Montana State Legislature

2013 Session

Additional Documents include:

***Business Report**
***Roll Call-attendance**
***Standing Committee Reports,**
***Table Bills, Fiscal reports etc.**
***Roll Call Votes**
***Witness Statements**
***Informational items**
***Visitor Registrations**
***Any other Documents;**
~Petitions if any?
~Any and all material handed in after the meeting end.

The original is on file at the Montana Historical Society and may be viewed there.

Montana Historical Society Archives
225 N. Roberts
Helena MT 59620-1201
2013 Legislative Scanner Susie Hamilton

BUSINESS REPORT

MONTANA HOUSE OF REPRESENTATIVES
63rd LEGISLATURE - REGULAR SESSION

HOUSE FISH, WILDLIFE AND PARKS COMMITTEE

Date: Thursday, January 31, 2013 **Time:** 3:00 PM
Place: Capitol **Room:** 152

BILLS and RESOLUTIONS HEARD:

HB 247 - Create permit for salvage of game killed by vehicles - Rep. Steve Lavin
HB 273 - Revise fish, wildlife, and parks laws - Rep. Edith (Edie) McClafferty
HB 278 - Reduce waiting period to use bear license after purchase - Rep. Ted Washburn

EXECUTIVE ACTION TAKEN:

HB 273
HB 180
HB 198
HB 27

Comments:

REP. Jeffrey W. Welborn, Chair

HOUSE OF REPRESENTATIVES
Roll Call
FISH, WILDLIFE, AND PARKS COMMITTEE

DATE: 1/31/2013

NAME	PRESENT	ABSENT/EXCUSED
REP. DOUG KARY, VICE CHAIR	X	
REP. FRANKE WILMER, VICE CHAIR	X	
REP. GORDON VANCE		X
REP. CARLIE BOLAND	X	
REP. PAT CONNELL	X	
REP. JP POMNICHOWSKI	X	
REP. EDWARD GREEF	X	
REP. VIRGINIA COURT	X	
REP. KERRY WHITE	X	
REP. BRIDGET SMITH		X
REP. WENDY WARBURTON	X	
REP. ALAN DOANE	X	
REP. ED LIESER	X	
REP. KELLY FLYNN	X	
REP. TOM JACOBSON	X	
REP. BRIAN HOVEN	X	
REP. JEAN PRICE	X	
REP. KIRK WAGONER	X	
REP. RAY SHAW	X	
REP. TED WASHBURN	X	
REP. JEFFERY WELBORN, CHAIR	X	

HOUSE STANDING COMMITTEE REPORT

Mr. Speaker:

We, your committee on **Fish, Wildlife and Parks** recommend that **House Bill 27** (first reading copy -- white) **do pass as amended**.

Signed: _____
Representative Jeffrey W. Welborn, Chair

And, that such amendments read:

1. Page 1, line 17.
Strike: "mountain lions or"
Following: "wolves"
Insert: "after the general deer and elk season"

- END -

Committee Vote:
Yes 12, No 9
Fiscal Note Required __

HB0027001SC.hjk

DC 2-1-13
10:20

HOUSE STANDING COMMITTEE REPORT

January 31, 2013

Mr. Speaker:

We, your committee on **Fish, Wildlife and Parks** recommend that **House Bill 273** (first reading copy -- white) **do pass**.

Signed: _____
Representative Jeffrey W. Welborn, Chair

- END -

Committee Vote:
Yes 21, No 0
Fiscal Note Required __

HB0273001SC.hjk

DC 2-1-13
10:20

COMMITTEE FILE COPY

BILL TABLED NOTICE

HOUSE FISH, WILDLIFE AND PARKS COMMITTEE

The **HOUSE FISH, WILDLIFE AND PARKS COMMITTEE** TABLED
HB 198 - Authorize late season deer and elk hunting - Rep. Champ Edmunds
, by motion, on **Thursday, January 31, 2013**.

Marissa Stockton
(For the Committee)

TC
(For the Chief Clerk of the House)

10:10 / 2-1-13
(Time) (Date)

January 31, 2013 (3:34pm) Marissa Stockton, Secretary Phone: 444-1864

COMMITTEE FILE COPY

BILL TABLED NOTICE

HOUSE FISH, WILDLIFE AND PARKS COMMITTEE

The **HOUSE FISH, WILDLIFE AND PARKS COMMITTEE** TABLED
HB 180 - Revise requirements for nonresident relative to get reduced cost hunting license - Rep. Kirk Wagoner
, by motion, on **Thursday, January 31, 2013**.

