup	2,320 (16.2)	3,413 (23.8)	3,580 (25.0)
Young Foraging	Goat Creek	0 (0)	0 (0)	0 (0)
	Lion Creek	0 (0)	0 (0)	0 (0)
	Porcupine Woodward	0 (0)	0 (0)	0 (0)
	South Fork Lost Soup	17 (0.1)	17 (0.1)	17 (0.1)
Total Acres Lynx Habitat	Goat Creek	*804*	*804*	*804*
	Lion Creek	*237*	*237*	*237*
	Porcupine Woodward	*9,864*	*9,864*	*9,864*
	South Fork Lost Soup	*14,344*	*14,344*	*14,344*

SENSITIVE SPECIES

- **Bald Eagle**

Issue

The proposed activities could reduce bald eagle nesting and perching structures and/or disturb nesting bald eagles.

Introduction

Bald eagles are diurnal raptors associated with significant bodies of water, such as major rivers, lakes, and coastal zones. The bald eagle diet consists primarily of fish and waterfowl, but includes carrion, mammals, and items taken from other birds of prey. In northwestern Montana, bald eagles begin the breeding process with courtship behavior and nest building in early February; the young fledge by approximately mid-August, ending the breeding process. Preferred nest-stand characteristics include large emergent trees that are within site distances of lakes and rivers and screened from disturbance by vegetation.

Analysis Area

Direct and indirect effects were analyzed for activities conducted in the project area within 2.5 miles of the nest. Cumulative effects were analyzed on the Van Lake bald eagle territory home range. This cumulative effects analysis area includes the likely nesting home range area used by the pair of eagles, considering the size of such areas typically used by eagles breeding in western Montana.

Analysis Methods

Effects were analyzed using a combination of field evaluations and aerial photograph interpretation in the bald eagle home range. Factors considered in this analysis include disturbance levels and availability of snags and large, emergent trees with stout horizontal limbs for nests and perches.

Existing Environment

The project area includes the Van Lake bald eagle nest site and a portion of the associated nest site, primary use, and home range areas. Eagles have been documented on Van Lake for the last 7 years. The territory has produced at least 6 chicks in the last 5 years. The aquatic habitat associated with this bald eagle territory includes Van Lake, Swan River, and several smaller wet meadows and wetlands in the project area. These waterbodies may all be important components of the Van Lake bald eagle territory. Aquatic and terrestrial prey species are fairly common in the home range. The terrestrial habitat incorporated by the Van Lake bald eagle territory is a coniferous/deciduous mixture along the lakeshores and riparian areas, with coniferous forests in the upland areas. Within the present home range, black cottonwood is the deciduous tree of primary importance to bald eagles, while large emergent conifers also provide important nesting, roosting, and perching sites.

Bald eagle habitat is managed at 3 spatial scales, according to *ARM 36.11.429*; the nest area (area within a 0.25-mile radius of the active nest tree or nest sites that have been active within 5 years), the primary use area (an area 0.25 to 0.50 miles from the

nest tree), and the home range (area within 2.5 miles of all nest sites that have been active within 5 years).

Human disturbance, including timber harvesting, residential development, various forms of recreation, as well as the disturbance associated with the Highway 83 corridor, are potential sources of disturbance to the nesting territory. Several large emergent trees are available across portions of the home range, but logging in the last 100 years has likely reduced some of these trees, while others have experienced mortality and are declining in quality. Any harvesting that may be occurring on other ownerships in the home range could continue to disturb bald eagles or modify their habitats.

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Bald Eagles***

  No direct or indirect effects to bald eagles would be expected. Human disturbance would continue at approximately the same levels. No changes in available nesting or perching structures would occur. Thus, since: 1) no changes to human disturbance levels would occur; and 2) no changes in the availability of large, emergent trees would be expected, negligible direct and indirect effects would be expected to affect bald eagles using the territory.

- ***Direct and Indirect Effects of Action Alternative B to Bald Eagles***

  None of the proposed activities associated with this alternative would occur in the Van Lake bald eagle home range. No direct or indirect effects to bald eagles would be expected. Human disturbance would continue at approximately the same levels. No changes in available nesting or perching structures would occur. Thus, since: 1) no changes to human disturbance levels would occur; and 2) no changes in the availability of large, emergent trees would be expected, negligible direct and indirect effects would be expected to affect bald eagles using the territory.

- ***Direct and Indirect Effects of Action Alternative C to Bald Eagles***

  Approximately 3 acres of one proposed harvest unit exists in the primary use area associated with the Van Lake bald eagle territory; and an additional 247 acres of proposed harvest units occur in the home range associated with the territory. The proposed unit in the primary-use area would receive a shelterwood treatment, which would alter existing upland habitats, but would retain some structural and ecological characteristics important to eagles, such as large emergent trees, snags, and potential perch and roost trees. This unit would be harvested between November 16 and February 1, limiting potential disturbance during the nesting season. Additionally, roads needed to access 2 other proposed units (total of approximately 18.5 acres) in the home range are in the primary use area, and would also be restricted to being harvested between November 16 and February 1, unless other access from the open road can be identified that is outside of the primary use area. The remaining 228.5 acres of proposed harvest units in the home range are fairly evenly split between the active grizzly bear subunit (Goat Creek) and the inactive subunit (Lion Creek).

Those units in the active subunit are generally further from the nest and could be harvested when appropriate soil conditions are met; meanwhile, those units in the inactive subunit, which are generally the proposed units closer to the nest tree, would be limited to being harvested between November 16 and March 31. Should those units in the home range be harvested when the eagles are not using the nest (August 16 through February 1), activities would be expected to have minimal effects to bald eagles and any harvesting during the nesting period (February 1 through August 15) would be expected to have minor effects to bald eagles, with a gradual decrease in effects as time progresses through the nesting period and/or distance increases from the nest. Efforts to limit harvesting in the portions of these units in the home range to the nonnesting period would have the least risk of displacing the bald eagle pair and/or disrupting their breeding activities. The potential for displacement would only be expected to affect eagles during the proposed activities and not beyond. Prescriptions for most of the proposed harvest units in the home range would be regeneration-type treatments and the resultant stands would be fairly open after completion, which could slightly increase visibility and associated disturbance. The remaining units in the home range would receive variable thinning treatments, which would increase stand openness, but wouldn't appreciably alter nest visibility or potential for disturbance from any future uses. In the home range, prescriptions call for the retention of some large snags and emergent trees that could be used in the future as nest or perch trees as the stands develop around these resources. No changes to human access to the home range would occur, thus limiting potential for introduction of additional human disturbance to this territory. Thus, minor direct and indirect effects to bald eagles would be anticipated since: 1) disturbance could be elevated in a portion of the territory during operations; 2) no change in human access in the project area would occur; and 3) negligible changes in the availability of large, emergent trees in areas important for this pair of eagles would be expected.

- ***Cumulative Effects to Bald Eagles Common to No-Action Alternative A and Action Alternative B***

  Nesting bald eagles would continue to experience varying levels of disturbance from the ongoing recreational use as well as any ongoing timber management on other nearby ownerships. Additionally, human developments on private lands and the potential disturbance associated with the Highway 83 corridor would continue to provide potential sources of disturbance to the territory. Emergent trees exist across portions of the home range. No further changes in human disturbance, development, recreation, timber harvesting, or firewood gathering within the home range area would be anticipated. Thus, no cumulative effects to bald eagles would be expected since: 1) no changes to human disturbance levels would occur, and 2) no changes in the availability of large, emergent trees would be expected.

- ***Cumulative Effects to Bald Eagles of Action Alternative C***

  Nesting bald eagles would continue to experience varying levels of disturbance from the ongoing recreational use of the vicinity, as well as any ongoing timber harvesting. Additionally, human developments on private lands and the disturbance associated with the Highway 83 corridor would continue to provide potential sources of disturbance to the territory. Any potential disturbance and/or noise from the proposed harvesting would be additive to any of these other forms of disturbance; however, no changes in bald eagle behavior would be anticipated. Emergent trees exist across ownerships in the home range. Thus, minor cumulative effects to affect bald eagles would be anticipated since: 1) disturbance would be elevated within the territory during harvesting operations; 2) no changes in human access within the territory would occur; and 3) negligible changes in the availability of large, emergent trees would be expected.

➢ **Fisher**

Issue

The proposed activities could reduce the amount and/or quality of fisher habitats, which could alter fisher use of the area.

Introduction

Fishers are a mid-sized forest carnivore whose prey includes small mammals such as voles, squirrels, snowshoe hares, and porcupines, as well as birds (*Powell and Zielinski 1994*). They also take advantage of carrion and seasonally available fruits and berries (*Foresman 2001*). Fishers use a variety of successional stages, but are disproportionately found in stands with dense canopies (*Powell 1982, Johnson 1984, Jones 1991, Heinemeyer and Jones 1994*) and avoid openings or young forested stands (*Buskirk and Powell 1994*). However, some use of openings may occur for short hunting forays or if sufficient overhead cover (shrubs, saplings) is present. Fishers appear to be highly selective of stands that contain resting and denning sites and tend to use areas within 150 feet of water (*Jones 1991*). Resting and denning sites are found in cavities of live trees and snags, downed logs, brush piles, mistletoe brooms, squirrel and raptor nests, and holes in the ground. Forest-management considerations for fisher involve providing resting and denning habitats near riparian areas while maintaining travel corridors.

Analysis Area

Direct and indirect effects were analyzed for activities conducted in the project area. Cumulative effects were analyzed on the Goat Creek, Lion Creek, Porcupine-Woodward, and South Fork Lost Soup grizzly bear subunits (per *ARM 36.11.440[1][a]*). Each of these analysis areas includes enough area to approximate overlapping home ranges of male and female fishers (*Heinemeyer and Jones 1994*).

Analysis Methods

To assess potential fisher habitat and travel cover on DNRC lands in the cumulative effects analysis area, sawtimber stands in preferred fisher covertypes (*ARM 36.11.403[60]*) below 6,000 feet in elevation with 40-percent or greater canopy closure

were considered potential fisher habitat. Fisher habitat was further divided into upland and riparian-associated areas, depending on the proximity to streams and stream classification. Direct and indirect effects were analyzed using field evaluations and *GIS* analysis of potential habitat. Cumulative effects were analyzed using field evaluations and *GIS* analysis of potential habitat; habitats on other ownerships within the cumulative effects analysis areas were evaluated using aerial photographs and USDA remotely-sensed data. Factors considered include the amount of suitable fisher habitats, landscape connectivity, and human access.

Existing Environment

The project area ranges from 3,120 to 6,080 feet in elevation, with nearly 40 miles of perennial streams and roughly 13 miles of intermittent streams. DNRC manages preferred fisher covertypes within 100 feet of Class 1 and 50 feet of Class 2 streams, so that at least 75 percent of the acreage (trust lands only) would be in the sawtimber size class in moderate to well-stocked density (*ARM 36.11.440[1][b][i]*). An estimated 8,045 acres of fisher habitat, potentially suitable for foraging, resting, denning, and travel activities, occur in the upland and riparian areas (7,512 upland acres and 533 riparian acres) in the project area. Much of the riparian areas in the project area are preferred fisher covertypes (64 percent), and much of the preferred fisher covertypes (533 of 630 acres, or 85 percent) are moderately or well-stocked and likely support the structural features necessary for use as fisher resting and denning habitats in addition to serving as travel habitats and maintaining landscape connectivity. Connectivity in the project area is relatively intact (see *CONNECTIVITY* in this *WILDLIFE ANALYSIS*). Motorized human access to the project area that could expose fisher to trapping pressure is rather widespread with numerous open roads; nonmotorized access exists on a fairly extensive network of restricted roads.

Within the individual cumulative effects analysis areas, between 1,403 and 2,327 acres of riparian areas are associated with 32 to 100 miles of perennial streams and 27 to 66 miles of intermittent streams (*TABLE III-70 – RIPARIAN HABITATS-CUMULATIVE EFFECTS ANALYSIS AREA*. Within the cumulative effects analysis areas, between 82.2 and 96.9 percent of the DNRC acreage in preferred fisher covertypes in the riparian areas currently supports moderate- to well-stocked densities of sawtimber; thus, each of the cumulative effects analysis areas exceed the 75-percent threshold established in *ARM 36.11.440(1)(b)(i).* Additionally, within the cumulative effects analysis areas, between 70.1 and 85.3 percent of the uplands on DNRC lands in preferred fisher covertypes currently support moderate- to well-stocked densities of sawtimber, indicating potential upland fisher habitats. In the cumulative effects analysis areas, several recently completed or ongoing salvage/sanitation projects (such as the *Winter Blowdown, Low Wood 2, Micro Goat, Lucky Logger, Luckow Lodgepole 612, Lodgepole 2, Shay Post and Pole2* and *Shay Post and Pole 3*) altered upland fisher habitats; however, no riparian fisher habitats were altered with any of these projects. Additionally, the ongoing harvesting associated with the *White Porcupine Multiple Timber Sale Project* as well as the recently completed *Three Creeks Timber Sale Project* removed approximately 2,341 of upland fisher habitats. Ongoing precommercial thinning could alter stand conditions in preferred

covertypes on 228 acres, but would not occur in areas presently considered as fisher habitat due to the existing age and structure of those stands. Based on interpretation of aerial photographs and USDA remotely-sensed data for the larger cumulative effects analysis areas, between 6,228 and 15,222 acres of adjacent lands provide forested habitats with greater than 40-percent canopy closure, providing stand conditions that could support fisher habitat. The remaining 5,316 to 12,287 acres are comprised of younger stands, sparsely vegetated stands, and natural openings that do not meet structural requirements for fishers. In the Lion Creek cumulative effects analysis area, ongoing activities on USFS lands associated with the *Lion Creek Mountain Pine Beetle Project* could alter some upland habitats, but would maintain important riparian fisher habitats; no other activities are occurring on USFS lands in the Goat Creek, Porcupine Woodward, or South Fork Lost Soup cumulative effects analysis areas (*J. Dunham, USFS, personal communication September 14, 2011*). Within the individual cumulative effects analysis areas, some future logging could occur on lands currently owned by The Nature Conservancy in conjunction with their 10-year *Fiber Supply Agreement* with Plum Creek. However, currently, activity is not planned in the near term (*M. Mantas, TNC, personal communication August 24, 2011*). Landscape connectivity in the cumulative effects analysis areas is fairly intact, but has been diminished in places (see *CONNECTIVITY* in this *WILDLIFE ANALYSIS*). Additionally, open roads provide motorized human access to the project area, and nonmotorized access exists on a fairly extensive network of restricted roads; however, motorized access is limited to administrative uses on restricted roads, and relatively large areas are free of motorized access open to the public (see *SECURITY HABITAT* under *GRIZZLY BEAR* in this *WILDLIFE ANALYSIS).*

TABLE III-70 – RIPARIAN HABITATS - CUMULATIVE EFFECTS ANALYSIS AREA.
Miles of perennial and intermittent streams as well as riparian acres[1] for each of the cumulative effects analysis areas.

CUMULATIVE EFFECTS ANALYSIS AREAS	MILES OF PERENNIAL STREAMS	MILES OF INTERMITTENT STREAMS	RIPARIAN ACRES[1]
Goat Creek	42	40	1,403
Lion Creek	32	66	1,565
Porcupine Woodward	100	27	2,327
South Fork Lost Soup	46	38	1,459

[1]*includes areas within 100 feet of perennial streams and 50 feet of intermittent streams.*

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Fishers***

  No effects to fishers would be expected under this alternative. Little change to the 8,045 acres of potential fisher denning and foraging habitats would be expected. Habitats that are conducive to fisher denning and travel may improve over time due to increased tree growth and canopy closure; however, foraging opportunities may decline due to the lack of diversity in habitat, such as edge and younger age-class stands. No changes in snag, snag recruit, or coarse woody debris levels would be anticipated. Landscape connectivity would not change. Motorized human access and potential trapping mortality would be expected to

remain similar to current levels. Thus, no direct and indirect effects would be anticipated that would affect fishers in the project area since: 1) no changes to existing habitats would be anticipated; 2) landscape connectivity would not be altered; 3) no appreciable changes to snags, snag recruits, and coarse woody debris levels would be anticipated; and 4) no changes to human access or the potential for trapping mortality would be anticipated.

- ***Direct and Indirect Effects of Action Alternatives B and C to Fishers***

Of the 8,045 acres of potential fisher habitats in the project area, 1,603 to 1,763 acres would be harvested, with the larger reduction associated with Action Alternative C (*TABLE III-71 – PROJECT AREA FISHER HABITATS)*. In each harvest unit, leave trees, at least 2 large snags, and 10 to 25 tons of coarse woody debris per acre (emphasizing retention of downed logs 15-inch diameter and larger) would be retained, providing some fisher habitat attributes. All Class 1 streams would have a no-harvest buffer of at least 120 feet, with the exception of a short segment along Cedar Creek where harvesting and road construction would occur on roughly 1 acre of riparian fisher habitats to access roughly 120 acres of DNRC lands. Additionally, any potential harvesting within 50 feet of Class 2 streams, would not reduce canopy closure below 40 percent, so fisher habitats in those areas would be modified, but would continue to meet structural requirements for use by fisher after the proposed harvesting. Therefore, those habitats in the riparian areas adjacent to the Class 1 and 2 streams in the project area that are conducive to fisher denning, foraging, or traveling would continue to provide these attributes for fishers. Upland habitats, which are less frequently used by fisher, would be harvested with both action alternatives leading to reduced quantity and quality of fisher habitats on 1,602 to 1,762 acres, with the larger reduction associated with Action Alternative C (*TABLE III-71 – PROJECT AREA FISHER HABITATS*). Proposed harvesting would reduce canopy closure to less than 40 percent and remove understory vegetation to provide for seedling establishment. Since fishers avoid stands with less than 40 percent canopy closure (*Jones 1991*) and areas that lack overhead cover (*Buskirk and Powell 1994*), these silvicultural prescriptions would result in a loss of habitat for 50 to 80 years. However, after regeneration of conifer trees starts providing overhead cover, some use by fisher could occur for foraging. Retention of snag-recruitment trees and a minimum of 2 large snags per acre could provide denning or resting sites between the time the stands develop overhead cover and when the stands develop to a point of starting to produce large snags again. As stands mature in 50 to 80 years, canopy cover and additional structure in the form of large trees, snags, and coarse woody debris would reestablish. Additionally, in these regeneration units, a number of unharvested patches of at least 1.6 acres would be retained so that no point of the unit exceeds 600 feet to cover as required under the *SVGBCA*; these patches could aid fisher movements in the future if left unharvested. Minor changes in covertypes (see *COVERTYPE* in this *WILDLIFE ANALYSIS*) associated with the proposed treatments would, through time, provide slight increases in the amount of preferred fisher

covertypes in the project area by 6 to 339 acres, with the greatest improvement associated with Action Alternative C (*TABLE III-71 – PROJECT AREA FISHER HABITATS*). Forest connectivity around the openings created with either alternative would be largely maintained through riparian buffers and other forested habitats not altered in the project area, but overall connectivity would be reduced to varying levels depending on the alternative (see *CONNECTIVITY* in this *WILDLIFE ANALYSIS*). Negligible changes to potential human-disturbance levels or potential for trapping mortality would be expected because open-road densities would not change, but the existence of closed roads might facilitate some increases in trapping pressure; both action alternatives would add additional closed roads to the existing network of roads, with the larger amount added with Action alternative C. Thus, minor adverse direct and indirect effects would be anticipated under both action alternatives that would affect fishers in the project area since: 1) harvesting would largely avoid riparian areas, and any harvesting associated with Class 2 streams would maintain sufficient cover so that current levels of fisher use would likely continue; 2) harvesting would reduce or remove upland fisher habitats and mature upland stands in preferred covertypes; 3) motorized human-access levels, particularly in riparian areas, and trapping mortality potential would not change; 4) harvesting would reduce snag and coarse woody debris levels; however, some of these resources would be retained; 5) landscape connectivity would be altered, but those areas associated with riparian areas would remain largely unaffected; and 6) minor amounts of the project area would be converted to preferred fisher covertypes.

TABLE III-71 – PROJECT AREA FISHER HABITATS. *Acres of habitats modified or removed as a result of each alternative, acres of fisher habitats following the proposed harvesting, and changes in preferred fisher covertypes available in the project area.*

FISHER HABITAT PARAMETER		ALTERNATIVES		
		NO-ACTION	ACTION	
		A	B	C
Acres of habitat removed and (percentage) of fisher habitats in the project area [1, 2]	Upland	0	1,602 (21.3)	1,762 (23.5)
	Riparian	0	1	1
Acres and (percentage) of fisher habitat in the project area following implementation of each alternative	Upland	7,512 (100)	5,910 (78.7)	5,750 (76.5)
	Riparian	533 (100)	532 (99.8)	532 (99.8)
Acres of upland preferred covertypes removed		0	8	9
Acres of upland preferred covertypes to develop with stand covertype conversions[2]		0	6	338

[1] *Following proposed harvesting, canopy closure would likely be less than 40 percent.*

[2] *Covertype conversions would lead to the establishment of additional acres in preferred covertypes after implementation of any action alternative.*

- ***Cumulative Effects of No-Action Alternative A to Fishers***

  Fisher habitats, preferred covertype stocking, and habitat connectivity in the project area would remain relatively unchanged in the short term. Fisher habitats on DNRC lands in each of the cumulative effects analysis areas would remain between 70.1 and 85.3 percent in the uplands and between 82.2 and 96.9 percent in the riparian areas. Road access in the cumulative effects analysis areas would not change; therefore, human disturbance and fisher vulnerability to trapping would remain unchanged. In the longer term, available fisher habitats in the uplands and riparian areas would increase as stands develop more overhead cover. Resting/denning structure would also develop as trees increase in size, die, and fall to the ground. Landscape connectivity would not change appreciably, but successional advances could provide slight improvements in connectivity in the cumulative effects analysis areas. Thus, minor positive cumulative effects to fishers would be anticipated in the cumulative effects analysis areas since: 1) no changes to existing habitats on DNRC ownership would occur; 2) landscape connectivity afforded by the stands on DNRC ownership would not appreciably change; 3) no changes to snags, snag recruits, or coarse woody debris levels would be expected; and 4) no changes to human access or the potential for trapping mortality would be anticipated.

- ***Cumulative Effects to Fishers Common to Action Alternatives B and C***

  Both action alternatives would harvest upland fisher habitats while reducing snags, and increasing coarse woody debris and the amount of preferred fisher covertypes. Available fisher habitat in the uplands would decline by up to 16.7 to 18.7 percent on DNRC lands in each of the cumulative effects analysis areas, with the larger reduction associated with Action Alternative C (*TABLE III-72 - FISHER HABITATS - CUMULATIVE EFFECTS ANALYSIS AREAS*). Negligible reductions in riparian habitats due to the proposed road construction near Cedar Creek would occur with both action alternatives. Within the individual cumulative effects analysis areas, between 82.2 and 96.9 percent of preferred fisher covertypes on DNRC lands would continue providing structural features that could facilitate fisher use, which would continue to exceed the 75-percent threshold established in *ARM 36.11.440(1)(b)(i)*. Slight increases in preferred fisher covertypes over time on DNRC lands would be possible with the proposed treatments converting the covertypes of some stands in the project area. Any reductions in fisher habitats would be additive to past losses associated with timber harvesting in the cumulative effects analysis areas; however, limited riparian fisher habitats (83 acres associated with *Three Creeks Timber Sale*) were altered with these projects. Additionally, habitat connectivity would be maintained across a number of residual stands, along the streams, and on some ridges.

  Any habitats that exist on adjacent ownership within the 6,228 to 15,222 acres of forested stands with greater than 40-percent canopy closure would not be expected to change appreciably. Through time, some of the 5,316 to 12,287 acres of younger stands, sparsely vegetated stands, and natural openings that do not

meet structural requirements for fishers could start to provide those attributes as the stands continue developing. Reductions in fisher habitats associated with either of these alternatives would be additive to past losses of habitat across all ownerships. A range of 4.9 to 8.2 miles of new roads would be constructed, with the larger amount being constructed with Action Alternative C. Motorized access in conventional passenger vehicles that could increase fisher vulnerability to trapping would not be expected to change under any action alternative; however, given that the fisher trapping season overlaps the winter months when snowmobiles could access these newly constructed roads, as well as the 48 to 80 miles of roads to be improved and/or maintained, some minor increases in motorized human access would be possible during the fisher trapping season, which could increase fisher vulnerability to trapping. However, these newly constructed roads would largely avoid riparian habitats where fishers are more commonly found. Thus, minor cumulative effects would be anticipated that would affect fisher in the project area since: 1) harvesting would remove upland fisher habitats and mature upland stands in preferred fisher covertypes, but considerable upland habitats would persist; 2) negligible changes to fisher habitats associated with the riparian areas in the cumulative effects analysis areas would be anticipated; 3) landscape connectivity would be reduced, but not to a level that would appreciably disrupt fisher movements; 4) harvesting would partially reduce snags and snag recruits, while increasing the coarse woody debris levels, largely in the smaller-sized pieces; 5) no appreciable changes to motorized human access, but slight increases in snowmobile access might increase fisher vulnerability to trapping mortality; and 6) minor increases in the amount of preferred covertypes on DNRC lands in the cumulative effects analysis areas would be anticipated.

TABLE III-72 - FISHER HABITATS – CUMULATIVE EFFECTS ANALYSIS AREAS. *Acres of preferred covertypes and fisher habitats on DNRC-managed lands in the cumulative effects analysis areas following each alternative.*

FISHER HABITAT PARAMETER	CUMULATIVE EFFECTS ANALYSIS AREA	Existing Condition	ALTERNATIVES		
			A-No Action	B	C
Acres of upland fisher habitats (percent change)	Goat Creek Lion Creek Porcupine Woodward South Fork Lost Soup	2,498 1,529 5,582 8,607	2,498 (0) 1,529 (0) 5,582 (0) 8,607 (0)	2,080 (16.7) 1,529 (0.0) 5,428 (2.8) 7,577 (12.0)	2,032 (18.7) 1,480 (3.2) 5,428 (2.8) 7,514 (12.7)
Acres of preferred covertype in uplands (percent change)	Goat Creek Lion Creek Porcupine Woodward South Fork Lost Soup	3,510 1,792 8,657 12,011	3,510 (0) 1,792 (0) 8,657 (0) 12,011 (0)	3,593 (2.4) 1,819 (1.5) 8,681 (0.3) 12,215 (1.7)	3,419 (2.6) 1,792 (0.0) 8,657 (0.0) 12,108 (0.8)
Percentage of upland preferred covertypes providing habitat (percent change)	Goat Creek Lion Creek Porcupine Woodward South Fork Lost Soup	71.2 85.3 70.1 76.2	71.2 (0) 85.3 (0) 70.1 (0) 76.2 (0)	57.9 (13.3) 84.1 (1.2) 62.5 (7.6) 62.0 (14.2)	59.4 (11.8) 82.3 (3.0) 62.7 (7.4) 62.1 (14.1)
Acres of riparian fisher habitats (percent change)	Goat Creek Lion Creek Porcupine Woodward South Fork Lost Soup	150 82 490 545	150 (0) 82 (0) 490 (0) 545 (0)	150 (0) 82 (0) 489 (0.2) 545 (0)	150 (0) 82 (0) 489 (0.2) 545 (0)
Acres of preferred covertype in riparian area (percent change)	Goat Creek Lion Creek Porcupine Woodward South Fork Lost Soup	170 84 564 663	170 (0) 84 (0) 564 (0) 663 (0)	170 (0) 84 (0) 563 (0.2) 663 (0)	170 (0) 84 (0) 563 (0.2) 663 (0)
Percentage of riparian preferred covertypes providing habitat (percent change)	Goat Creek Lion Creek Porcupine Woodward South Fork Lost Soup	88.3 96.9 86.9 82.2	88.3 (0) 96.9 (0) 86.9 (0) 82.2 (0)	88.3 (0) 96.9 (0) 86.9 (0) 82.2 (0)	88.3 (0) 96.9 (0) 86.9 (0) 82.2 (0)

- ***Flammulated Owl***

Issue

The proposed activities could alter flammulated owl habitat by reducing canopy closure and increasing tree spacing, and could remove snags needed by flammulated owls for nesting.

Introduction

Flammulated owls are tiny, migratory, insectivorous forest owls that inhabit old, open stands of warm-dry ponderosa pine and cool-dry Douglas-fir forests in the western United States and are secondary cavity nesters. In general, preferred habitats have open to moderate canopy closure (30 to 50 percent) with at least 2 canopy layers, and are often near small clearings. They usually nest in cavities excavated by pileated woodpeckers or northern flickers in 12 to 25-inch dbh ponderosa pine, Douglas-fir, or aspen. Without disturbance, Douglas-fir encroach upon ponderosa pine stands, resulting in increased stand density and decreased habitat quality for flammulated owls. Periodic, low-intensity underburns can increase habitat suitability and sustainability by reducing the density of understory seedlings and saplings, stimulating shrub growth, and protecting large dominant trees from ladder fuels and competition with other mature trees.

Analysis Area

Direct and indirect effects were analyzed for activities conducted in the project area. Cumulative effects were analyzed in the 65,682-acre area encompassing the entirety of the Swan River State Forest and intermingled checkerboard lands of differing ownerships. This area includes enough area to support several pairs of flammulated owls (*McCallum 1994*).

Analysis Methods

To assess potential flammulated owl habitat on the project area, *SLI* data were used to identify stands in preferred habitat types (*ARM 36.11.403(28)*). Direct and indirect effects, as well as cumulative effects, were analyzed using a variety of information obtained from field evaluations, aerial-photograph interpretation, USDA remotely-sensed data, and a *GIS* analysis of available habitats. Factors considered within the cumulative effects analysis area included the degree of harvesting and the amount of continuous forest within the cumulative effects analysis area.

Existing Environment

The stands in the project area are largely dominated by western larch/Douglas-fir, mixed conifers, and lodgepole pine, and contain some ponderosa pine stands along with some dry Douglas-fir types. In the project area, there are approximately 1,196 acres of potential flammulated owl habitat. During field reviews, approximately 1.8 (range 0 to 13.2) large-sized (greater than 21 inches dbh) snags per acre were observed in the project area (see *SNAGS AND COARSE WOODY DEBRIS* in this *WILDLIFE ANALYSIS*).

Presently, roughly 1,639 acres of potential flammulated owl habitat (4 percent of the larger cumulative effects analysis area) exists on DNRC lands in the cumulative effects analysis area, with the majority of these habitats (73 percent) being in the project area. Some potential flammulated owl habitats also likely exist on a portion of the 13,377 acres of open-forest and closed-forest habitats on other ownerships in the cumulative effects analysis area. Existing and regenerating forested stands are largely dominated by western larch/Douglas-fir and mixed-conifer covertypes. A portion of those habitats in the project area and cumulative effects analysis area have been harvested in the recent past, potentially improving flammulated owl habitat by creating foraging areas and reversing a portion of the Douglas-fir and ponderosa pine encroachment. Modern fire suppression has allowed Douglas-fir ingrowth to create denser stands of ponderosa pine and Douglas-fir in portions of the cumulative effects analysis area, which has reduced habitat quality for flammulated owls. Recently completed sanitation/salvage activities associated with the *Micro Goat* (100 acres) and *Retreat* (1 acre) permits altered flammulated owl habitat. No USFS projects are planned or in progress that would alter flammulated owl habitat within the 65,682-acre cumulative effects analysis area (*J. Dunham, USFS, personal communication September 14, 2011*). Within the 65,682-acre cumulative effects analysis area, some future logging could occur on lands currently owned by The Nature Conservancy in conjunction with their 10-year *Fiber Supply Agreement* with Plum Creek. However, there are no current plans for activity in the near term (*M. Mantas,*

TNC, personal communication August 24, 2011). Collectively, the flammulated owl habitats in the cumulative effects analysis area are somewhat limited.

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Flammulated Owls***

  Existing flammulated owl habitat in the project area would continue maturing; likewise, younger stands from past harvesting would also mature and become more dense, which would reduce the quality of this area for foraging owls. In the long-term, stands once dominated by ponderosa pine could continue to be converted to Douglas-fir stands through succession, become densely stocked, and exist at high risk to insects, diseases, and stand-replacement fire. Therefore, habitat sustainability and quality for flammulated owls would continue to decline. Thus, minor adverse direct and indirect effects would be expected to affect flammulated owls in the project area since: 1) no harvesting would occur; 2) no changes in the number of large snags or recruitment trees important for nest sites would be anticipated in the short-term; and 3) long-term, succession-related declines in foraging habitats coupled with advancing succession leading to denser stands could further degrade existing habitat and reduce the sustainability of large dominant trees preferred by owls for nesting, but on relatively few affected acres.

- ***Direct and Indirect Effects of Action Alternatives B and C to Flammulated Owls***

  Proposed timber harvesting would open the canopy while favoring ponderosa pine on between 46 and 208 acres of potential flammulated owl habitat, with the greater amount of habitat modification associated with Action Alternative C. Elements of the forest structure important for nesting flammulated owls, including snags (a minimum of 2 snags per acre greater than 21 inches dbh where they exist, otherwise the next largest size class), numerous leave trees, and snag recruits (greater than 21 inches dbh where they exist, otherwise the next largest size class) would be retained in the proposed units. Some large snags would likely be removed due to safety and/or logistical concerns (see *SNAGS AND COARSE WOODY DEBRIS* in this *WILDLIFE ANALYSIS*), which could further degrade flammulated owl habitat on some sites into the future. The resulting more open stand conditions, the retention of fire-adapted tree species, and the maintenance of snags would move treated portions of the project area toward historical conditions, which is preferred flammulated owl habitat. Thus, minor positive direct and indirect effects to flammulated owls in the project area would be expected since: 1) harvesting would open up dense stands on a relatively small amount of suitable ponderosa pine and dry Douglas-fir stands; 2) elements of forest structure (snags and snag recruits) used for foraging and nesting by flammulated owl would be retained; 3) prescriptions would lead to more open stands with scattered mature ponderosa pine in a relatively small amount of the project area; and 4) prescriptions would promote future development of ponderosa pine in a relatively small portion of the project area that may be suitable for flammulated owls.

