Peter Kolb statements for SJ 15 EQC hearing January 8, 2014

Topic 1: Comparison of Conditions

References: Montana DNRC records 1990-2013

Montana Wildfire and Bark Beetle Forest Impacts Years 2000-2012

Acres Burned

Year	Acres
2000	1,160,145
2001	146,819
2002	110,309
2003	736,809
2004	18,445
2005	103,294
2006	1,047,118
2007	778,079
2008	166,842
2009	48,912
2010	56,710
2011	*168,100*
2012	*1,100,000*
Total:	***5,641,582***

Annual Acres Bark Beetle Mortality

Year	Acres
2000	103,920
2001	223,892
2002	450,134
2003	493,785
2004	730,782
2005	1,213,602
2006	1,000,289
2007	948,517
2008	1,905,355
2009	3,810,080
2010	2,205,971
2011	1,092,878
2012	672,788
Total:	***14,861,993***

Compare Large Fires (>200 acres) in Montana with Large Fires in DNRC Protection (57% human caused)

In Montana		DNRC	County acres
2002	41	9	28,393
2003	91	40	168,115
2004	15	9	10,712
2005	31	13	16,062
2006	70	44	468,165
2007	57	39	160,024
2008	29	16	138,918
2009	21	3	6,924
2010	20	5	40,115
2011	33	8	31,064

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Comparing federal versus state lands is a difficult proposition because there are different mandates for these ownerships. In general, state land has a higher percentage that has been harvested or under the influence of some form of management as it is managed as trust lands mandates to generate revenue. For federal lands the mandate is multiple use with special concern for biodiversity and preservation of natural processes. The level of management has great variability based on the particular National Forest and the type of topography and access within that forest. Wildfire hazards also vary greatly with National Forests have a high percentage of woody debris fuel loading resulting from a natural successional progression of species and climatic variability as well as some wildfire suppression. Alternatively state lands fire hazards stems from the potential of higher human use because of greater access and fine fuels from grasses, shrubs and forbs associated with reduced tree densities from management. Wildfire impacts may be less on state lands as greater access allows for quicker and more effective suppression, because fine fuels burn quickly, allows for greater rates of spread but less long term impact and more effective suppression, and thinned tree stands allow for less torching and active crownfire behavior. The accumulations of woody debris found on many federal lands tends to release more heat and thus have greater long term impacts on live trees and surface vegetation and under extreme conditions may produce highly erratic fire behavior. Large diameter woody debris during cool/wet climatic phases does not represent a significant contribution to wildfires, though during hot dry climatic phases can cause extreme fire behavior and consequences. Across both ownerships past management actions that have created a more diverse species and age distribution across the landscape tend to have less probability of large scale and severe bark beetle outbreaks (Kootenai National Forest for example that harvested a large portion of it susceptible lodgepole pine in the 1970-80's) but may enhance specific defoliator outbreaks such as spruce budworm when true fir and Douglas-fir are the major species present. Considering the management mandates of each agency, DNRC trust lands would tend to have less insect outbreak issues with bark beetles.

These comparisons can be highly speculative as forest ecology across Montana is highly variable and it is difficult to compare one site to another simply because of different natural histories, site characteristics and species compositions. Ownerships based on a survey grid do not reflect ecological boundaries created by topography, geologic substrate, microclimate, hydrology and dispersal of organisms.

<u>Topic 2: Laws affecting ownership and management</u>

References:

Forest Service; Barriers to Generating Revenue or Reducing Costs

Edited by Marcus R. Clark; U.S. GAO report to the chairman, Committee on the Budget, House of Representatives – Feb. 1998.

The Forest Service: A Study in Public Land Management

By Glen O. Robinson 2013 Routledge publishing

The U.S. Forest Service is responsible for 155 forests across the nation – 192 million acres of land and 6 renewable surface uses: recreation, rangeland, timber, watersheds and water flows, wilderness, and wildlife and fish; and nonrenewable subsurface resources – oil, gas an hardrock minerals.