Marissa Stockton
(For the Committee)

DC
(For the Chief Clerk of the House)

10:10 / 2-1-13
(Time) (Date)

February 1, 2013 (10:00am) Marissa Stockton, Secretary Phone: 444-1864

HOUSE OF REPRESENTATIVES
Roll Call Vote
FISH, WILDLIFE, AND PARKS COMMITTEE

DATE: 1/31/2013 BILL NO HB 180 MOTION NO. 1
MOTION: HB 180 DO Pass

NAME	AYE	NO	If Proxy Vote, check here & include signed Proxy Form with minutes
REP. DOUG KARY, VICE CHAIR		X	
REP. FRANKE WILMER, VICE CHAIR		X	
REP. CARLIE BOLAND		X	
REP. PAT CONNELL		X	
REP. JEAN PRICE		X	
REP. EDWARD GREEF		X	
REP. VIRGINIA COURT		X	
REP. KERRY WHITE	X		
REP. BRIDGET SMITH		X	
REP. WENDY WARBURTON	X		X
REP. KELLY FLYNN		X	
REP. ALAN DOANE	X		
REP. ED LIESER		X	
REP. TOM JACOBSON	X		
REP. BRIAN HOVEN	X		
REP. JP POMNICHOWSKI		X	
REP. KIRK WAGONER	X		
REP. RAY SHAW	X		
REP. TED WASHBURN		X	
REP. GORDON VANCE	X		X
REP. JEFFERY WELBORN, CHAIR		X	
	8	13	

HOUSE OF REPRESENTATIVES
Roll Call Vote
FISH, WILDLIFE, AND PARKS COMMITTEE

DATE: 1/31/2013 BILL NO HB 27 MOTION NO. 8
MOTION: HB 27 DO Pass as amended

NAME	AYE	NO	If Proxy Vote, check here & include signed Proxy Form with minutes
REP. DOUG KARY, VICE CHAIR	X		X
REP. FRANKE WILMER, VICE CHAIR		X	
REP. CARLIE BOLAND		X	
REP. PAT CONNELL	X		
REP. JEAN PRICE		X	
REP. EDWARD GREEF	X		
REP. VIRGINIA COURT		X	
REP. KERRY WHITE	X		
REP. BRIDGET SMITH		X	
REP. WENDY WARBURTON	X		X
REP. KELLY FLYNN		X	
REP. ALAN DOANE	X		
REP. ED LIESER		X	
REP. TOM JACOBSON		X	
REP. BRIAN HOVEN	X		
REP. JP POMNICHOWSKI		X	
REP. KIRK WAGONER	X		
REP. RAY SHAW	X		
REP. TED WASHBURN	X		
REP. GORDON VANCE	X		X
REP. JEFFERY WELBORN, CHAIR	X		

AUTHORIZED
COMMITTEE PROXY

I request to be excused from the F W P

Committee because of other commitments. I desire to leave my proxy vote with:

Rep WHITE Pat Connell (in ink)

Indicate Bill number and your vote Aye or No. If there are amendments, list them by name and number under the bill and indicate a separate vote for each amendment.

BILL/AMENDMENT	AYE	NO
rev. to Table HB 180	X	
HB 198 to Table	X	
HB 27		X
HB 273	X	

BILL/AMENDMENT	AYE	NO
HB 002701, ahs		X

Rep. _____
(Signature)

Date 1/31/13

AUTHORIZED
COMMITTEE PROXY

I request to be excused from the FWP

Committee because of other commitments. I desire to leave my proxy vote with:

Doug Kary Pat Connell (in ink

Indicate Bill number and your vote Aye or No. If there are amendments, list them by name and number under the bill and indicate a separate vote for each amendment.

BILL/AMENDMENT	AYE	NO
Rep Tobin HB 180	X	
HB 198 Tobin	X	
HB 27	X	
HB 273	X	

BILL/AMENDMENT	AYE	NO
1'		
HB 00270.ahs	~~X~~	X

Rep. Wendy Hawker (Signature)

Date 1/31/13

AUTHORIZED
COMMITTEE PROXY

I request to be excused from the FWP

Committee because of other commitments. I desire to leave my proxy vote with:

Pat Connell (in ink)

Indicate Bill number and your vote Aye or No. If there are amendments, list them by name and number under the bill and indicate a separate vote for each amendment.

BILL/AMENDMENT	AYE	NO
HB27	X	

BILL/AMENDMENT	AYE	NO

Rep. Tom Kary
(Signature)

Date 31 JAN 2013

MONTANA House of Representatives
Visitors Register
HOUSE FISH, WILDLIFE AND PARKS COMMITTEE

Thursday, January 31, 2013
HB 278 - Reduce waiting period to use bear license after purchase
Sponsor: **Rep. Ted Washburn**

PLEASE PRINT

Name	Representing	Support	Oppose	Info
BILL MITCHELL	MT SFW	X		
Jean Johnson	MT Out. & Guides	X		
Rod Bullis	Self	X		
Jim Knopp	Fwp			✓

Please leave prepared testimony with Secretary. Witness Statement forms are available if you care to submit written testimony.

MONTANA House of Representatives
Visitors Register
HOUSE FISH, WILDLIFE AND PARKS COMMITTEE

Thursday, January 31, 2013
HB 273 - Revise fish, wildlife, and parks laws
Sponsor: **Rep. Edith (Edie) McClafferty**

PLEASE PRINT

Name	Representing	Support	Oppose	Info
HANK Worsech	FWP	X		
Ted WASHBURN	Self	X		
Jean Johnson	MT Outa Guides	X		
Rod Bullis	Self	X		

Please leave prepared testimony with Secretary. Witness Statement forms are available if you care to submit written testimony.