- ***Cumulative Effects of No-Action Alternative A to Flammulated Owls***

  Existing flammulated owl habitat in the cumulative effects analysis area would continue to persist. No other projects are proposed or are occurring on DNRC lands in the cumulative effects analysis area that would be altering flammulated owl habitat. Similarly, no other activities are known to be occurring or are proposed on other ownerships in the cumulative effects analysis area. Potential habitats that exist on the portions of the 22,377 acres of closed and open forest on non-DNRC lands in the cumulative effects analysis area would be expected to persist. Other portions of the cumulative effects analysis area that are not currently providing quality flammulated owl habitat are not expected to change any time in the foreseeable future. Collectively, stands would continue to mature and become more densely stocked, which would reduce habitat quality for flammulated owls. Thus, negligible adverse cumulative effects would be expected to affect flammulated owls in the cumulative effects analysis area since: 1) no harvesting would occur; 2) no changes or improvements to potential habitat would be anticipated; and 3) long-term, succession-related declines in habitat coupled with advancing succession leading to denser stands would occur, which could further degrade existing habitat and reduce the sustainability of large dominant trees preferred by owls for nesting, but on a small number of acres of potentially suitable habitat in the cumulative effects analysis area.

- ***Cumulative Effects to Flammulated Owls Common to Action Alternatives B and C***

  Proposed harvesting would increase the amount of the cumulative effects analysis area that has been recently harvested by 46 acres (Action Alterative B) or 208 acres (Action Alternative C), which would add to the amount of potential habitat available, but possibly at the expense of losing valuable snags and large trees important for nesting. No other projects on DNRC lands in the cumulative effects analysis area would alter flammulated owl habitat. No other activities are known to be occurring or are proposed on other ownerships in the cumulative effects analysis area that would alter flammulated owl habitat. Potential habitat that exists on the portions of the 22,377 acres of closed and open forest on non-DNRC lands in the cumulative effects analysis area would be expected to persist. Overall a slight improvement in habitat quality at the cumulative effects analysis level could be realized with this alternative. The portions of the cumulative effects analysis area not currently providing flammulated owl habitats would not be expected to change any time in the future. Collectively, stands would continue to mature and become more densely stocked, which would reduce habitat quality for flammulated owls. Thus, negligible beneficial cumulative effects would be expected to affect flammulated owls in the cumulative effects analysis area since: 1) harvesting would improve the quality and sustainability of flammulated owl habitat on a small number of acres (46 acres with Action Alternative B or 208 acres with Action Alternative C); and 2) a small increase in the amount of the cumulative effects analysis area would be more representative of historic conditions.

- **Gray Wolf**

Issues

Prey availability

The proposed activities could result in reduced habitat quality on winter range for white-tailed deer and elk, which could lead to reduced prey availability and reduce the potential for the area to support a wolf pack.

Disturbance at den and rendezvous sites

The proposed activities could result in disturbance of wolves at denning or rendezvous sites, which could lead to pup abandonment and/or increased risk of mortality.

Disturbance and wolf-human conflicts

The proposed activities could result in increased human disturbance and the potential for wolf-human conflicts that could alter wolf use of suitable habitats.

Introduction

The gray wolf was listed as 'endangered' under the *Endangered Species Act* in the northern portion of Montana, which includes the project area. The gray wolf was delisted on March 28, 2008; however, a preliminary injunction (July 18, 2008) led to the relisting of wolves in this area as 'endangered.' Following the injunction, the USFWS requested that the court allow them to voluntarily withdraw its decision to delist wolves and reevaluate information and make a new decision, which was granted (October 14, 2008). The USFWS then delisted the gray wolf (May 4, 2009), and a recent federal ruling (August 8, 2010) re-instated the 'endangered' classification for gray wolves under the *Endangered Species Act*. To meet the delisting criteria, the 3 recovery areas need to support a minimum of 30 breeding pairs for 3 consecutive years. The 3 recovery zones have met the recovery objectives for breeding pairs since 2000. In 2010, 111 of the 244 documented packs in the tri-state region met the definition of a `breeding pair'(*USFWS et al. 2011*). Of those 111 packs, 35 occurred in Montana, with 21 of those found in the northern Montana portion of the recovery area, along with 47 additional packs that did not meet the requirements to be considered a 'breeding pair' (*Sime et al. 2011*).

Wolves are a wide-ranging, mobile species. Adequate habitat for wolves consists of areas with adequate prey and minimal human disturbance, especially at den and/or rendezvous sites. Several different wolf packs (Cilly, Condon, and Squeezer) have been thought to potentially be in the vicinity of the project area in the recent past; regardless of the name(s) applied to these social groups, wolves have been documented in the project area each of the last several years and are expected to continue using the project area and cumulative effects analysis area into the future.

The *Northern Rocky Mountain Wolf Recovery Plan* (*USFWS 1987*) identified the key components of wolf habitat as: 1) a sufficient, year-round prey base of ungulates (big game) and alternate prey; 2) suitable and somewhat secluded denning and rendezvous sites; and 3) sufficient space with minimal exposure to humans.

Prey Availability

Wolves are opportunistic carnivores that frequently take vulnerable prey (including young individuals, older individuals, and individuals in poor condition). In general, wolf densities are positively correlated to prey densities (*Oakleaf et al. 2006, Fuller et al. 1992*). Wolves prey primarily on white-tailed deer and, to a lesser extent, elk and moose, in northwest Montana (*Kunkel et al. 1999*). However, some studies have shown that wolves may prey upon elk more frequently during certain portions of the year (particularly winter) or in areas where elk numbers are higher (*Arjo et al. 2002, Kunkel et al. 2004, Garrott et al. 2006*). Thus, reductions in big game populations and/or winter range productivity could indirectly be detrimental to wolf populations.

Disturbance at den and rendezvous sites

Wolves typically den during late April in areas with gentle terrain near a water source (valley bottoms), close to meadows or other openings, and near big game wintering areas. When the pups are 8 to 10 weeks old, wolves leave the den site and start to leave their pups at rendezvous sites while hunting. These sites are used throughout the summer and into the fall. When the pups are 5 to 6 months old, they start traveling with the pack (*DFWP 2003a*). Disturbance at den or rendezvous sites could result in avoidance of these areas by the adults or force the adults to move the pups to a less adequate site. In both situations, the risk of pup mortality increases.

Disturbance and wolf-human conflicts

One of the primary risks to gray wolves in northwestern Montana is human-wolf conflicts, including control actions to resolve conflicts with livestock, legal and illegal killings, and car/train collisions (*DFWP 2003a*). Besides disturbance at den and rendezvous sites, disturbance can disrupt wolves and/or big game prey species, emphasizing the need for areas with lower human disturbances. Therefore, activities that lead to increased human presence in wolf habitats could alter wolf use of suitable habitats and reduce overall habitat quality.

Analysis Area

Direct and indirect effects were analyzed for activities conducted in the project area. Cumulative effects for the prey availability component were analyzed in the 65,682-acre area encompassing the entirety of the Swan River State Forest and intermingled checkerboard lands of differing ownerships, and the disturbance components were analyzed on each of the subunits that include portions of the project area, including the Goat Creek, Lion Creek, Porcupine-Woodward, and South Fork Lost Soup grizzly bear subunits. Each of these cumulative effects analysis areas approximates the amount of area that a wolf pack may use during the summer months while raising their pups (*Mech 1987, Ream et al. 1988*). Outside the denning and rearing period, the pups travel with the pack and home ranges can expand greatly (*DFWP 2003a, USFWS et al. 2011*). More information regarding the grizzly bear subunits can be found under *GRIZZLY BEAR* in this analysis.

Analysis Methods

Prey availability

Since changes in winter range could have a sizable effect on the availability of prey for wolves, this section tiers to the *BIG GAME WINTER RANGE* section of this analysis. Direct and indirect, as well as cumulative effects, were analyzed using field evaluations, aerial-photograph interpretation, and a *GIS* analysis of habitat components. Factors considered in the analysis include the amount of winter range altered due to cover removal, amount of mature forested habitats retained on the winter range, and level of human disturbance. More specifics can be found under *BIG GAME* in this analysis.

Disturbance at den and rendezvous sites

Direct, indirect, and cumulative effects were determined qualitatively following a review of known den and rendezvous sites in the cumulative effects analysis area. Since these sites are important during certain portions of the year, timing of proposed activities in relation to these sites is also important. Factors considered include the timing and proximity of any activities in relation to any known den or rendezvous sites.

Disturbance and wolf-human conflicts

Open-road density and hiding-cover analyses from the *GRIZZLY BEAR* section provide the basis for this section since open roads facilitate human access, which can lead to disturbance of wolves and/or wolf-human conflicts. The hiding-cover component analyzed for grizzly bears was considered a relevant and reasonable parameter for evaluating human-conflict risk in Swan Valley for gray wolves as well. Factors considered in the analysis include the amount of hiding cover available and open-road densities (and associated human disturbance). More specifics can be found under *GRIZZLY BEAR* in this analysis.

Existing Environment

Prey availability

Big game species are abundant in the project area and the cumulative effects analysis area. Big game winter range is also fairly common in the project area and cumulative effects analysis area (see *WINTER RANGE* under *BIG GAME* in this *WILDLIFE ANALYSIS*). In the cumulative effects analysis area, 30,925 acres of white-tailed deer and 38,102 acres of elk winter range exist (see *WINTER RANGE* under *BIG GAME* in this *WILDLIFE ANALYSIS*), as well as numerous meadows and other openings near water. Past harvesting, human developments, and road construction on all ownerships in the cumulative effects analysis area has altered big game and wolf habitats; however, these activities have likely had negligible effects to wolves or their prey. Appreciable amounts of mature, forested habitats exist in the winter range. Low to moderate levels of human disturbance in winter likely affect big game on the winter range. Many of the ongoing or recently completed projects identified in the list of other relevant DNRC actions have altered big game or wolf habitats or affected these same species. While individual wolves, deer, or elk may be affected, minor to negligible effects would be anticipated at the population level.

Habitats for big game and wolves also likely exist on much of the 22,377 acres of open-canopied forest and dense closed forest as well as a portion of the 3,578 acres of various nonforested habitats on other ownerships in the cumulative effects analysis area. No USFS projects are planned or in progress that would alter big game winter range within the 65,682-acre cumulative effects analysis area (*J. Dunham, USFS, personal communication September 14, 2011*). Within the 65,682-acre cumulative effects analysis area, some future logging could occur on lands currently owned by The Nature Conservancy in conjunction with their 10-year *Fiber Supply Agreement* with Plum Creek. However, currently, activity is not planned in the near term (*M. Mantas, TNC, personal communication August 24, 2011*). Additionally, the proposed development near Metcalf Lake on private lands, as well as any other developments on other ownerships, could increase disturbance levels in a portion of the big game winter range, which could affect wolf prey species.

Disturbance at den and rendezvous sites

Landscape features commonly associated with denning and rendezvous sites occur in the project area and each of the cumulative effects analysis areas. No den or rendezvous sites are known to exist in the project area or cumulative effects analysis areas (*K. Laudon, MT FWP, personal communication July 28, 2011*), but given the uncertainty associated with the wolves in the area and the presence of favorable landscape features, the assumption could be that both den and rendezvous sites likely occur in some portion of the project area or cumulative effects analysis areas. In the Lion Creek cumulative effects analysis area, ongoing activities on USFS lands associated with the *Lion Creek Mountain Pine Beetle Project* could be disturbing wolves and/or altering habitats for gray wolves or their prey; no other activities are occurring on USFS lands in the Goat Creek, Porcupine Woodward, or South Fork Lost Soup cumulative effects analysis areas (*J. Dunham, USFS, personal communication September 14, 2011*). Within the individual cumulative effects analysis areas, some future logging could occur on lands currently owned by The Nature Conservancy in conjunction with their 10-year *Fiber Supply Agreement* with Plum Creek. However, there are no current plans for activity in the near term (*M. Mantas, TNC, personal communication August 24, 2011*). Additionally, the proposed development near Metcalf Lake on private lands, as well as any other developments on other ownerships, could increase the potential disturbance at den and/or rendezvous sites with the increased human presence in the area.

Disturbance and wolf-human conflicts

Potential activities that could disturb wolves or cause wolf-human conflicts away from den and rendezvous sites in the project area and cumulative effects analysis areas are largely limited to timber harvesting, general recreation, and any potential for conflicts with human developments on private property. Human activity, generally in the form of dispersed and locally concentrated recreation, ranges from high along Swan River to low along the high elevations of the Mission and Swan divides. Roughly 2.4 miles of open roads provide some motorized public access to the project area. As reported in the *GRIZZLY BEAR section*, 30.1 to 44.9 percent of DNRC lands within the individual cumulative effects analysis areas exceed an open-

road density of 1 mile per square mile *(TABLE III-64 – GRIZZLY BEAR HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA).* In addition, in the individual cumulative effects analysis areas, 67.5 to 214.3 miles of restricted roads provide considerable nonmotorized access. Hiding cover is fairly abundant in the project area (8,801 acres, 56.5 percent; *TABLE III-73 – PROJECT AREA WOLF HABITATS*) and cumulative effects analysis areas (61.4 to 72.3 percent; *TABLE III-74 – WOLF HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA*). In the Lion Creek cumulative effects analysis area, ongoing activities on USFS lands associated with the *Lion Creek Mountain Pine Beetle Project* could be disturbing wolves and/or increasing the potential for wolf-human conflicts; no other activities are occurring on USFS lands in the Goat Creek, Porcupine Woodward, or South Fork Lost Soup cumulative effects analysis areas (*J. Dunham, USFS, personal communication September 14, 2011*). Within the individual cumulative effects analysis areas, some future logging could occur on lands currently owned by The Nature Conservancy in conjunction with their 10-year *Fiber Supply Agreement* with Plum Creek. However, currently, no activity is planned in the near term (*M. Mantas, TNC, personal communication August 24, 2011*). Additionally, the proposed development near Metcalf Lake on private lands, as well as any other developments on other ownerships, could increase the potential for wolf-human conflicts.

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Gray Wolves***

  Prey availability

  No changes in white-tailed deer or elk habitat would be expected during the short-term; therefore, no changes in wolf prey would be anticipated. Continued use of the project area by wolf prey species would be anticipated. Thus, no direct and indirect effects to wolf prey availability in the project area would be anticipated since: 1) no winter range would be altered; 2) existing mature, forested stands providing thermal cover and snow intercept would persist; 3) no subsequent changes in abundance of wolf prey would be anticipated; and 4) human disturbance levels would not change.

  Disturbance at den and rendezvous sites

  No activities would be conducted that could disturb wolves at potential den or rendezvous sites; therefore, no changes to the levels of disturbance to gray wolves at den or rendezvous sites would be anticipated. Wolf use of the project area for denning or rendezvous sites would be expected to continue at current levels. Thus, no direct and indirect effects to gray wolf denning or rendezvous sites in the project area would be anticipated.

  Disturbance and wolf-human conflicts

  No changes in wolf disturbance levels, open road densities, available hiding cover, or the potential for wolf-human conflicts would be anticipated that could alter use of the project area. Wolf use of the project area would be expected to continue at current levels. Thus, no direct or indirect effects associated with wolf disturbance and wolf-human conflicts in the project area would be anticipated.

- ***Direct and Indirect Effects of Action Alternatives B and C to Gray Wolves***

Prey availability

Stand density and mature forested cover would be reduced on 2,010 to 2,636 acres, including approximately 1,197 to 1,314 acres that would be incapable of ameliorating adverse effects of severe winters for big game following the proposed treatments (see *WINTER RANGE* under *WINTER RANGE* in this *WILDLIFE ANALYSIS)*. Reductions in winter-range capabilities would likely alter big game use of the winter range; however, mature, forested stands would generally remain well connected and provide a suitable network of cover capable of facilitating movements of wintering big game. Elevated human-disturbance levels would also alter big game use and subsequent wolf use of the project area when the timber sale is active. Timber harvesting on 1,182 to 1,553 acres would be conducted only during the winter period, as required under the *SVGBCA*, which could disturb and displace wintering big game. Non-winter use by wolves and their prey would be altered with the proposed harvesting of 2,010 to 2,636 acres, with proportionally greater effects anticipated with Action Alternative C. Continued use of the project area by wolves and their prey species would be anticipated following proposed activities. Thus, moderate adverse direct and indirect effects to wolf prey availability would be anticipated that would affect wolves in the project area since: 1) roughly 2,010 to 2,636 acres of mature forested cover, including 1,197 to 1,314 acres of winter range would be removed, reducing the overall amount of forested stands providing thermal cover and snow-intercept capacity in the project area; 2) shifts in habitat use by big game could lead to changes in prey numbers in the project area, which could also lead to shifts in habitat use by wolves; and 3) human-disturbance levels would be elevated during proposed activities.

Disturbance at den and rendezvous sites

Proposed harvesting associated with either action alternative could disrupt wolves at den or rendezvous sites. Between 58.8 and 58.9 percent of the proposed units (1,182 to 1,553 acres) could only be harvested during the grizzly bear denning period (November 16 through March 31). This seasonal restriction would limit the potential for disturbance to wolves during the spring period when they are more susceptible to disturbance at dens and rendezvous sites. In the remaining 828 to 1,083 acres (41.1 to 41.2 percent) of the proposed units that are in the active Goat Creek Subunit or in the South Fork Lost Soup Subunit that would be active in 2015, harvesting could occur during either the denning or non-denning periods (after 2015 in the South Fork Lost Soup Subunit only). However, of those acres, 738 to 786 acres (72.5 to 89.1 percent of the units that could be harvested in the non-denning period) occur in the linkage zone, where harvesting would be precluded during the spring period (April 1 through June 15) due to *SVGBCA* stipulations, thereby further limiting the risk of disturbance to wolves at den sites should they occur in the vicinity. Additionally, should a den site be identified near any of the proposed units, DNRC would temporarily suspend operations within 1.0 mile of the site until wolves are known to have

vacated the site or the determination is made that resumption of activities will not present conflicts with wolf use (*ARM 36.11.430[1][a]*). In those units in the linkage zone (828 to 1,038 acres) with spring restrictions, when harvesting would become active in mid-June, wolves would likely have already moved their pups to rendezvous sites, where human disturbance could also be harmful. If a rendezvous site were located near any proposed harvesting, DNRC would temporarily suspend operations within 0.5 mile of the site until the determination is made that resumption of activities will not present conflicts with wolf use (*ARM 36.11.430[1][b]*). Additionally, DFWP plans to continue monitoring wolves in the vicinity and could provide further information should either of these sites be identified. With these mitigations in place, neither of the action alternatives would be expected to disrupt wolves at key locations. Thus, since disruptions at den and rendezvous sites would be mitigated, minor adverse direct and indirect effects to disturbance levels at dens and rendezvous sites would be anticipated that would affect wolves in the project area for the duration of the proposed project activities (3 to 5 years).

Disturbance and wolf-human conflicts

Disturbance at den and rendezvous sites should be minimized with included mitigations; however, both action alternatives could increase human activities in wolf habitats, thereby increasing the potential for disturbing wolves. The risk of human-wolf conflicts and/or wolf mortality in the project area could be increased through additional human access and reduced hiding cover attributable to new road construction and logging operations. A range of 4.9 to 8.2 miles of new, restricted road would be constructed to harvest the proposed units, with the largest increase in permanent, closed road being associated with Action Alternative C (*TABLE III-73 – PROJECT AREA WOLF HABITATS*). All new roads would be managed as restricted, limiting increases in open-road densities, but facilitating increased non-motorized traffic. Timber harvesting could remove 1,538 or 2,088 acres of hiding cover for 10 to 20 years, depending on the alternative (*TABLE III-73 – PROJECT AREA WOLF HABITATS*). Following proposed harvesting, a moderate amount of hiding cover (ranging from 43 to 47 percent) would still remain in the project area. To mitigate the risks associated with increased human access during logging operations and the reduction of hiding cover, regeneration units would be laid out, so that no point of any unit would be greater than 600 feet to cover, visual screening would be retained between open roads and regeneration units (seedtree and shelterwood), and contractors would not be allowed to carry firearms while on duty. Action Alternative C would alter more hiding cover across a slightly larger and more widespread area, and would construct more new, restricted roads, yielding slightly greater potential for effects than Action Alternative B. Overall, minor adverse direct and indirect effects to wolves associated with disturbance levels and wolf-human conflicts would be anticipated that would affect wolves in the project area since: 1) no changes in open-road densities would be anticipated; 2) newly constructed roads would be closed to the general public, but could

facilitate increased non-motorized human access; 3) hiding cover would be removed, but a sizable amount of hiding cover would be retained in the project area under both action alternatives and a considerable amount of brush and cover would be expected to develop in proposed harvest units within 5 to 10 years; and 4) *SVGBCA* stipulations would mitigate some of the cover losses/conflict issues while the *Forest Management Rules* would mitigate potential disturbance at key denning and rendezvous sites.

TABLE III-73 – PROJECT AREA WOLF HABITATS. *Proposed amounts of hiding cover removed; remaining hiding cover; amount of linear miles of permanent, restricted road construction; and resultant miles of restricted roads expected under each alternative in the project area.*

PARAMETER		ALTERNATIVES		
	EXISTING	NO ACTION	ACTION	
	CONDITION	A	B	C
Acres of hiding cover removed	-	0	1,538	2,088
Acres of hiding cover in the project area and after implementation of each alternative (percent reduction)	8,801	8,801 (0)	7,263 (17.5)	6,713 (23.7)
Linear miles of permanent, open road	28	28	28	28
Linear miles of new permanent, restricted road	-	0	4.9	8.2
Linear miles of permanent restricted road (percent increase)	-	102 (0)	107 (4.9)	110.2 (8.0)

- ***Cumulative Effects of No-Action Alternative A to Gray Wolves***

Prey availability

No changes in prey availability would be anticipated under this alternative. No additional disturbance or displacement would be anticipated in the cumulative effects analysis area. Minimal changes in white-tailed deer and elk habitats would be expected during the short-term; therefore, no changes in wolf prey densities would occur. Continued white-tailed deer and elk use of the winter range and cumulative effects analysis area during the non-winter period would be anticipated, and no changes in wolf use of the cumulative effects analysis area would be expected. Thus, no further cumulative effects to wolf prey availability in the cumulative effects analysis area would be anticipated since: 1) no winter range would be harvested; 2) existing mature, forested stands providing thermal cover and snow intercept would persist; 3) no changes to wolf prey numbers would be anticipated; and 4) human-disturbance levels would not change.

Disturbance at den and rendezvous sites

Under this alternative, no DNRC activities associated with this proposal would be conducted that would affect known den or rendezvous sites during the period when wolves are rearing pups; thus, no further cumulative effects to gray wolf denning or rendezvous sites in the cumulative effects analysis area would be anticipated.

Disturbance and wolf-human conflicts

No changes to wolf disturbance levels, open-road densities, hiding cover, or the potential for wolf-human conflicts would be expected with this alternative. Thus, no further cumulative effects to wolves associated with disturbance or wolf-human conflicts in the cumulative effects analysis area would be anticipated since: 1) no change in disturbance levels or open-road densities would be anticipated; 2) no further changes in available hiding cover would be anticipated; and 3) no increases in the potential for wolf/human conflicts would be anticipated.

- ***Cumulative Effects to Gray Wolves Common to Action Alternatives B and C***

Prey availability

Reductions in the big game winter range capacity would be anticipated with the proposed harvesting of 2,010 to 2,636 acres of winter range, including approximately 1,197 to 1,314 acres that would be incapable of ameliorating adverse effects of severe winters for big game following proposed treatments. Changes in nonwinter habitat use would be possible; however, negligible changes in overall big game numbers would be anticipated with either alternative. Reductions in winter-range capacity and subsequent big game use of the area associated with either of the alternatives would be additive to past reductions from timber harvesting, road building, and human developments. However, temporary concentrations of big game in the proposed harvest units (particularly in winter) would be possible with the increase in available forage from felled tree tops and limbs. Elevated human-disturbance levels on the winter range would be anticipated, which would be expected to displace wintering big game and could cause shifts in wolf use of the project area. Continued big game use of the winter range and cumulative effects analysis area during the nonwinter period would be anticipated, and no appreciable changes in wolf use of the cumulative effects analysis area would be expected. Thus, low-moderate adverse cumulative effects to wolves associated with prey availability would be anticipated, which would affect wolves in the cumulative effects analysis area since: 1) considerable acreage of big game winter range would be harvested, including rendering much of that habitat unable to offset the adverse effects of severe winters; 2) over 4,500 acres of existing mature, forested stands providing thermal cover and snow intercept would persist in the cumulative effects analysis area; 3) negligible changes to wolf prey numbers would be anticipated with the reductions in winter range capacity; and 4) moderate changes in human-disturbance levels during project activities (3 to 5 years) could occur.

Disturbance at den and rendezvous sites

Proposed harvesting associated with either action alternative could disrupt wolves at den or rendezvous sites. Most of the proposed harvesting would occur in the winter period or outside of the time periods when wolves would be using den or rendezvous sites. Additionally, mitigations that would be included with

both alternatives would reduce the risk of potential disturbance to wolves at dens and rendezvous sites, should one be confirmed in any of the cumulative effects analysis areas. Ongoing activities on DNRC lands, as well as any activities that may be occurring on the other ownerships in the cumulative effects analysis areas, could disturb wolves at den and rendezvous sites; however, no den or rendezvous sites are confirmed in the cumulative effects analysis areas. Thus, negligible cumulative effects to gray wolf denning or rendezvous sites would be anticipated that would affect wolves in the cumulative effects analysis areas for 3 to 5 years since: 1) no activities would be conducted near known den or rendezvous sites during the important pup-rearing period; and 2) DNRC employs mitigations to protect these important locations during the seasons of potential use should these locations be identified.

Disturbance and wolf-human conflicts

Both action alternatives could increase human presence in wolf habitats and increase the risk of wolf-human conflicts by increasing the potential for nonmotorized access and reducing hiding-cover values in the project area. Implementation of either action alternative would reduce hiding cover by up to 8.4 or 12.7 percent on DNRC lands in the individual cumulative effects analysis areas, and by up to 3.4 to 4.1 percent across all ownerships in the individual cumulative effects analysis areas for 10 to 20 years, with greater effects being expected with Action Alternative C (*TABLE III-74 – WOLF HABITAT PARAMETERS - CUMULATIVE EFFECTS ANALYSIS AREA*). These reductions in cover would be additive to losses associated with ongoing activities on all ownerships. Despite these reductions, following implementation of either action alternative, a high proportion of hiding cover (from minimums of 58.6 and 59.5 percent of all ownerships) would still remain in the individual cumulative effects analysis areas. Although no threshold levels of hiding cover have been established for wolves, the threshold (i.e., at least 40 percent to be retained in each subunit) developed for grizzly bears (*SVGBCA 1997*) would likely also provide security for wolves.

The presence and maintenance of restricted roads produce a long-term potential for additional disturbance to wolves and increased risk of wolf/human conflicts when compared to areas without road access. These alternatives would increase the amount of restricted roads in the individual cumulative effects analysis areas by up to 4.1 or 5.6 percent, with the larger increases anticipated with Action Alternative C (*TABLE III-74 – WOLF HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA*). No further changes in open roads or their associated potential for wolf-human conflicts on DNRC ownership would occur. Mitigations would be in place to protect denning and rendezvous sites on DNRC ownership should they occur (*ARM 36.11.430[1][a]*) and restrictions on carrying firearms while on duty (*SVGBCA 1997*) would apply across the lands of all *SVGBCA* cooperators, reducing the overall risk to wolves in the individual cumulative effects analysis areas. Collectively Action Alternative C, with fewer activities being confined to the denning period, more road construction, and

larger reductions in hiding cover, would be anticipated to have a larger chance of disturbing wolves. Collectively, minor adverse cumulative effects to wolves associated with increased disturbance levels and risk of wolf-human conflicts would be anticipated that would affect wolves in the cumulative effects analysis area since: 1) no changes in open roads would be anticipated; 2) a moderate amount of hiding cover would be removed; and 3) *SVGBCA* stipulations would mitigate some of the cover losses/conflict issues while the Forest Management Rules would reduce disturbance at denning and rendezvous sites, should they be located.

TABLE III-74 – WOLF HABITAT PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA.
Estimated percentages of hiding cover retained and amounts of linear miles of permanent, restricted road construction that would result following implementation of each alternative.

PARAMETER		Existing Condition	ALTERNATIVES		
			A - No Action	B	C
Percent of hiding cover retained on DNRC-managed lands (percent of subunit changed)	Goat Creek	60.7	60.7 (0)	52.3 (8.4)	48.0 (12.7)
	Lion Creek	55.2	55.2 (0)	55.2 (0.0)	52.4 (2.8)
	Porcupine Woodward	62.0	62.0 (0)	61.5 (0.5)	61.5 (0.5)
	South Fork Lost Soup	68.1	68.1 (0)	62.7 (5.4)	61.5 (6.6)
Percent of hiding cover anticipated to exist on all ownerships (percent reduction)	Goat Creek	61.4	61.4 (0)	59.5 (1.9)	58.6 (2.8)
	Lion Creek	67.2	67.2 (0)	67.2 (0)	66.8 (0.4)
	Porcupine Woodward	72.3	72.3 (0)	72.1 (0.2)	72.1 (0.2)
	South Fork Lost Soup	70.6	70.6 (0)	67.2 (3.4)	66.5 (4.1)
Linear miles of permanent, open road	Goat Creek	23.8	23.8	23.8	23.8
	Lion Creek	27.8	27.8	27.8	27.8
	Porcupine Woodward	32.0	32.0	32.0	32.0
	South Fork Lost Soup	28.0	28.0	28.0	28.0
Linear miles of restricted roads (percent increase)	Goat Creek	130.6	130.6 (0)	130.7 (0)	131.9 (1.0)
	Lion Creek	67.5	67.5 (0)	67.5 (0)	67.7 (0.3)
	Porcupine Woodward	214.3	214.3 (0)	215.1 (0.4)	215.1 (0.4)
	South Fork Lost Soup	96.1	96.1 (0)	100.0 (4.1)	101.5 (5.6)

- ***Pileated Woodpecker***

Issue

The proposed activities could reduce suitable nesting and foraging habitat for pileated woodpeckers, which could alter pileated woodpecker use of the area.

Introduction

Pileated woodpeckers play an important ecological role by excavating cavities that are used in subsequent years by many other species of birds and mammals. Pileated woodpeckers excavate the largest cavities of any woodpecker. Preferred nest trees are western larch, ponderosa pine, cottonwood, and quaking aspen, usually 20 inches dbh and larger. Pileated woodpeckers primarily eat carpenter ants, which inhabit large downed logs, stumps, and snags. *Aney and McClelland (1985)* described pileated nesting habitat as "...stands of 50 to 100 contiguous acres, generally below 5,000 feet in elevation with basal areas of 100 to 125 square feet per acre and a relatively closed canopy." The feeding and nesting habitat requirements, including large snags or decayed trees for nesting and downed wood for feeding, closely tie these woodpeckers to mature forests with late-successional characteristics. The

density of pileated woodpeckers is positively correlated with the amount of dead and/or dying wood in stands (*McClelland 1979*).

Analysis Area

Direct and indirect effects were analyzed for activities conducted in the project area. Cumulative effects were analyzed in the 65,682-acre area encompassing the entirety of the Swan River State Forest and intermingled checkerboard lands of differing ownerships. This scale includes enough area to support several pairs of pileated woodpeckers (*Bull and Jackson 1995*).

Analysis Methods

To assess potential pileated woodpecker nesting habitats on DNRC lands in the cumulative effects analysis area, *SLI* data were used to identify sawtimber stands with more than 100 square feet of basal area per acre, were older than 100 years old, had greater than 40-percent canopy closure, and were occurring below 5,000 feet in elevation. Foraging habitats were defined as areas that did not meet the definition above, but included the remaining sawtimber stands below 5,000 feet in elevation with greater than 40-percent canopy cover. To assess habitat on other ownerships in the cumulative effects analysis area, aerial photographs and USDA remotely-sensed data were interpreted to assess forest stands. Where stands appeared to meet the minimum potential foraging habitat parameters, pileated woodpecker habitat was considered present. Potential foraging and nesting habitat were not differentiated on other ownerships for this analysis due to data limitations. Direct and indirect effects, as well as cumulative effects, were analyzed using a variety of information obtained from field evaluations, aerial photograph interpretation, USDA remotely-sensed data, and these mapped potential habitats. Factors considered included the amount of potential habitat, degree of harvesting, and the amount of continuous forested habitat.

Existing Environment

In the project area, potential pileated woodpecker nesting habitat exists on approximately 4,389 acres. These nesting habitats are dominated by western larch/Douglas-fir and mixed conifers. Additionally, 6,771 acres of sawtimber stands dominated by western larch/Douglas-fir, Engelmann spruce, and mixed conifers, which are potential foraging habitats, exist in the project area, along with approximately 4,228 acres of non-sawtimber-sized stands that are largely western larch/Douglas-fir types, which might provide lower quality foraging habitats. Although nesting habitat is defined differently than foraging habitat, nesting habitat also provides foraging opportunities for pileated woodpeckers.

Removal of large western larch by past timber-harvesting activities has reduced the quality of habitat for pileated woodpeckers. Large live and dead trees are less common than would occur naturally due to these past timber-harvesting activities in portions of the project area. Black cottonwood occurs in some of the riparian areas in the project area. Large (greater than 21 inches dbh) western larch, Douglas fir, western red cedar, and ponderosa pine exist in the project area, which could become suitable nesting sites, and existing Douglas-fir/western larch and mixed-conifer

stands are likely providing foraging habitats. During field reviews, roughly 2.7 (range 0 to 26.4) medium-sized (15 to 20 inches dbh) snags per acre and 1.8 (range 0 to 13.2) large-sized (greater than 21 inches dbh) snags per acre were observed in the project area (see *COARSE WOODY DEBRIS* in this *WILDLIFE ANALYSIS* –). Additionally, during field visits, pileated woodpeckers were seen and heard; many feeding sites and a limited number of old nest sites were observed in the project area as well.