Regarding environmental laws the forest service must comply with more than 200 laws affecting its activities and programs starting with the 1897 Organic Administration Act that was continually added onto for the purpose of improving and protecting use of federal lands . Some of the major environmental statutes include the Clean water act, the Clean air act, the Wilderness act, the National historic preservation act and the Migratory bird treaty act.

Of particular interest are the:

<u>Multiple-Use Sustained-Yield Act of 1960</u>

"Multiple use means…….that some land will be used for less than all the resources and harmonious and coordinated management of the various resources each with the other, without impairment of the productivity of the land with consideration being given to the relative values of the various resources and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output."

<u>National Environmental Policy Act of 1969 (NEPA)</u>

Specifies procedures for integrating environmental and public considerations through a detailed environmental impact statement (eis) for every major federal action that may significantly affect the quality of the human environment.

<u>Endangered Species Act 1973</u>

Was designed to protect critically imperiled species from extinction as a "consequence of economic growth and development untempered by adequate concern and conservation. According to the U.S. Supreme court " The ESA "was to halt and reverse the trend toward species extinction, whatever the cost."

<u>National Forest Management Act of 1976</u> – 1) recognize wilderness as a use 2) maintain biological diversity.

"insure that timber will be harvested from National Forest System lands only where…..the harvesting system to used is not selected primarily because it will give the greatest dollar return or the greatest unit output of timber"

Although revenue generation has always been an important consideration for federal lands such as National Forests, great effort was taken subsequent to their designation, such as in the ESA and other acts to ensure that endangered species and biological diversity take precedence to revenue generation, resulting in a majority of federal lands being set aside for "conservation of natural processes" that allows no commercial timber harvesting as a use. An example is for western Washington, Oregon and northern California where 77% of federal lands that were classified as suitable for timber harvesting have been set aside.

All of these laws and acts were enacted as knowledge about species, natural processes and the consequences of then human management practices was studied and published upon in various venues – some scientific and others advocacy based. Their intent as individual acts and rules are commendable and they have served well to change the behaviors and attitudes towards national Forests, though applied collectively there have also been negative consequences. There are several basic areas of concern to me regarding the laws and rules dictating federal land management that have implications to the Northern and Central Rocky Mountain ecosystems that I work with and study. First is the assumption that forests are relatively stable entities that can and do persist into perpetuity with specific species and populations in a steady state, and in the absence of human interference. Climate science, both predictive and retrospective has shown otherwise. Research over the past decade into the historical development of species assemblages and disturbance processes of the region since the last ice age indicate tremendous changes in all aspects, primarily linked to past climate trends, but also potentially species interactions and Native American activities. Basically our regions forests are ecologically young and far from biologically stable entities. Douglas-fir for example, our current most common species first appeared as a major species only 4 thousand years ago – that could be represented as only 8 generations of old-growth trees. That major changes can and do occur is supported by the recent occurrences of large regional scale wildfires and insect outbreaks, that are perhaps not unprecedented since our climate relatively stabilized after the past ice age 10,000 years ago, but certainly outside the expectations and knowledgebase of past lawmakers that enabled the various acts. The disturbances of the past decade, impacting roughly half of Montana's forests have shown that vast acreages of natural landscapes can rapidly change to varying degrees in their species composition and landscape function. This transition is not implied to be a bad or good change from a long-term and overall ecological perspective, however it has significant implications on local biodiversity, water, soils, endangered species and human communities. One reaction, in part because human caused climate change has been theorized by many to be the root cause of these changes, has been to further restrict or limit any human activity on impacted lands, which operates on the assumption that these forest ecosystems have been functioning on their own for millennia and thus are best left to restore themselves through natural processes. Based on the ecological history and core drivers of Northern Rocky Ecosystems (climate), I would contend there is good reason to believe that this will not be the case, and that different levels of human management, specific and timely to each impacted locale, can mitigate to some degree the natural boom and bust cycles that often occur within nature, and that have negative consequences to not only the human communities that lie within these ecosystems, but to the levels of biodiversity and adaptability of these natural systems. The current acts and rules as currently applied do not adequately allow for such management.