MONTANA House of Representatives
Visitors Register
HOUSE FISH, WILDLIFE AND PARKS COMMITTEE

Thursday, January 31, 2013
HB 247 - Create permit for salvage of game killed by vehicles
Sponsor: **Rep. Steve Lavin**

PLEASE PRINT

Name	Representing	Support	Oppose	Info
BILL MITCHELL	MT SFW	X		
John Mundinger	Self	X		
Jean Johnson	self	x		
Rod Bullis	Self	X		
Jim Knopp	FWP		–	

Please leave prepared testimony with Secretary. Witness Statement forms are available if you care to submit written testimony.

Copy to House Fish-Wildlife and Parks Committee
House Bill 0031

Status of Montana's Ungulate and Predator Populations - Spring 2012

EXECUTIVE SUMMARY

1.) As of 2011, estimates of Statewide elk populations in Montana are 24% above Objective, White-tailed deer are 8% below Objective, and mule deer are 29% below Objective. For elk, 7 EMUs are below Objective, 11 are at Objective, and 24 are above Objective. By subunit for elk, 26 are below Objective, 38 at Objective, and 50 above Objective. Statewide, elk numbers are up. Areas under Objective are generally in western and northwestern Montana and those above Objective are generally in central and eastern Montana.

2.) Despite increased numbers of hunting districts allowing harvest of antlerless elk on the general license and also issuing a 2nd license for antlerless elk (A9/B12), statewide antlerless elk harvest has declined. Recent harvest restrictions in portions of Regions 1 and 2 and declining hunter access and participation in portions of the State may have contributed to this. Harvest restrictions due to reduced elk numbers in some areas related to predation has also contributed.

3.) Areas with substantial recent declines in elk numbers are not numerous, but where they have occurred, some population declines have been substantial and hunter harvest has been reduced to historically low levels.

4.) Mule deer populations numbers have been in long-term (50 year) decline in Montana and much of the western U.S. Causes are unclear.

5.) White-tailed deer numbers have been in a long-term (50 year) increasing trend in Montana, but have stabilized or recently declined in some areas. Declines of white-tailed deer in portions of Regions 1 and 2 can generally be tied to effects of the severe winter of 1996-97 and high antlerless harvest during 1993-97 and 2006-08. However declines have continued in some areas after 2008, populations and harvest levels have not recovered and it is likely that recent increase in predation loss from wolves is contributing. White-tailed deer numbers have generally been increasing to stable in the agricultural, low predation pressure valleys of Region 3 as they have in the limited similar environments in Regions 1 and 2. Declines in white-tailed deer numbers in eastern Regions 4, 5, 6, and 7 can primarily be tied to periodic severe winter weather, epizootic hemorrhagic disease outbreaks in 2001, 2007, and 2011, and occasional contributions by high antlerless harvest.

6.) Moose harvest and probably populations have declined by about 50% since 1990. Reasons for this are unclear and probably multiple. However, in areas where high numbers of wolves are maintained by white-tailed deer and elk, moose as a low-density species may be particularly vulnerable to predation loss.

7.) Wolves have increased substantially in Montana since 1995 and were conservatively estimated at 130 packs and 653 wolves in 2011. These wolves are almost entirely in western Montana. Although wolf numbers are low relative to most other native predators, they are added to what was likely the richest abundance of large predators in the lower 48 States. Statewide estimates of other predators are 13,307 black bear, 3,668+ mountain lions, and 650+ grizzly bear. Grizzly bear have generally been increasing in number over the last 25 years, black bear have been stable to slightly

increasing, and mountain lion numbers appeared to increase to 1997, declined, and now appear to be in an increasing trend.

8.) Currently, significant baseline predation pressure exists for the following Montana hunting districts: 100, 101, 102, 103, 104, 109, 110, 121, 122, 123, 124, 130, 140, 141, 150, 151, 200, 201, 202, 203, 240, 250, 270, 280, 281, 282/285, 301, 310, 311, 313/316, 314, 317, 360, 362, 422, 424/425, and 442. Some of these areas can no longer support historic hunter harvest levels and remain at stable numbers. It will likely be necessary to reduce harvest in the others as well to maintain stability at current predator numbers.

9.) Generally, high numbers of wolves and wolf packs overlap areas where elk counts have declined since 2005. Similarly, few wolves are present where elk counts have increased or remained stable. Similar conclusions can be made for white-tailed deer. Some exceptions occur. Unfortunately, there is limited evidence to determine population trend for both elk and white-tailed deer in Region 1 and white-tailed deer in parts of Region 2.

10.) For many areas of Montana, there are relatively low levels of predators and/or low levels of hunter access to private lands. Elk numbers have temporarily been reduced in a few of these areas, but numbers are generally above Objective and increasing in most. The level of antlerless harvest that has been achieved and sustained (low or high) can generally explain elk population trend in these areas.