In the cumulative effects analysis area, potential pileated woodpecker nesting habitat exists on approximately 6,079 acres (19.2 percent) of DNRC lands. Similar to the project area, these nesting habitats are dominated by western larch/Douglas-fir and mixed conifers. Additionally, 16,198 acres (51.1 percent) of sawtimber stands dominated by western larch/Douglas-fir, western red cedar, Engelmann spruce, subalpine fir, and mixed conifers exist on DNRC ownership in the cumulative effects analysis area; these stands are potential foraging habitats, along with approximately 6,666 acres (21.0 percent) of nonsawtimber-sized stands in largely western larch/Douglas-fir types that might provide lower quality foraging habitats. Some potential pileated woodpecker habitats also exist on the 22,377 acres of forested habitats on other ownerships in the cumulative effects analysis area. In the cumulative effects analysis area, the recently completed salvage associated with the *Winter Blowdown Salvage Project* (240 acres of mostly blowdown, but approximately 10 acres of dead standing timber is included*), Low Wood 2 Salvage Project* (60 acres), *Lucky Logger Salvage Project* (66 acres), *Lodgepole 2 612 Permit* (31 acres modified) reduced or modified pileated nesting and foraging habitats; however, these projects would retain snags, snag recruits, and coarse woody debris. Additionally, the ongoing harvesting associated with the *White Porcupine Multiple Timber Sale Project* also removed (1,046 acres) and modified (232 acres) pileated woodpecker habitats. Additionally, the ongoing precommercial thinning on 228 acres could beneficially alter future pileated woodpecker habitats by improving the growth of trees and manipulating species composition to favor shade-intolerant species such as ponderosa pine and western larch. No USFS projects are planned or in progress that would alter pileated woodpecker habitats within the 65,682-acre cumulative effects analysis area (*J. Dunham, USFS, personal communication September 14, 2011*). Within the 65,682-acre cumulative effects analysis area, some future logging could occur on lands currently owned by The Nature Conservancy in conjunction with their 10-year *Fiber Supply Agreement* with Plum Creek. However, currently, activity is not planned in the near term (*M. Mantas, TNC, personal communication August 24, 2011*).

Environmental Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Pileated Woodpeckers***

  Forest succession and natural disturbance agents would continue to bring about changes in existing stands. Trees would continue to grow, mature, and die, thus providing potential nesting and foraging structure for pileated woodpeckers. Continual conversion to shade-tolerant species would reduce the quality of habitat for pileated woodpeckers over time. Therefore, a reduction in suitable nesting trees would be likely over time, which could lead to decreased

reproduction in the project area. Thus, negligible adverse indirect effects to pileated woodpeckers in the project area would be expected until some other disturbance reverses stand succession since: 1) no further harvesting would occur; 2) no changes in the amount of continuously forested habitats would be anticipated; 3) no appreciable changes to existing pileated woodpecker habitats would be anticipated; and 4) long-term, succession-related declines in the abundance of shade-intolerant tree species, which are valuable to pileated woodpeckers, would be anticipated.

- ***Direct and Indirect Effects of Action Alternatives B and C to Pileated Woodpeckers***

  Pileated woodpeckers tend to be tolerant of human activities (*Bull and Jackson 1995*), but could be temporarily displaced by the proposed harvesting and road-building activities. Harvesting between 2,010 and 2,636 acres would reduce continuous forested habitats for pileated woodpeckers, with the larger reduction associated with Action Alternative C. Between 1,108 and 1,149 acres of potential nesting, plus an additional 729 to 1,184 acres of potential foraging habitat, would be removed (*TABLE III-75 - PROJECT AREA PILEATED WOODPECKER HABITATS*). Proposed harvesting would remove potential pileated nesting and foraging habitats for 30 to 100 years, depending on the density of trees retained. Elements of the forest structure important for nesting pileated woodpeckers, including snags (a minimum of 2 snags greater than 21 inches dbh per acre), coarse woody debris (10 to 25 tons per acre), numerous leave trees, and snag recruits (a minimum of 2 trees per acre greater than 21 inches dbh) would be retained in the proposed units. Since pileated woodpecker density is positively correlated with the amount of dead and/or dying wood in a stand (*McClelland 1979*), pileated woodpecker densities in the project area could be slightly reduced with both action alternatives. The silvicultural prescriptions would retain healthy western larch, western white pine, ponderosa pine, and Douglas-fir while promoting the regeneration of these same species, which would benefit pileated woodpeckers in the future by providing nesting, roosting, and foraging habitats. Action Alternative C would reduce more nesting and foraging habitats; therefore, slightly more effects would be anticipated under Action Alternative C. Thus, minor direct and indirect effects would be anticipated that would affect pileated woodpeckers in the project area since: 1) harvesting would reduce the amount of continuous forested habitats available; 2) potential nesting and foraging habitats would be reduced; 3) several snags and snag recruits per acre would be removed; however, mitigation measures to retain a minimum of 2 snags per acre and 2 snag recruits per acre would be included; and 4) harvest prescriptions would promote seral species in the proposed units.

TABLE III-75 – PROJECT AREA PILEATED WOODPECKER HABITATS. *Changes in pileated woodpecker nesting and foraging habitats under each alternative in the project area.*

PILEATED WOODPECKER HABITAT	ALTERNATIVES		
	NO-ACTION	ACTION	
	A	B	C
Acres of nesting habitat removed	0	1,108	1,149
Total acres of nesting habitat on the project area postharvest (percent reduction)	*4,389 (0)*	*3,281 (25.2)*	*3,240 (26.2)*
Acres of foraging habitat removed	0	729	1,184
Total acres of foraging habitat on the project area postharvest (percent reduction)	*6,771 (0)*	*6,042 (10.8)*	*5,587 (17.5)*
Total acres of nesting and foraging habitats removed	*0*	*1,837*	*2,333*
Total acres of nesting and foraging habitat on the project area postharvest (percent reduction)	*11,160 (0)*	*9,847 (16.5)*	*8,827 (20.9)*

- ***Cumulative Effects of No-Action Alternative A to Pileated Woodpeckers***

  Trees would continue to grow, mature, and die, thus providing potential nesting and foraging structure for pileated woodpeckers. Existing pileated woodpecker habitats would persist. Potential habitats that exist on the portions of the 22,377 acres of closed and open forest on non-DNRC lands in the cumulative effects analysis area would be expected to persist. Continued widespread use of the cumulative effects analysis area by pileated woodpeckers would be expected. Thus, negligible adverse cumulative effects to pileated woodpeckers in the cumulative effects analysis area would be expected since: 1) no further changes would occur to existing habitats on DNRC ownership; 2) no changes to the amount of continuously forested habitats available for pileated woodpeckers would be anticipated; and 3) long-term, succession-related declines in the abundance of shade-intolerant tree species, which are valuable to pileated woodpeckers, would occur.

- ***Cumulative Effects to Pileated Woodpeckers Common to Action Alternatives B and C***

  Potential nesting habitat would be reduced to 4,930 or 4,971 acres (representing a reduction of 18.2 to 18.9 percent) in the cumulative effects analysis area (*TABLE III-76 - PILEATED WOODPECKER HABITATS – CUMULATIVE EFFECTS ANALYSIS AREA*), with the larger reduction associated with Action Alternative C. Similarly, foraging habitats would be reduced to between 15,014 and 15,469 acres (representing a 4.5- to 7.3-percent reduction from current levels; *TABLE III-76 - PILEATED WOODPECKER HABITATS – CUMULATIVE EFFECTS ANALYSIS AREA*), with the larger reduction also associated with Action Alternative C. Potential habitats that exist on the portions of the 22,377 acres of closed and open forest on non-DNRC lands in the cumulative effects analysis area would be expected to persist. Although potential habitat would be reduced under these alternatives, much of the remaining habitats in the cumulative effects analysis area contain high densities of snags that provide foraging and nesting structure. Elements of the forest structure important for nesting pileated

woodpeckers, including snags (a minimum of 2 snags greater than 21 inches dbh per acre), coarse woody debris (10 to 25 tons per acre), numerous leave trees, and snag recruits (a minimum of 2 trees per acre greater than 21 inches dbh) would be retained in the proposed units to provide foraging and nesting structure when the canopy closure recovers to the point of encouraging pileated woodpecker use. Many of these stands would be expected to regenerate with a high proportion of western larch, western white pine, ponderosa pine, and Douglas-fir, which could provide nesting and feeding structural components in 80 to 120 years, thereby improving pileated woodpecker habitat. Ongoing and recently completed harvesting and salvage activities have reduced pileated nesting and foraging habitats; however, snags, snag recruits, and coarse woody debris were retained with these projects. Additionally, the ongoing precommercial thinning on 228 acres of DNRC lands could beneficially alter future pileated woodpecker habitats by improving growth of trees and by manipulating species composition to favor shade-intolerant species such as ponderosa pine and western larch. No other activities on other ownerships are known to be occurring or are proposed in the cumulative effects analysis area that would alter or remove pileated woodpecker habitats. The reductions and modifications associated with this project would be additive to past losses from timber harvesting and human development. However, continued widespread use of the cumulative effects analysis area by pileated woodpeckers during and following completion of either of the action alternatives would be expected. Action Alternative C would reduce more nesting and foraging habitats; therefore, slightly more effects would be anticipated under Action Alternative C. Thus, low to moderate adverse cumulative effects would be anticipated that would affect pileated woodpeckers in the cumulative effects analysis area since: 1) harvesting would further reduce the amount of continuous forested habitats; 2) potential nesting and foraging habitats would be reduced; 3) snags and snag recruits in the cumulative effects analysis area would be reduced and coarse woody debris levels would increase, but much of this increase would be in the smaller size classes, which are of lower quality to pileated woodpeckers; however, mitigation measures to retain a minimum of 2 snags per acre and 2 snag recruits per acre would be included; and 4) prescriptions would promote seral species in the proposed units.

TABLE III-76 – PILEATED WOODPECKER HABITATS – CUMULATIVE EFFECTS ANALYSIS AREA. *Amounts of pileated woodpecker habitats modified, removed, and retained on DNRC-managed lands in the cumulative effects analysis area under each alternative.*

PILEATED WOODPECKER HABITAT	ALTERNATIVES		
	NO-ACTION	ACTION	
	A	B	C
Acres of nesting habitat removed (percent)	0	1,108 (18.2)	1,149 (18.9)
Amount of pileated nesting habitat unaffected (percent)	*6,079 (100)*	*4,971 (81.8)*	*4,930 (81.1)*
Acres of foraging habitat removed (percent)	0	729 (4.5)	1,184 (7.3)
Amount of pileated foraging habitat unaffected (percent)	*16,198 (100)*	*15,469 (95.5)*	*15,014 (92.7)*

BIG GAME

ISSUES

Big Game Winter Range

The proposed activities could remove forest cover on important winter ranges, which could lower their capacity to support elk, mule deer, and white-tailed deer.

Elk Security Habitat

The proposed activities could remove elk security cover, which could affect hunter opportunity and the quality of recreational hunting in the local area.

Introduction

Big game species in northwest Montana that are commonly hunted and relevant to this project include elk, mule deer and white-tailed deer. Highly valued recreational opportunities exist for these species in Montana, and hunting provides substantial economic contributions to the state.

Big Game Winter Range

When considering populations of big game species, the abundance and quality of winter range is often considered a limiting factor in driving big game populations. Winter ranges enable survival of big game animals by minimizing the effects of severe winter weather conditions. Winter ranges tend to be restricted to zones with low snow accumulation that support concentrations of big game animals, which are typically more widely distributed during the remainder of the year. Desirable forest-stand characteristics on winter ranges in western Montana include adequate midstory and overstory cover to reduce wind velocity and intercept snow, while moderating ambient temperatures. Besides providing a moderated climate, the snow-intercept capacity of densely forested stands effectively lowers snow depths, which facilitates big game movement and access to forage, and reduces their expenditure of energy. This is particularly important during severe winters when elk and deer are under extreme levels of stress.

ANALYSIS AREA

Direct and indirect effects were analyzed for activities conducted in the project area. Cumulative effects were analyzed on the 65,682-acre area encompassing the entirety of

the Swan River State Forest and intermingled checkerboard lands of differing ownerships. This cumulative effects analysis area provides enough winter habitat to support several hundred wintering white-tailed deer, mule deer, and elk.

ANALYSIS METHODS

Area biologists for DFWP recently mapped big game winter ranges across the state for all applicable big game species (*DFWP 2008*). Direct and indirect, as well as cumulative effects, were analyzed using the DFWP maps, field evaluations, aerial photograph interpretation, and a review of habitat components. Factors considered in the analysis include the amount of winter range altered due to cover removal associated with this project and past projects in the cumulative effects analysis area, amount of mature forested habitat retained on the winter range, and relative levels of human disturbance associated with proposed activities.

EXISTING ENVIRONMENT

Elk, mule deer, and white-tailed deer wintering areas exist on the project area and cumulative effects analysis area (*DFWP 2008*). On the 15,586-acre project area, elk winter range exists on 14,925 acres, mule deer winter range occurs on 3,086 acres, and white-tailed deer winter range is present on 14,341 acres (*TABLE III-77 - EXISTING BIG GAME WINTER RANGE AREA BY SPECIES*). The white-tailed deer winter range occurs primarily on the valley floor along Swan River, whereas mule deer winter range occurs primarily along foothills along the eastern portion of the valley. Elk winter range occurs both across the valley floor and extends into some foothill portions of the valley. Winter range areas for each of these species overlap. Within the 65,682-acre cumulative effects analysis area, elk winter range exists on 38,102 acres, mule deer winter range occurs on 14,408 acres, and white-tailed deer winter range is present on 30,925 acres (*TABLE III-77 - EXISTING BIG GAME WINTER RANGE AREA BY SPECIES*). Much of this winter range exists on DNRC ownership. Across all ownerships, past timber-harvesting activities, human development, and road construction in big game winter range areas has likely lowered the carrying capacity to some degree. However, patches of cover comprised of dense, mature forest (i.e., greater than 60 percent canopy cover) are relatively abundant (see *TABLE III-81- MILES OF ACTIVE SYSTEM ROADS AND ACTIVE ROAD DENSITY* under *NO-ACTION ALTERNATIVE A [existing condition]*) and well distributed across the cumulative effects analysis area.

TABLE III-77 - EXISTING BIG GAME WINTER RANGE AREA BY SPECIES *on the DNRC Scout Lake Multiple Timber Sale 15,586-acre project area and 65,682-acre cumulative effects analysis area. Data sources DNRC SLI (2011), and DFWP (2008).*

SPECIES	EXISTING WINTER RANGE ACRES ON PROJECT AREA (PERCENT OF PROJECT AREA)	EXISTING WINTER RANGE ACRES ON CUMULATIVE EFFECTS ANALYSIS AREA (PERCENT OF CUMULATIVE EFFECTS ANALYSIS AREA)
Elk	14,925 (95.8)	38,102 (57.9)
Mule deer	3,086 (19.8)	14,408 (21.9)
White-tailed deer	14,341 (92)	30,925 (47.0)

ENVIRONMENTAL EFFECTS

- ***Direct and Indirect Effects of No-Action Alternative A to Big Game Winter Range***

  Under this alternative, no additional disturbance or displacement would be anticipated in the project area. No changes in existing levels of mature forest cover would occur, and continued use of the project area by wintering elk and deer would be anticipated. As no project-related disturbance or alteration of forest vegetation would occur on identified winter range areas, no direct or indirect effects to big game or big game winter range in the project area would be expected.

- ***Direct and Indirect Effects of Action Alternative B to Big Game Winter Range***

  Under Action Alternative B, stand density and mature forest cover would be reduced on 2,010 acres of mature forest in the 15,586-acre project area. Of these 2,010 acres, at least 1,182 (59 percent) would be logged in winter, which would equate to about 8 percent of the project area. Given the proposed project operating window of 3 to 4 years, an average of about 296 to 394 acres per winter would be harvested. Of the existing 3,747 elk winter range acres with greater than 60 percent mature overstory cover on the project area, 1,891 acres (50.5 percent) would remain following harvesting, resulting in a decrease from existing conditions at the scale of the project area of 11.9 percent (*TABLE III-78- ACREAGE OF BIG GAME WINTER RANGE*). For the existing 522 acres of mule deer winter range with greater than 60 percent cover, 476 acres would remain following harvesting, resulting in a 0.4 percent decrease from existing conditions at the scale of the project area. Of the existing 3,571 acres of white-tailed deer winter range with greater than 60 percent cover, 1,562 acres (43.7 percent) would remain following logging, resulting in a decrease at the project area scale of 12.9 percent (*TABLE III-78- ACREAGE OF BIG GAME WINTER RANGE*). Following logging, forest patches on the project area would continue to have variable tree densities and would continue to provide a mosaic of habitat conditions. Mature forest stands in the project area would generally remain well connected and provide a suitable network of cover capable of facilitating movements of wintering animals across the local landscape, particularly along riparian areas. Within harvested stands on 696 acres (4 percent of the project area), which would be partially harvested, individual trees and patchy tree retention

would remain, which would continue to provide limited escape cover and visual screening. Following logging, the area of stands capable of ameliorating adverse effects of severe winter conditions for elk and deer would be reduced by 1,314 acres. New forest openings would be created by logging that could provide minor benefits for elk and deer for foraging during mild winters and early and late portions of each winter. Minor positive, short-term benefits would be anticipated as deer and elk may concentrate feeding activity on felled tree tops, limbs, and slash piles during nighttime and quiet periods when logging operations are shut down during the winter. These benefits would be offset by disturbance effects to wintering deer and elk, described below.

TABLE III-78 - ACREAGE OF BIG GAME WINTER RANGE *by species and alternative posttreatment possessing more than 60-percent overstory cover on the DNRC Scout Lake Multiple Timber Sale Project Area. Data sources DNRC SLI (2011) and DFWP (2008).*

Winter Range Type	**NO-ACTION ALTERNATIVE A ACRES WITH >60% OVERSTORY COVER (PERCENT OF PROJECT AREA)**	**ACTION ALTERNATIVE B ACRES WITH >60% OVERSTORY COVER (PERCENT OF PROJECT AREA)**	**ACTION ALTERNATIVE C ACRES WITH >60% OVERSTORY COVER (PERCENT OF PROJECT AREA)**
Elk	3,747 (24.0)	1,891 (12.1)	1,360 (8.7)
Mule deer	522 (3.4)	476 (3.0)	163 (1.0)
White-tailed deer	3,571 (22.9)	1,562 (10.0)	1,032 (6.6)

Under Action Alternative B, 4.9 miles of new restricted road would be constructed in the project area to access logging units and 48 miles of existing road would be brought up to *BMP* standards and used. Also, 2.5 miles of temporary roads would be employed and reclaimed following use. In total, 55.4 miles of road would be operational and used in conjunction with logging activities for the duration of the project (3 to 4 years). On identified elk winter range areas in the project area, 27.7 miles of existing open roads would correspond to a linear density of 1.1 miles per square mile (linear calculation). On mapped mule deer winter range are 3.9 miles of existing open roads at a density of 0.2 mile per square mile, and on mapped white-tailed deer wintering areas are 28.4 miles of existing open roads at a density of 1.2 miles per square mile (*TABLE III-79 - MILES OF ACTIVE SYSTEM ROADS AND ACTIVE ROAD DENSITY*). Implementation of Action Alternative B would result in a temporary increase in open roads on identified wintering areas for each species (*TABLE III-79 - MILES OF ACTIVE SYSTEM ROADS AND ACTIVE ROAD DENSITY*). On elk winter range, motorized activity would potentially increase on 31.9 miles of roads, which would result in up to 1.3 miles per square mile increase in

density of temporarily open roads subject to active operations on the 15,586-acre project area. Use of these roads would be spread spatially across the project area and temporally over 3 to 4 years that proposed operations would occur. Similarly on mule deer winter range, motorized activity would potentially increase on 1.3 miles of roads, which would result in a 0.1 mile per square mile increase in density of temporarily open roads subject to active operations on the project area. On white-tailed deer winter range, activity would potentially increase on 34.1 miles of roads, which would result in a 1.4 miles per square mile increase in density of temporarily open roads subject to active operations on the project area (*TABLE III-79 - MILES OF ACTIVE SYSTEM ROADS AND ACTIVE ROAD DENSITY*). During winter harvesting operations, disturbance from motorized equipment would likely perturb and potentially displace elk and deer, and habitat in the project area and nearby vicinity may temporarily be unusable due to the level of noise and human activity. No public motorized access would be allowed on restricted or temporary roads used in the project area while harvesting activities are underway; thus, no added risk of disturbance or displacement of elk and deer due to that cause would be present. A short-term added risk of disturbance and displacement of wintering animals could result in minor adverse effects associated with logging operations.

Given that: 1) project activities would reduce winter cover attributes on 2,010 acres; 2) at least 1,182 of those 2,010 acres (59 percent) would be logged in winter; 3) 1,314 (65 percent) of the 2,010 acres would be incapable of ameliorating any adverse effects of severe winter conditions following logging; 4) over 1,900 acres of mature forest cover with greater than 60 percent overstory canopy cover would be retained in the project area; 5) remaining patches of mature forest cover would generally remain well connected across the project area (including considerable acreage possessing 40 to 60percent canopy cover); 6) approximately 34.1 miles of road would be used to conduct logging activity over a period of 3 to 4 years in addition to the approximately 28 miles of existing open roads on winter range areas in the project area, and 7) public motorized access would remain restricted on proposed new roads, reconstructed roads and temporary roads, -- a moderate degree of adverse effects to winter range habitat and associated big game species would be anticipated as a result of this alternative. White-tailed deer would likely be affected to the greatest extent of the 3 species, due to the reduction of 1,314 acres of mature forest cover that would be altered and rendered incapable of lessening severe winter conditions following logging. Mule deer would likely be impacted least given the relatively small portion of their preferred winter range that would be affected.

TABLE III-79 - MILES OF ACTIVE SYSTEM ROADS AND ACTIVE ROAD DENSITY
(miles per square mile) by wintering area type (i.e., elk, mule deer, and white-tailed deer) for each alternative on the DNRC Scout Lake Multiple Timber Sale Project Area. Data sources DNRC SLI (2011), and DFWP (2008).

WINTERING AREA TYPE	NO-ACTION ALTERNATIVE A	ACTION ALTERNATIVE B	ACTION ALTERNATIVE C
	(DENSITY MILES PER SQUARE MILE)		
Elk winter range	27.7 (1.1)	59.6 (2.4)	73.8 (3.0)
Mule deer winter range	3.9 (0.2)	5.2 (0.2)	12.1 (0.5)
White-tailed deer winter range	28.4 (1.2)	62.5 (2.6)	75.6 (3.1)

- ***Direct and Indirect Effects of Action Alternative C to Big Game Winter Range***

  Under Action Alternative C, stand density and mature forest cover would be reduced on 2,636 acres of mature forest in the 15,586-acre project area. Of these 2,636 acres, at least 1,553 (59 percent) would be logged in winter, which would equate to about 10 percent of the project area. Given the proposed project operating window of 3 to 4 years, an average of about 388 to 518 acres per winter would be harvested. Of the existing 3,747 elk winter range acres with greater than 60-percent mature overstory cover on the project area, 1,360 acres (36.3 percent) would remain following harvesting, resulting in a decrease at the project-area scale of 15.3 percent (*TABLE III-78 - ACREAGE OF BIG GAME WINTER RANGE*). For the existing 522 acres of mule deer winter range with greater than 60-percent cover, 163 acres would remain following harvesting, resulting in a decrease at the project area scale of 2.4 percent. Of the existing 3,571 acres of white-tailed deer winter range with greater than 60-percent cover, 1,562 acres (43.7 percent) would remain following logging, resulting in a decrease at the project area scale of 12.9 percent from existing conditions (*TABLE W-25- ACREAGE OF BIG GAME WINTER RANGE*). As under Action Alternative B, forest patches on the project area would continue to have variable tree densities and would continue to provide a mosaic of habitat conditions following logging. Mature forest stands in the project area would generally remain well connected and provide a suitable network of cover capable of facilitating movements of wintering animals across the local landscape, particularly along riparian areas. Within harvested stands on 1,439 acres (9 percent of project area), which would be partially harvested, individual trees and patchy tree retention would remain, which would continue to provide limited escape cover and visual screening. Following logging, the area of stands capable of ameliorating adverse effects of severe winter conditions for elk and deer would be reduced by 1,197 acres. New forest openings would be created by logging that could provide minor benefits for elk and deer for foraging during mild winters, and early and late portions of each winter. Minor positive, short-term benefits would be anticipated as deer and elk may concentrate feeding activity on felled tree tops, limbs, and slash piles during nighttime and quiet periods when logging operations are shut down during the winter. These benefits would be offset by disturbance effects to wintering deer and elk described below.

  Under Action Alternative C, 8.2 miles of new restricted road would be constructed in the project area to access logging units and 81 miles of existing road would be

brought up to *BMP* standards and used (89.2 total miles). Also, 3.5 miles of temporary roads would be employed and reclaimed following their use. In total, 93 miles of road would be operational and used in conjunction with logging activities for the duration of the project (3 to 4 years). On identified elk winter range areas in the project area there are 27.7 miles of existing open roads that would correspond to a linear density of 1.1 miles per square mile (linear calculation). On mapped mule deer winter range there are 3.9 miles of existing open roads at a density of 0.2 mile per square mile, and on mapped white-tailed deer wintering areas there are 28.4 miles of existing open roads at a density of 1.2 miles per square mile (*TABLE III-79 - MILES OF ACTIVE SYSTEM ROADS AND ACTIVE ROAD DENSITY*). Implementation of Action Alternative C would also result in a temporary increase in open roads on identified wintering areas for each species (*TABLE III-79 - MILES OF ACTIVE SYSTEM ROADS AND ACTIVE ROAD DENSITY*). On the elk winter range, motorized activity would potentially increase on 46.0 miles of roads, which would result in a 1.9 miles per square mile increase in density of temporarily open roads subject to active operations on the 15,586-acre project area. Use of these roads would be spread spatially across the project area and temporally over 3 to 4 years that the proposed operations would occur. Similarly on mule deer winter range, motorized activity would potentially increase on 8.2 miles of roads, which would result in an increase of 0.3 mile per square mile in density of temporarily open roads subject to active operations on the project area. On white-tailed deer winter range, activity would potentially increase on 47.2 miles of roads, which would result in a 1.9 miles per square mile increase in density of temporarily open roads subject to active operations on the project area (*TABLE III-79 - MILES OF ACTIVE SYSTEM ROADS AND ACTIVE ROAD DENSITY*). During winter-harvesting operations, disturbance from motorized equipment would likely perturb and potentially displace elk and deer, and habitat in the project area and nearby vicinity may temporarily be unusable due to the level of noise and human activity. No public motorized access would be allowed on restricted or temporary roads used in the project area while harvesting activities are underway; thus, no added risk of disturbance or displacement of elk and deer due to that cause would be present. A short-term added risk of disturbance and displacement of wintering animals could result in minor adverse effects associated with logging operations.

Given that: 1) project activities would reduce winter cover attributes on 2,636 acres; 2) at least 1,553 of those 2,636 acres (59 percent) would be logged in winter; 3) 1,197 (45 percent) of the 2,636 acres would be incapable of ameliorating any adverse effects of severe winter conditions following logging; 4) approximately 1,400 acres of mature forest cover with greater than 60 percent overstory canopy cover would be retained in the project area; 5) remaining patches of mature forest cover would generally remain well connected across the project area (including considerable acreage possessing 40 to 60 percent canopy cover); 6) approximately 47.2 miles of road would be used to conduct logging activity over a period of 3 to 4 years in addition to the approximately 28 miles of existing open roads on winter range areas in the project area; and 7) public motorized access would remain restricted on proposed new roads, reconstructed roads, and temporary roads -- a moderate degree of adverse effects to winter range habitat and associated big game species would also be anticipated as a result of this alternative. White-tailed deer would likely be

affected to the greatest extent of the 3 species, due to the reduction of 1,197 acres of mature forest cover that would be altered and rendered incapable of lessening severe winter conditions following logging. Mule deer would likely be impacted least given the relatively small portion of their preferred winter range that would be affected. Under this alternative, there would be considerably more disturbance potential associated with the greater amount of roads that would be required than Action Alternative B, and more cover would be altered across more harvest acres. The acreage of stands that would be incapable of providing severe winter cover following logging would be similar between alternatives (i.e., Action Alternative B, 1,314 acres, and Action Alternative C, 1,197 acres).

- ***Cumulative Effects of No-Action Alternative A to Big Game Winter Range***

  Under No Action Alternative A, no additional disturbance or displacement would be anticipated in the project area. No changes in existing levels of mature forest cover would occur, and continued use of the project area by wintering elk and deer would be anticipated. As no project-related disturbance or alteration of forest vegetation would occur on identified winter range areas, no cumulative effects to big game or big game winter range in the cumulative effects analysis area would be expected.

- ***Cumulative Effects of Action Alternative B to Big Game Winter Range***

  Under Action Alternative B, stand density and mature forest cover would be reduced on 2,010 acres of mature forest in the 65,682-acre cumulative effects analysis area. Of these 2,010 acres, 1,182 (59 percent) would be logged in winter, which would equate to about 2 percent of the cumulative effects analysis area. Given the proposed project operating window of 3 to 4 years, about 296 to 394 acres per winter would be harvested. Of the existing 6,380 acres on elk winter range areas with greater than 60-percent mature overstory cover that occur within the cumulative effects analysis area, 4,524 acres (70.9 percent) would remain following harvesting, resulting in a decrease from existing conditions at the scale of the cumulative effects analysis area of 2.8 percent (*TABLE III-80-ACREAGE OF BIG GAME WINTER RANGE BY SPECIES*). For the existing 2,191 acres of mule deer winter range with greater than 60-percent cover, 2,144 acres (97.9 percent) would remain following harvesting, resulting in a negligible decrease from existing conditions at the scale of the cumulative effects analysis area. Of the existing 4,694 acres of white-tailed deer winter range with greater than 60-percent cover, 2,684 acres (57.2 percent) would remain following logging, resulting in a decrease at the scale of the 65,682-acre cumulative effects analysis area of 3.1 percent (*TABLE III-80 - ACREAGE OF BIG GAME WINTER RANGE BY SPECIES*). Following logging, forest patches on the project area would continue to have variable tree densities and would continue to provide a mosaic of habitat conditions. Mature forest stands in the project area would generally remain well connected and provide a suitable network of cover capable of facilitating movements of wintering animals across the cumulative effects analysis area. Within harvested stands on 696 acres (1 percent of the cumulative effects analysis area), which would be partially harvested, individual trees and patchy tree retention would remain, which would continue to provide escape cover and visual screening. Following logging, the area of stands capable of ameliorating adverse effects of severe winter conditions for elk and deer would be reduced by 1,314 acres, affecting 2 percent of the cumulative effects analysis area. New forest

openings would be created by logging that could provide minor benefits for elk and deer for foraging during mild winters and the early and late portions of winter. Minor positive, short-term benefits would be anticipated as deer and elk may concentrate feeding activity on felled tree tops, limbs, and slash piles during nighttime and quiet periods when logging operations are shut down during the winter. These benefits would be offset by the disturbance effects to wintering deer and elk described below.

TABLE III-80 - ACREAGE OF BIG GAME WINTER RANGE BY SPECIES *and alternative post treatment possessing greater than 60 percent overstory cover on the 65,682-acre DNRC Scout Lake Multiple Timber Sale Cumulative effects Analysis Area. Data sources DNRC SLI (2011), USFS (2009) and DFWP (2008).*

SPECIES	NO-ACTION ALTERNATIVE A	ACTION ALTERNATIVE B	ACTION ALTERNATIVE C
	ACRES WITH GREATER THAN 60-PERCENT OVERSTORY COVER (PERCENT OF CUMULATIVE EFFECTS ANALYSIS AREA)		
Elk	6,380 (9.7)	4,524 (6.9)	3,993 (6.1)
Mule deer	2,191 (3.3)	2,144 (3.3)	1,831 (2.8)
White-tailed deer	4,694 (7.1)	2,684 (4.0)	2,154 (3.3)

Under Action Alternative B, 4.9 miles of new restricted road would be constructed in the project area to access logging units and 48 miles of existing road would be brought up to *BMP* standards and used. Also, 2.5 miles of temporary roads would be employed and reclaimed following their use. In total, 55.4 miles of road would be operational and used in conjunction with logging activities for the duration of the project (3 to 4 years) in the cumulative effects analysis area. On identified elk winter range areas within the cumulative effects analysis area are 78.1 miles of existing open roads that would correspond to a linear density of 0.8 mile per square mile (linear calculation). On mapped mule deer winter range there are 21.1 miles of existing open roads at a density of 0.2 mile per square mile, and on mapped white-tailed deer wintering areas there are 74.3 miles of existing open roads at a density of 0.7 mile per square mile (*TABLE III-81 - MILES OF ACTIVE SYSTEM ROADS AND ACTIVE ROAD DENSITY*) in the cumulative effects analysis area. Implementation of Action Alternative B would result in a temporary increase in open roads on identified wintering areas for each species (*TABLE III-81 - MILES OF ACTIVE SYSTEM ROADS AND ACTIVE ROAD DENSITY*). On the elk winter range, motorized activity would potentially increase on 32.6 miles of roads, which would result in a 0.3 mile per square mile increase in density of temporarily open roads subject to active operations on the 65,682-acre cumulative effects analysis area. Use of these roads would be spread spatially across the cumulative effects analysis area and temporally over the 3 to 4 years that proposed operations would occur. Similarly on mule deer winter range, motorized activity would potentially increase on 1.3 miles of roads, which would result in a negligible increase in density of temporarily open roads subject to active operations on the cumulative effects

analysis area. On white-tailed deer winter range, activity would potentially increase on 35.3 miles of roads, which would result in a 0.3 mile per square mile increase in density of temporarily open roads subject to active operations on the project area (*TABLE III-81 - MILES OF ACTIVE SYSTEM ROADS AND ACTIVE ROAD DENSITY*). During winter harvesting operations, noise from motorized equipment would likely disturb and potentially displace elk and deer, and habitat in the project area and nearby vicinity may temporarily be unusable due to the increased level of human activity. No public motorized access would be allowed on restricted or temporary roads used in the project area while harvesting activities are underway; thus, no added cumulative risk of disturbance or displacement of elk and deer due to that cause would be present. A short-term added risk of disturbance and displacement of wintering animals could result in minor adverse cumulative effects associated with logging operations.