Topic 3 Suggested solutions

Human assistance for the purpose of moderating ecological fluctuations that have been identified to have negative impacts on human expectations of forested landscapes (wood, water, wildlife, biodiversity, recreation, climate stability, bioenergy, etc) must utilize available science and place based experiential knowledge expediently and thoughtfully. Forest management practices are based on core scientific principles but must be tempered by local knowledge and experience as these complex systems have not been simulated and modeled to the extent that the certainty of outcome from models are more accurate than the experience of a well-trained natural resources professionals and other practitioners that are intimately familiar with local nuances and conditions. Climatic variability has shown to facilitate rapid changes, that can only be adequately moderated by a managers ability to implement expedient and flexible actions. An example of this may be found in the management practices of tribal foresters as well as family forest owners where both short term (5-10 years) and long term (10-100 years) management plans have been formulated to guide, but not dictate future actions. Management costs in many cases can be offset by revenue generated from harvested forest products, however, it is essential that the infrastructure that can provide harvesting and forest products processing exists to allow for reasonable and predictable revenue to be generated. Alternatively, in order for service providers to invest and pay off capital purchases that represent modern effective, efficient and ecologically sensitive processing capacity, a predictable supply of raw materials needs to be available. Such relationships are common in European nations such as Norway, Sweden and Germany which allows them to invest in the science that allows them to improve practices and commodity products as well as the technological innovation required to be ecologically sensitive.

To meet these needs, federal lands need to: 1) Promote local managers that can develop long term familiarity with their land resources and communities; 2) Develop and work from both short term (5-year) action plans and long term landscape plans that have the flexibility to incorporate unforeseen or predicted changes to the resources as well as reasonable predicted annual products that allow for some level of community and infrastructure stability ; 3) Provide for manager accountability and flexibility to provide the agency, local resources and community with agreed upon landscape level outcomes. Agency topic experts should be available to provide background information but not dictate management actions.

Some examples of what has worked in various situations:

Habitat conservation plans to address ESA – Washington DNR and White Mountain Apache Tribe

Longer term Stewardship contracts for larger landscapes.

Suggested changes:

NEPA analysis for longer term large landscape plans versus individual short term projects.

Further reference: Climatic Influence on Forests across Montana – Strategies for Conservation and Functional Retention - by Peter Kolb

2013 Tree Farm Tour – Wildfires of 2000, what have we learned?

Historic picture of elk standing in the Bitterroot river as the wildfires of 2000 raged across the surrounding forests. Low to mid-elevation forests of ponderosa pine survived as scattered trees and Douglas-fir was virtually eliminated as a large land cover change from forest to grass and shrublands. (Laird creek in 2013 below)

The Wildfires 0f 2000

During August of 2000, approximately 356,000 acres across the southern Bitterroot valley burned. Prolonged drought followed by storm systems that produced over 75,000 lightning strikes across the western United States resulted in numerous fires. These fires burned in a mosaic of severities, determined by fuel, winds, time of day and topography