11.) Two major trends have occurred in Montana since the 1970s that have had significant impact on status and management of Montana's wildlife and hunting. With the banning of Compound 1080 and other toxicants for killing predators in the early 1970s and a more environmentally conscious public, all predators began to increase in numbers. Although coyotes were the species most immediately impacted, non-target species such as bears, mountain lions, bobcats, eagles, and others benefitted as well. The increase in predator numbers was immediately apparent for coyotes, but was more gradual and not noticed by many for the other species. Further protection for predators by statute and by management intent followed. Restoration of wolves to Montana, Idaho, and Wyoming occurred beginning in 1995. In Montana, this addition occurred to the richest environment of large predator in the lower 48 States. Predators kill and eat ungulates to survive. Only a portion of this kill is "compensatory mortality" as recent studies have determined. Thus, to maintain stable ungulate populations in the areas where natural predation is high, hunter harvest must necessarily be reduced from earlier levels. In some areas (limited thus far), hunter harvest has significantly declined and may do so in other areas, depending on predator population levels maintained. Also, more intensive management of all predators, including black bear and mountain lions could occur as long as these species remained at publically desirable levels and wolves remained safely above levels that would result in re-listing and removing management control from Montana.

Secondly, landownership status and development changed significantly in Montana over the same time period. As traditional, hunter friendly land owners aged, their children became less able for economic and tax reasons to assume ownership and some had less inclination to assume the sometimes arduous, economically

unrewarding, and isolated existence of traditional ranchers and farmers. Increasingly, large ranches began to be sold to amenity owners and developers. Amenity owners did not need to try to "make a living" from the land and either did not like hunters or purchased the land in part for their own private hunting reserve. As opposed to traditional landowners who often desired fewer ungulates competing with their livestock for forage, many amenity owners wanted even more elk, deer, etc.

"Harboring" of wildlife has developed on some landownerships and once hunting season is over, increased elk numbers used neighboring traditional owners grazing lands and crops. These increased numbers and large winter groups may also contribute to spread of disease, including brucellosis and potentially even more concerning diseases such as chronic wasting disease and tuberculosis. Some land remained in old family hands, but to increase income, these traditional landowners began to lease hunting rights to individual and groups of hunters or outfitters. This effectively reduced general public hunter access and harvest, increasing ungulate populations in many cases. Ranches sold to developers were often subdivided into many parcels for individual homes. In many cases, this did not reduce habitat for elk and deer substantially, but rather created "refuges" from hunting of which the elk and deer soon took advantage. These "refuges" were necessary for human safety reasons as well as being the choice of the new landowners. In total over the last 40 years, much more habitat for elk and deer is unavailable for general hunter access and harvest and elk populations have increased in these areas beyond management control.

The two overriding trends have led to increased and often conflicting management demands and reduced management options. Public lands where more ungulates and hunter harvest are desired and could be supported are the areas with the highest predator populations competing for prey with hunters. Areas with traditional landowners trying to convert grass to pounds of livestock may suffer overabundance of native ungulates because of their own or neighboring amenity owner's reductions in hunter access and harvest. Similarly, hunting "refuges" created by housing/ranchette development result in growing ungulate populations and damage complaints there and on neighboring lands.

For responsive, timely management of predators relative to ungulates and ungulate hunting opportunity, continued and improved trend counts of elk must continue. Additionally, increased efforts should be made to record recruitment ratios (calf:100 cow ratios) in all areas. Accurate ratios are more difficult to make during mid- to late winter than most realize and accuracy should be emphasized. For areas in northwestern Montana where counts of ungulates are not feasible or accurate, hunting regulations must be relatively conservative at current predator population and ungulate recruitment levels to maintain stable ungulate populations.

Harvest is the primary tool that MDFWP can employ to address both over-abundant and under-abundant species (and there is much difference of opinion on appropriate abundance levels).

Status of Montana's Ungulate and Predator Populations

ISSUES: 1.) Influence of Montana Code Annotated 87-1-322 and 87-1-323 resulting from HB 42 in 2003 Montana Legislature on ungulate population status and; Montana Fish, Wildlife & Parks (MFWP) compliance with those codes.
2.) Status of Montana's ungulate populations as of spring 2012 and relative influence of wolves/predators, hunters, weather, disease, HB 42, and other factors.

INTRODUCTION

Status and numbers of Montana's ungulate populations and allocation of public and private "benefits" and "detriments" resulting from those numbers have been controversial throughout Montana's history. The primary management tool for adjusting ungulate numbers is through adjustments of level of annual of hunter harvest. Recommendations of MFWP staff and MFWP Commission final decisions provide geographic targeting of harvest to areas/populations/hunting districts (HDs) to achieve objectives and "fair" allocation among user groups. Desired ungulate population size by hunters, outfitters, landowners, and increasingly, non-consumptive users, and the effect of past and proposed hunting regulations on those populations were and are annual controversies.