Given that: 1) project activities would reduce winter cover attributes on 2,010 acres; 2) at least 1,182 of those 2,010 acres (59 percent) would be logged in winter and would remove cover on 2 percent of the cumulative effects analysis area; 3) 1,314 (65 percent) of the 2,010 acres would be incapable of ameliorating any adverse effects of severe winter conditions following logging; 4) over 4,500 acres of mature forest cover with greater than 60 percent overstory canopy cover would remain in the cumulative effects analysis area; 5) remaining patches of mature forest cover would generally remain well connected across the cumulative effects analysis area (including considerable acreage possessing 40 to 60 percent canopy cover); 6) approximately 55.4 miles of road would be used to conduct logging activity over a period of 3 to 4 years in addition to the approximately 78 miles of existing open roads on winter range areas in the cumulative effects analysis area; 7) public motorized access would remain restricted on proposed new roads, reconstructed roads, and temporary roads; and 8) about 296 to 394 acres per winter would be harvested for the 3 to 4 year duration of the project, -- a low to moderate degree of adverse cumulative effects to winter range habitat and associated big game species would be anticipated as a result of this alternative.

TABLE III-81 - MILES OF ACTIVE SYSTEM ROADS AND ACTIVE ROAD DENSITY *(miles/square mile) by wintering area type (i.e., elk, mule deer, and white-tailed deer) for each alternative on the DNRC Scout Lake Multiple Timber Sale Cumulative effects Analysis Area. Data sources DNRC SLI (2011), DNRC road data layer, and DFWP (2008).*

WINTERING AREA TYPE	**NO-ACTION ALTERNATIVE A**	**ACTION ALTERNATIVE B**	**ACTION ALTERNATIVE C**
	LINEAR MILES (DENSITY - MILES PER SQUARE MILE)		
Elk winter range	78.1 (0.8)	110.7 (1.1)	134.8 (1.3)
Mule deer winter range	21.1 (0.2)	22.4 (0.2)	38.3 (0.4)
White-tailed deer winter range	74.3 (0.7)	109.6 (1.1)	123.4 (1.2)

- ***Cumulative Effects of Action Alternative C to Big Game Winter Range***

  Under Action Alternative C, stand density and mature forest cover would be reduced on 2,636 acres of mature forest in the 65,682-acre cumulative effects analysis area. Of these 2,636 acres, 1,553 (59 percent) would be logged in winter, which would also equate to about 2 percent of the cumulative effects analysis area. Given the proposed project operating window of 3 to 4 years, about 296 to 394 acres per winter would be harvested. Of the existing 6,380 acres on elk winter range areas with greater than 60 percent mature overstory cover that occur within the cumulative effects analysis area, 3,993 acres (62.6 percent) would remain following harvesting, resulting in a decrease from existing conditions at the scale of the cumulative effects analysis area of 3.6 percent (*TABLE III-80-ACREAGE OF BIG GAME WINTER RANGE BY SPECIES*). For the existing 2,191 acres of mule deer winter range with greater than 60 percent cover, 1,831 acres (83.6 percent)would remain following harvesting, resulting in a 0.5 percent decrease from existing conditions at the scale of the cumulative effects analysis area. Of the existing 4,694 acres of white-tailed deer winter range with greater than 60 percent cover, 2,154 acres (45.9 percent) would remain following logging, resulting in a decrease at the scale of the 65,682-acre cumulative effects analysis area of 3.8 percent (*TABLE III-80-ACREAGE OF BIG GAME WINTER RANGE BY SPECIES*). Following logging, forest patches on the project area would continue to have variable tree densities and would continue to provide a mosaic of habitat conditions. Mature forest stands in the project area would generally remain well connected and provide a suitable network of cover capable of facilitating movements of wintering animals across the cumulative effects analysis area. Within harvested stands on 1,439 acres (2 percent of the cumulative effects analysis area), which would be partially harvested, individual trees and patchy tree retention would remain, which would continue to provide escape cover and visual screening. Following logging, the area of stands capable of ameliorating adverse effects of severe winter conditions for elk and deer would be reduced by 1,197 acres, affecting 2 percent of the cumulative effects analysis area. New forest openings would be created by logging that could provide minor benefits for elk and deer for foraging during mild winters, and the early and late portions of each winter. Minor positive, short-term benefits would be anticipated as deer and elk may concentrate feeding activity on felled tree tops, limbs, and slash piles during nighttime and quiet periods when logging operations are shut down during the winter. These benefits would be offset by the disturbance effects to wintering deer and elk, described below.

  Under Action Alternative C, 8.2 miles of new restricted road would be constructed in the project area to access logging units and 81 miles of existing road would be brought up to *BMP* standards and used (89.2 miles total). Also, 3.5 miles of temporary roads would be employed and reclaimed following their use. In total, 92.7 miles of road would be operational and used in conjunction with logging activities for the duration of the project (3 to 4 years) in the cumulative effects analysis area. On identified elk winter range areas in the cumulative effects analysis area there are 78.1 miles of existing open roads that would correspond to a linear density of 0.8 mile per square mile (linear calculation). On the mapped mule deer winter range are 21.1 miles of existing open roads at a density of 0.2 mile per square mile, and on the mapped white-tailed deer wintering areas are 74.3 miles of existing

open roads at a density of 0.7 mile per square mile (*TABLE III-81 - MILES OF ACTIVE SYSTEM ROADS AND ACTIVE ROAD DENSITY*) in the cumulative effects analysis area. Implementation of Action Alternative C would result in a temporary increase in open roads on identified wintering areas for each species (*TABLE III-81 - MILES OF ACTIVE SYSTEM ROADS AND ACTIVE ROAD DENSITY*). On the elk winter range, motorized activity would potentially increase on 56.7 miles of roads, which would result in a 0.6 mile per square mile increase in density of temporarily open roads subject to active operations on the 65,682-acre cumulative effects analysis area. Use of these roads would be spread spatially across the cumulative effects analysis area and temporally over the 3 to 4 years that proposed operations would occur. Similarly, on the mule deer winter range, motorized activity would potentially increase on 17.7 miles of roads, which would result in a 0.2 mile per square mile increase in density of temporarily open roads, subject to active operations on the cumulative effects analysis area. On the white-tailed deer winter range, activity would potentially increase on 49.1 miles of roads, which would result in a 0.5 mile per square mile increase in density of temporarily open roads subject to active operations on the project area (derived from *TABLE III-81 - MILES OF ACTIVE SYSTEM ROADS AND ACTIVE ROAD DENSITY*). During winter harvesting operations, noise from motorized equipment would likely disturb and potentially displace elk and deer, and habitat in the project area and nearby vicinity may temporarily be unusable due to the increased level of human activity. No public motorized access would be allowed on restricted or temporary roads used in the project area while harvesting activities are underway; thus, no added cumulative risk of disturbance or displacement of elk and deer due to that cause would be present. A short-term added risk of disturbance and displacement of wintering animals could result in minor adverse cumulative effects associated with logging operations.

Given that: 1) project activities would reduce winter cover attributes on 2,010 acres; 2) at least 1,182 of those 2,010 acres (59 percent) would be logged in winter and would remove cover on 2 percent of the cumulative effects analysis area; 3) 1,314 (65 percent) of the 2,010 acres would be incapable of ameliorating any adverse effects of severe winter conditions following logging; 4) over 4,500 acres of mature forest cover with greater than 60 percent overstory canopy cover would remain in the cumulative effects analysis area; 5) remaining patches of mature forest cover would generally remain well connected across the cumulative effects analysis area (including considerable acreage possessing 40 to 60 percent canopy cover); 6) approximately 55.4 miles of road would be used to conduct logging activity over a period of 3 to 4 years in addition to the approximately 78 miles of existing open roads on winter range areas in the cumulative effects analysis area; 7) public motorized access would remain restricted on proposed new roads, reconstructed roads, and temporary roads; and 8) about 296 to 394 acres per winter would be harvested for the 3 to 4 year duration of the project, -- a low to moderate degree of adverse cumulative effects to winter range habitat and associated big game species would be anticipated as a result of this alternative.

Elk Security Habitat

Timber harvesting can increase elk vulnerability by changing the size, structure, juxtaposition, and accessibility of areas that provide security during hunting season (*Hillis et al. 1991*). As visibility and accessibility increase within forested landscapes, elk and deer have a greater probability of being observed and, subsequently, harvested by hunters. Because the female segments of the elk and deer populations are normally regulated carefully during hunting seasons, primary concerns are related to a substantial reduction of the male segment and the subsequent decrease in hunter opportunity. The presence of fewer males at the beginning of the hunting season reduces the odds of a hunter seeing or harvesting such an animal throughout the remainder of the season.

ANALYSIS AREA

Direct and indirect effects were analyzed on the project area. For cumulative effects analysis purposes, Swan River State Forest (DNRC lands only) was used as the scale of the analysis. This cumulative effects analysis area should provide enough area for an elk herd to avoid hunting pressure during the general hunting season and approximates the size of an elk herd's fall home range.

ANALYSIS METHODS

Given that areas within 0.5 mile of an open road do not provide elk security habitat (*Hillis et al. 1991*), existing open roads that would remain open to the public were buffered 0.5 mile and identified as areas not meeting the criteria for elk security habitat. Areas that were recently harvested (in the past 20 years) in the cumulative effects analysis area were not expected to provide security habitat and were removed from potential security cover. Additionally, elk security habitat patches need to be somewhat larger forested blocks (greater than 250 acres) with adequate cover to afford elk security during the general big game hunting season, so areas failing to meet this criteria were also removed, leaving patches that were distant enough from open roads, were large enough to meet the minimum criteria, and had adequate cover to provide elk security habitat (*Hillis et al. 1991*). Factors considered in the analysis include the amount of security habitat available and the level of human access for recreational hunting.

EXISTING ENVIRONMENT

In the 15,586-acre project area, approximately 2,966 (19 percent) acres of security habitat exists that are distant enough from open roads, were large enough to meet the minimum criteria, and had adequate cover to provide elk security habitat (*Hillis et al. 1991*). Hiding cover, which is inherently a component of elk security habitat, is abundant in the project area; however, approximately 931 acres (6 percent) in the project area do not provide cover. Moderate levels of hunter access exist in the project area with numerous open roads and considerable nonmotorized access on closed roads.

In the cumulative effects analysis area, 13,999 acres meet the distance, cover, and size requirements of elk security habitats. This amount of security habitat (33.6 percent of the cumulative effects analysis area) exceeds the 30-percent minimum threshold established by *Hillis et al. (1991)*. Additionally, appreciable amounts of hiding cover exist in the cumulative effects analysis area; however, approximately 5,255 acres in the cumulative effects analysis area do not currently meet the cover requirements. Hunter

access in the cumulative effects analysis area is relatively unlimited, with several open roads and considerable nonmotorized access on closed roads. Evidence of nonwinter use by elk was noted throughout the project area during field reviews.

ENVIRONMENTAL EFFECTS

- ***Direct and Indirect Effects of No-Action Alternative A to Big Game Elk Security Habitat***

  No changes in elk security cover would be expected. Existing cover would continue to contribute to security habitat. No alterations in cover would occur that would increase elk vulnerability during the hunting season. No changes would be anticipated in disturbance, potential mortality due to hunting, or human access. Thus, no direct or indirect effects related to elk vulnerability or elk security habitat in the project area would be anticipated.

- ***Direct and Indirect Effects of Action Alternatives B and C to Big Game***

  No changes in open roads or motorized access would occur. During all phases of the project, any roads opened with project activities would be restricted to the general public and would be closed after the completion of project activities. Proposed new roads would be restricted to the general public, but could facilitate nonmotorized access during the hunting season using mountain bikes, horses, and/or foot travel. Action Alternative C constructs the highest amount of roads that could facilitate this increased human presence, while Action Alternative B constructs the fewest miles of road (*TABLE III-82 – PROJECT AREA ELK SECURITY PARAMETERS*). Additionally, provisions in the *SVGBCA* prohibit contractors from carrying firearms while on duty, which would effectively further reduce access to some of these elk security habitats by people who could harvest elk.

  In the project area, proposed units with seedtree and shelterwood treatments would likely be too open to provide elk security, while those areas receiving variable thinning-type treatments would likely continue to provide some cover that could benefit elk during the hunting season (*TABLE W-29 – PROJECT AREA ELK SECURITY PARAMETERS*). Under the action alternatives, 54 to 210 acres of security habitat would be altered and 296 to 346 acres of security habitat would be removed for 20 to 30 years until trees and shrubs provide adequate cover for elk, with the greatest reduction being associated with Action Alternative C, and the smallest reduction being associated with Action Alternative B. Reductions in suitable cover that contribute to elk security habitat would be additive to past harvesting in the project area (approximately 5,255 acres), and that does not meet the cover requirement for elk security habitat. Layout in the proposed units to meet the *SVGBCA* requirement of 600 feet to cover (see *HIDING COVER* under *GRIZZLY BEAR* in this analysis) would provide some benefits to elk in the proposed regeneration units by requiring a specified distribution of hiding cover. Overall, increased sight distances and the reduction in hiding cover may increase elk vulnerability risk in the project area. Action Alternative B, which builds fewer miles of new roads, reduces the least amount of elk security habitat and would be expected to have proportionally fewer effects to elk security; meanwhile, Action Alternative C would have greater effects to elk security due to the increased amounts of hiding

cover affected and the higher amounts of new road construction. Collectively, minor adverse effects to elk security habitat would be anticipated that would affect elk vulnerability risk in the project area for 20 to 30 years since: 1) no changes in open roads or motorized access for the general public would be anticipated that would increase hunter access; 2) minor increases in nonmotorized access could increase hunter access on 5.0 to 8.0 miles of new restricted roads, depending on alternative; 3) minor amounts of elk security habitat would be affected (11.8 to 18.8 percent, depending on alternative); and 4) slight decreases big game survival could potentially occur with increased access and increased visibility.

TABLE III-82 - PROJECT AREA ELK SECURITY PARAMETERS. *Proposed amounts of elk security habitat removed, amount of elk security habitat retained, and amount of linear miles of permanent, restricted road construction expected under each alternative in the project area.*

PARAMETER	ALTERNATIVES		
	NO-ACTION	ACTION	
	A	B	C
Acres elk security habitat altered (percent of project area security habitat)	0 (0)	54 (1.8)	210 (7.1)
Acres elk security habitat removed (percent of project area security habitat)	0 (0)	296 (10.0)	346 (11.7)
Acres of elk security habitat (percent of project area security habitat)	2,966 (100)	2,670 (90.0)	2,620 (88.3)
Linear miles of new permanent, restricted road	0	5.2	8.0
Linear miles of permanent restricted road (percent increase)	90.7 (0)	95.9 (5.7)	98.7 (8.8)

- ***Cumulative Effects of No-Action Alternative A to Big Game Elk Security Habitat***

  Approximately 33.6 percent of the cumulative effects analysis area (*TABLE III-83 – ELK SECURITY PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA*) would continue providing elk security habitat, which would exceed the 30-percent minimum threshold recommended by *Hillis et al. (1991)*. Continued maturation in previously harvested stands on all ownerships in the cumulative effects analysis area would improve hiding cover in those older units. No changes in open roads occur, thus no changes in the amount of the cumulative effects analysis area near open roads would be anticipated; no other changes in disturbance and potential mortality due to hunting would be anticipated. Thus, negligible positive cumulative effects to elk security would be anticipated that would benefit elk since: 1) no changes in open roads, motorized access, or human access would be anticipated; 2) no further reductions in elk security habitat would occur; and 3) modest levels of security habitat and hiding cover would persist in the cumulative effects analysis area.

- ***Cumulative Effects to Big Game Elk Security Habitat Common to Action Alternatives B and C***

  No changes would be anticipated in open roads or motorized access for the general public that would influence elk vulnerability, but project-level alterations of cover could reduce elk security habitat. Depending on alternative, between 296 and 346 acres of elk security habitats in the project area would be removed with the proposed activities, with the greatest reductions being associated with Action Alternative C

(TABLE III-83 – ELK SECURITY PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA). Increased sight distances could reduce elk survival in the project area and proposed road construction could facilitate an increase in nonmotorized traffic. Moderate levels of motorized access in the cumulative effects analysis area facilitate recreational hunting, and nonmotorized access via closed roads is relatively high. Improvements to permanent, restricted roads could facilitate slight increases in nonmotorized uses. Ongoing and completed salvage/sanitation projects and proposed precommercial thinning projects would not affect elk security habitats appreciably.

Suitable cover that may contribute to elk security habitat would be reduced with these action alternatives, which would be additive to harvesting on approximately 5,255 acres in the recent past. Between 32.7 and 33.9 percent of the cumulative effects analysis area would be providing elk security habitat following proposed harvesting (*TABLE III-83 – ELK SECURITY PARAMETERS – CUMULATIVE EFFECTS ANALYSIS AREA*), which would exceed the 30-percent minimum threshold recommended by *Hillis et al. (1991)*. Continued maturation in previously harvested stands in the cumulative effects analysis area would improve hiding cover in those older units and partially offset these current losses. All *SVGBCA* cooperators would be required to lay out timber sale projects so that no point is more than 600 feet to cover, which would have some benefits to big game by providing some cover. In general, minor effects to elk security cover or survival at the level of the cumulative effects analysis area would be expected under both action alternatives; however, since Action Alternative B retains more hiding cover and would construct less permanent road, slightly fewer effects would be anticipated than with Action Alternative C. Thus, minor adverse cumulative effects to elk security would be anticipated that would affect elk using the cumulative effects analysis area for 10 to 30 years since: 1) no changes in open roads or motorized access for the general public would be expected; 2) changes to nonmotorized access would be minor; 3) minor amounts of elk security habitat would be affected; and 4) modest levels of security habitat and hiding cover would persist in the cumulative effects analysis area.

TABLE III-83 - ELK SECURITY PARAMETERS - CUMULATIVE EFFECTS ANALYSIS AREA.
Amount of elk security habitat removed and modified, amount of retained elk security habitat, and percentage of the entire subunit providing elk security habitats in the cumulative effects analysis area.

PARAMETER	ALTERNATIVES		
	No-Action A	**B**	**C**
Acres elk security habitat altered (percent of elk security habitat in cumulative effects analysis area)	0 (0)	54 (0.4)	210 (1.5)
Acres elk security habitat removed (percent of elk security habitat in cumulative effects analysis area)	0 (0)	296 (2.1)	346 (2.5)
Acres of elk security habitat (percent of elk security habitat in cumulative effects analysis area)	13,999 (100)	13,703 (97.9)	13,653 (97.5)
Percent of the cumulative effects analysis area providing elk security habitat	33.6	32.9	32.7
Linear miles of permanent, restricted road improved	0	62.9	41.6

Suggested Wildlife Mitigations Associated with the Action Alternatives

- A DNRC biologist will be consulted if a threatened or endangered species is encountered to determine if additional mitigations that are consistent with the administrative rules for managing threatened and endangered species (*ARM 36.11.428 through 36.11.435*) are needed.
- Public access would be restricted at all times on restricted roads that are opened for harvesting activities; signs will be used during active periods and a physical closure (gate, barriers, equipment, etc.) will be used during inactive periods (nights, weekends, etc.).
- Warning signs would be posted along Highway 83 while logging adjacent harvest units in winter to minimize vehicle/deer collisions.
- Roads and skid trails that are opened with the proposed activities would be reclosed to reduce the potential for unauthorized motor vehicle use.
- A combination of topography, group retention, and roadside vegetation would be used to reduce views into harvest units along open roads.
- Vegetation screening would be retained within a 100-foot buffer along open roads where regeneration units would be adjacent to the open roads.
- Proposed regeneration units would be laid out so that no point within the proposed unit is more than 600 feet to cover.
- Snags, snag recruits, and coarse woody debris will be managed according to *ARM 36.11.411* through *36.11.414*, particularly favoring western larch, ponderosa pine, and western white pine. Clumps of existing snags could be maintained where they exist to offset areas without sufficient snags. Ten to 25 tons per acre of coarse woody debris would be retained and retention of 15-inch dbh or larger downed logs would be emphasized.

- Contractors and purchasers conducting contract operations will be prohibited from carrying firearms while operating on restricted roads.
- Potential disturbance to grizzly bears would be limited by harvesting much of the proposed units during the denning period (November 16 through March 31).
- Retention of visual screening adjacent to *RMZs* would reduce detection of grizzly bears near these important habitats.
- Retention of patches of advanced regeneration of shade-tolerant trees in proposed units, where feasible, would provide some break-up site distances, horizontal cover, and forest structural attributes preferred by snowshoe hares and lynx.
- Connectivity for fisher, Canada lynx, grizzly bears, and a host of other species would be provided by maintaining corridors of unharvested and/or lighter harvested areas along riparian areas, ridgetops, and saddles.

GEOLOGY AND SOILS ANALYSIS

INTRODUCTION

The following document discloses the potential impacts to soils resources in the project area as defined in *CHAPTER I – PURPOSE AND NEED* for each of the 3 alternatives outlined in *CHAPTER II – ALTERNATIVES*. Both action alternatives vary by the amount of new and temporary road construction, type and extent of logging system used, and sivilcultural prescription. All of the variables mentioned above have been shown to result in a range of impacts to soil resources in both magnitude and spatial extent (*DNRC 2009*). The following analysis will analyze each alternative with respect to issues and concerns that were raised internally within DNRC and through public comment and public field tours as described in *CHAPTER I – PURPOSE AND NEED, SCOPE OF THIS EIS, ISSUES STUDIED IN DETAIL.*

ISSUES ANALYZED AND DISMISSED

The bulleted issue statements listed below summarizes both internal and public concerns that were identified prior to field review and document development.

- Traditional ground-based harvest operations have the potential to compact and displace surface soils that can reduce hydrologic function, macroporosity, and aggregate stability. This suite of processes is referred to as soil function.
- Areas of impacted soil function have the potential to increase rates of offsite erosion that may affect productive surface soils.
- Activities associated with the proposed actions such as timber harvesting and road construction, have the potential to affect slope stability through increased water yields and road-surface drainage concentration resulting in the exceedence of resisting forces.
- The removal of large volumes of both coarse and fine woody material through timber harvesting reduces the amount of organic matter and nutrients available for nutrient cycling possibly affecting the long-term productivity of the site.
- Repeat entries into a forest stand with heavy equipment has the potential to reinforce existing detrimental soil impacts and cumulatively inhibit soil recovery and soil productivity.

Upon completion of field review and *GIS* analysis, it was confirmed that the locations proposed for timber harvesting and road construction avoid areas with a high probability of slope instability. Issues related to slope instability will be dismissed from further analysis in this document.

MEASUREMENT CRITERIA

Field reviews, professionally published soils surveys, geologic maps, landscape vegetation data, and DNRC soil monitoring data guided data collection of measurement criteria for this analysis. The methods for how this information will be used to disclose impacts can be reviewed in the *ANALYSIS METHODS* section of this document with technical details further described in a report in the project file (*DNRC, 2011*). The measurement criteria that will be used to assess direct, indirect, and cumulative effects

regarding the issues previously listed are outlined below in *TABLE III-84 - MEASUREMENT CRITERIA*.

TABLE III-84 - Measurement CRITERIA

GENERALIZED ISSUE	MEASUREMENT CRITERIA	UNITS
Soil physical properties	Displacement, rutting, and compaction (Howes et al. 1983)	Percent of area
Erosion	K factor, slope, erosion risk and sediment delivery efficiency, rainfall intensity	K, %, risk, in/day
Site nutrients	Volume of coarse and fine woody debris	Tons/acre
Long-term productivity	Amount of acres proposed for reentry, coarse and fine woody debris	Acres, tons/acre

ANALYSIS AREA

The project area consists of 15,586 acres located in Swan River State Forest (*FIGURE III-17 – SCOUT LAKE MULTIPLE TIMBER SALE PROJECT AREA AND SOIL MAP UNITS*). While the harvest for each alternative varies by location and intensity, as well as by the type and extent of logging systems employed, the common analysis area for direct and indirect effects for soil physical properties, erosion, nutrient cycling, and site productivity will include harvest units, log landings, and areas of new and temporary road construction.

Cumulative effects by definition are the collective impacts on the human environment of the proposed action(s) when considered in conjunction with other past, present, and future actions related to the proposed action by location or generic type. For an impact to soil resources to be cumulative they must overlap at least twice in both time and space. Considering this constraint, the cumulative-effects analysis area for all proposed alternatives will be the same as that described for direct and indirect impacts above.

ANALYSIS METHODS

DNRC soil monitoring *(DNRC 2009*) has shown that past performance in harvest design, *BMP* design and implementation, and timber sale contract administration are good indicators of expected future results regarding impacts to soil resources. The following soil analysis was designed around this assumption which has been validated through 20-plus years of quantitative soil monitoring conducted by DNRC.

Soil disturbance within harvest units proposed for reentry were evaluated for current levels of detrimental soil impacts through pace transects established in portions of harvest units with documented historic harvesting. The level of existing impacts within these areas, as well as data from soil monitoring results, will be used to forecast potential effects of the proposed actions. Numerous efforts in past DNRC soil monitoring and environmental documents (*DNRC 2008*) have explored the natural amelioration rate of compacted soils similar to those found in the project area; this information will also assist in forecasting potential effects.

Erosion will be qualitatively assessed using variables of erosion K factors, erosion risk, sediment-delivery efficiency, slope, and probability of various rainfall intensities.

Forecasting effects to site nutrient pools will be guided by coarse and fine woody debris data collected throughout the project area (*Brown 1974*) in various habitat types and intensity of historic management. This data will be used in concert with scientific literature (*Harvey et al. 1987, Graham et al. 1994, Laiho and Prescott 1999, Harrison et al. 2011*) to not only forecast potential impacts but recommend effective mitigations.

All of the above-listed measurement criteria are interconnected and support positive feedback mechanisms with soil biologics. The summation of all the above-listed variables (physical, chemical, and biological soil properties) create a suite of processes that together control soil productivity and, ultimately, forest productivity. The risk of impacts to each measurement criteria will be summarized and qualitatively assessed to forecast potential impacts to the soil resources long-term productivity.

Effective risk management requires assessment of inherently uncertain events and circumstances, typically addressing 2 dimensions: how likely the effect is to occur (probability), and the magnitude the effect would be if it happened (impact) (*Hillson and Hulett, 2004*). This method of risk management and communication is employed for all issues throughout this document.

The description of analytical and qualitative methods used to forecast potential impacts to soil resources from the proposed actions was briefly outlined above by intention. For a more detailed overview of methods, refer to a supplemental document to this EIS in the project file (*DNRC, 2011*).

Relevant Agreements, Laws, Plans, Rules, and Regulations

Developed in 1996, the *SFLMP* is a programmatic plan that outlines the approach and philosophy guiding land-management activities on forested school trust lands throughout the State of Montana (*DNRC 1996*). Within this plan, detrimental soil disturbance is defined and recommends that projects implemented by DNRC should strive to maintain the long-term soil productivity of a site by limiting detrimental soil impacts to 20 percent or less of a harvest area and retain adequate levels of both coarse and fine woody material to facilitate nutrient retention and cycling.

To accomplish these goals and objectives contract stipulations and site-specific *BMPs* are developed to provide protection for soil resources in a project area. *The Forest Management Rules (ARM 36.11.422 [2] [2] [a])* state that appropriate *BMPs* shall be determined during project design and incorporated into implementation. *ARM 36.11.414* mandates that adequate coarse woody debris shall be left on site to facilitate nutrient conservation and cycling. To ensure the incorporated *BMPs* are implemented and site productivity maintained, specific requirements are incorporated into the DNRC timber sale contracts. The following are general *BMPs* and mitigations that would be incorporated into the proposed action to ensure adequate soil protection and long-term productivity of the site.

- Equipment operations are limited to periods when soils are relatively dry, (less than 20-percent soil moisture), frozen or snow-covered (12 inches packed or 18 inches unconsolidated) to minimize soil compaction and rutting, and maintain drainage features.

- Ground-based logging equipment (tractors, skidders, and mechanical harvesters) is limited to less than 45 percent on ridges, convex slopes, and to 40 percent or less on concave slopes without winter conditions.
- The Forest Officer shall approve a plan for felling, yarding, and landings in each harvest unit prior to the start of operations in that unit. The locations and spacing of skid trails and landings shall be designated and approved by the Forest Officer prior to construction.
- Levels of coarse and fine woody material will be retained on site as prescribed by the Forest Officer and recommended by the project soil scientist using the best available science (*Graham et al. 1994*). Recommendations for the Scout Lake Multiple Timber Sale Project Area are 10 to 15 tons per acre of woody material and upwards of 25 tons per acre, in favorable habitat types. Upwards of 35 percent of this volume should be retained as fine woody material (1 to 3 inches) with as much fine needles retained on site as possible.

These general *BMPs,* along with site-specific mitigations designed during contract development, have been monitored for effectiveness by DNRC since 1988 and have repeatedly been shown to be effective measures to achieve objectives described in the *SFLMP* (*DNRC 2009*).

EXISTING ENVIRONMENT

This section describes the current conditions and trends of the soil resources in the project area. These conditions, with respect to geology and soils, will serve as the baseline to which environmental effects of the alternatives will be compared.

CLIMATE

The climate of the Scout Lake Multiple Timber Sale project area is seasonal and high seasonal variable. The average annual precipitation of 23 to 43 inches in the project area is directly correlated to elevation that ranges from 3,100 to 6,100 feet. Approximately 53 percent of this precipitation is received as snow in winter months from late November to early April, although spring rains during May and June also comprise a large portion of annual precipitation. *TABLE III-86 – PRECIPITATION INTENSITY AND RECURRENCE,* below, provides storm recurrence intervals for the project area, along with the associated 24-hour precipitation totals and the probability of such a storm happening in any given calendar year.

TABLE III-86 – PRECIPITATION INTENSITY AND RECURRENCE

RECURRENCE INTERVAL (YEARS)	24-HOUR PRECIPITATION (INCHES)	EVENT PROBABILITY OF OCCURRENCE PER YEAR (%)
1	1.1	100
2	1.3	50
4	1.5	25
5	1.6	20
10	1.7	10
20	2.2	5
25	2.3	4
50	2.4	2

The probability of intense precipitation over short durations can be an analog to erosive events and can help highlight the probability of erosion during such events. The assumption here is that *BMP* effectiveness would be compromised to varying degrees during a storm with an event probability less than 5 percent.

GEOLOGY

The geology in the project area is dominated by the middle to upper stratigraphic sections of the Ravalli group and conformably above this sequence, the Piegan group, both Precambrian in age. The only formation within the Ravalli group exposed in the project area is the poorly exposed Spokane formation. This formation is thinly bedded to laminated, red to maroon-gray, coarse-grained argillite and siltites (*MBMG 2004*). The Spokane formation is relatively resistant to weathering and is a fair nutrient source for soils (*Johnson 2007*).

Basal sections of the Piegan group include the Helena formation which dominates outcrops in higher elevations of the project area. This formation is characterized by cyclic bedding, forming bands of gray to black argillite or gray dolomitic siltite that weathers to a tan color, alternating with dense limestone that weathers to orange-brown (*MBMG 2004*). Moderately resistant to weathering, the mineralogy of this formation makes for a poor source of soil nutrients required for tree growth (*Johnson, 2007*).

During the Laramide orogeny, a period of mountain building in western North America, which started in the late Cretaceous, 70 to 80 million years ago, and ended 35 to 55 million years ago, Swan Valley was formed through block faulting along the Swan fault on the eastern margins of the valley. This period of uplift is responsible for the dramatic relief observed today along the Swan front and more gradual grades of the headwall dipping to the east in the southern Mission Mountains.

Landforms and Soils

The landforms and valley morphology observed today in Swan Valley are largely a result of glacial and fluvial processes working in concert to erode, transport, and redeposit sediment. Two large-scale continental glacial advances and recessions have helped to transport the massive glacial till deposits we observe today in the form of moraines, eskers, outwash plains, and numerous other glacial features. Since the end of the Pinedale Glaciation, approximately 15,000 years ago, massive alpine glaciers had

advanced and receded through Swan Valley, ultimately resulting in the numerous lakes and glacial outwash deposits at canyon mouths along the Swan and Mission mountains.

In general, the soils in the project area adjacent to the valley floor include deep alluvial and glacial deposits on low grades. Wetland or hydric soils have been identified adjacent to kettle lakes, areas consistently inundated by flood waters and areas influenced by beaver activity. Shallow bedrock and high rock content residual soils are found on glacial scoured ridges while valley hillslopes have moderate to deep glacial till deposits with cobble silt loam subsoils. For further discussion of map unit attributes and locations refer to *FIGURE III-17 – SCOUT LAKE MULTIPLE TIMBER SALE PROJECT AREA AND SOIL MAP UNITS* and *TABLE III-85 – SOIL MAP UNITS AND ATTRIBUTES* in the appendix of this section.

Erosion and sediment delivery efficiency is based on slope and soil erosion K factor. The risk of erosion is described as slight, moderate, high, or severe (*Hansen 2004*):

- a rating of low indicates that erosion is unlikely under ordinary climatic conditions;
- a rating of moderate indicates that some erosion is likely and erosion-control measures may be needed;
- a rating of high indicates that erosion is very likely and that erosion control measures, including revegetation of bare areas are advised; and
- a rating of severe indicates that substantial erosion is expected, loss of soil productivity and off-site damage are likely, and erosion–control measures are costly and generally impractical.

Sediment-delivery efficiency refers primarily to the slope of the landform where the map unit is located and the proximity of the map unit with respect to water features. Soil map units associated with upland environments or on ridges are typically inefficient at transporting sediment to water features when compared to those associated with riparian or streambank map units. *TABLE III-87 - SLOPE CLASS DISTRIBUTIONS* presents the slope of the project area as well as individual alternatives. A very large portion of each alternative is below 30-percent slope which indicates the project area is largely a low-energy environment (*Carson and Kirby 1972*). When a low-energy environment is coupled with moderately erosive soils, base erosion rates are typically low as observed in the project area.