Tour Map

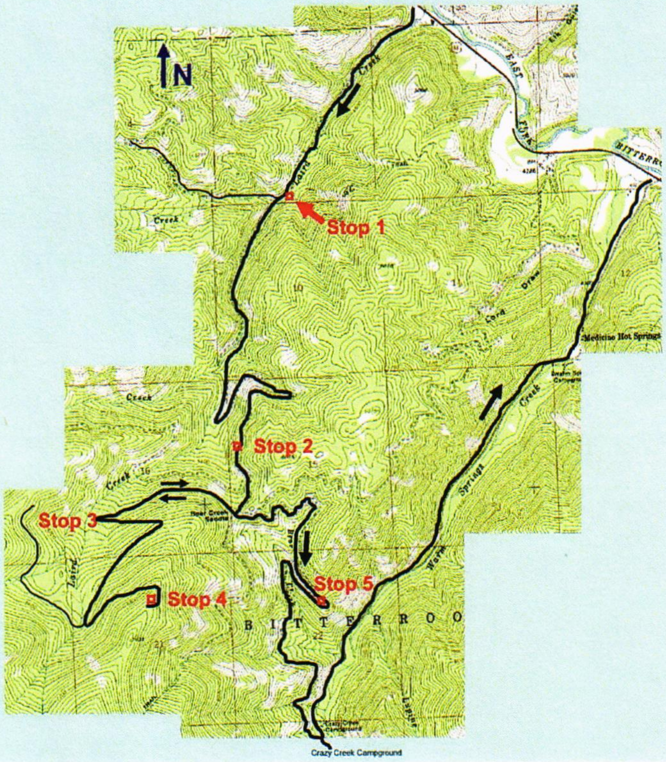
Stop 1 Riparian and road restoration

Stop 2 Landscape fire effects pine vs Douglas-fir

Stop 3 Severe fire effects and recovery

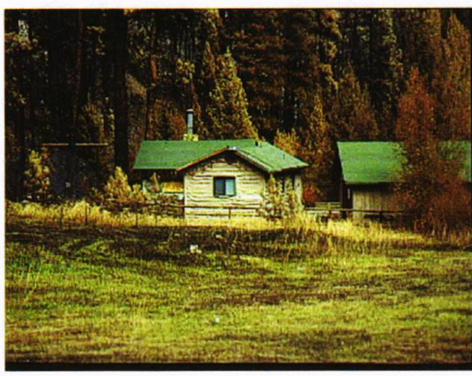
Stop 4 Landscape overlook – managed vs. unmanaged

Stop 5 Fire hazard reduction strategies across landscapes



Location and density of lightning strikes on August 10, 2000

(from Rorig and Ferguson 2002. Journal of Applied Meteorology 41: 786-791)



Impacted house in Laird creek immediately after the fires

Dead standing trees and erosion one year after fires

Produced by Peter Kolb, Montana State University Extension Forestry in cooperation with the Bitterroot National Forest and Rocky Mountain Research Station as part of the Bitterroot Ecosystem Management and Research Project

Fire Impacts to Stream and Riparian Areas

Streamside management zones (SMZ)

In Montana and most other states riparian areas are granted special protection. At least 50 feet, and sometimes upwards of 300 feet on either side of a stream can only have limited management activity that preserves the shade from trees and prevents any soil erosion into the stream. The purpose is to protect the unique plants and animals that inhabit riparian forests. Native trout require cold water, which is maintained by shade. Approximately 80% of Montana's migratory neotropical birds nest and find food in these riparian zones as well.

Wildfires dramatically alter riparian forests

The additional moisture near streams allows trees and other vegetation to grow very rapidly. This results in heavy fuel accumulations that during periods of drought can burn very severely, resulting in high tree mortality and sometimes high soil erosion directly into streams.

Rain runoff results in massive pulses of sediment and gully erosion (below), mass erosion into streams (above), which can lead to both bad effects such as stream sedimentation and good effects such as new stream bank building (above).

Erosion pulses have some benefits

Streams need occasional floods and pulses of sediment to build stream banks and new channels. Typical flooding and erosion effects only occur the first few years after a fire. Monitoring of Laird Creek has shown a sharp initial decline in fish followed by a rapid recovery. Fish numbers by 2004 were at or higher than pre-fire levels.

Riparian vegetation can recover quickly

Moist soils that protect plant roots as well as the ability of most riparian plant species to resprout results in rapid recovery. In some areas, the destruction of conifer trees helps riparian area rejuvenation, with a greater abundance of broadleaf species such as willows, aspen and cottonwood. These tree and shrub species are preferred by many wildlife species for food and nesting sites.