Similarly, status, numbers, and controversy about predators and their management have varied throughout Montana history. From first settlement through the 1950s, reduction and even elimination of predators of all kinds was a generally accepted goal and wolves were essentially eliminated from Montana by 1930. However, through legislation, MFWP obtained game animal status for bears and mountain lions and furbearer status for bobcats and other species, enabling regulated management and conservation for those species to occur. In the late 1960s and early 1970s national sentiment began to oppose predator reductions as practiced, and poisoning with toxicants such as Compound 1080 was eliminated in 1972. These prohibitions, along with additional laws and policy changes also resulted in reduced mortality of eagles and "non-target" game species such as bears and lions. Numbers of predators of all types began to increase above levels that occurred in the 1950s. Controversy then began over increased actual or perceived predation (especially by coyotes) on livestock and ungulates. Small numbers of wolves began colonizing northwestern Montana in the late 1970s with little controversy. However, a Federal program to restore wolves to Yellowstone National Park and Central Idaho in 1995 ignited substantial controversy. The subsequent restoration and expansion of wolf numbers beyond projected numbers and distribution, legal delay in removing wolves from the Endangered Species list, and real and perceived declines in ungulate numbers further fueled controversy about the impacts of wolves on ungulates.

The numbers of animals in a population depends on the sum of two things: reproduction (animals entering the population) and mortality (animals leaving the population), current and previous. On a local population scale, immigration and emigration can be considered special

cases of reproduction and mortality, respectively. Information on immigration/emigration is seldom available for management and for practical purposes, is ignored.

Reproduction has several meanings depending on the temporal perspective of the issue. In a pure population sense, young animals may not be considered as adding to the population until they have survived to breeding age. This might be at 1- or 2-years-old. From a hunter's perspective, where young-of-the-year are legal to harvest, young may be considered to be added to the population as early as 3-months-of-age (September). Typically, biologists measure reproduction as recruitment in the late winter or spring of the year after birth through sex/age classifications.

For purposes of determining causes of poor recruitment, measurements of reproduction may start with determination of pregnancy rates. For example, poor nutrition may result in low pregnancy rates and mortality factors that operate after birth may be of lesser importance to recruitment. If reproductive rates are low because of poor nutrition, the traditional management response has been to reduce the total numbers of the population through hunter harvest to provide more forage per animal, thereby increasing nutritional status and pregnancy/birth rate. If pregnancy rates are "normal" and young are healthy at birth, mortality factors such as predation, hunting, winter loss, disease, accidents, etc. may be most important to recruitment. Thus, reproduction measured to "recruitment" (to the hunt, to breeding) has a mortality component. Measurements of reproduction/recruitment are considered measurements of animals added to the population in an annual accounting.

Mortality may include early, first year mortality as discussed above under reproduction/recruitment. It also includes mortality of adult animals from hunter harvest, predation, accidents, disease, old age, winter-kill/malnutrition or other causes. Determination of timing and causes of mortality is usually necessary for recommendation of the most effective management actions designed to either decrease or increase mortality rates to affect desired population level.

The annual sum of reproduction/recruitment and mortality determines population level at the time of measurement. Usually, hunter harvest level that directly affects the mortality portion of the equation is the only or primary management tool available to wildlife management agencies. As discussed earlier, hunter harvest also may be used to try to reduce population level and increase nutritional level to affect reproductive success. Predator control to reduce mortality of ungulates has also been used as a management tool. Habitat manipulations such as planting, burning, mechanical manipulations, etc. have also been tried to increase population nutritional level and it's reproductive component.

The annual sum of reproduction/recruitment and mortality is measured through attempted (preferably annual) counts of animal populations, or portions of populations, to index increase or decrease from the previous year. In many cases, counts are impossible because of type of habitat, costs, time or other logistical constraints and indirect measurements or indexes to population change are used. Attempts to answer questions about population level and causes of increases or decreases are dependent upon measurements of reproduction/recruitment,

mortality, and population numbers discussed above. In practice, trends in these parameters are most important in determining management/conservation action.

MEASUREMENT DATA AND THEIR USE AND LIMITATIONS

Counts and classifications are direct measurements of population size and composition. However, as discussed in Montana's Elk Plan, they are often inconsistently collected and counts do not represent true population size because animals are always undercounted due to various factors, including habitat type and weather. This degree of undercounting may be estimated on some areas where other types of data have been collected. Observability in Montana has ranged from averages of 30% in some timbered habitats to 80% in open winter ranges. Snow cover at time of counting may also affect observability. In milder winters, and especially for migratory animals, not all of the population may be on the area counted at the time of the count, contributing to undercounts. These counts are most useful for long-term comparisons and determining population trends and only of marginal value for precise year-to-year comparisons.

Statewide, elk are the most completely and consistently counted of ungulates. Only a few areas are counted for mule deer and moose; white-tailed deer are generally not counted.

Classifications for ungulate sex and age are consistently conducted in only limited areas. Thus, measurements of reproduction/recruitment are limited.