TABLE III-87 – SLOPE CLASS DISTRIBUTIONS

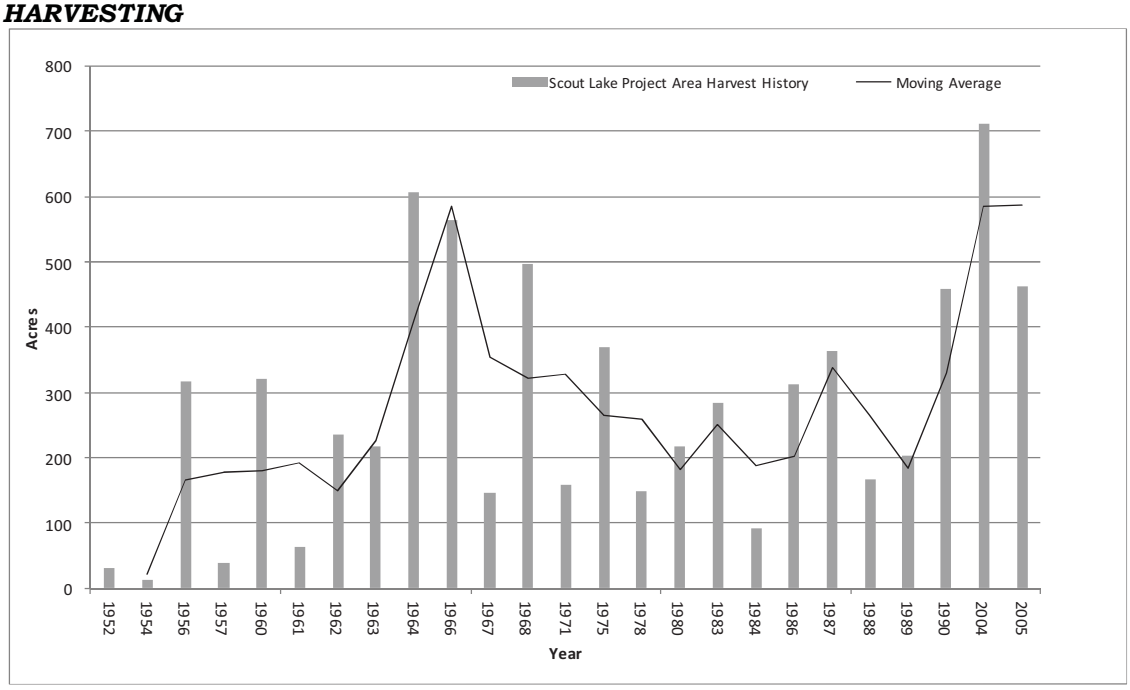
	SLOPE CATEGORY (%)						
	0 TO 10	**11 to 20**	**21 TO 30**	**31 TO 40**	**41 TO 50**	**51 TO 60**	**>60**
Project Area							
Acres	9,822	3,211	1,088	717	453	173	124
Percent of project area	63.0	20.6	7.0	4.6	2.9	1.1	0.8
Cumulative total (%)	*63.0*	*83.6*	*90.6*	*95.2*	*98.1*	*99.2*	*100.0*
Analysis Area – Action Alternative B							
Acres	1,430	410	90	41	24	3	0
Percent of project area	71.6	20.5	4.5	2.0	1.2	0.1	0.0
Cumulative total (%)	*71.6*	*92.1*	*96.6*	*98.7*	*99.9*	*100.0*	*100.0*
Analysis Area – Action Alternative C							
Acres	1,654	614	177	72	50	38	20
Percent of project area	63.0	23.4	6.8	2.7	1.9	1.4	0.8
Cumulative total (%)	*63.0*	*86.4*	*93.1*	*95.9*	*97.8*	*99.2*	*100.0*

A common feature to all soil map units in the project area, though spatially explicit, is the influence of volcanic ash. Volcanic ash from eruptions along the Pacific Northwest Cascade Range has significantly influenced forest soil productivity in the Inland Northwest (*Mullineaux 1996; Shipley 1983*) and particularly the project area. Soils influenced by volcanic ash have lower bulk densities, higher porosities, high cation-exchange capacity, and higher water infiltration and retention (*Shoji, 1993*), as well as reduced stress to plant growth during droughty conditions. Very low bulk density values are consistent with ash-influenced surface soils. Ash thickness in the project area has been observed to range from a few inches to 6to 8 inches in favorable aspects.

HISTORIC HARVESTING AND RELATED MANAGEMENT ACTIVITIES

Since the 1920s, Swan River State Forest has been actively managed for timber production. The majority of timber harvesting in these early periods involved select cutting of only the most merchantable timber. Timber was typically hand-felled and skidded with horses until mechanized equipment was employed. Impacts to soil resources prior to the late 1950s are assumed to be ameliorated except for the most heavily impacted skid trails, which comprise a very low percentage of the project area.

FIGURE III-18 – SCOUT LAKE MULTIPLE TIMBER SALE PROJECT AREA HISTORIC HARVESTING



The harvest pattern in the project area has been relatively consistent since the mid 1950s with two pronounced periods of activity in the mid 1960s and again in the mid-2000s. This data is presented in *FIGURE III-18 – SCOUT LAKE MULTIPLE TIMBER SALE PROJECT AREA HISTORIC HARVESTING.*

SOIL PHYSICAL PROPERTIES

The area proposed for reentry varies by action alternative. Existing detrimental soil impacts within harvest units proposed for entry was found to be rather consistent between alternatives and throughout the project area. Results from pace transects designed to asses soil disturbance are presented below in *TABLE III-88 - EXISTING DETRIMENTAL SOIL DISTURBANCE.*

TABLE III-88 - EXISTING DETRIMENTAL SOIL DISTURBANCE

	ACTION ALTERNATIVE	
	B	**C**
Proposed reentry (acres)	403	546
Sample transects (n)	12	19
Total sample length (miles)	7.4	10.1
Undisturbed samples (percent)	76.7	76.5
Slight disturbance (percent)	11.9	13.1
Displaced (percent	5.1	5.1
Deposited (percent)	1.8	1.6
Rutted (percent)	0.5	0.7
Eroded (percent)	0.0	0.0
Compacted (percent)	3.3	2.6
Total disturbance (percent)	8.9	8.4
Average total coarse woody debris (tons/acre)	16.3	15.5

**Individual sample points were taken at the boot toe every 30 feet along pace transect*

The majority of impacts fell on historic skid trails and/or temporary road locations. All of the historic trail locations within the sampling area met *BMPs* and will be reused in subsequent entries. The level on existing detrimental soil disturbance is well within the guidelines outlined in the *SFLMP* (*DNRC, 1997*), and soil productivity has been maintained in the sampled areas.

The data collected from pace transects also shows an interesting relationship between the siviculture prescription that was implemented during harvesting and the level of soil disturbance. In general, soil disturbance was found to increase with elevated harvesting intensity. Although the data showed no statistically powerfully evidence that related time since harvesting to the current level of disturbance, modern equipment, operator skill, and motivation as well as effective *BMP* implementation has undoubtedly decreased harvest related impacts to soil resources over the past 20 years.

NUTRIENT CYCLING AND SITE PRODUCTIVITY

Coarse and fine woody debris and the organic forest floor provide a critical role in all forested ecosystems through nutrient cycling, microbial habitat, moisture retention and protection of the forest floor, and mineral soil from erosion (*Harmon et al. 1986*). Coarse woody debris decays at various rates and is largely dependant on local climatic conditions with the degree of decay directly related to the service it provides to the ecosystem. Coarse wood in advance stages of decay contains many nutrients (sulfur, phosphorous, and nitrogen), provides important sites for nonsymbiotic nitrogen fixation (*Larson et al. 1978, Wicklow et al. 1973*) and can hold large volumes of moisture for vegetation during dry periods.

Forest management can affect the volumes of both fine and coarse woody debris through timber harvesting resulting in changes (both positive and negative) to site nutrient pools necessary for the long-term nutrient demands of the forest and, thus, long-term productivity of the site. The data in *TABLE III-89 – WOODY DEBRIS VOLUMES BY PRESCRIPTION* was collected from 97 randomly orientated transect in previously managed stands with various siviculture prescription throughout the project area (*DNRC 2011*). Similar to soil disturbance, as harvest intensity increases, coarse and fine woody debris retention can decrease if not properly managed. This data helps to forecast proper woody debris retention mitigations in concert with logging systems and prescriptions.

TABLE III-89 – WOODY DEBRIS VOLUMES BY PRESCRIPTION

PRESCRIPTION	n	AVERAGE (TONS/ACRE)	AVERAGE FINE WOODY DEBRIS RATIO*
Clearcut	10	14.3	0.28
Seedtree	10	11.8	0.40
Shelterwood	3	17.6	0.26
Salvage	3	21.4	0.28
Commercial thin	3	26.4	0.29
Select harvest	3	32.0	0.17

*Fine woody debris ratio = fine woody debris /total woody material

The data in *TABLE III-90 – COARSE AND FINE WOODY DEBRIS VOLUMES* was also collected from the same transects and provides similar information with respect to various habitat types in the project area (*DNRC 2011*). Stands managed since the early 1960s, while on the low end of the range, are consistent with coarse woody debris recommendations made by *Graham et al (1994)* to support soil biologics and nitrogen fixation processes. This type of data validates that contract administration processes can achieve recommended mitigation measures specific to woody debris retention.

TABLE III-90 – COARSE AND FINE WOODY DEBRIS VOLUMES

HABITAT TYPE	n	AVERAGE (TONS PER ACRE)	AVERAGE FWD RATIO*	GRAHAM ET AL. (1994)
Douglas-fir	7	13.3	0.40	12 to 24
Grand fir	7	13.6	0.32	7 to 14
Engelmann spruce	7	24.9	0.32	n/a
Subalpine fir	3	14.0	0.19	11 to 23
Western red cedar	8	18.6	0.25	16 to 33

* Fine woody debris *ratio* = fine woody debris /*total woody material*

Historical nutrient management practices did not have the benefit of the scientific and research knowledge that we have acquired in the last 2 decades. As shown in *TABLE III-88 - EXISTING DETERMENTAL SOIL DISTURBANCE*, levels of woody material in previously harvested stands are adequate and would not require additional mitigations to maintain the stable trend of site productivity. Prescriptions for nutrient and slash management for both action alternatives would use the data collected during field reconnaissance in concert with those recommended in the literature (*Graham et a*l. *1994*).

ENVIRONMENTAL EFFECTS

This section will disclose the direct, indirect, and cumulative effects of all proposed action alternatives. Direct and indirect environmental effects common to both alternatives will be summarized and then followed by effects unique to each alternative. Cumulative effects will be summarized by alternative and will be under *CUMULATIVE EFFECTS BY ALTERNATIVE* immediately following *DIRECT AND INDIRECT EFFECTS*.

OVERVIEW

Past soil-monitoring projects of DNRC timber sales on soils similar to those found in the project area allows informed forecasting of potential effects to soils resource from the implementation of each action alternative. Presented below in *TABLE III-91 – SOIL*

MONITORING PROJECTS RELEVANT TO THE PROJECT AREA are soil monitoring projects completed by DNRC since 1987 that were conducted within the boundaries of the *Flathead National Forest Land System Inventory* (*Martinson 1999*).

Soil monitoring of the Coal Creek Timber Sale in 1987 documented the highest level of soil disturbance on state lands; it should be noted that operations were conducted prior to *BMP* implementation. While these values are excessive, much was learned from these old practices and, thus, are still relevant. The average value of total impacts from all projects will be used to forecast detrimental effects for tractor harvesting units in each alternative along with a potential range of impacts. The range of impacts in the forecast will omit the *Coal Creek Project* (Units 8, 9, and 10) as Forest Officers would cease operations prior to achieving this level of impact under current forest practice standards. Range of impacts will include values within one standard deviation of the sample mean.

TABLE III-91 – SOIL MONITORING PROJECTS RELEVANT TO THE PROJECT AREA

PROJECT	YEAR	MAP UNITS	AVERAGE SLOPE (%)	PRESCRIPTION	EQUIPMENT	SEASON	TOTAL DETRIMENTAL IMPACTS (%)
Coal Creek Unit 5	1987	26C-8*	23	Seedtree	Ground-based	Winter	19.1
Coal Creek Units 8, 9, and 10	1987	73	31	Seedtree	Ground-based	Summer/fall	34.2
Goat Rot Hill Unit 2	1989	26A-9*	15	Clearcut	Ground-based	Summer	10.2
South Wood 2 Unit 2	1991	23-9	29	Commercial thin	Ground-based	Summer	8.1
Lower Stillwater 2 Units 2 and 6	1991	28-7 26G-7	7	Clearcut	Ground-based	Winter	7.7
Chicken Werner Unit 10	2003	26C-8*	37	Seedtree	Ground-based	Summer	8.0
Dog Meadow North Unit 9	2006	26C-8*	10	Seedtree	Ground-based	Summer/fall	21.2
Shorts Meadows Units 6 and 9	2010	27-7*	29	Seedtree	Ground-based	Summer	1.8
White Donut Unit 1	2011	27-7*	16	Seedtree	Ground-based	Summer/fall	12.0
** Denotes map units within the Scout Lake Multiple Timber Sale analysis area*							Average: 13.6

It has been shown that cable- logging systems have less soil disturbance than ground-based systems (*Allen 1999; Aulerich 1974; Cromack et al. 1978; DNRC 2009*). Due to these research findings, applying a soil disturbance rate from ground-based systems to cable or skyline systems would be inappropriate. DNRC has conducted soil monitoring on 7 harvest units that employed cable logging systems and found that ground disturbance values average 7.0 percent of the unit and range from 2.3 to 11.4 percent (*DNRC 2009*). The results of these findings will be applied to all cable harvest units when predicting potential soil impacts. All cable harvest monitoring projects were completed after full implementation of *BMPs* and are assumed here to be reflective of current forest

practices. Due to this, the actual range of impacts will be used to forecast potential soil impacts and not the standard deviation as in ground-based forecasts.

DIRECT AND INDIRECT EFFECTS

- **Direct and Indirect Effects of No-Action Alternative A to Geology and Soils**

  Under No-Action Alternative A, timber harvesting or road construction would be deferred. No harvest units would be entered or reentered, resulting in no new detrimental soil impacts. Erosion and sediment production from proposed harvest units would continue to be stable and mimic natural base erosion rates. Nutrient pools would continue to accumulate with additional inputs from the surrounding forest stands. Productivity within historic harvest units would continue to recover with soil physical properties returning to reference conditions over various time frames dependant on the severity of impact. Data collected during project development and information gained from past DNRC soil-monitoring projects and the research community show that the soils in the project area will continue on a stable or increasing trend with regard to productivity and soil function. No adverse direct or indirect effects to soils resources would occur under this alternative.

- ***Direct and Indirect Effects to Geology and Soils Common to Both Action Alternatives***

  Erosion

  Under both action alternatives, the potential for upland erosion and transport within actual harvest unit boundaries would be low based on field observation of past projects, DNRC monitoring data, moderate erosion rates, and generally low angle slopes in harvest units. Observed erosion is typically limited to compacted locations where organic matter, vegetative cover, and surface soils have been most disturbed and the hydrologic function of the soil has been limited. These locations are usually found on main skid trails and landings. On these impacted sites the potential for erosion is a function of the soil texture, severity of impacts, and rainfall intensity. Erosion risk and sediment delivery efficiency has been summarized by a soil map unit that can be found in; *FIGURE III-18 – SOIL MAP UNITS AND ATTRIBUTES*. In general, steep impacted sites are most prone to erosion and offsite transport. Due to the moderate risk of erosion and low probability of high rainfall intensity, impacted areas can be mitigated with standard erosion-control measures. These include providing temporary vegetative cover with logging slash, installing drainage features on landings and main skid trails, and mechanically ripping heavily impacted sites to assist the hydrologic recovery of compacted soils. Considering all these factors, a low probability of low level effects to soil productivity resulting from off-site erosion is expected as a result of implementing either action alternative. Immeasurable differences in sediment production and erosion exist between either action alternative.

  Nutrient Cycling and Site Productivity

- Both action alternatives would have a low probability of low level impacts for a short duration (15 to 20 years) to site nutrient pools and site productivity. The removal of nitrogen, potassium, and sulfur, along with other micronutrients from the site through timber harvesting, would be mitigated by mimicking volumes of

coarse and fine woody material found throughout the project area as represented in *TABLE III-91 – SOIL MONITORING PROJECTS RELEVANT TO THE PROJECT AREA*. The volume of coarse and fine woody material retained on site would vary by habitat type and sivilcultural prescription but would typically range from 10 to 25 tons per acre as recommended by *Graham et al. (1994)*.

- ***Direct and Indirect Effects of Action Alternative B to Geology and Soils***

Soil Physical Properties

Under Action Alternative B, approximately 2,009 acres would be harvested from the project area and 4.92 miles of permanent road and up to 2.5 miles of temporary road would be constructed. Tractor and cable logging systems would be used to extract the timber. Temporary roads, once reclaimed and stabilized, would be expected to return to lands capable of producing forest products, though over very long time frames, and the long-term productivity of these areas would be impacted. Permanent roads would change the land use of the affected area from forest products to transportation. *TABLE III-92 – SOIL IMPACTS RESULTING FROM ACTION ALTERNATIVE B*, below presents the approximate amount of acres that would be disturbed and the expected range of detrimental soil effects.

TABLE III-92 – SOIL IMPACTS RESULTING FROM ACTION ALTERNATIVE B

HARVEST SYSTEM	ACRES/ MILES	SOIL IMPACT RATE		IMPACTED AREA	
		AVERAGE (%)	RANGE (%) (σ 6.4)	AVERAGE (ACRES)	RANGE (ACRES)
Tractor	1,866	13.6	7.2 to 20.0	253.8	134.4 to 373.2
Cable	143	7.0	2.3 to 11.4	10.0	3.3 to 16.3
Temporary road construction	2.50	100 percent (25-foot clearing limit)		7.6	0.0
New road construction	4.92	100 percent (50-foot clearing limit)		29.8	0.0
Analysis area; acres of expected impacts		14.7	8.6 to 20.9	301.2	176.6 to 428.4

The level of soil disturbance forecasted from harvesting activities are below that recommended in the *SFLMP* (*DNRC, 1996*) and will result in less disturbance than Action Alternative C. Action Alternative B presents a high probability of low- to moderate-level impacts to soil physical properties in the analysis area for moderate durations (80 to 100 years). The long-term soil productivity is expected to be maintained at levels described in the existing conditions. It should be noted that a large portion of these acres could potentially be harvested with winter conditions and many of the temporary roads could be constructed as snow roads. Because winter logging and snow-road construction is highly condition-dependant, analyzing for potential worst-case scenarios in the event that adequate winter conditions do not materialize is prudent. The data in *TABLE III-92 - SOIL IMPACTS RESULTING FROM ACTION ALTERNATIVE B* should be considered as the high end for potential effects.

- ***Direct and Indirect Effects of Action Alternative C to Geology and Soils***

Soil Physical Properties

Under Action Alternative C, approximately 2,635 acres would be harvested from the project area and 8.20 miles of permanent and 3.50 miles of temporary road would be constructed. Tractor and cable logging systems would be used to extract the timber. *TABLE III-93 – SOIL IMPACTS RESULTING FROM ACTION ALTERNATIVE C,* below, presents the approximate amount of acres that would be disturbed and the expected range of detrimental soil effects. The level of soil disturbance forecasted from harvesting activities are approximately equal to that recommended in the *SFLMP* (*DNRC, 1996*), but would result in more disturbance than Action Alternative B.

TABLE III-93 – SOIL IMPACTS RESULTING FROM ACTION ALTERNATIVE C

HARVEST SYSTEM	ACRES/ MILES	SOIL IMPACT RATE		IMPACTED AREA	
		AVERAGE (%)	RANGE (%) (σ 6.4)	AVERAGE (ACRES)	RANGE (ACRES)
Tractor	2,492	13.6	7.2 to 20.0	338.9	179.4 to 498.4
Cable	143	7.0	2.3 to 11.4	10.0	3.3 to 16.3
Temporary road construction	3.50	100 percent (25-foot clearing limit)		10.6	0.0
New road construction	8.20	100 percent (50-foot clearing limit)		49.7	0.0
Analysis area; acres of expected impacts		15.2	9.0 to 21.3	409.2	243.0 to 575.0

Action Alternative C presents a high probability of low- to moderate-level impacts to soil physical properties in the analysis area, and the long-term soil productivity is expected to be maintained at levels described in the existing conditions. It should be noted that a large portion of these acres could potentially be harvested with winter conditions and many of the temporary roads could be constructed as snow roads. Because winter logging and snow-road construction is highly condition-dependent, analyzing for potential worst case scenarios in the event that adequate winter conditions do not materialize is prudent. The data in *TABLE III-93 – SOIL IMPACTS RESULTING FROM ACTION ALTERNATIVE C* should be considered as the high end for potential effects.

CUMULATIVE EFFECTS BY ALTERNATIVE

As mentioned previously, for a proposed action to have cumulative effects to soil resources, the action must overlap a previous or potential future action. The overlap refers to both the harvest unit in question and two points in time. The following summarizes cumulative effects by each alternative.

- ***Cumulative Effects of No-Action Alternative A to Geology and Soils***

Under No-Action Alternative A, no timber harvesting or road construction would be implemented. No new impacts to the soils resources would be expected and soil productivity trends would continue on a stable to upward trend resulting from continual amelioration of past soil impacts within the harvest units, but not permanent roads. Nutrient cycling would continue as both coarse and fine woody

materials decay and are incorporated into the soil profile as organic matter and soil wood. Potential future actions to actively manage the stands selected in each alternative are foreseeable, but the design and objectives of future projects is impractical to predict. Small sanitation, salvage, and firewood permits would continue to be offered in the project area under No-Action Alternative A. If stands are reentered in potential future projects or permits, historic skid trails and landings would be reused and all relevant *BMPs* and mitigations would be included into the project design to minimize the potential of cumulative effects.

- ***Cumulative Effects of Action Alternative B to Geology and Soils***

Under Action Alternative B, a total of 403 acres would be reentered that have had past management activities since the 1960s. Data collected at 30-foot intervals along 7.4 miles of pace transects show existing impacts on 8.9 percent of this area. The level of disturbance in individual units ranged from 2.2 to 12.6 percent. The majority of impacts were isolated to historic skid trails and temporary roads. These locations would again be used under the proposed action and existing impacts would be reinforced, slowing natural amelioration rates. The topography of the harvest units in question is well suited for winter logging operations and, if conducted, minimal additional impacts would be expected. If summer operations are chosen, additional impacts would be expected, but with primary skid trails already established, cumulative soil impacts are expected to remain below 20 percent of the harvest area as recommended by the *SFLMP*. Assuming *BMPs* and general mitigations outlined in this document are applied, the long-term productivity of the site is expected to be maintained. Action Alternative B presents a moderate risk of moderate cumulative effects to soil physical properties that would be expected to ameliorate within a stand rotation. Action Alternative B presents less risk for cumulative effects to soil function than Action Alternative C.

No harvest units proposed for reentry under Action Alternative B were observed to contain areas of chronic erosion. All past impacted areas have revegetated naturally and have returned, or are returning, to their natural base erosion rates. No cumulative effects from erosion in the analysis area are expected.

The probability of low-level cumulative effects to nutrient pools within the reentered stands would be high under Action Alternative B. In general, stands currently contain adequate levels of both fine and coarse woody material averaging approximately 16.3 tons per acre. The variability observed in the dataset can largely be described by habitat type and, to a lesser degree, sivicultural prescription, with ranges from 1 to 32 tons per acre. If a site's nutrient-retention levels were mismanaged in the past, the reentry allows DNRC to better manage site nutrients through woody debris retention that mimics that found in similar habitat types and as recommended by *Graham et al. (1994)*.

In summary, Action Alternative B presents a moderate probability of low-level cumulative effects to soil productivity in the 403 acres proposed for reentry.

- ***Cumulative Effects of Action Alternative C to Geology and Soils***

  Under Action Alternative C, a total of 546 acres would be reentered that have had past management activities since the 1960s. Data collected at 30-foot intervals along 10.1 miles of pace transects show existing impacts on 8.4 percent of this area. The level of disturbance in individual units also ranged from 2.2 to 12.6 percent. The majority of impacts were again isolated to historic skid trails and temporary roads. These locations would be reused under the proposed action and existing impacts would be reinforced, slowing natural amelioration rates. The topography of the harvest units in question is well suited for winter logging operations and, if conducted, minimal additional impacts would be expected. If summer operations are chosen, additional impacts would be expected, but with primary skid trails already established, cumulative soil impacts are expected to remain below 20 percent of the harvest area as recommended by the *SFLMP*. Assuming *BMPs* and general mitigations outlined in this document are applied, the long-term productivity of the site is expected to be maintained. Action Alternative C presents a moderate risk of moderate cumulative effects to soil physical properties that would be expected to ameliorate within a stand rotation. Action Alternative C presents more risk of cumulative effects to soil function than Action Alternative B.

  No historically managed sites in the project area were observed to contain chronic erosion features. All past impacted areas have revegetated naturally and have returned or are returning to their natural base erosion rates. No cumulative effects from erosion in the analysis area are expected.

  The probability of low-level cumulative effects to nutrient pools within the reentered stands would be high under Action Alternative C. In general, stands currently contain adequate levels of both fine and coarse woody material averaging approximately 15.5 tons per acre. The variability observed within the dataset can largely be described by habitat type and, to a lesser degree, sivicultural prescription, with ranges from 1 to 32 tons per acre. If a site's nutrient-retention levels were mismanaged in the past, the reentry allows DNRC to better manage site nutrients through woody debris retention that mimics that found in similar habitat types and as recommended by *Graham et al. (1994)*.

  In summary, Action Alternative C presents a moderate probability of low-level cumulative effects to soil productivity in the 546 acres proposed for reentry.

FIGURE III-17 – SCOUT LAKE PROJECT AREA AND SOIL MAP UNITS

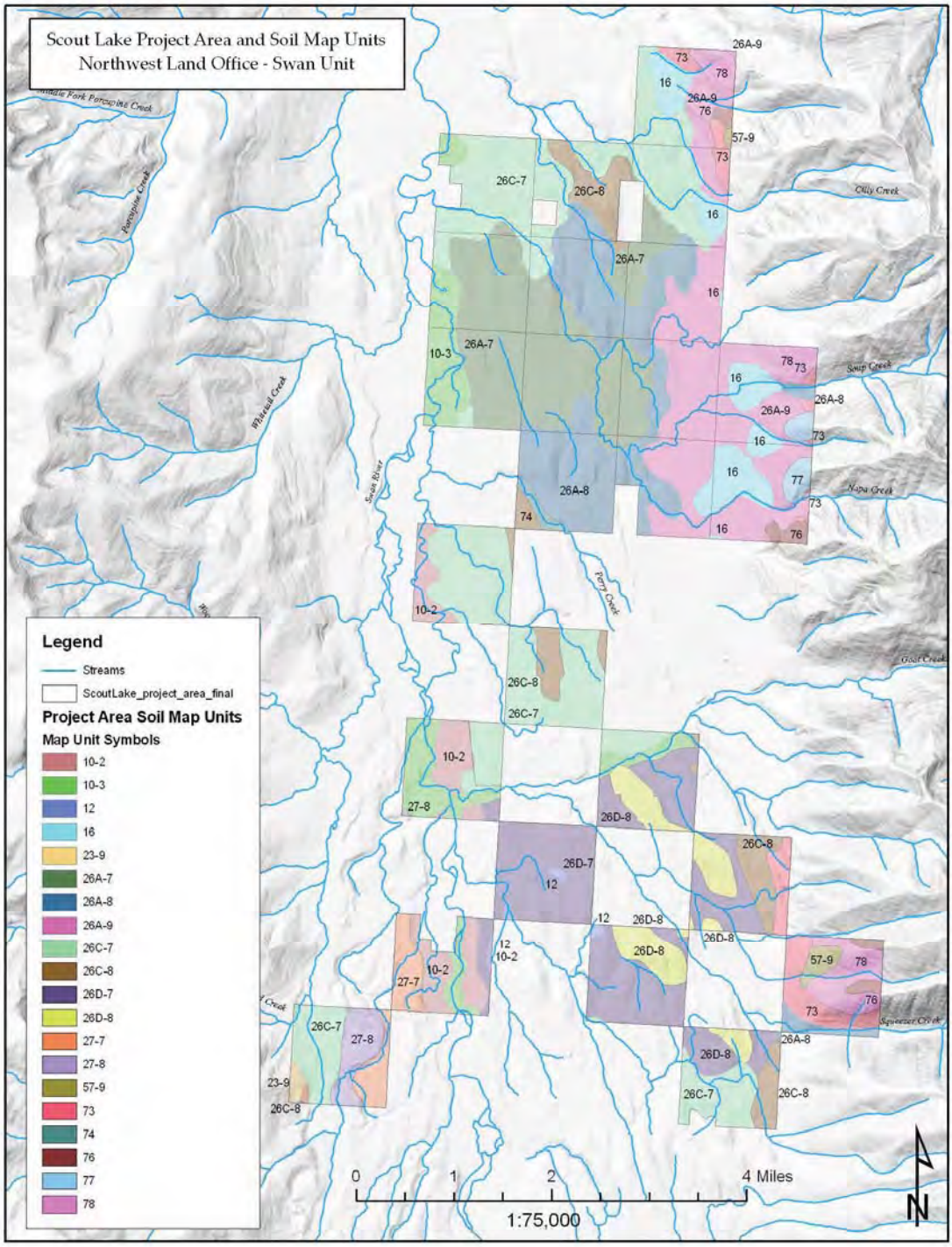


FIGURE III-85 - SOIL MAP UNITS AND ATTRIBUTES

Map Unit	Alt "B" Harvest Units / New Rd	Alt "C" Harvest Units / New Rd	K Factor (rock free)	Map Unit Name	Landform	Erosion & Sediment Delivery Efficiency	Compaction / Displacement Hazard
10-2	14.9/0.2	14.9/.2	0.17	Fluvents, stream bottoms	Dominant slopes have gradients of 0-5%. Stream bottoms are along streams and are subject to flooding during spring snowmelt. Streams have braided channels and change course frequently.	Severe, but SMZ laws would prohibit most operations	High / Moderate
10-3	6.6/0.0	31.7/0.0	0.32	Aquepts, stream bottoms	Dominant slopes have gradients of 0-5%. Located in depressions on flood plains and often shallow ponds. Subject to flooding during spring snowmelt and have highly fluctuating water tables.	Severe, but SMZ laws would prohibit most operations	High / Moderate
12	0.0/0.0	2.6/0.0	0.02	Borosaprists, depressions	Dominant slopes have gradients of 0-2%. Depressions have no well defined drainage outlets. Show contain shallow ponds.	High, but lack of defined stream networks limit sediment transport.	High / Moderate
16	3.6/0.9	29.4/0.9	0.17	Fluvents, alluvial fans	Dominant slopes have gradients of 5-25%. Alluvial fans are fan-shaped alluvial deposits at the point where steep mountain streams enter valley bottoms. Seeps and springs are in drainages.	Low	High/Moderate
26A-7	432.9/3.7	350.7/5.5	0.32	Andeptic Cryobralfs, silty till substratum, calcareous, rolling	Dominant slopes have gradients of 10-20%. Moraines are rolling glacial till deposits. They have deranged drainage patterns.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Low
26A-8	429.6/10.4	536.2/12.8	0.32	Andeptic Cryobralfs, silty till substratum, calcareous, hilly	Dominant slopes and gradients of 20-40%. Glaciated mountain slopes are mantled with glacial till. The drainage pattern is dendritic and drainages are widely spaced.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Moderate
26A-9	200.6/6.4	193.7/6.4	0.32	Andeptic Cryobralfs, silty till substratum, calcareous, steep	Dominant slopes have gradients of 40-60%. Glaciated mountain slopes are mantled with glacial till. The drainage pattern is dendritic and drainages are widely spaced.	Moderate erosion hazard. High sediment delivery efficiency.	Moderate/Moderate
26C-7	588/5.2	799.2/8.9	0.32	Andeptic Cryobralfs, silty till substratum, rolling	Dominant slopes have gradients from 10- 20%. Moraines are rolling glacial till deposits. They have deranged drainage patterns.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Moderate
26C-8	44.2/0.0	69.1/0.4	0.32	Andeptic Cryoboralfs, silty till substratum, hilly	Glaciated mountain slopes and ridges with dominant slopes from 20-60%. Typically mantled with glacial tills. The drainage pattern is dendritic and drainages are widely spaced.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Moderate
26D-7	0.0/0.0	134.4/1.0	0.37	Dystric Cryochrepts, rolling	Dominant slopes have gradients from 10-20%. Moraines are rolling glacial till deposits. They have deranged drainage patterns.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate/Moderate
26D-8	0.0/0.0	82.6/0.0	0.37	Dystric Cryochrepts, hilly	Dominant slopes have gradients of 20-40%. Glaciated mountain slopes are mantled with glacial till. The drainage pattern is dendritic and drainages are widely spaced.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Low/Moderate
27-7	198.4/4.8	198.4/4.7	0.32	Dystric Eutrochrepts, till substratum	Dominant slopes have gradients of 10-20%. Kames and kettles are a complex pattern of knolls and depressions. The drainage pattern is deranged. There are bogs and marshes in kettles. Terraces have a dendritic pattern of widely spaced drainages.	Moderate to low erosion hazard. Low sediment delivery efficiency.	Low/Moderate
27-8	78.6/0.0	84.9/0.0	0.32	Dystric Eutrochrepts, till substratum, steep	Dominant slopes have gradients of 20-40%. Kames and kettles are a complex pattern of knolls and depressions. The drainage pattern is deranged. There are bogs and marshes in kettles. Terraces have a dendritic pattern of widely spaced drainages.	Moderate erosion hazard. Low sediment delivery efficiency.	Low/Moderate
57-9	0.0/0.0	5.9/0.7	0.32	Andic Cryochrepts, glaciated mountain slopes	Dominant slopes have gradients of 40-60%. Glaciated mountain slopes have thin glacial till in places. Drainage pattern is dendritic and widely spaced.	Moderate erosion hazard. Moderate sediment delivery efficiency.	Moderate / Moderate
76	0.0/0.0	13.7/2.7	0.10	Rock outcrop-Ochrepts complex, structural breaklands	Dominant slopes have gradients of 60-90%. These structural breaklands have slope shapes controlled by underlying bedrock. The dip of underlying rock strata is roughly perpendicular to slopes. The unit has common avalanche paths. The drainage pattern is dendritic or parallel and drainages are widely spaced and weakly incised.	Moderate to high erosion hazard though highly site specific. High sediment delivery efficiency.	Low / Moderate
77	11.6/0.0	11.6/0.0	0.10	Ochrepts-Rock outcrop complex, structural breaklands	Dominant slopes have gradients of 60-90%. These structural breaklands have slope shapes controlled by underlying bedrock. The dip of underlying rock strata is roughly perpendicular to slopes. The landform has few avalanche paths. The drainage pattern is dendritic and drainages are relatively closely spaced and deeply incised.	Moderate to high erosion hazard though highly site specific. High sediment delivery efficiency.	Low / Moderate
78	0.0/0.0	75.7/6.0	0.20	Ochrepts-Rock outcrop complex, southern aspects	Dominant slopes are on southerly aspects and have gradients of 60-90%. Glacial though walls are the upper valley hillslopes in U-shaped glacial valleys. They have straight slopes and a parallel drainage pattern. Structural breaklands have slope shapes controlled by underlying bedrock. Rock strata are roughly perpendicular to slope. The landform has a few avalanche paths. The drainage pattern is dendritic on structural breaklands.	Moderate to high erosion hazard though highly site specific. High sediment delivery efficiency on lower slopes and moderate on upper slopes.	Low / Moderate
Total Area of Operations (acres)	2,009.2/31.7	2,634.7/50.5					

ECONOMIC ANALYSIS

INTRODUCTION

This analysis describes existing economic conditions associated with the Scout Lake Multiple Timber Sale and indentifies potential direct, indirect, and cumulative economic effects of the proposed alternative actions.