Wildfire Impacts Hydrological Processes

Snow and rain accumulate faster on severely burned sites.

Upper Laird Creek fire landscape shows how fire has reduced the forest canopy and it capacity to intercept rain and snow.

Intact forest canopies intercept water and snow, reducing the rate and quantity that is delivered to the soil. This can give the soil more time to absorb water, as well as reduce snow accumulations, particularly at mid-elevations. In addition, shade from trees can slow the rate of snow melt and water evaporation back into the air. Burned trees lack leaves and needles, so don't intercept moisture or provide as much shade. This can result in deeper snow packs and faster melt rates.

Severe fire burns off soil organic layers, reducing water infiltration rates.

Typical forest soils are covered by dead and decomposing leaves, needles, twigs, and other organic debris. This layer acts like a sponge, holding large amounts of water and slowing its flow over the soil surface. Without this layer, erosion increases. The ash left by a fire can plug the soil surface for several years, resulting in increased surface water runoff.

Normal forest organic layer

Ash-plugged soil post-fire

Large areas with severe wildfire effects funnel water.

Burned slopes collect water from rain and snowmelt, which then flows into gullies and stream channels. The reduced water-holding capacity of the landscape allows water to reach streams at a faster rate and in greater quantities. This results in erosion and flooding that can have severe downstream impacts such as silt deposits in fish spawning beds as well as damage to roads, bridges and homes.

Rain runoff results in gully erosion (right) and fire-induced mass erosion (below).

Restoration practices can reduce flooding and erosion.

Burned Area Emergency Rehabilitation teams implement a variety of practices designed to slow water movement across the soil surface, and accommodate increased stream flows. Cutting down trees and orienting them along the contours along with trenching on the uphill side is one technique. Straw wattles, dispersed straw, grass seeding, and hydro-mulching are a few others. In addition, larger culverts and bridges are often installed to accommodate flood events.

Different Types of Wildfires, Different Outcomes

A surface fire in more open forest in foreground (inset) left trees intact whereas a crown fire in dense trees on back slope (inset) killed all trees

Wildfire behavior is affected by weather, fuel, and topography

To burn, a forest fire requires fuel, oxygen, warm temperatures, and an ignition (2000 ºF). The mountainous terrain of western Montana creates diverse conditions for plants and trees to grow in but also for wildfire behavior. More productive sites support denser trees, more fuel and a higher potential for severe fire effects. Weather, however, is an overriding fire behavior driver. Hot dry conditions disperse moisture and make plant debris more flammable. Wind increases the supply of oxygen allowing fire to burn hotter and also pushes fire into fuels that might not otherwise ignite, resulting a greater probability of fires that burn into the crowns of trees.

Low and mixed severity fires leave some live trees behind

A low severity fire burns the surface vegetation and fuel but does not generate enough heat to kill trees or climb into the crowns of trees. We have found that different tree species survive as different rates. Middle aged ponderosa pine with good crowns that survive girdling heat appear to persist well into the future, whereas Douglas-fir may appear to survive fires but the majority seem to perish over the next 10 years.

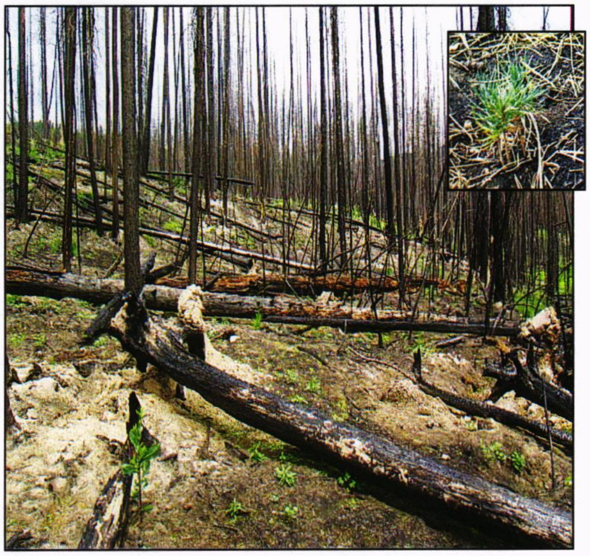
A surface fire left what appear to be live trees behind, but 4-years later a combination of root damage and bark beetles killed 80% of the remaining Douglas-fir. Some trees will take 10-years before they die from surface fire injuries .