Indirect measurements of population size and sex/age composition are available, but are one-year delayed indexes. Where any hunter with a license may harvest an adult male or other sex/age category without restriction, annual estimated harvest of adult males may serve as an index to population level that assumes the more males available, the more harvested. Where restriction on take has changed over time, such as any bull legal to brow-tined bull only legal, adjustments must be made in interpretations during the time of change. Weather conditions during the hunting season, changes in hunter access, changes in animal distribution, and other factors also may affect harvest from year-to-year. Thus harvest of males, as an indirect index to populations is not useful as a year-to-year decision tool but its backward looking trend is informative for explaining past long-term trends.

Similarly, past trends in sex/age structure can be inferred from age of harvest determined at check stations. The percent yearlings in the harvest is particularly informative as an index of prior fawn survival. Although this information is one-year delayed, it has the advantage of including any mortality that may have occurred after the period of typical classifications in winter and spring.

Because of the types of data available and their limitations, I will not attempt rigorous analysis. Rather my analysis and interpretations will be based on 35+ years of experience and preponderance of evidence. I will not clutter the text with literature citations, but will include references at the end.

HB 42 AND CURRENT UNGULATE STATUS

Montana Code 87-1-322. Calculation of available habitat for elk deer and antelope. MC 87-1-323. Determining viable elk, deer and antelope populations based on habitat acreage.

MFWP is compliant with the determination and reporting requirements of these codes although not all elk populations are at or below sustainable population objectives. **There could be questions about the techniques and models used to provide estimates of numbers, but if the same techniques are used consistently, the relative ups and downs of the populations from objectives should be adequately represented.** For deer, 10-year averages, ending in 2010 are considered the fundamental objective. There is no information to determine if this is a fixed objective with 2010 as the final year for calculations or if a running average is going to be used. Similarly, there is no justification listed for one method or the other. I did not find population objectives for antelope.

Examples of reports can be found at the following locations:
www.fwp.mt.gov/fwpDoc.html?id=52445 - elk distribution, population estimate, and habitat acreages occupied reported by public and private land.
www.fwp.mt.gov/fwpDoc.html?id=52440 - elk objectives and recent population counts.
The page to access this information for all four species is:
www.fwp.mt.gov/hunting/planahunt/huntingGuides/dea/default.html

As reported for 2011, statewide estimated mule deer populations are 29% below Objective and white-tailed deer populations are 8% below Objective. Elk counted statewide are 24% above Objective. The status of elk populations varies by Elk Management Unit (EMU) and subunits within EMUs. In 2005, at the time the current Elk Management Plan was produced, elk populations in 6 EMUs were below objective, 20 were at objective, and 16 were above objective. At that time, 35% of elk were estimated to be unavailable to general hunting access. Percent elk unavailable to general hunting access was at or above 50% in 12 EMUs. In 2011, elk populations in 7 EMUs were below objective, 11 were at objective, and 24 were above objective. When including objectives by subunit of EMUs in 2011, 26 were below objective, 38 at objective, and 50 above objective. I could find no revised estimate of the percentage of elk unavailable to general hunting access in 2011.

For at least some of the EMUs with decreased elk numbers, increased antlerless harvest in response to HB 42 and to bring populations to Elk Plan Objectives contributed to population declines.

STATEWIDE AND REGIONAL COUNT & HARVEST TRENDS
Ungulates

Elk: On a statewide basis, elk numbers counted have increased since 2005 and are above objective in many areas (Fig. 1). From 2005 to 2011, elk population objective levels increased by 4,555 elk statewide (5.3%) and number of elk counted increased from 86,355 in 2004 to 112,490 in 2011 (+14.6%). Numbers counted could have increased because elk numbers have increased, because counting conditions were better in 2011, because more effort was expended in counting, or all of the above.