ISSUES AND MEASUREMENT CRITERIA

The following issue statement was crafted to account for concerns of the economic benefits of the Scout Lake Multiple Timber Sale and guide the analysis of this section: The proposed action may affect revenue generated for the Common School Trust, funding for FI projects, timber-related employment, and revenue generated in the regional economy.

> *The proposed action may directly affect income in the regional forest products economy. This includes revenue for state trust beneficiaries, infrastructure development, and other forest improvements on state trust forestlands. The proposed action may also directly affect employment opportunities in the regional forest products economy.*

The following measurement criteria were selected to describe the existing economic environment in the area and to 'measure' the extent of the potential direct, indirect, and cumulative economic effects under each alternative: For revenue, the measurement criterion is dollars distributed to the Common School Trust, FI program, and regional economy. For employment, the measurement criterion is the number of timber-related jobs provided.

- *For all income, revenues, and prices the measurement criterion is current U.S. dollars.*
- *For employment, the measurement criterion is full-time jobs sustained for one year.*

ANALYSIS AREA

The geographic scope of the economic analysis includes the 3 counties closest in proximity to the proposed action. This 3-county area (Flathead, Lake, and Missoula) is both geographically and economically relevant to the proposed action. The temporal scope of the economic analysis is the duration of the proposed activities.

ANALYSIS METHODS

The economic analysis of proposed timber sales is limited to the estimation of income and employment opportunities occurring as a result of the proposed action.

Total income, defined as income earned in all stages of the forest resources economy up to the point of industrial processing, is estimated by multiplying reported regional gate prices[1] (the delivered log price paid by industrial wood processors) by the total harvest volume expected in the proposed timber sale. Stumpage prices, the contractual price paid for standing timber, are analyzed to determine the portion of this total income earned by the trust beneficiaries. Stumpage prices are estimated through transaction evidence from comparable timber sales,

[1] *Surveyed gate prices are reported quarterly by the Bureau of Business and Economic Research, an industry research organization at the University of Montana.*

highlighting unique characteristics of the proposed sale (i.e. species mix, wood quality, density and diameter, terrain, development requirements, and proximity to markets). State trust management expenses are estimated from annual cash-flow records from DNRC's *TLMD* forest-management program.

Direct employment opportunities are estimated using employment multipliers published by the *University of Montana's Bureau of Business and Economic Research*. Additionally, data sources for the economic analysis include DNRC's *TLMD*, the *Department of Labor and Industry*, *Research and Analysis Bureau*, *Western Wood Products Association* and *Random Lengths*.

AFFECTED ENVIRONMENT

The proposed action would take place in Swan River State Forest located in the southeastern corner of Lake County. Timber sales in this area generally supply lumber, plywood, and pulp to industrial processors in Lake, Missoula, and Flathead counties. Flathead County includes the northern portion of Flathead Lake and the west side of Glacier Park. Lake County encompasses a large part of Flathead Lake and includes much of the Flathead Indian Reservation. Missoula County is located to the south and east of Lake County and encompasses Missoula Valley and the greater surrounding area.

Summary state and county level economic data are presented in *TABLE III-94 – MONTANA COUNTY ECONOMIC OVERVIEW*. Flathead and Missoula counties each have approximately 10 percent of the state's total population; whereas Lake County remains considerably more rural. The total estimated labor force population in the 3-county area is 110,255. Average unemployment in 2011 measured lower in Missoula County at 6.8 percent, where Lake and Flathead County have experienced unemployment rates near to 10.0 percent.

The number of firms and average employment in Montana are also reported in *TABLE III-94 – MONTANA COUNTY ECONOMIC OVERVIEW*. (*North American Industry Classification System*) data, available from the Montana Department of Labor and Industry, measure the number of taxed firms and their average employment in the fourth quarter of 2010. Average employment data is expected to be significantly lower than actual employment in many subsectors due to unmonitored activity in seasonal hiring, informal economies, and small operators. Additionally, firm data accounts for all legally formed businesses, including proprietorships, and, therefore, may not be useful in estimating relative industry size.

While the economies and demographics in each of these counties are different, they do share semiintegrated forestry and logging, and wood product manufacturing subsectors. Present in these 3 counties are 75 percent of forestry and logging firms (147 of 197) and 35 percent of wood-product manufacturing firms (53 of 151).

Many industrial-scaled, wood-product manufacturing firms exist in this region. Their presence appears in private average employment data that shows approximately half of this subsector's statewide employees (1,365 of 2,618) and 80 percent of all private logging and forestry employees (548 of 679) working from these 3 counties.

TABLE III-94 – MONTANA COUNTY ECONOMIC OVERVIEW

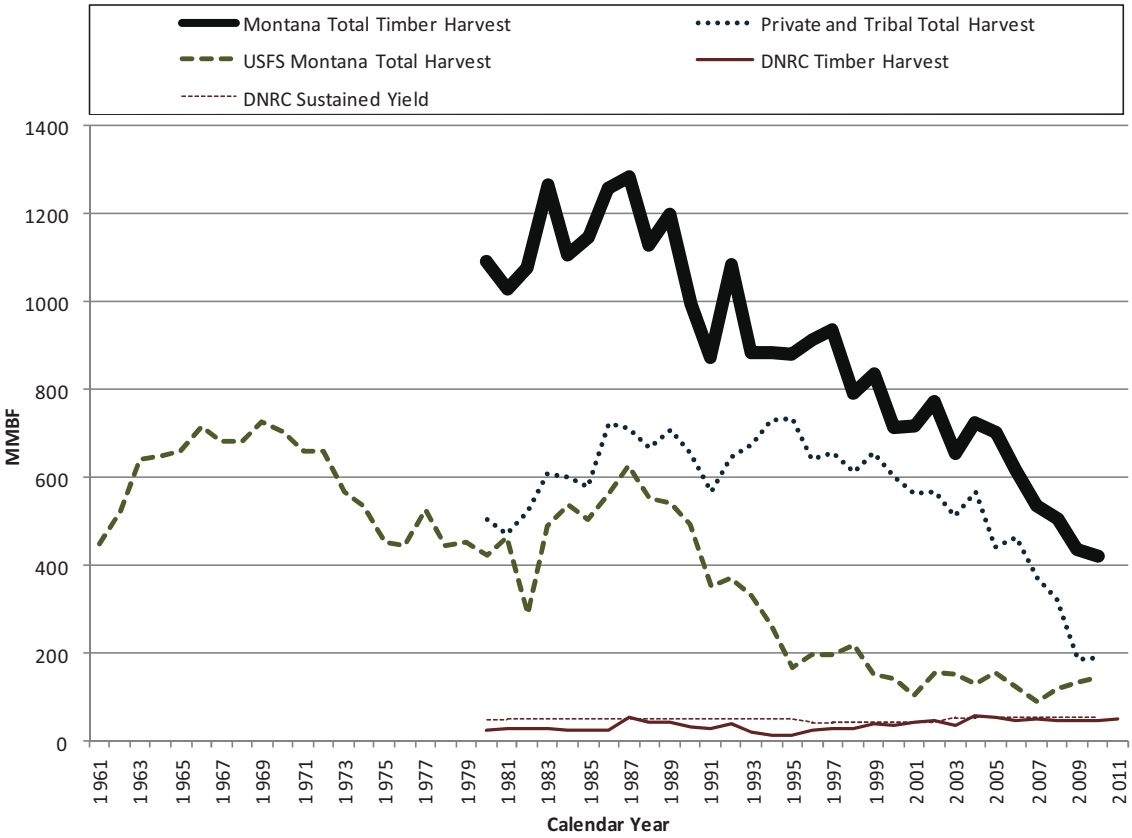
STATISTIC	MONTANA	FLATHEAD COUNTY	LAKE COUNTY	MISSOULA COUNTY
Population (2011)	989,415	90,928	28,746	109,299
Labor force (2011)	502,217	43,404	11,435	55,416
Employed (2011)	468,156	39,097	10,287	51,559
Unemployed (2011)	34,061	4,307	1,148	3,857
Unemployment rate	6.8	9.9	10.0	7.0
Per capita income (2009)	33,708	34,424	27,427	35,156
Firms (2010, fourth Quarter)				
All industries, all ownership, *NAICS* 0	42,168	4,209	924	4,471
All industries, state government, *NAICS* 0	458	14	11	17
All industries, private, *NAICS* 0	39,891	4,096	872	4,358
Forestry and logging, private, *NAICS* 113	197	83	29	35
Wood product manufacturing, private, *NAICS* 321	151	37	6	10
Average employment (2010, fourth quarter)				
All Industries, all ownership, *NAICS* 0	421,408	36,918	8,125	54,488
All industries, state government, *NAICS* 0	22,465	649	74	4,089
All industries, private, *NAICS* 0	335,408	31,720	5,175	45,043
Forestry and logging, private, *NAICS* 113	679	270	109	169
Wood product manufacturing, private, *NAICS* 321	2,618	950	60	355

Notes: NAICS = North American Industry Classification Code

Sources: Montana Department of Labor and Industry, Bureau of Research and Analysis 2011; U.S. Department of Commerce, Bureau of Economic Analysis 2011; U.S. Department of Labor, Bureau of Labor Statistics 2011.

Montana timber and lumber markets have declined over recent history. *FIGURE III-19 – MONTANA WORKING FORESTS TIMBER HARVEST (1961 to 2011)* shows a steady decrease in Montana's timber supply since the late 1980s. Aggregate timber supply chains have been affected by both changes in Federal policy and market demand. Aggregate timber supplies in Montana peaked in 1987 near 1.3 billion board feet and are down to approximately 400 million board feet in 2011. During this period in Montana, only state forests have continued to supply the same or increasing volumes year after year. Likewise, this supply of timber from state forests has also increased as a percentage of the total Montana timber supply, from approximately 3 to 10 percent. Over the past 10 years, state forests have supplied markets with an average of approximately 49 MMbf.

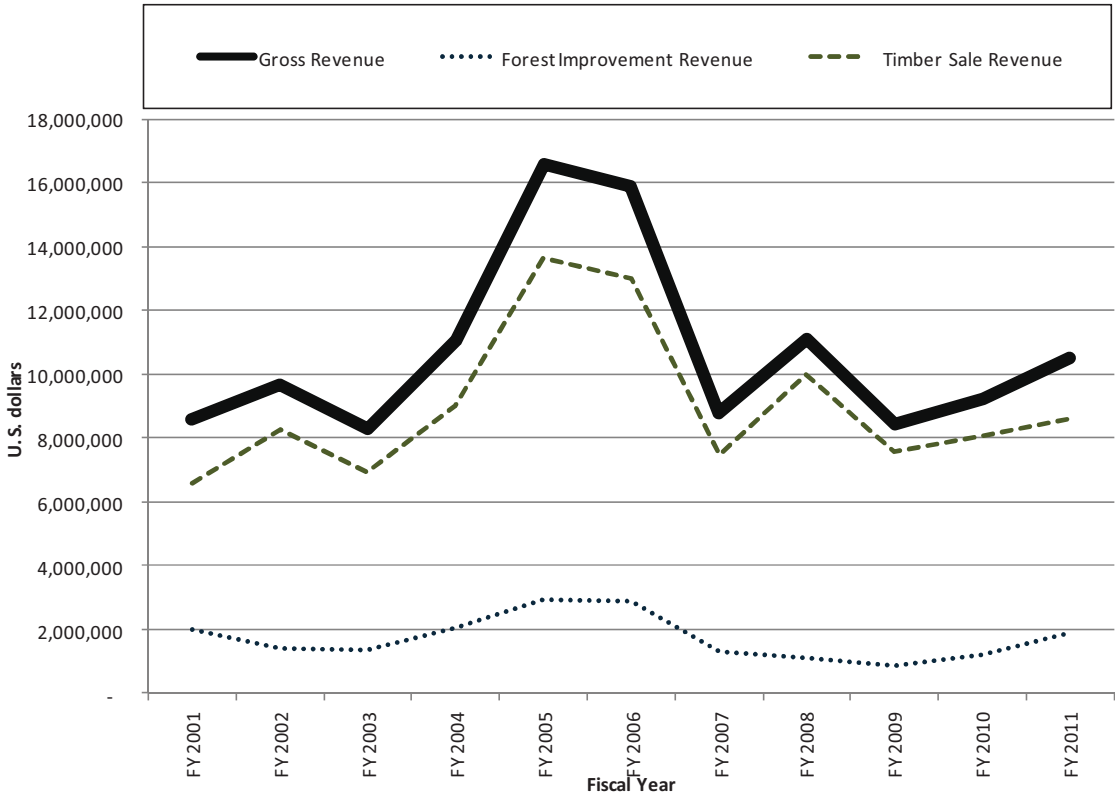
FIGURE III-19 – MONTANA WORKING FORESTS TIMBER HARVEST (1961 TO 2011)



Source: Montana DNRC 2011; University of Montana, Bureau of Business and Economic Research 2011.

In addition to supplying natural resources, state forests generate revenue for state trust beneficiaries. Revenue from state forests experienced volatility over the last decade due in part to fluctuating timber prices. *FIGURE III-20 – STATE FOREST TIMBER SALE REVENUE AND FI (Fiscal Year [FY] 2005 TO 2010)* displays state forest gross revenue, which includes both timber sale and FI revenue. FY 2005 and 2006 were banner years, with $16 million grossed in each year. Otherwise, state forest gross revenue in the last decade has trended between $8 and $11 million.

FIGURE III-20 – STATE FOREST TIMBER SALE REVENUE AND FI (FY 2005 TO 2010)



Source: DNRC 2011.

FI revenues are a component of revenues earned from state forests, are collected on non-Morrill Grant lands, and are used to finance projects that improve the health, productivity, and value of forested trust lands. FI activities may include the piling and disposal of logging slash, reforestation, thinning, prescribed burning, site preparation, noxious-weed control, seed collection, acquiring access and maintaining roads necessary for timber harvesting, and monitoring.

Timber sales are an established part of the Montana natural resource economy. They provide employment in multiple sectors; industrial processors with raw materials and revenue for forest owners.

ECONOMIC EFFECTS

Direct economic effects are those that directly alter income and employment in the forestry and logging and wood-product manufacturing subsectors of the economy. Indirect economic effects are those that alter other economic sectors within the 3-county area. Cumulative economic effects are typically seen as those that contribute to long-term changes in any part of the economy.

All economic effects are related to the scale and type of timber harvested and sold. *TABLE III-95 – ESTIMATED HARVEST VOLUMES AND LOG PRICES BY SPECIES* identifies by species all standing and harvest volumes by proposed alternatives. Action Alternative B is estimated to harvest 19,009 Mbf and Action Alternative C is estimated to harvest 21,057 Mbf,

which is 50 and 45 percent of their respective standing volumes. Estimated log prices range from $240 to $319 per Mbf for grand fir and ponderosa pine, respectively.

TABLE III-95 – ESTIMATED HARVEST VOLUMES AND LOG PRICES BY SPECIES

SPECIES	*ACTION ALTERNATIVE B*			*ACTION ALTERNATIVE C*			*LOG PRICES*
	STANDING VOLUME (MBF)	HARVEST (MBF)	HARVEST (PERCENT)	STANDING VOLUME (MBF)	HARVEST (MBF)	HARVEST (PERCENT)	SAWLOG PRICE ($/MBF)
Subalpine fir	830	393	47	823	384	47	249
Douglas-fir	8,562	4,885	57	11,936	6,226	52	281
Engelmann spruce	4,364	2,542	58	5,392	2,955	55	295
Grand fir	4,403	1,551	35	5,296	1,767	33	240
Lodgepole pine	1,596	377	24	2,589	623	24	290
Ponderosa pine	754	204	27	1,415	361	25	319
Western red cedar	581	271	47	1,132	553	49	225
Western larch	16,816	8,520	51	17,731	7,943	45	281
Western white pine	473	264	56	464	244	52	275
Totals	***38,383***	***19,009***	***50***	***46,779***	***21,057***	***45***	-

Notes: Harvest volumes are estimated as the net of cull and defect timber as well as deferred volume from various prescribed silviculture treatments assigned to the individual cutting units in each alternative.
Source DNRC 2011; University of Montana Bureau of Business and Economic Research Third Quarter 2011.

ENVIRONMENTAL EFFECTS

- ***Direct and Indirect Effects of No-Action Alternative A to Economics***

  Information organized in *TABLE III-96 – ESTIMATED DIRECT AND INDIRECT EFFECTS* shows that under No-Action Alternative A, income effects from the project area would not be realized at this time. However, if timber from this project is not sold, equivalent volumes would need to come from sales on other trust forestlands in the State, lending to income and employment effects of an unknown scale to occur elsewhere. Local mills may not be able to substitute the potential loss of delivered logs from their regional resource supply chain.

  Negative economic effects can also occur from a no-action alternative concerning salvage condition trees where a particular forest stand is left unmanaged in a dead or dying state. Unmanaged dead stands can produce negative externalities and extend economic losses by promoting unwanted silvicultural conditions and slowing down the rate at which a replacement stand matures. These effects are not quantified in this analysis, but do represent an increase in the total economic opportunity costs for a no-action alternative decision concerning salvage or overgrown stands.

- ***Direct and Indirect Effects of Action Alternatives B and C to Economics***

  Direct income effects up to the stage of industrial processing are estimated with current regional *Bureau of Business and Economic Research* log-price data, and state revenues are estimated using the transaction-evidence appraisal approach discussed earlier. Information

organized in *TABLE III-96 – ESTIMATED DIRECT AND INDIRECT EFFECTS* shows an estimated total direct income of $5,300,660 or $5,866,059 would be generated in the harvest and delivery of logs from Action Alternative B and C, respectively. Much of this income represents the margin for operators to harvest, load, and haul the logs to mill locations. The other portion includes revenue for state trust beneficiaries, infrastructure development, and other forest improvements on state trust forestlands. The subtotal income to the State is estimated at $3,794,767 and $3,860,801 for Action Alternative B and C, respectively. This subtotal represents total revenue received by the State plus additional capitalized value to trust land as a result of the proposed alternatives. A large portion of this value represents the expected distributable income to trusts, the rest would cover the expenses from the State to provide sale preparation and management associated with the proposed alternatives as well as FI activities. Management expenses are estimated using an average program revenue/cost ratio from annual accounting records highlighted in the F*ORMULA* column of *TABLE III-96 - ESTIMATED DIRECT AND INDIRECT ECONOMIC EFFECTS.*

Direct and indirect employment effects include an estimated 171 to 189 full-time annual jobs in multiple sectors of the economy for Action Alternatives B and C, respectively. The level of employment sustained by these proposed alternatives is estimated using industry research by the *Bureau of Business and Economic Research*.

Indirect income effects are not quantified in this analysis, but they represent additional benefits to the economy as income earned from the proposed action is recycled within the 2-county area, buying other goods and services. Assuming a regionally average leakage rate (the rate at which money escapes the local economy and is spent elsewhere), the indirect income effects would be represented by some additional sum of money in the proximity to the direct income effects experienced within the 2-county area.

TABLE III-96 – ESTIMATED DIRECT AND INDIRECT ECONOMIC EFFECTS

MEASURABLE EFFECT	**FORMULA**	***ALTERNATIVE***		
		A	**B**	**C**
Total harvest volume	[a]	0	19,009	21,057
Delivered log price[1]/Mbf	[b]	0	278.85	278.58
Total delivered log value	[a] x [b]	0	5,300,660	5,886,059
Timber sale revenue/Mbf	[c]	0	148.19	117.63
FI revenue/Mbf	[d]	0	39.24	39.24
Development costs/Mbf	[e]	0	12.20	26.48
Total value to the State	[a] x ([c] + [d] + [e])	0	3,794,767	3,860,801
Total state revenue	[a] x ([c] + [d])	0	3,562,857	3,303,212
Total trust revenue[2]	[a] x ([c] + [d]) x (.53)	0	1,888,314	1,750,702
Direct industry jobs supported[3]	[a] x (.009)	0	171	189

[1]*Current Bureau of Business and Economic Research market price for delivered sawlogs in the Central and Eastern Montana regions.*

[2]*State management expenses estimated with the revenue and cost summary in the 2010 SFLMP Monitoring Report.*

[3]*Direct full-time logging and forest-products jobs per Mbf annually; not including indirect jobs, or forestry and forest management jobs. (Keegan et. al. 2004)*

AIR QUALITY ANALYSIS

INTRODUCTION

This analysis describes the existing air quality and discloses the potential direct, indirect, and cumulative environmental effects the proposed action (see *CHAPTER I – PURPOSE AND NEED*) may have on air quality throughout the area.

ISSUES AND MEASUREMENT CRITERIA

ISSUES

The following issues concerning air quality were raised during internal and external scoping and will be analyzed in further detail in this analysis:

- Smoke produced from prescribed burning associated with the proposed actions may adversely affect local air quality.
- Dust produced from road construction, road maintenance, harvest-related traffic, and gravel pit operations associated with the proposed action may adversely affect local air quality.

MEASUREMENT CRITERIA

Quantitative and qualitative changes to the following measurement criteria are intended to 'measure' the extent of the potential direct, indirect, and cumulative environmental effects that the proposed action may have on existing air quality in the area.

- To determine the impacts from smoke, the measurement criteria include: the amount, location, timing (including season), and duration of prescribed burning.
- To determine the impacts from dust, the measurement criteria include: the amount, location, timing (including season), and duration of road construction and maintenance, harvest-related traffic, and gravel pit operation.

ANALYSIS AREA

The analysis area used to determine direct, indirect, and cumulative environmental effects of the proposed action on air quality includes all of the Swan River Subbasin (fourth-level hydrologic unit) and all lands within a 5-mile buffer distance outside the boundary of the subbasin.

ANALYSIS METHODS

The methodologies used to determine the environmental effects of the proposed action on air quality in the project and surrounding areas include considering the amount, location, timing, and duration of smoke and dust generated by activities associated with the proposed action. Cumulative effects include consideration of other actions indicated under *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* under *SCOPE OF THIS EIS* in *CHAPTER I*.

RELEVANT LAWS, PERMITS, AGREEMENTS, PLANS, LICENSES, AND OTHER REQUIREMENTS

CLEAN AIR ACT OF MONTANA

MCA 75-2-101 through *429* is known as the *Clean Air Act of Montana* and requires the State of Montana to provide for a coordinated statewide program to prevent, abate, and control air pollution while balancing the interest of the public.

MONTANA/IDAHO AIRSHED GROUP

DNRC is a member of the *Montana/Idaho Airshed Group*, which was formed to minimize or prevent smoke impacts while using fire to accomplish land-management objectives and/or fuel hazard reduction (*Montana/Idaho Airshed Group 2010*). The *Montana/Idaho Airshed Group* determines the delineation of airsheds and impact zones throughout Idaho and Montana. As a member, DNRC must submit burn plans to the smoke-monitoring unit that describe the type of burn to be conducted, the size of the burn in total acres, and the location and elevation of each burn site. The smoke-monitoring unit provides timely restriction messages by airshed. DNRC and other cooperators are required to abide by those restrictions and burn only when conditions are conducive to good smoke dispersion.

AIR QUALITY MAJOR OPEN-BURNING PERMIT

DEQ issues permits to entities that are classified as major open burners (*ARM 17.8.610).* DNRC is permitted to conduct prescribed wildland open-burning activities that are either deliberately or naturally ignited. Planned prescribed burn descriptions must be submitted to *DEQ* and the smoke-monitoring unit of the *Montana/Idaho Airshed Group*. All burns must be conducted in accordance with the major open-burning permit.

AFFECTED/EXISTING ENVIRONMENT

The analysis area is located within Montana Airshed 2, which encompasses the entire Flathead and Lake counties, most of Sanders County, and the smaller, northernmost portions of Missoula, Mineral, and Powell counties. The project area (see *CHAPTER I –PURPOSE AND NEED*) is located 5 miles from the 2 nearest population centers on either of its ends, which are Swan Lake and Salmon Prairie. Condon, the nearest population center after those, is 14 miles. The analysis area occurs outside of designated 'impact zones' that refer to areas the *Montana/Idaho Airshed Group* or affiliated local program identifies as smoke sensitive and/or having an existing air quality problem. Within the periphery of the analysis area are 3 'Class I Areas', which include the Mission Mountain and Bob Marshall wilderness areas and the Flathead Indian Reservation. Both wilderness areas are considered Mandatory Federal Class I Areas, which refer to areas specified as Class I by the *1977 Clean Air Act* and include international and national parks greater than 6,000 acres and national wilderness areas greater than 5,000 acres that existed on August 7, 1977. The Flathead Indian Reservation is considered a non-Federal Class I Area, yet still receives recognition and protection under the *1977 Clean Air Act*.

Air quality in the analysis area is generally excellent and has limited local emission sources and consistent wind dispersion throughout most of the year. Existing emission sources include residential wood-burning stoves, private homeowner debris burns, road dust created by

recreational or forest-management activities, and periodic wildland fires and prescribed burns on federal, private, state, and tribal forested lands. Prevailing winds typically blow from west to east; thus, emissions from activities in the western portion of the analysis area tend to drift into the valley bottom, particularly during the late afternoon and evening. Currently, emissions do not affect local population centers, impact zones, or Class I Areas beyond *EPA* and *DEQ* standards. All burning activities by major burners comply with emission levels authorized by the *Montana/Idaho Airshed Group*.

ENVIRONMENTAL EFFECTS

- ***Direct and Indirect Effects of No-Action Alternative A to Air Quality***

  No prescribed burning, road construction and maintenance, harvest-related traffic, or gravel pit operation would occur. Therefore, direct and indirect effects to air quality as a result of this alternative would not be expected.

- ***Direct and Indirect Effects of Action Alternatives B and C to Air Quality***

  Some differences between the 2 action alternatives do exist, specifically with regard to the amount of road miles, where Action Alternative C includes nearly twice as many road miles as Action Alternative B. Despite this, the amount of particulate matter released into the analysis area is expected to be indistinguishable between alternatives. The only distinguishable difference between alternatives occurs in the location of emission sources. Sources associated with Action Alternative C would be spread throughout the project area, while those associated with Action Alternative B would be concentrated specifically in the northern and southwestern portions of the project area.

PRESCRIBED BURNING

Under each action alternative, DNRC would conduct prescribed burning following harvesting activities in order to remove residual logging waste and fine fuels. These burning activities would subsequently reduce fire risk in the area and prepare site conditions conducive to tree regeneration. Starting in the spring of 2013, 100 to 115 piles of slash would be burned each fall over a period of approximately 7 years. Burning, which would vary by location under either action alternative, depending on weather conditions and which piles are ready to burn, would likely occur during the months of October and November. Burning would be done only during conditions that are conducive to good smoke dispersion. Actual burning days would be controlled and monitored by *DEQ* and the smoke monitoring unit of the *Montana/Idaho Airshed Group* and would meet *EPA* standards, which would further minimize the direct and indirect effects of burning activities.

ROAD CONSTRUCTION AND MAINTENANCE

Under each action alternative, operators conducting new road construction and road maintenance on existing roads are expected to produce particulate matter (*TABLE III-97 – MILES OF ROAD CONSTRUCTION AND MAINTENANCE BY ALTERNATIVE*).

Over the 7-year operating period, 6 to 8 timber sales are expected to be implemented. Varying levels of road construction and maintenance would typically occur prior to each sale and during drier conditions to avoid damaging road-drainage features. Depending on the size and location

of each sale and on the alternative implemented, 4.9 to 8.2 miles of new road construction and 33 to 60 miles of road maintenance would occur over the 4-year project period during the months of June through November, conditions permitting. Depending on the season and conditions of the road, DNRC would require that purchasers apply dust abatement to segments of roads in order to reduce particulate emissions.

Direct and indirect effects to air quality as a result of road construction and maintenance are expected to be localized to the roadways and areas directly adjacent to the roadways. Vegetative barriers along the roadside and dust-abatement mitigations are expected to greatly limit the dispersion of particulate matter beyond these areas. Thus, direct and indirect effects to air quality throughout the analysis area as a result of road construction and maintenance are expected to be minor.

TABLE III-97 - MILES OF ROAD CONSTRUCTION AND MAINTENANCE BY ALTERNATIVE

ACTION ALTERNATIVE	MAINTENANCE	RECONSTRUCTION	NEW CONSTRUCTION	TOTAL ROAD MILES
B	33	15	4.9	52.9
C	60	20	8.2	88.2

HARVEST-RELATED TRAFFIC

Under each action alternative, harvest-related traffic on gravel roads would be expected to produce particulate matter. According to the analysis conducted in the *RECREATION ANALYSIS*, approximately 3,020 to 4,742 harvest-related trips would be expected per year over the 7-year operating period (see *TABLE III-100 – HARVEST-RELATED TRAFFIC*). Traffic on designated restricted roads would be limited to 9 months due to restrictions during the grizzly bear denning period (April 1 through June 15) that are enforced under the *SVGBCA.* Traffic along open roads would likely continue during the denning period, but at rates lower than those expected outside of the denning period.

Dust production on roads during the dry summer and fall months would likely be higher than during the late fall, winter, and early spring months when frozen ground conditions and/or higher levels of moisture are expected to abate particulate production. During the dry months, log-, rock-, and equipment-hauling traffic would be expected to produce more particulate matter than the other harvest-related traffic due to the size and weight of the vehicles.

Half to two-thirds of the harvest operations would occur during the late-spring and winter months, while the other remaining proportion would occur during wetter months. During the drier months, and depending on the condition of the roads, DNRC would require that harvest operators apply dust abatement to segments of roads used for hauling and other harvest-related traffic in order to reduce particulate emissions.

Direct and indirect effects to air quality as a result of harvest-related traffic are expected to be localized to the roadways and areas directly adjacent to the roadways. Vegetative barriers along the roadside and dust abatement mitigations are expected to greatly limit the dispersion

of particulate matter beyond these areas. Thus, direct and indirect effects to air quality throughout the analysis area as a result of harvest-related traffic are expected to be minor.

GRAVEL-PIT OPERATIONS

Under each action alternative, DNRC would utilize gravel pit resources from 2 different pits. These would be the Goat Creek Pit (Section 16, T23N, R17W) and the Woodward Pit (Section 24, T23N, R18W). Contractors are required to hold a *Montana Air Quality Permit* for Portable Sources and abide by air-quality regulations set forth by *DEQ* under this permit. Operators regularly apply water during crushing and loading operations and wet stockpiles in order to reduce particulate emissions. Crushing would occur in the Woodward Pit and is planned for the summer of 2012, though other crushing may occur as needed.

Direct and indirect effects of the gravel pits are expected to be localized to Sections 16 and 24. Both gravel pits are at a greater distance than a mile from the primary travel route through the area, Highway 83, and vegetative barriers adjacent to the gravel pit and abatement measures are expected to greatly limit the dispersion of particulate matter beyond their immediate surroundings. Thus, direct and indirect effects to air quality throughout the analysis area as a result of gravel pit operations are expected to be minor.

- ***Cumulative Effect of No-Action Alternative A to Air Quality***

  Cumulative effects to air quality as a result of this alternative would not be expected.

- ***Cumulative Effects of Action Alternatives B and C to Air Quality***

  Actions on adjacent properties and ongoing DNRC timber sales in the analysis area would continue. Burning, road construction, road maintenance, and gravel crushing and hauling associated with ongoing and foreseeable actions on DNRC, federal, private, and tribal forested lands would produce particulate matter. Existing emission sources from residential wood-burning stoves, private homeowner debris burning, road dust created by recreational activities, and periodic wildland fires would continue. Nearby residential areas and towns in the analysis area would experience reductions in air quality during peak burning periods. All burning activities by major burners would continue to comply with emission levels authorized by *DEQ, Montana/Idaho Airshed Group*, and *EPA*.

  All above-mentioned emissions in conjunction with expected particulate production from the proposed action would occur at higher levels than currently expected. Providing that dust abatement would be used during dry conditions and gravel operations, half of the harvesting operations would occur during frozen and/or wetter conditions, construction activities would be short in duration, and emissions produced from burning would be appropriately controlled and monitored, the cumulative effects to air quality are not expected to exceed *EPA* and *DEQ* standards.

RECREATION ANAYLSIS

INTRODUCTION

Many residents and nonresidents of Montana enjoy recreational opportunities in and around Swan River State Forest. Over 41,700 acres of mostly forested, legally accessible land are available for various recreational activities. This analysis describes the existing environment of recreational uses in the project area and surrounding areas and discloses the potential environmental effects the proposed action may have on those uses (see *CHAPTER I – PURPOSE AND NEED*).

ISSUES AND MEASUREMENTS CRITERIA

ISSUES

Two concerns were raised during the scoping period regarding potential impacts the proposed action may have on recreation throughout the area. The following issue statement summarizes those concerns and ultimately guides this analysis:

- The proposed action may affect recreational uses in the area and the subsequent revenue generated by such uses.
- The recreational uses of particular concern include; public motorized use, hunting, and other nonmotorized uses.

MEASUREMENT CRITERIA

The following measurement criteria are intended to determine the extent of any potential direct, indirect, and cumulative environmental effects the proposed action may have on existing recreational uses in the project area:

- miles of motorized and nonmotorized recreational access;
- big game use of the area;
- amount, duration, and location of forest-management activities in the area; and
- recreation revenue generated from 4 categories: *General Recreational Use, Special Recreational Use, Conservation*, and *Land Use* licenses.