The blackened forest typical of a high severity fire. Typically high elevation forests comprised of lodgepole pine are adapted to this kind of fire and naturally recover. Other forest types may have difficulty naturally recovering from such a fire.

High severity fires kill all trees

In areas with high fuel accumulations, dense forest canopies, and during periods of hot, dry weather, fires can burn very intensely releasing enormous energy. In areas where trees are widely spaced but with high surface fuel accumulations the heat is enough to kill the trees by baking the live tissue under the bark. Where tree canopies are dense enough fire can jump into the tops of trees and start an "active or running" crown fire. Such fires are spectacular and very difficult to contain and suppress. In addition, such fires also tend to kill the seed sources of all tree species except lodgepole pine. Stand replacing wildfires in low to mid-elevation forests typically result in a land cover change from forest to grass and shrublands.

What Happens After a Wildfire?



A severely burned sub-alpine forest in the spring after fire. Inset: 3-week old ponderosa pine seedlings

Most Montana forests are adapted to some form of wildfire

Almost all of Montana's forest ecosystems have experienced fire in some form during their past 10,000 years. As a result, many plant and tree species developed adaptations that allow them to take advantage of the disturbance caused by fire. Some, like fireweed, quaking aspen, and western larch produce numerous wind-borne seeds that are capable of finding burned areas and quickly colonizing them. Others, like snowberry, huckleberry and willow can resprout after the tops have been burned off. Finally, there are those that store their seeds, either in the soil such as wild currants and roses, or in fire protective cones such as lodgepole pine, waiting for the heat of fire to stimulate their germination

Post-fire climate influences recovery

Although many plants have adaptations that allow them to recover or recolonize fire affected sites, wildfires and the ensuing blackened environment pose some formidable challenges. Blackened surfaces heat up very rapidly in the sun, often reaching temperatures in excess of 170ºF. Water boils at 212ºF and most plant tissue dies at 130ºF unless it has specific mechanisms to disperse or protect itself from heat. Recovery occurs best when the spring and summer following wildfire offers frequent light rain with no downpours or prolonged drought.

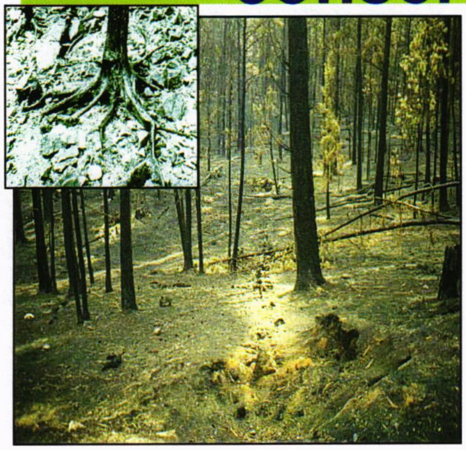
Heavy spring rain after the wildfire eroded most of the ash and remaining top soil from this basin as seen by the exposed rocks. Trees will have difficulty growing on this site for the next century.

4 years after a severe and expansive fire, 80% of a former ponderosa pine/Douglas-fir forest is devoid of tree regeneration, except within 100 yards of green tree "islands." Inset: a 3-year old ponderosa pine seedling Sula state forest 4 years after wildfire.