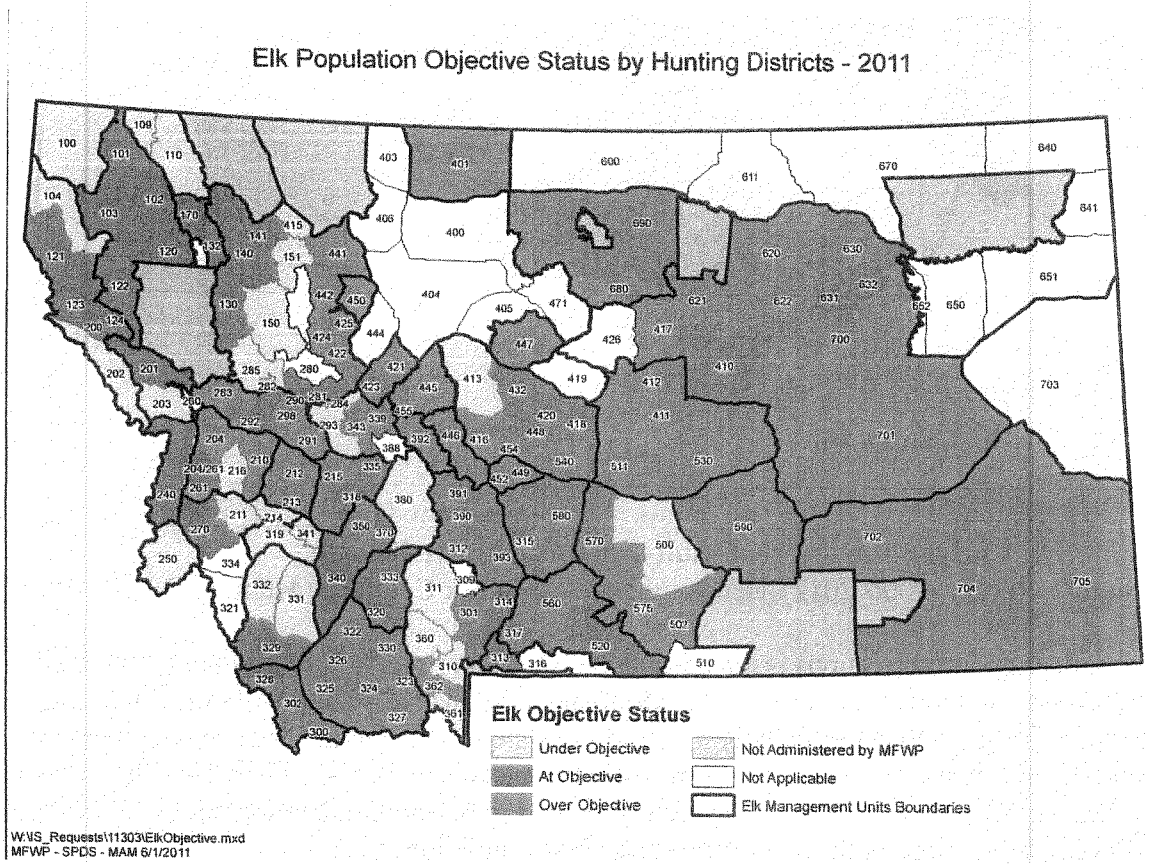


Figure 1. Elk Population Objective Status by Hunting District, 2011 (Montana Fish, Wildlife & Parks).

Post-season elk counts, where they occur consistently, indicate relatively few areas of substantial decline (Fig. 2). Some areas with declines in counts remain above or at objective for elk population numbers. (Figs.1 and 2).

As discussed previously, trend in harvest of males can index population level as long as anyone with a license can harvest a male. Montana elk populations began to increase as indicated by bull harvest trends when in 1976, harvest of antlerless elk was severely restricted (Fig. 3). In 1983, harvest of antlerless elk increased (Figs. 3 and 4), reaching a peak of about

1.5 antlerless elk harvested per bull harvested in 2001. Since that time, harvest of antlerless elk declined, but has remained high compared to anytime prior to 1992.

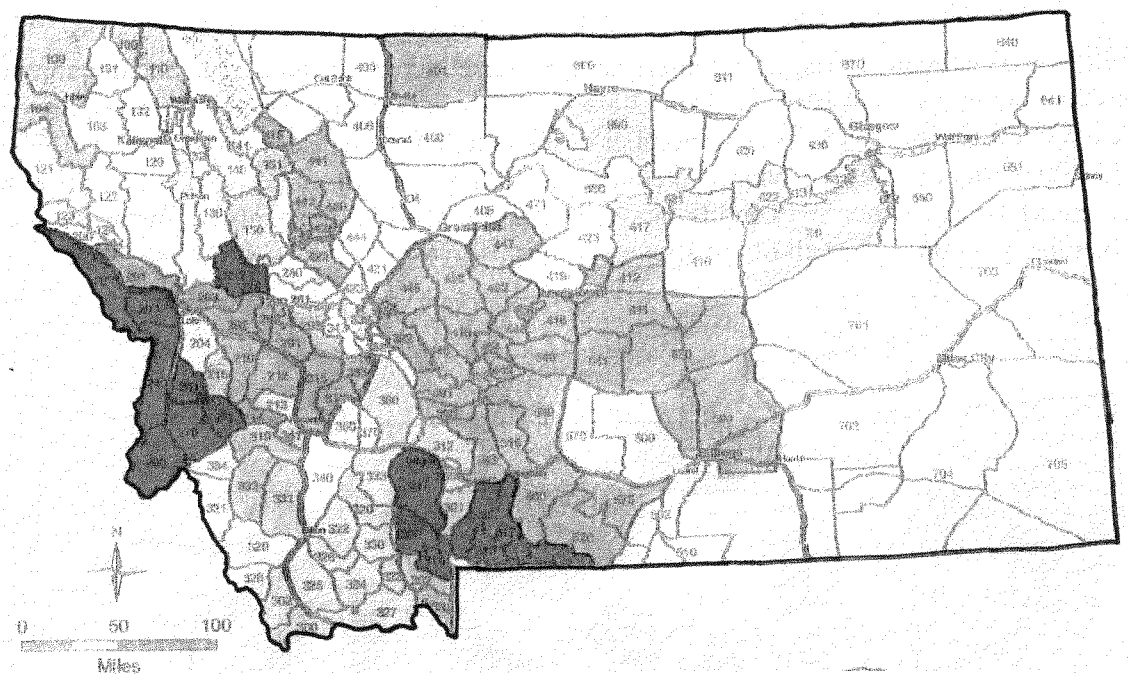


Figure 2. Recent (2006-2012) Trends in Post-season Elk Counts by Hunting District or EMU.