PROJECT AND ANALYSIS AREAS

The project area will be used to determine direct and indirect environmental effects of the proposed action on the recreational resource.

The analysis area used to determine cumulative environmental effects of the proposed action will include all legally accessible state, federal, and private lands within the perimeter of Swan River State Forest and the roads used to access those lands. This analysis area will herein be referred to as the cumulative-effects analysis area.

ANALYSIS METHODS

The methodologies used to portray the existing environmental conditions and determine the environmental effects of the proposed action on recreational uses in the project and cumulative-effects analysis areas include: 1) determining amounts and types of existing recreational uses,

2) determining the existing condition of each of the measurement criteria, and 3) estimating any changes to the measurement criteria that may result under each alternative. Cumulative effects include consideration of other actions indicated in *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* under *SCOPE OF THIS EIS* in *CHAPTER I – PURPOSE AND NEED.*

DNRC developed the following calculations to determine how many harvest-related traffic trips would result from each action alternative. A 'trip' refers to travel in one direction. That is, a trip *to* the harvest site is counted as one event while the trip *from* the harvest site is counted as a separate event.

- Trips associated with road and harvesting operations = 20 days per month times 9 months of operation per year for 4 to 7 years of operation for 4 to 5 vehicles times 2 trips (20 x 9 x [4 to 7] x [4 to 5] x 2)
- Trips associated with gravel hauling = 2,000 to 5,000 cubic yards of gravel hauled divided by 12 cubic yards per load times 2 trips ([2,000 to 5,000] / 12 x 2)
- Trips associated with sale administration = 10 to 16 days per month times 9 months of operation per year for 3 to 7 years of operation for 1 vehicle times 2 trips ([10 to 16] x 9 x [4 to 7] x 1 x 2)
- Trips associated with log hauling = Volume in MMbf divided by 4.5 Mbf, plus 33 percent more trips for cull and pulp material times 2 trips (to and from the site) (20.2 to 22.3 MMbf/4.5 Mbf + .33 [20.2 to 22.3 MMbf/4.5 Mbf] x 2)
- Trips associated with sale preparation = 12 to 16 days per month times 9 months of marking times 1 to 2 vehicles times 2 trips for 4 to 5 years of operations ([12 to 16] x 9 x [1 to 2] x 2 x [4 to 5])

RELEVANT AGREEMENTS, LAWS, PLANS, PERMITS, LICENSES, AND OTHER REQUIREMENTS

DNRC RECREATION USE RULES

DNRC *Recreational Use Rules* (*ARM 36.25.146* though *162*) regulate and provide for the reasonable recreational use of legally accessible school trust lands. Recreational use is divided into 2 categories and, subsequently, requires 2 different types of recreational licenses for those wishing to engage in recreational activities on school trust lands:

GENERAL RECREATIONAL USE LICENSE

General recreational use refers to recreational activities that are nonconcentrated and noncommercial. Examples of these activities include snowmobiling, hiking, bicycling, hunting, motorized use, horseback riding, and berry picking. Any person over the age of 12 who wishes to engage in activities that pertain to general recreational uses is required to obtain a 12-month *General Recreational Use License* from a state licensed provider or DFWP. For recreationists younger than 17 or older than 60, the license is $5. For recreationists between the ages of 17 and 60, the license is $10. All license holders are required to abide by current restrictions, closures, and regulations.

SPECIAL RECREATIONAL USE LICENSE

Special recreational use refers to recreational commercial activities where an entity charges a participant a fee for specific noncommercial organized group activities or overnight activities including outfitting, noncommercial recreational lodges or retreats, and overnight horse camping. Any person who wishes to engage in activities that pertain to special recreational uses is required to obtain a *Special Recreational Use License* from DNRC. The cost of the license is determined by DNRC and is assessed at what is considered to be the full market value of that use.

MEMORANDUM OF AGREEMENT AFFECTING RECREATIONAL USE OF STATE SCHOOL TRUST LANDS

This agreement entered into by DFWP and DNRC, requires DFWP to reimburse DNRC $2 for every wildlife conservation license and certain game animal licenses sold in accordance with *MCA 87-2-202, 505, 510,* and *511*.

LAND USE LICENSE

DNRC *Surface Management Rules* (*ARM 36.25.102[14]*) define and allow for the use of state lands for uses other than for which the land is classified. Such uses are allowed for a specific fee and a term not to exceed 10 years (*ARM 36.25.106[2]*).

SWAN VALLEY GRIZZLY BEAR CONSERVATION AGREEMENT

As a cooperator of the *SVGBCA*, DNRC has agreed to a number of mitigations that restrict motorized use of roads in the project and surrounding areas. Recreational motorized road use is limited to those roads that are open year-round and seasonally to the public (this includes wintertime snowmobile access on otherwise restricted roads).

EXISTING ENVIRONMENT

MOTORIZED AND NONMOTORIZED RECREATIONAL ACCESS

The project and cumulative-effects analysis areas both receive moderate recreational use throughout the year by anyone holding a *General Recreational Use License*. Current uses include berry and mushroom picking, snowmobiling, cross-country skiing, horseback riding, bicycling, fishing, hiking, and hunting. These activities primarily occur on or adjacent to open, seasonally restricted, and closed roads. Over 208 road miles are available for recreational opportunities throughout the project area, while 498 miles are available throughout the cumulative-effects analysis area (*TABLE-III-98 - RECREATIONAL ROAD ACCESS*).

While only a limited amount of the existing roads are available for motorized activities, all roads throughout both analysis areas are open year-round to nonmotorized activities, including hiking, horseback riding, bicycling, hunting, and other similar activities that do not require a vehicle.

TABLE III-98 – RECREATIONAL ROAD ACCESS

ANALYSIS AREA	OPEN YEAR-ROUND TO PUBLIC MOTORIZED ACCESS	SEASONALLY RESTRICTED TO PUBLIC MOTORIZED ACCESS*	CLOSED YEAR-ROUND TO PUBLIC MOTORIZED ACCESS	TOTALS
	MILES			
Project area	45	5	158	208
Cumulative effects[1]	84	11	403	498

**As cooperators of the SVGBCA, DNRC, Plum Creek, and FNF restricts public motorized use on designated seasonally restricted roads during the grizzly bear spring period (April 1 through June 15).*

[1]Total road miles in the cumulative-effects analysis area include road miles in the project area.

BIG GAME USE

As indicated in *EXISTING ENVIRONMENT* and *ENVIRONMENTAL EFFECTS* under *WILDLIFE ANALYSIS*, a number of threatened, sensitive, and other wildlife species persist throughout the area. Of those, big game species are perhaps the most important to many recreationists who use the area. According to the wildlife analyses for this and prior proposed actions, big game species are currently abundant throughout both analysis areas, affording many hunting opportunities.

FOREST-MANAGEMENT ACTIVITIES

A great portion of the land available to recreationists throughout both analysis areas has undergone levels of forest management in the past, is undergoing current forest management, or is expected to be managed at some point in the future. Many recreationists who frequent the area are, therefore, most likely accustomed to forest-management activities and are adept at shifting their use based on the location and duration of those activities.

Activities that may displace recreationists include harvest-related traffic and active harvesting. Displacement of recreationists from areas of active harvesting and traffic likely coincides with the rotational schedule required under the *SVGBCA*. Under this agreement subunits are deemed 'inactive' for at least a 3-year period, thereby greatly limiting the amount of forest-management activities occurring in the area. By default, these inactive subunits provide recreationists large areas that are relatively free of active harvesting and harvest-related traffic except for occasional administrative uses and small-scale salvage or sanitation sales. Recreationists are free to take part in motorized and nonmotorized activities in active and inactive subunits while abiding by restrictions set forth under the *SVGBCA*.

REVENUE FROM GENERAL RECREATION USE, SPECIAL RECREATION USE, CONSERVATION, AND LAND USE LICENSES

Recreationists wanting to engage in hunting and fishing activities on state trust lands must obtain the appropriate game and fishing licenses and a *Conservation License*, which includes the *General Recreational Use License* for these activities. For other general recreational activities you must obtain a *General Recreational Use License*. Additional revenue produced from recreation comes from *Special Recreational Use* and *Land Use* licenses. The sales of *General Use*, *Conservation*, and *Special Recreation Use* licenses for FY 2006 and 2010 generated gross annual revenues of

$1,037,648 and $1,087,310, respectively. Average gross revenue generated from both licenses per acre of state trust lands over the 5-year period was $0.208 per acre. Applying this average to acreages in both the project area and cumulative- effects analysis area, an estimated gross annual revenue of $3,241.89 and $8,673.60 was generated by each, respectively, between FY 2006 and 2010.

Additional revenue produced from recreation comes from *Special Recreational Use* and *Land Use* licenses. For FY 2011, such licenses generated a total of $8,950 for the trust beneficiaries (*TABLE III-99 – SPECIAL RECREATIONAL USE AND LAND USE LICENSES*).

TABLE III-99 – SPECIAL RECREATIONAL AND LAND LICENSES

LICENSE TYPE	NUMBER OF LICENSES ISSUED	REVENUE ($) GENERATED PER LICENSE TYPE	TOTAL REVENUE ($) GENERATED BY LICENSE TYPE
Special Recreational Use License			
Bobcat trapping	0	0	0
Beaver, muskrat, marten, and fisher trapping	0	0	0
Winter mountain lion outfitting	1	2,000	2,000
Spring bear and big game outfitting	2	2,000	4,000
Point Pleasant camping	1	200	200
Trans Montana Snowmobile Ride	1	200	200
Scenic Horse/Llama Tours	2	300	600
Fishing outfitting	6	200	1,200
Land Use License			
Nature trail	1	500	500
Nordic ski trail	1	250	250
Total			*8,950*

ENVIRONMENTAL EFFECTS

- ***Direct and Indirect Effects of No-Action Alternative A to Recreation***

  No appreciable changes to motorized and nonmotorized access, big game use, forest-management activities, or revenue generated by *General Recreational Use*, *Special Recreation Use*, *Conservation*, and *Land Use* licenses would occur. Therefore, direct and indirect effects to recreational use and revenue as a result of No-Action Alternative A would not be expected.

- ***Direct and Indirect Effects of Action Alternatives B and C to Recreation***

  While some differences occur in harvest amounts and road miles between the 2 action alternatives, the effects to recreation are expected to be indistinguishable between these alternatives. For recreational purposes the only distinguishable differences between alternatives occurs in the harvest prescription and location of some harvesting activities. Activities associated with both action alternatives would be spread throughout the project

area. Action Alternative C would have a slightly higher amount of harvest units plus additional units in the southeast corner of the project area.

Motorized and Nonmotorized Recreational Access

Under each action alternative, all newly constructed road miles would be closed year-round to public motorized use, yet remain open to public nonmotorized use. Approximately 5 miles of road would be constructed under Action Alternative B and 8 miles under Action Alternative C. Thus, the action alternatives would lead to a 1- to 2.4- percent increase in road miles available for public nonmotorized recreation in the project area.

Big Game Use

According to *EXISTING ENVIRONMENT* and *ENVIRONMENTAL EFFECTS* in *WILDLIFE ANALYSIS*, negative impacts to big game use in the project area are expected to be minor under each action alternative. Therefore, adverse direct and indirect effects to hunting and wildlife-viewing opportunities are expected to be minor as well.

Forest Management Activities

Under each action alternative, active harvesting and harvest-related traffic would occur up to 9 months per year over the 3- to 7-year operating period. Operators would continue to recognize restrictions in place under the *SVGBCA* and concentrate management activities outside of the grizzly bear spring habitat for the period (April 1 through June 15).

Harvesting operations and associated traffic would mostly occur during the typical business workweek (Monday through Friday) and cease each day by early evening except for the occasional operator and use of campgrounds by contractors.

Harvest-related traffic under each action alternative is expected to be considerable, resulting in approximately 3,020 to 4,742 traffic trips per year along designated haul routes (*TABLE III-100 - HARVEST-RELATED TRAFFIC*). Forty-two to 66 percent of those trips would be completed by large trucks.

TABLE III-100 - HARVEST-RELATED TRAFFIC

HARVEST-RELATED TRIPS	ACTION ALTERNATIVE	
	B	C
Road/harvesting operations	5,760 to 12,600	
Gravel hauling	333 to 833	
Sale administration	720 to 2,016	
Log hauling	13,467	14,867
Sale preparation	864 to 2,880	
Totals	*21,144 to 31,796*	*22,544 to 33,196*

Direct and indirect effects to recreational use as a result of forest-management activities are expected to be localized to harvest units and harvest-related roads (see *CHAPTER II-ALTERNATIVES, FIGURE II-1 - ACTION ALTERNATIVE B* and *FIGURE II-2 - ACTION ALTERNATIVE C*). Those who choose to recreate in the area during the workweek daytime hours would likely meet harvest-related traffic on designated haul routes and operators in

designated harvest units; thus, direct and indirect effects on these recreationists are expected to be moderate to high. Those who choose to recreate in the area on the weekend or during the workweek evenings would likely meet minimal harvest-related traffic and harvesting operations, except for occasional operators; thus, direct and indirect effects to these recreationists are expected to be minimal.

Revenue from General Recreational Use, Special Recreational Use, Conservation, and Land Use Licenses

No changes in revenue produced from *General Recreational Use*, *Special Recreational Use*, *Conservation*, and *Land Use* licenses are expected to occur under the action alternatives. Forest-management activities in the area may temporarily displace some license holders.

- ***Cumulative Effects of No-Action Alternative A to Recreation***

Cumulative effects to recreational use and revenue would not be expected.

- ***Cumulative Effects of Action Alternative B and C to Recreation***

Foreseeable future road development on adjacent lands in conjunction with that proposed under each action alternative would lead to increases in public nonmotorized access. As required under the *SVGBCA*, any new road miles built by cooperators would be closed year-round to motorized public access. Ongoing and proposed future actions outside of the proposed action would likely continue on state land and adjacent properties. Traffic increases from those activities in conjunction with those that would occur under each action alternative would temporarily displace recreationists from areas during the workweek. Those who plan to recreate during the weekend would likely meet minimal harvest-related traffic except for occasional weekend operators and homeowners in the area. Inactive subunits closed to major commercial activities throughout the area would continue to be available for public motorized and nonmotorized use as regulated under the *SVGBCA*.

Thus, cumulative effects would result in increases in nonmotorized public access and further displacement of recreationists from active harvest areas during typical business hours. Adverse cumulative effects are expected to be minor since recreationists would continue to have recreational opportunities throughout the inactive subunits.

AESTHETICS ANALYSIS

INTRODUCTION

This analysis describes the existing visual quality and noise levels throughout the area and discloses the potential environmental effects the proposed action may have on those attributes.

ISSUES AND MEASUREMENT CRITERIA

Issues

The following issues concerning visual quality and noise levels were raised during internal and external scoping and will be analyzed in further detail in this analysis:

- Activities associated with the proposed action may affect the visual quality as seen from specific observation points within the area.
- Activities associated with the proposed action may affect local noise levels.

Measurement Criteria

Quantitative and qualitative changes to the measurement criteria are intended to 'measure' the extent of the potential direct, indirect, and cumulative environmental effects the proposed action may have on existing visual quality and noise levels in the area. Following are the measurement criteria:

- The number of harvest-unit acres and road miles visible from specific viewpoints.
- The quality of views from specific observation points in terms of texture, form, line, and color as viewed in the foreground, middle ground, and background.
- The magnitude, timing, and type of activities that produce noise in the area.

ANALYSIS AREAS

Direct and Indirect Effects

The analysis area used to determine direct and indirect environmental effects of the proposed action on the visual quality and noise levels will be the project area.

Cumulative Effects

The analysis area used to assess cumulative environmental effects of the proposed action on the visual quality and noise levels will include all state, federal, and private lands within the perimeter of Swan River State Forest. This analysis area will herein be referred to as the cumulative-effects analysis area.

ANALYSIS METHODS

VISUAL QUALITY

The methodologies used to portray the existing environment and determine the environmental effects of the proposed action on the visual quality in the project area and cumulative-effects analysis area include using *GIS* and methods adapted from the *Landscape Visibility* section of the *USFS Scenery Management System (USFS 1995)*.

Using a *GIS* viewshed analysis and historical harvest data, DNRC calculated past, present, and future DNRC-managed acres of harvest units and miles of road visible and not visible from observation points for both the *EXISTING ENVIRONMENT* and *ENVIRONMENTAL EFFECTS* sections of this analysis. Harvest history on adjacent ownerships was not available; therefore, viewshed analyses were cross-referenced with digital air photos to estimate the amount of land that has been previously harvested on these ownerships and is visible from the observation points.

Viewpoints from along roads that are open and seasonally restricted to public motorized use, as well as viewpoints along the portion of Highway 83 within the perimeter of the project and cumulative-effects areas, were determined to be important areas of concentrated public-viewing use.

Acres and road miles visible and not visible from these viewpoints do not account for existing or potential obstructions, such as trees and other vegetation, in the following visibility ranges: foreground (0 to 0.5 mile), middle ground (0.5 to 4.0 miles), and background (4 miles and beyond). Therefore, reported visible acres and road miles are likely to be overestimations of what would currently or potentially be visible from each observation point.

Methods adapted from the *USFS Scenery Management System* were used to account for obstructions in the visibility ranges and describe existing form, lines, textures, colors and potential changes to those attributes as proposed under the action alternatives. Harvest units associated with the action alternatives were displayed by prescription type to more accurately disclose the potential visual quality of harvest units expected under each alternative.

NOISE LEVELS

The methodologies used to portray the existing environment and determine the environmental effects of the proposed action on the noise levels in the project area and cumulative-effects analysis area include estimating the magnitude, timing, and type of activities that produce noise.

Cumulative-effects analyses for both visual quality and noise levels include consideration of other actions indicated in *RELEVANT PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS* under *SCOPE OF THIS EIS* in *CHAPTER I – PURPOSE AND NEED.*

EXISTING ENVIRONMENT

VISUAL QUALITY

Harvest Units

Data describing forest-management activities on Swan River State Forest date back beyond 1935; the current *SLI* denotes harvesting activity dating back to 1970. According to the *SLI*, approximately 20 percent of DNRC-managed lands have undergone treatment since 1970. By cross-referencing aerial photos with the viewshed analyses generated for the viewpoints, approximately 35 percent of DNRC-managed lands have undergone treatment to date. According to the viewshed analysis, 21 percent of the acres in the project area and the DNRC-managed cumulative-effects analysis area that are currently visible from the viewpoints have been harvested in the past 40 years (*TABLE III-101 – EXISTING VISUAL ENVIRONMENT –*

ACRES). By cross-referencing aerial photos with the viewshed analyses generated for the viewpoints, about 67 percent of the visible acres on adjacent properties, as viewed from the viewpoints, have likely been harvested in the past.

TABLE III-101 – EXISTING VISUAL ENVIRONMENT – ACRES. *Existing harvested and unharvested acres visible and not visible in the project area and cumulative-effects analysis area.*

ANALYSIS AREAS	VIEWPOINTS		
	HARVESTED	UNHARVESTED	TOTALS
	ACRES		
Project Area State			
Visible	2,089	7,809	9,898
Not visible	1,630	4,058	5,688
Totals	*3,719*	*11,867*	*15,586*
Cumulative Effects			
State			
Visible	5,492	21,055	26,547
Not visible	2,927	12,225	15,152
Totals	*8,419*	*33,280*	*41,699*
Other Ownerships			
Visible			40,562
Not visible			50,307
Totals			*90,869*

Most visible harvested acres currently occur in the foreground and middleground of the viewpoints. DNRC, *The Nature Conservancy* (formerly *Plum Creek*), and *FNF* are required to provide vegetative visual screening along open roads under the *SVGBCA*. As a result, many foreground views along such roads are inhibited by a barrier of standing trees. Depending on visual screening characteristics and topography, harvest stands further away from all viewpoints may be more visible than those nearby.

Due to the evolution of forest-management practices and the diversity of ownerships in both analysis areas, the existing landscape has various modifications of vegetative textures, forms, lines, and colors affecting the visual quality of the area. Hard, distinctive lines exist where different ownerships meet, making for a 'checkerboard' appearance when viewed from the viewpoints. The historical development of small harvest units in some areas has created a relatively patchy-looking landscape. Such characteristics have led to a multitude of different colors dotting the landscape. Areas that have undergone more intensive treatments (i.e., clearcut, seedtree) often appear lighter in color than those that have undergone less intensive treatments (i.e. commercial thinning).

As stands have regenerated, so has the scenic integrity (degree of intactness) of the forested landscape. DNRC-managed stands harvested prior to 1970 have regenerated to the point that they have blended in with adjacent unharvested stands, while stands harvested after 1970 are more evident. These newer stands appear lighter in color, are more distinctive in form, and have harder perimeter lines. By comparing DNRC-managed harvest units with those on adjacent ownerships, approximately half of the visible harvested acres on other lands have been

harvested in the past 3 decades, thereby, resulting in similar visual qualities as the DNRC-managed stands that have been known to have been harvested after 1970.

Roads

Over 694 miles of highway, open, closed, and seasonally restricted roads occur throughout the cumulative-effects analysis area. Roads introduce hard distinctive lines that are very light-colored in comparison to adjacent forested and harvested areas. According to the viewshed analysis, 61 percent of the road miles in the project area and 58 percent of the road miles in the cumulative-effects analysis area are visible from the viewpoints (*TABLE III-102 – EXISTING VISUAL ENVIRONMENT - ROADS).* Of the visible road miles, 26 percent in the project area and 17 percent in the cumulative-effects analysis area are open. As stated earlier, managers are required to provide visual screening along open roads; therefore, views of these roads are likely inhibited by barriers alongside the roadways. Depending on potential visual barriers in the foreground and middle ground, restricted roads may be more visible from the viewpoints.

TABLE III-102 – EXISTING VISUAL ENVIRONMENT – ROADS. *Existing road miles visible and not visible within the project area and cumulative-effects analysis area by viewpoints and road type.*

ROAD TYPE BY VIEWPOINTS	ANALYSIS AREAS					
	PROJECT AREA - STATE			CUMULATIVE EFFECTS - ALL OWNERSHIP		
	VISIBLE	NOT VISIBLE	TOTALS	VISIBLE	NOT VISIBLE	TOTALS
	MILES			MILES		
Open, highway	18	10	28	68	100	168
Private, seasonal, restricted	52	35	87	336	190	526
Totals	*70*	*45*	*115*	*404*	*290*	*694*

NOISE LEVELS

Activities that generate noise within the project and cumulative–effects analysis areas include:

- traffic associated with harvesting, road building, motorized recreation, and administrative use;
- harvesting operations; and
- rock blasting and gravel crushing.

Noise generation from forest-management activities coincides with the rotational schedule required under the *SVGBCA*. Under this agreement, subunits are deemed 'inactive' for at least a 6-year period, thereby greatly limiting the amount of forest-management activities occurring in the area. By default, these inactive subunits are relatively free of forest-management activities except for occasional administrative use and small-scale salvage or sanitation sales. Currently, the project area subsides in subunits that vary from currently active to inactive until 2015 or 2018. Therefore, noise generated by forest-management activities varies from subunit to subunit. Noise generated by management activities occurs daily within the active subunit and

relatively infrequently within the inactive subunits. Noise created by motorized public use continues to be frequent throughout both areas.

ENVIRONMENTAL EFFECTS

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Aesthetics***

  No harvest-related activities would occur; therefore, no direct and indirect effects to visual quality and noise levels would be expected.

- ***Direct and Indirect Effects of Action Alternatives B and C to Aesthetics***

  While there are some differences in the amount and quality of visible harvested acres, amount of visible road miles, and noise generation that exist between the action alternatives, the anticipated effects to visual quality and noise levels are expected to be somewhat distinguishable between alternatives. The difference between the alternatives occurs in the location of visible harvest units, visible road miles, and noise levels. Effects associated with Action Alternative C would be spread throughout the project area, while most effects associated with Action Alternative B would be concentrated in the northern and southwestern portions of the project area.

VISUAL QUALITY

Harvest Units

The amount, location, and quality of visible acres would vary by action alternative as viewed from all viewpoints (*TABLE III-103 – VISUAL ENVIRONMENTAL EFFECTS - ACRES).*

See also *FIGURE III-21 - ACTION ALTERNATIVE B, VIEWPOINTS* and *FIGURE III -22 - ACTION ALTERNATIVE C, VIEWPOINTS* at the end of this analysis.

TABLE III-103 – VISUAL ENVIRONMENTAL EFFECTS – ACRES. *Proposed harvested acres visible and not visible within the project and cumulative–effects analysis areas by action alternative and viewpoints.*

ANALYSIS AREAS	ACTION ALTERNATIVE B	ACTION ALTERNATIVE C
	ACRES	
Project Area - State		
Scout Lake units visible	1,423	1,715
Scout Lake units not visible	596	920
Scout Lake totals	*2,009*	*2,635*
All harvest units visible	3,025	3,380
All harvest units not visible	2,044	2,302
Totals	*5,069*	*5,682*
Cumulative Effects – State		
All harvests visible	6,428	6,783
All harvests not visible	3,341	3,599
Totals	*9,769*	*10,382*

Viewers at the viewpoints would tend to see more harvested acres under Action Alternative C than Action Alternative B. Action Alternative C would result in a 62-percent increase in visible harvested acres in the project area seen from the viewpoints, while Action Alternative B would result in a 45-percent increase. The vast majority of visible harvest units would occur within the foreground and middle ground of the viewpoints. Due to visual barriers mentioned in *EXISTING ENVIRONMENT*, views of harvest units in the immediate foreground would likely continue to be partially obstructed, while views of harvest units in the distance may be more apparent under each action alternative.

Various types of prescriptions associated with each action alternative would result in various types of textures, forms, lines, and colors.

- Seedtree prescriptions would result in stands with approximately 10-percent canopy cover. Stands undergoing this type of treatment are expected to appear very light in color, distinctive in form, and have hard perimeter lines where the stand meets adjacent regenerating or unharvested stands. Approximately 6 to 8 of the larger, best available trees per acre would be left along with varying amounts of small submerchantable trees. Seedtree stands would be most apparent compared to the other prescription types.
- Shelterwood prescriptions would result in stands with approximately 15-percent canopy cover. Stands undergoing this type of treatment are expected to have similar qualities to seedtree stands, only to a lesser degree. Approximately 12 to 16 trees per acre would be left along with varying amounts of small submerchantable trees. These stands would be only slightly less apparent than seedtree stands.
- Variable thinning prescriptions would result in stands with a minimum of 35-percent canopy cover. Stands undergoing this type of treatment are expected to be darker in color, less distinctive in form, and have softer perimeter lines than stands undergoing any of the other prescriptions.

All harvesting types would be visible, with seedtree and shelterwood treatments resulting in stand conditions that appear relatively stark in contrast when adjacent to regenerating or unharvested stands. When feasible, these lines would be 'softened' by tapering or feathering stand perimeters and rounding hard stand corners. Over time, these stands are expected to become less apparent and darker in color, thereby blending with adjacent unharvested and regenerating stands in the project area.

Roads

Of the new road miles proposed under each alternative, 50 percent would be visible from each observation point under Action Alternative B, and 57 percent under Action Alternative C (*TABLE III–104 – VISUAL ENVIRONMENTAL EFFECTS – ROADS).* Visible road miles from the viewpoints would be broken up into several small segments and scattered throughout the project area. All new road miles would be managed as restricted or closed roads; therefore, visual screening requirements would not apply.

Depending on topography and visual barriers in the foreground and middle ground, some road segments may be visible from the viewpoints. Since the increase in visible road miles would be

relatively small overall, direct and indirect effects to visual quality as a result of new road segments associated with the action alternatives are expected to be minor.

TABLE III-104 – VISUAL ENVIRONMENTAL EFFECTS – ROADS. *Proposed road miles visible and not visible within the project area and cumulative-effects analysis area by action alternative and viewpoints.*

ANALYSIS AREAS	VIEWPOINTS	
	ACTION ALTERNATIVE B	ACTION ALTERNATIVE C
	MILES	
Project Area - State		
New roads visible	2.57	4.58
New roads not visible	2.59	3.41
Totals	**5.16**	**7.99**
All roads visible	72.57	74.58
All roads not visible	47.29	48.41
Totals	**119.86**	**122.99**
Cumulative Effects – All Ownerships		
Visible	406.57	408.58
Not visible	292.59	293.41
Totals	**699.16**	**701.99**

NOISE LEVELS

Under each action alternative, noise would be generated by harvesting operations, harvest-related traffic, road construction, and gravel pit activity, including rock blasting and gravel crushing.

Under each action alternative, harvesting activities, harvest-related traffic, road construction, and gravel pit activity would occur up to 9 months per year of the 3- to 7-year operating period. Operators would continue to recognize restrictions in place under the *SVGBCA* and concentrate most management activities outside of the grizzly bear spring period (April 1 through June 15).

Activities would mostly occur during the typical business workweek (Monday through Friday) and cease each day by early evening except for occasional operators and the use of the campgrounds by contractors.

According to *RECREATION ANALYSIS* in *CHAPTER III,* 21,144 to 33,196 harvest-related trips would be expected to occur per year over the 3- to 7-year operating period along designated haul routes (see *RECREATION ANALYSIS, TABLE III-100 – HARVEST-RELATED TRAFFIC).* Traffic associated with gravel hauling, road and harvesting operations, and log hauling is expected to be louder than other harvest-related traffic. This louder traffic would constitute 85.2 to 92.5 percent of the traffic trips expected under each action alternative.

Any rock development would occur in existing pits and coincide with gravel needs for ongoing road construction and maintenance work. Rock blasting and gravel crushing would produce high levels of noise.

Direct and indirect effects to noise levels as a result of harvesting operations, harvest-related traffic, and gravel pit activity associated with the action alternatives are expected to be moderate during the workweek and minor during the weekend.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Aesthetics***

  No harvest-related activities would occur; therefore, no cumulative effects to visual quality and noise levels would be expected.

- ***Cumulative Effects of Action Alternatives B and C to Aesthetics***

  Current and foreseeable scheduled activities on DNRC-managed and adjacent properties would continue. These activities, in conjunction with those proposed under each action alternative, would result in an increase of total harvested acres and road miles visible from each observation point and a minor increase in noise levels.

  The contribution of visible harvested acres under each action alternative as seen from each viewpoint would be minor in comparison to what exists currently throughout the landscape (*TABLE III-103 - VISUAL ENVIRONMENTAL EFFECTS – ACRES* and *TABLE III-104 – VISUAL ENVIRONMENTAL EFFECTS – ROADS).* Visual barriers along open roads would continue to be in place, thereby obstructing foreground views from the viewpoints. Depending on type and amount of forest management planned on adjacent land ownerships, lands throughout the cumulative-effects analysis area would likely continue to experience similar forms, lines, textures, and colors. Older harvest units would continue to regenerate, blending lines, textures, forms, and colors, while newer harvest units would continue to introduce new attributes in sharper contrast to regenerating stands.

  Except during periods of rock blasting and gravel crushing, cumulative effects to noise would result in a minor increase beyond the current levels found in the cumulative-effects analysis area. Rather, noise generated by forest-management activities would be concentrated in the Goat Subunit during the active period from 2012 to 2015, in the Porcupine Woodward Subunit during the denning periods from 2012 to 2017, and in the South Fork Lost Soup Subunit during the denning periods from 2012 to 2015 and the active period from 2015 to 2017. Noise generated by motorized public use would continue throughout the area on designated roads.