Recovery after fire depends on the adaptations of local vegetation

Plants have adapted to the type of fire that historically helped shape them. Warmer drier sites historically experienced frequent (2-15 years) wildfires that would burn off lesser accumulations of forest litter, but not emit too much heat. In this system trees developed deeper roots and thicker bark that protected them from such low severity burns. High severity fires on this type of forest could result in a change from forest to non-forest as the native species cannot survive as adults or seeds. Likewise, large expanses of severe fires in the mixed severity fire type could remove "survivor islands" and result in poor seed availability.

Human intervention can help conserve soils and forests



Stabilizing soils is a #1 priority

Severely burned forested areas are highly susceptible to soil erosion the first several years following the fire. Live plants as well as organic litter such as decomposing needles and branches typically hold the soil in place during snowmelt and rainfall events. After a fire, these soil stabilizers are converted to ash, which in itself is highly erosive. The impact of raindrops as well as soil surface water flow breaks ash and soil particles free, moving them down-slope and into water ways. Two major impacts result. First, water quality can be degraded, and second, soil productivity can be lost

Fine ash layer is all that remains on soil surface during the first season. Inset: exposed root system after heavy rainfall erodes ahs and soil away.

Fine ash layer covered with moss persists 13 years after the wildfire. The impacts , other than appearing to inhibit other plant growth remains to be studied.

Forest cycles

Forests grow and shrink in expansiveness and tree density as part of their historic natural cycle and in response to climatic trends. Wet climatic fluctuations allow many tree seedlings to survive and promotes faster and denser tree growth. When a warm dry climatic period develops, trees become stressed and die, large amounts of fuel accumulate and severe wildfires reduce the forested area. Although this is part of a natural process, nature often works on a boom and bust cycle that does not always conserve the values that we want from our forests and landscapes. By managing tree densities and fuel accumulations, we can moderate the magnitude of natural events, and help forests survive during major climatic cycles and catastrophic events.

40-year old clearcut remained mostly fire resistant during 2000 fires .

Across the Bitterroot valley, the wildfires of 2000 had a profound impact . Forest recovery varies by site tremendously and many questions about other impacts remain to be answered. Past human management activities had both negative and positive impacts, resulting in the promotion of exotic noxious weed s, and in creating forested areas that were more resistant or resilient to wildfire impacts , promoting more of a mosaic effect from wildfires and creating seed and habitat refugia on the landscape. Taking steps to aid in soil stability, snowpack and water retention and native seed sources all are important aspects that help conserve a landscapes ability to recover from major disturbances.

What about salvage logging?

The Sula State forest severely burned during the 2000 wildfire season. First winter salvage logging not only maximized wood recovery, It slowed down the surface erosion that devastated Laird Creek the following spring and promoted excellent natural regeneration of tree seedlings. Pictures above from 2001 and 2013 on the same site.

How and when makes all the difference

Restoration practices can be very expensive, averaging from $300 to $2000 per acre treated. Of the 354,000 acres that burned across the Bitterroot Valley in 2000 approximately 1/3 burned severely. Conducting restoration practices on those acres could have cost between 36 and 250 million dollars. Salvage logging fire killed trees can help cover some of these costs and provide wood products and income for the local economy. Salvage logging requires special care that some dead trees are left for wildlife habitat, logging debris is either cleaned up or oriented on slopes to slow water flow, and that noxious weeds are not introduced onto these disturbed sites.

The best time to harvest in wildfire affected areas is immediately after the fire. Logging disturbs the thick ash layer that can facilitate erosion and exposes mineral soil that is a better medium for tree seed germination. Fire injured trees often will produce a good seed crop following wildfires or have seeds that survived. Soil surface nutrient levels are typically elevated for only the first two years after a wildfire and competition from other plants is minimal – giving new tree seedlings an excellent chance to get established and rapidly grow. Finally, logging fire killed trees typically results in abundant branch and woody debris accumulation on the soil surface with helps retain surface water, water infiltration and slows down soil erosion.

Sula state forest following salvage logging in the winter of 2000-2001 and in 2013. Most of the ponderosa pine that survived the fire recovered and produced natural regeneration .