FIGURE III–21 - ACTION ALTERNATIVE B, VIEWPOINTS

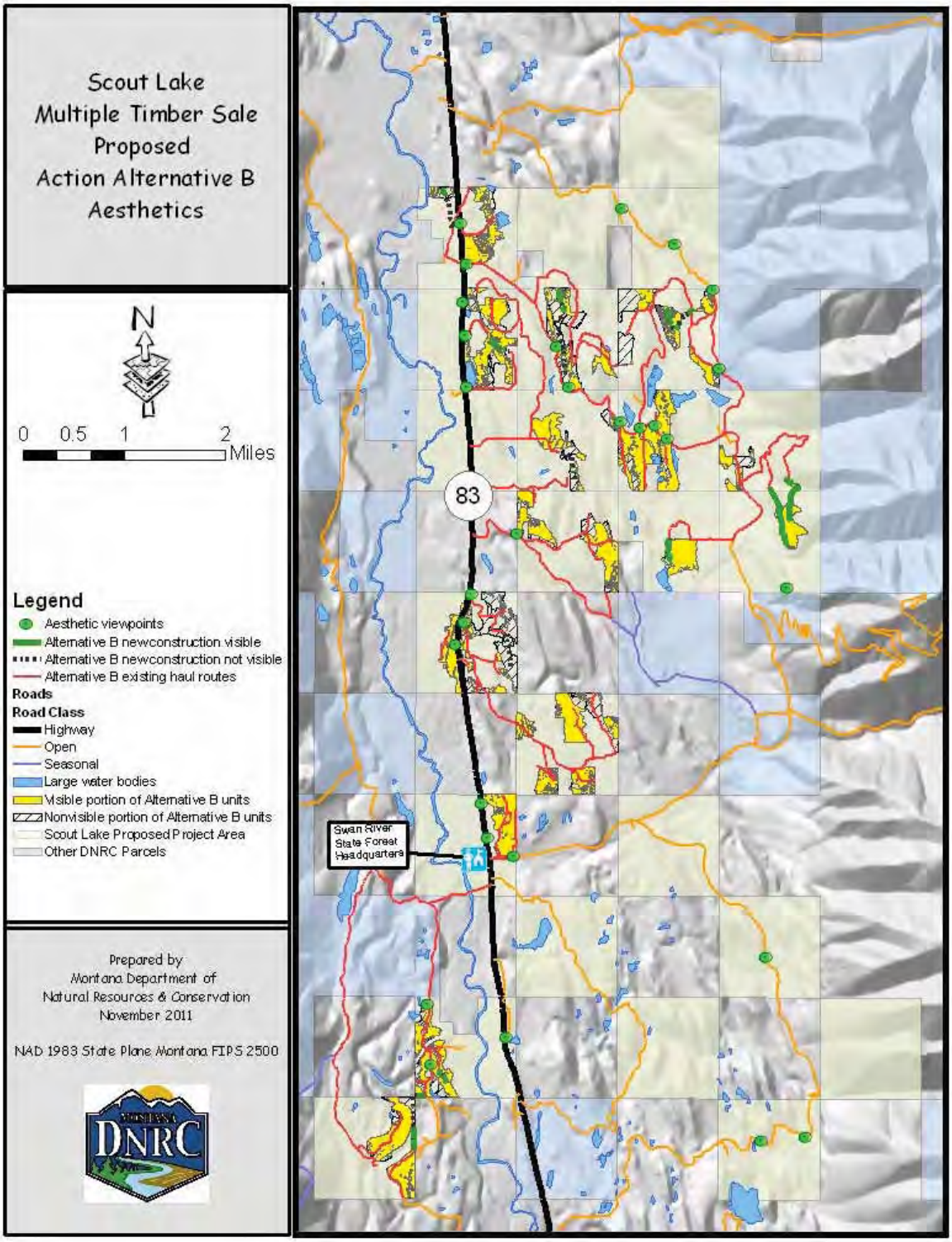
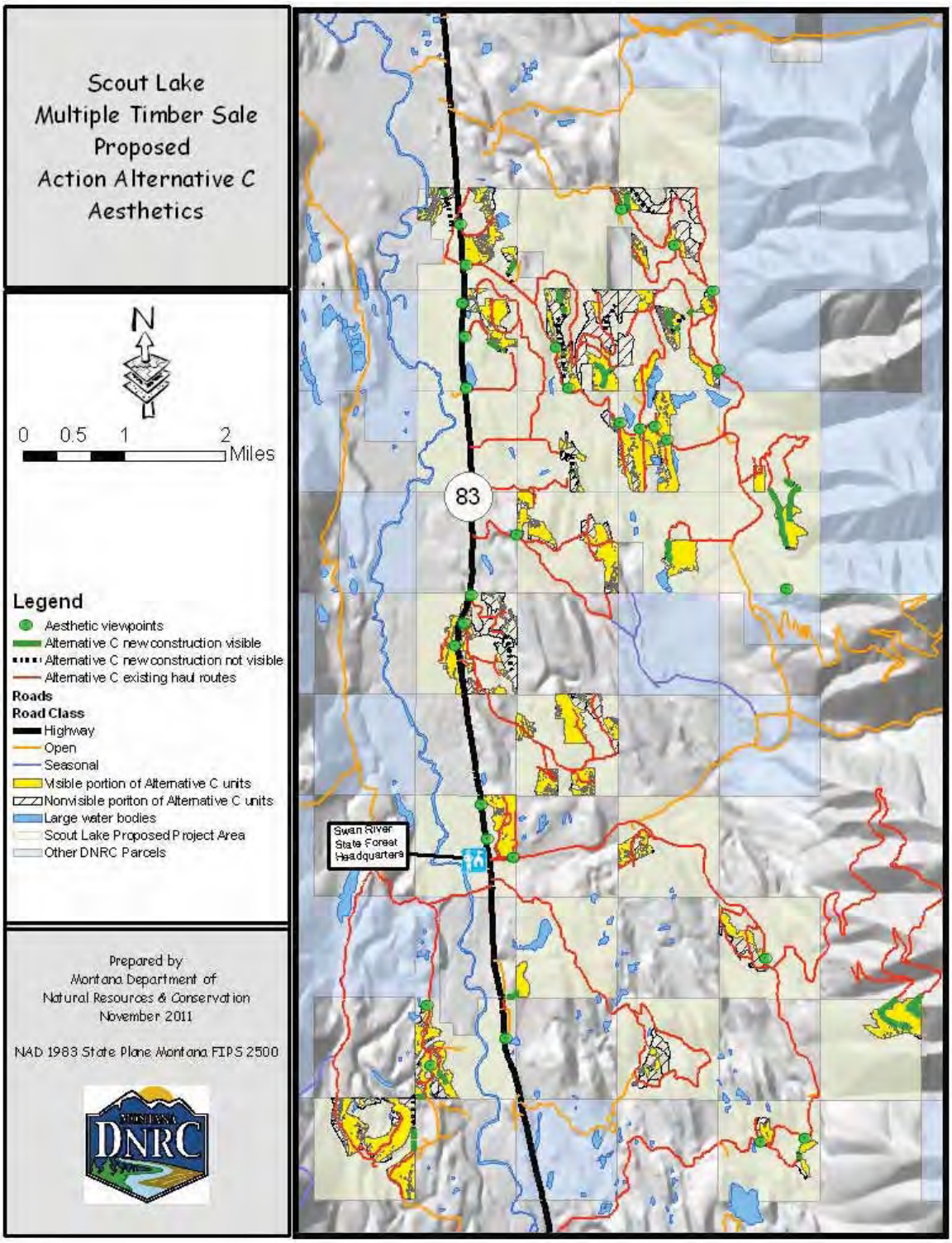


FIGURE III–22 - ACTION ALTERNATIVE C, VIEWPOINTS


Scout Lake
Multiple Timber Sale
Proposed
Action Alternative C
Aesthetics
N
0 0.5 1 2
Miles
83
Swan River
State Forest
Headquarters
Legend
Aesthetic viewpoints
Alternative C new construction visible
Alternative C new construction not visible
Alternative C existing haul routes
Roads
Road Class
Highway
Open
Seasonal
Visible portion of Alternative C units
Nonvisible portion of Alternative C units
Large water bodies
Scout Lake Proposed Project Area
Other DNRC Parcels
Prepared by
Montana Department of
Natural Resources & Conservation
November 2011
NAD 1983 State Plane Montana FIPS 2500
DNRC

IRRETRIEVABLE

A resource that has been irretrievably committed is lost for a period of time. Many timber stands in the project area are mature; some individual trees are more than 150 years old. Any of the timber-harvesting alternatives would cause live trees to be irretrievably lost; they would no longer contribute to future snag recruitment, stand structure and compositional diversity, aesthetics, wildlife habitat, the nutrient-recycling process, or any other important ecosystem functions.

Areas converted from timber production to permanent roads would be lost from timber production and would not function as forested lands for a period of time.

IRREVERSIBLE

A resource that has been irreversibly committed cannot be reversed or replaced. The initial loss of trees due to timber harvesting would not be irreversible. Natural regeneration combined with site preparation and artificial regeneration would promote the establishment of new trees. If management decisions allowed for the continued growth of established trees, they would ultimately become equivalent in size to the irretrievably harvested trees.

Areas that are initially lost to timber production through road construction could, over time, be reclaimed and once again produce timber and function as forested land.

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STIPULATIONS AND SPECIFICATIONS

The stipulations and specifications for the action alternatives were identified or designed to prevent or reduce the potential effects to the resources considered in this analysis. These measures are derived from issues raised internally and by the public, Forest Management Rules, and other requirements with which forest-management activities must comply, as listed under *RELEVANT AGREEMENTS, LAWS, PLANS, PERMITS, LICENSES, AND OTHER REQUIREMENTS* in *CHAPTER I – PURPOSE AND NEED*.

Stipulations and specifications that apply to harvesting or road-building operations are incorporated into the *State of Montana Timber Sale Contract*. As such, they are binding and enforceable. Project administrators will enforce stipulations and specifications relating to activities that may occur during or after the contract period, such as site preparation or hazard reduction.

The following stipulations and specifications will be incorporated to mitigate effects on the resources involved with the action alternatives considered in this proposal. Each section is organized by resource.

VEGETATION

- **SENSITIVE PLANTS**
  Appropriate measures will prevent the disturbance of sensitive plant populations. Riparian areas near harvest units will be marked to protect SMZs and isolated wetlands. No harvesting will take place in wetlands or near springs on localized features. If sensitive plant populations are found, the appropriate habitat area will be excluded from the harvest units.
- **NOXIOUS WEED MANAGEMENT**
  To further limit the possibility of spreading noxious weeds, the following weed-management mitigation measures will be implemented:
  - All tracked and wheeled equipment will be cleaned of noxious weeds prior to beginning project operations. The Forest Officer will inspect equipment periodically during project implementation.
  - Surface blading on roads affected by the proposal may result in required weed removal before the seed-set state.
  - Disturbed roadside sites will be promptly reseeded. Roads used and closed as part of this proposal will be reshaped and seeded.
  - Herbicide application, as designated by the Forest Officer, may be used to control weeds along roads that access the timber sale area. To reduce risk to aquatic and terrestrial resources, the following will be required:

- All herbicides will be applied by licensed applicators in accordance with laws, rules, and regulations of the State of Montana and Lake County Weed District.
- All applications will adhere to BMPs and the herbicides' specific label guidelines.
- Herbicide applications will not be general, but site-specific to areas along roads where noxious weeds grow. No-spray areas will be designated on the ground before applications begin.
- Herbicides will not be applied to areas where relief may contribute runoff directly into surface water.
- Herbicides will be applied on calm days free of rain to limit drift and the possibility of the herbicide moving off the road prisms.

WATERSHED AND FISHERIES

- Planned erosion-control measures and BMPs include:
  - -installing grade breaks on roads,
  - -installing water-diverting mechanisms on roads,
  - -installing slash-filter windrows, and
  - -grass seeding.
- All road-stream crossing will be monitored for sedimentation and the deterioration of the road prism.
- Equipment traffic will be allowed at road-stream crossings only where road prisms have an adequate load-bearing capacity.
- Culvert sizing for all new road construction projects will be as recommended by the DNRC hydrologist for a 50-year-flood period. New road stream-crossing structures will ensure fish passage.
- Stream crossings, where culvert or bridge removals and installations are planned, will have the following requirements, as needed, to meet the intent of water-quality permits and BMPs and protect water quality:
  - diversion channels will be constructed and lined with plastic to divert stream flow prior to any in-channel operations,
  - slash-filter windrows will be constructed on the base of fill slopes,
  - silt fences will be installed along the stream banks prior to and following excavation at crossing sites,
  - filter-fabric fences will be in place downstream prior to and during culvert installation, and
  - stream work will be limited to periods approved by permitting agencies to minimize potential impacts to fish species present.
- Brush will be removed from existing road prisms to allow effective maintenance. Improved road maintenance will reduce sediment delivery.

- The contractor will be responsible for the immediate cleanup of any spills that may affect water quality (fuel, oil, dirt, etc.).
- Equipment that is leaking fluids will not be permitted to operate in stream-crossing construction sites.
- The project proposal will include the following pertinent recommendations of the *Flathead Basin Forest Practices, Water Quality and Fisheries Cooperative Program Final Report, June 1991.* (The following numbers correspond to the numbering of recommendation items contained within the aforementioned document, included in pages 154 through 162 of the *Final Report*.)

1. BMPs are incorporated into the project design and operations.
2. Riparian indicators would be considered in the harvest unit layout.
3. Management standards of the *SMZ Law (75-5-301 MCA)* are used in conjunction with the recommendations of the study.
4. The BMP audit process will continue. This sale would likely be reviewed in an internal audit and may be randomly chosen as a statewide audit sale.

7. SMZs will be evaluated as a part of the audit process.

12. Watershed-level planning and analysis are completed. Logging plans of other agencies and private companies are used.

14. DNRC is cooperating with DFWP on the further study of fish habitat and populations in Soup, Goat, Squeezer, South Woodward, and Cedar creeks.

15. DNRC would use the best available methods for logging and road building for this project.

16A. Existing roads are fully utilized for this proposal.

16B. DNRC utilizes BMPs, transportation planning, and logging-system design to minimize new road construction.

17. DNRC contracts with DFWP to obtain species composition, spawning inventory, and spawning habitat quality. DNRC's mitigation plan for roads fits all recommendations for 'impaired streams'. Using 'worst-case scenario' criteria provides for conservative operations in this proposal.

18. Provisions that address BMPs are in the *State of Montana Timber Sale Contract* and would be enforced.

20. Long-term monitoring is planned for streams on Swan River State Forest.

29-34. DNRC plans to cooperate with DFWP to continue fisheries work. DNRC would continue to support fisheries-monitoring efforts in the future as funding allows.

- SMZs and RMZs will be defined along those streams that are in or adjacent to harvest units; all applicable BMPs and the Rules for fisheries' Riparian Management Zones to fish-bearing streams will be followed.
- A 120-foot no-harvest zone would be implemented immediately adjacent to all fish-bearing and non-fish-bearing Class 1 streams within or near proposed harvest units to provide shade and recruitable woody debris.
- The *SMZ law* and *Forest Management Rules* will be applied to all non-fish-bearing streams in the project area.
- *McNeil* core and substrate scores will be monitored in bull trout spawning reaches in Goat, Squeezer, Soup, and South Woodward creeks.
- Stream temperature will be monitored in Goat, Squeezer, and Soup.

WILDLIFE

THREATENED AND ENDANGERED SPECIES

- **Grizzly Bears**
  - All action alternatives will comply with the *SVGBCA*.
  - Roads and landings will be seeded to revegetate with species less palatable to grizzly bears to minimize the potential for bear-human conflicts.
  - Garbage will be hauled or stored in a safe place so bears will not be attracted to the area.
  - No logging camps will be allowed in the sale area.
  - The Forest Officer will immediately suspend activities directly related to the project to prevent imminent confrontation or conflict between humans and grizzly bears, or other threatened or endangered species.
  - Contractors are prohibited from carrying firearms onto closed roads while working under contract.
  - Where regeneration harvests are proposed along open roads, vegetation screening will be retained within a 100-foot buffer.
  - Where regeneration harvests are proposed, no point in the harvest unit will exceed 600 feet to cover.
- **Gray Wolves**

  A provision will be included in the Timber Sale Contract to protect wolf dens or rendezvous sites in the gross sale area that are discovered during implementation of the project.

BIG GAME

The purchaser will be authorized to enter the project area with motorized vehicles for only activities related to the performance of the *State of Montana Timber Sale Contract*. Road use is restricted to nonmotorized transportation behind road closures for any other purpose. Motorized vehicle entry for purposes other than contract performance, such as hunting or

transporting game animals, will be considered in trespass and prosecuted to the fullest extent of law (*ARM 45-6-203*).

WILDLIFE TREES AND SNAG RETENTION AND RECRUITMENT

- Wildlife trees of high quality, such as large broken-topped western larch, will be designated for retention and given special consideration during yarding operations to prevent loss.
- Snag retention and recruitment-All cull snags that are safe to operate near and a minimum of 2 snags greater than 21 inches dbh will be retained. If enough large snags are not present, the balance will be made up from the next largest size class available.
- Retained snags that need to be felled for operational or safely reasons will be left on site.

SOILS

- ***COMPACTION***
  - Logging equipment will not operate off forest roads unless:
    - soil moisture is less than 20 percent,
    - -soil is frozen to a depth of 4 inches or a depth that will support machine operations (whichever is greater), or
    - -soil is snow-covered to a depth of 18 inches or a depth that will prevent compaction, rutting, or displacement (whichever is greater).
  - Existing skid trails and landings will be used when their design is consistent with prescribed treatments and current BMP guidelines are met.
  - The harvest project foreman and sale administrator will agree to a skidding plan prior to operating equipment.
  - To reduce the number of skid trails and the potential for erosion, designated skid trails will be required where moist soils or short steep pitches (less than 300 feet) will not allow access by other logging systems.
  - The density of skid trails in a harvest area will not exceed 20 percent of the total area in the cutting unit.
- ***DISPLACEMENT***
  - Conventional ground-based skidding equipment will not be operated on slopes steep than 40 percent. Soft-tracked yarders are suitable on slopes up to 55 percent. Cable yarding will be used on sustained steeper slopes.
  - Slash piling and scarification will be completed with a dozer where slopes are gentle enough to permit (less than 35 percent). Slash treatment and site preparation will be done with an excavator in areas where soils are wet or slopes are steeper (up to 55 percent). Broadcast burning may also be utilized.
- ***EROSION***
  - Ground-skidding machinery will be equipped with a winchline to limit equipment operation on steeper slopes.

- Roads used by the purchaser will be reshaped and the ditches redefined to reduce surface erosion prior to and following use.
- Drain dips, open-topped culverts, and gravel will be installed on roads as needed to improve road drainage and reduce erosion and maintenance needs.
- Some road sections will be repaired to upgrade the roads to design standards that will reduce the potential for erosion and maintenance needs.
- Certified weed-free grass seed and fertilizer will be applied promptly to newly constructed road surfaces, cutslopes, and fillslopes. These applications will also be done on existing disturbed cutslopes, fillslopes, and landings immediately adjacent to open roads. These applications, which will stabilize soils and reduce or prevent the establishment of noxious weeds, would include:
  - -seeding all road cuts and fills concurrently with construction,
  - -applying 'quick cover' seed mix within 1 day of work completion at culvert-installation sites, and
  - -seeding all road surfaces and reseeding culvert installation sites when the final blading is completed for each specified road segment.
- Based on ground and weather conditions and as directed by the Forest Officer, water bars, logging-slash barriers, and, in some cases, temporary culverts will be installed on skid trails where erosion is anticipated. These erosion-control features would be periodically inspected and maintained throughout the Timber Sale Contract period or extensions thereof.

AIR QUALITY

- To prevent individual or cumulative effects and provide for burning during acceptable ventilation and dispersion conditions during burning operations, burning will be done in compliance with the Montana Idaho Airshed Group reporting regulations and any burning restrictions imposed in Airshed 2.
- Excavator, landing, and roadwork debris will be piled clean to allow easy ignition during fall and spring when ventilation is good and surrounding fuels are wet. The Forest Officer may require that piles be covered to reduce dispersed (unentrained) smoke and allow the piles to ignite more easily, burn hotter, and extinguish more quickly.
- The number of piles to burn will be reduced by leaving large wood debris in the harvest units.
- Depending on the season of harvest and level of public traffic, dust abatement may be applied on some segments of the roads that will be used during hauling.

AESTHETICS

- Damaged submerchantable residual vegetation will be slashed.

- Landings will be limited in size and number and located away from main roads when possible.
- Disturbed sites directly adjacent to roads will be grass seeded.
- When possible, healthy trees not big enough to be harvest will be retained.
- Techniques such as feathering, which involves marking additional timber along the harvest boundary lines, or rounding, which involves eliminating abrupt edges such as those found at property corners, will be implemented to reduce the appearance of straight boundary lines along harvest units.

CULTURAL RESOURCES AND ARCHAEOLOGY

- A review of the project area was conducted by a DNRC archaeologist and local Native American tribal organization.
- A contract clause provides for suspending operations if cultural resources are discovered, and only resuming operations when directed by the Forest Officer.

ROADS

- Information about road-reconstruction activities and road use associated with road-construction activities will be relayed to the general public.
- Signs will be placed on restricted roads to prohibit public access while harvesting operations are in progress; these roads will be physically restricted during inactive periods (nights, weekends, holidays, shutdowns).
- BMPs will be incorporated into all planned road construction.

GLOSSARY

Acre-foot
A measure of water or sediment volume equal to an amount of material that would cover 1 acre to a depth of 1 foot.

Action alternative
One of several ways of moving toward the project objectives.

Adfluvial
A fish that out migrates to a lake as a juvenile to sexually mature and returns to natal stream to spawn.

Administrative road use
Road use that is restricted to DNRC personnel and contractors for purposes such as monitoring, forest improvement, fire control, hazard reduction, etc.

Airshed
An area defined by a certain set of air conditions; typically a mountain valley where air movement is constrained by natural conditions such as topography.

Ameliorate
To make better; improve.

Appropriate conditions
Describes the set of forest conditions determined by DNRC to best meet the SFLMP objectives. The 4 main components useful for describing an appropriate mix of conditions are cover-type proportions, age-class distributions, stand-structure characteristics, and the spatial relationships of stands (size, shape, location, etc.); all are assessed across the landscape.

Background view
Views of distant horizons, mountain ranges, or valleys from roads or trails.

Best Management Practices (BMPs)
Guidelines to direct forest activities, such as logging and road construction, for the protection of soils and water quality.

Biodiversity
The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems where they occur.

Board foot
144 cubic inches of wood that is equivalent to a piece of lumber 1-inch thick by 1 foot wide by 1 foot long.

Canopy
The upper level of a forest consisting of branches and leaves of the taller trees.

Canopy closure
The percentage of a given area covered by the crowns, or canopies, of trees.

Cavity
A hollow excavated in trees by birds or other animals. Cavities are used for roosting and reproduction by many birds and mammals.

Centimeter
A distance equal to 0.3937 inch.

Commercial-thin harvesting
A harvest that cuts a portion of the merchantable trees within a stand to provide growing space for the trees that are retained. For the South Wood Timber Sale Project, thinning would reduce stand densities to approximately 100 trees per acre

Compaction
The increase in soil density caused by force exerted at the soil surface, modifying aeration and nutrient availability.

Connectivity
The quality, extent, or state of being joined; unity; the opposite of fragmentation.

Core area
See Security Habitat (grizzly bears).

Cover
See HIDING COVER and/or THERMAL COVER.

Coarse down woody material
Dead trees within a forest stand that have fallen and begun decomposing on the forest floor.

Crown cover or crown closure
The percentage of a given area covered by the crowns of trees.

Cull
A tree of such poor quality that it has no merchantable value in terms of the product being cut and manufactured.

Cumulative effect
The impact on the environment that results from the incremental impact of the action when added to other actions. Cumulative impacts can also result from individually minor actions, but collectively they may compound the effect of the actions.

Direct effect
Effects on the environment that occur at the same time and place as the initial cause or action.

Ditch relief
A method of draining water from roads using ditches and a corrugated metal pipe. The pipe is placed just under the road surface.

Dominant tree
Those trees within a forest stand that extend their crowns above surrounding trees and capture sunlight from above and around the crown.

Drain dip
A graded depression built into a road to divert water and prevent soil erosion.

Ecosystem
An interacting system of living organisms and the land and water that make up their environment; the home place of all living things, including humans.

Embeddeness
Embeddedness refers to the degree of armour or the tight consolidation of substrate.

Environmental effects
The impacts or effects of a project on the natural and human environment.

Equivalent clearcut area (ECA)
The total area within a watershed where timber has been harvested, including clearcuts, partial cuts, roads, and burns.

Allowable ECA - The estimated number of acres that can be clearcut before stream-channel stability is affected.

Existing ECA - The number of acres that have been previously harvested taking into account the degree of hydrologic recovery that has occurred due to revegetation.

Remaining ECA -The calculated amount of harvesting that may occur without substantially increasing the risk of causing detrimental effects to stream-channel stability.

Excavator piling
The piling of logging residue (slash) using an excavator.

Fire regimes
Describes the frequency, type, and severity of wildfires. Examples include: frequent, nonlethal underburns; mixed-severity fires; and stand-replacement or lethal burns.

Fluvial
A fish that outmigrates to a river from its natal stream as a juvenile to sexually mature in the river, and returns to its natal stream to spawn.

Forage
All browse and nonwoody plants available to wildlife for grazing.

Foreground view
The view immediately adjacent to a road or trail.

Forest improvement (FI)
The establishment and growing of trees after a site has been harvested. Associated activities include:

- site preparation, planting, survival checks, regeneration surveys, and stand thinnings;
- road maintenance;
- resource monitoring;
- noxious weed management; and
- right-of-way acquisition on a State forest.

Fragmentation (forest)
A reduction of connectivity and an increase in sharp stand edges resulting when large contiguous areas of forest with similar age and structural characteristics are interrupted through disturbances, such as stand-replacement fires and timber stand harvesting.

Geomorphological processes
The observed proportions of habitat types for each reach are within the broad ranges of expected conditions.

Habitat
The place where a plant or animal naturally or normally lives and grows.

Habitat type
Land areas that would produce similar plant communities if left undisturbed for a long period of time.

Harvest units
Areas of timber proposed for harvesting.

Hazard reduction
The abatement of a fire hazard by processing logging residue with methods such as separation, removal, scattering, lopping, crushing, piling and burning, broadcast burning, burying, and chipping.

Hiding cover
Vegetation capable of hiding 90 percent of a standing adult mammal from human view at a distance of 200 feet.

Historical forest condition
The condition of the forest prior to settlement by Europeans.

Indirect effects
Secondary effects that occur in locations other than the initial action or significantly later in time.

Intermediate trees
Characteristics of certain tree species that allow them to survive in relatively low-light conditions, although they may not thrive.

Interdisciplinary team (ID Team)
A team of resource specialists brought together to analyze the effects of a project on the environment.

K factor
The soil erodibility factor which represents both susceptibility of soil to erosion and the rate of runoff, as measured under the standard unit plot condition.

Landscape
An area of land with interacting ecosystems.

Macroinvertebrate richness
The relative abundance and diversity of insects and worms found throughout a streambed.

Macroporosity
The gaseous portion of a soil profile typically containing pores on the order of 3 to 100mm in diameter and are interconnected to varying degrees; thus, they can allow water to bypass the soil matrix and move rapidly to a basal saturated zone and/or move downslope as pipe flow at speeds greater than predicted by Darcy's Law.

McNeil Coring
McNeil coring is a method used to determine the size range of material in streambed spawning sites.

Meter
A distance equal to 39.37 inches.

Middleground view
The view that is 200 to 1,000 feet from a road or trail, usually consisting of hillsides and drainages.

Millimeter
A distance equal to .03937 inch.

Mitigation measure
An action or policy designed to reduce or prevent detrimental effects.

Multistoried stands
Timber stands with 2 or more distinct stories.

Nest site area (bald eagle)
The area in which human activity or development may stimulate the abandonment of the breeding area, affect successful completion of the nesting cycle, or reduce productivity. It is either mapped for a specific nest, based on field data, or, if that is impossible, is defined as the area within a ¼-mile radius of all nest sites in the breeding area that have been active within the past 5 years.

No-action alternative
The option of maintaining the status quo and continuing present management activities by not implementing the proposed project.

Nonforested area
A naturally occurring area, (such as a bog, natural meadow, avalanche chute, and alpine areas) where trees do not establish over the long term.

Old growth
Working definition - Old growth as defined by *Green et al*.

Conceptual definition - The term old growth is sometimes used to describe the later, or older, stages of natural development of forest stands. Characteristics associated with old-growth generally include relatively large old trees that contain a wide variation in tree sizes, exhibit some degree of a multi-storied structure, have signs of decadence,

such as rot and spike-topped structure, and contain standing large snags and large down logs.

Old-growth network
A collection of timber stands that are selected to meet a management strategy that would retain and recruit 150+-year-old stands over the long term (biodiversity, wildlife, the spatial arrangement of stands and their relationship to landscape patterns and processes) are elements that are considered in the selection of stands.

Overstory
The level of the forest canopy that include the crowns of dominant, codominant, and intermediate trees.

Patch
A discrete (individually distinct) area of forest connected to other discrete forest areas by relatively narrow corridors; an ecosystem element (such as vegetation) that is relatively homogeneous internally, but differs from what surrounds it.

Potential nesting habitat (bald eagle)
Sometimes referred to as 'suitable nesting habitat', areas that have no history of occupancy by breeding bald eagles, but contain potential to do so.

Project file
A public record of the analysis process, including all documents that form the basis for the project analysis. The project file for the South Wood Timber Sale Project EIS is located at the Swan River State Forest headquarters office at Goat Creek.

Redds
The spawning ground or nest of various fish species.

Regeneration
The replacement of one forest stand by another as a result of natural seeding, sprouting, planting, or other methods.

Reinitiation
The first phase of the process of stand development.

Resident
Pertaining to fish, resides and reproduces in natal stream.

Residual stand
Trees that remain standing following any cutting operation.

Road-construction activities
In general, "road-construction activities" refers to all activities conducted while building new roads, reconstructing existing roads, and obliterating roads. These activities may include any or all of the following:

- constructing road
- clearing right-of-way
- excavating cut/fill material
- installing road surface and ditch drainage features

- installing culverts at stream crossings
- burning right-of-way slash
- hauling and installing borrow material
- blading and shaping road surfaces

Road improvements
Construction projects on an existing road to improve the ease of travel, safety, drainage, and water quality.

Saplings
Trees 1.0 inches to 4.0 inches in dbh.

Sawtimber trees
Trees with a minimum dbh of 9 inches.

Scarification
The mechanized gouging and ripping of surface vegetation and litter to expose mineral soil and enhance the establishment of natural regeneration.

Scoping
The process of determining the extent of the environmental assessment task. Scoping includes public involvement to learn which issues and concerns should be addressed and the depth of the assessment that will be required. It also includes a review of other factors such as laws, policies, actions by other landowners, and jurisdictions of other agencies that may affect the extent of assessment needed.

Security
For wild animals, the freedom from the likelihood of displacement or mortality due to human disturbance or confrontation.

Security habitat (grizzly bears)
An area of a minimum of 2,500 acres that is at least 0.3 miles from trails or roads with motorized travel and high-intensity, nonmotorized use during the nondenning period.

Sediment
Solid material, mineral or organic, that is suspended and transported or deposited in bodies of water.

Seedlings
Live trees less than 1.0 inch dbh.

Seedtree harvesting
Removes all trees from a stand except for 6 to 10 seed-bearing trees per acre that are retained to provide a seed source for stand regeneration.

Sediment yield
The amount of sediment that is carried to streams.

Seral
Refers to a biotic community that is in a developmental, transitional stage in ecological succession.

Shade intolerant
Describes tree species that generally can only reproduce and grow in the open or where the overstory is broken and allows sufficient sunlight to penetrate. Often these are seral species that get replaced by more shade-tolerant species during succession. In Swan River State Forest, shade-intolerant species generally include ponderosa pine, western larch, Douglas-fir, western white pine, and lodgepole pine.

Shade tolerant
Describes tree species that can reproduce and grow under the canopy in poor sunlight conditions. These species replace less shade-tolerant species during succession. In Swan River State Forest, shade-tolerant species generally include subalpine fir, grand fir, Douglas-fir, Engelmann spruce, western hemlock, and western red cedar.

Sight distance
The distance at which 90 percent of an animal is hidden from view by vegetation.

Silviculture
The art and science of managing the establishment, composition, and growth of forests to accomplish specific objectives.

Site Preparation
A hand or mechanized manipulation of a harvested site to enhance the success of regeneration. Treatments are intended to modify the soil, litter, and vegetation to create microclimate conditions conducive to the establishment and growth of desired species.

Slash
Branches, tops, and cull trees left on the ground following harvesting.

Snag
A standing dead tree or the portion of a broken-off tree. Snags may provide feeding and/or nesting sites for wildlife.

Spur roads
Low-standard roads that are constructed to meet minimum requirements for harvesting-related traffic.

Stand
An aggregation of trees that are sufficiently uniform in composition, age, arrangement, and condition and occupy a specific area that is distinguishable from the adjoining forest.

Stand density
Number of trees per acre.

Stocking
The area of a piece of land that is now covered by trees is compared to what could ideally grow on that same area. The comparison is usually expressed as a percent.

Stream gradient
The slope of a stream along its course, usually expressed in percentage, indicating the amount of drop per 100 feet.

Stumpage
The value of standing trees in the forest. Sometimes used to mean the commercial value of standing trees.

Substrate scoring
Rating of streambed particle sizes.

Succession
The natural series of replacement of one plant (and animal) community by another over time in the absence of disturbance.

Suppressed
The condition of a tree characterized by a low-growth rate and low vigor due to overcrowding competition with overtopping trees.

Texture
A term used in visual assessments indicating distinctive or identifying features of the landscape depending on distance.

Thermal cover
For white-tailed deer, thermal cover has 70 percent or more coniferous canopy closure at least 20 feet above the ground, generally requiring trees to be 40 feet or taller. For elk and mule deer, thermal cover has 50 percent or more coniferous canopy closure at least 20 feet above the ground, generally requiring trees to be 40 feet or taller.

Timber-harvesting activities
In general, all the activities conducted to facilitate timber removal before, during, and after the timber is removed. These activities may include any or all of the following:

- felling standing trees and bucking them into logs
- skidding logs to a landing
- processing, sorting, and loading logs at the landing
- hauling logs to a mill
- slashing and sanitizing residual vegetation damaged during logging
- machine piling logging slash
- burning logging slash
- scarifying, preparing the site as a seedbed
- planting trees

Understory
The trees and other woody species growing under a, more-or-less, continuous cover of branches and foliage formed collectively by the overstory of adjacent trees and other woody growth.

Uneven-aged stand
Various ages and sizes of trees growing together on a uniform site.

Ungulates
Hoofed mammals, such as mule deer, white-tailed deer, elk, and moose, that are mostly herbivorous and many are horned or antlered.

Vigor
The degree of health and growth of a tree or stand.

Visual screening
The vegetation that obscures or reduces the length of view of an animal.

Watershed
The region or area drained by a river or other body of water.

Water yield
The average annual runoff for a particular watershed expressed in acre-feet.

Water-yield increase
An increase in average annual runoff over natural conditions due to forest canopy removal.

ACRONYMS

ARM	Administrative Rules of Montana
BMP	Best Management Practices
dbh	diameter at breast height
DEIS	Draft Environmental Impact Statement
DEQ	Department of Environmental Quality
DFWP	Montana Department of Fish, Wildlife, and Parks
DNRC	Department of Natural Resources and Conservation
ECA	Equivalent Clearcut Acres
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FI	Forest Improvement
FNF	Flathead National Forest
FY	Fiscal Year (July 1 – June 30)
FOGI	Full Old-Growth Index
GIS	Geographic Information System
ID Team	Interdisciplinary Team
LWD	large woody debris
MCA	Montana Codes Annotated
MEPA	Montana Environmental Protection Act
MBF	Thousand Board Feet
MMBF	Million Board Feet
MNHP	Montana Natural Heritage Program
NAIP	National Aerial Imagery Program
NWLO	Northwestern Land Office
RMZ	Riparian Management Zone
ROD	Record of Decision
SFLMP	State Forest Land Management Plan
SLI	Stand-level Inventory
SMZ	Streamside Management Zone
SVGBCA	Swan Valley Grizzly Bear Conservation Agreement
TMDL	Total Maximum Daily Load
USFS	United States Forest Service
USFWS	United States Fish and Wildlife

124 Permit	Stream Preservation Act Permit
318 Permit	A short-term Exemption from Montana's Surface Water Quality and Fisheries Cooperative Program
Forest Management Rules	Administrative Rules for Forest Management
Land Board	Board of Land Commissioners
Plum Creek	Plum Creek Timber Company

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