Complicating interpretations is the gradual conversion of regulations from any bull legal to Brow-tined bull only legal in much of Montana. That change started with a few hunting districts in 1984 and occurred over much of the state in 1992 and after. The decline in average annual bull harvest of about 10% from 1988-1994 levels to 1995-2011 levels (Fig.3) despite increasing elk populations may be partially related to research indicating about 15% illegal mortality of yearling bulls under brow-tined bull regulations.

These yearling bull elk did not survive to be legally harvested in following years, reducing expected bull harvest by 1,000-2,000 per year. This lower than expected harvest was evident beginning by 1995 and bull harvest changes between 1992 and about 1999 may not directly relate to population level.

The number of Montana elk hunters increased throughout 1951-1994 (Fig. 5). Only small annual fluctuations have occurred since then, but hunter numbers are down slightly since the peak in 2003 (Fig. 5). Hunter success rates peaked during 1988-1994 and have declined slightly since then (Fig. 6).
Antlerless elk harvest has declined by about 3,000 animals statewide since 2004 despite increased A9/B12 second elk licenses issued (Fig. 7). Because harvest by increased A9/B12

licenses issued has recently begun to more than replace decreased harvest on special permits (Fig. 7), increased antlerless harvest may occur in the future. However, a substantial portion of the recent decline in antlerless harvest is related to the elimination of the regularly scheduled Gallatin and Northern Yellowstone late season antlerless hunts beginning in 2005 and other regularly scheduled late season management hunts (e.g. HDs 311, 362). The loss of late season antlerless elk harvest opportunity in the Gallatin and Northern Yellowstone is unlikely to be restored in the foreseeable future because predator management cannot occur in Yellowstone National Park.

At least partially due to regulation changes, harvest of adult male elk has not tracked population level well since about 1994. Other factors such as changing hunter access, behavioral and distributional changes of elk due to wolf predation, mild, snow-free autumns, and other factors also may have played a role. In an attempt to reduce elk populations, at least in some areas, relatively high levels of antlerless harvest have been maintained however.

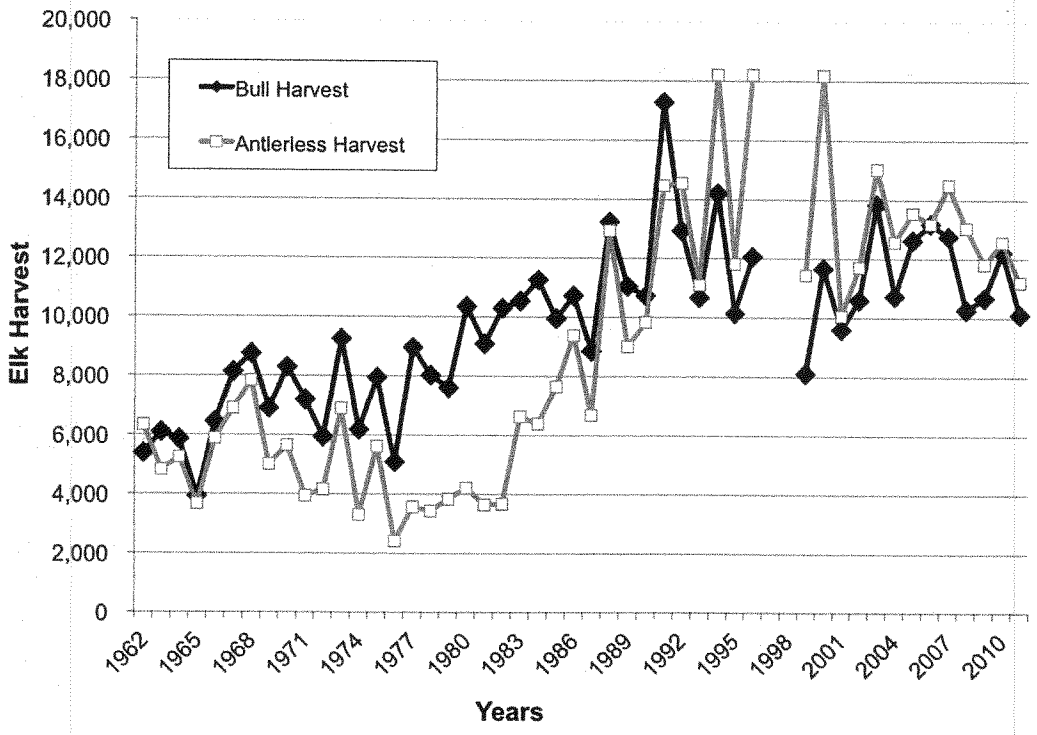


Figure 3. Bull and antlerless elk harvest trends in Montana, 1962-2011.

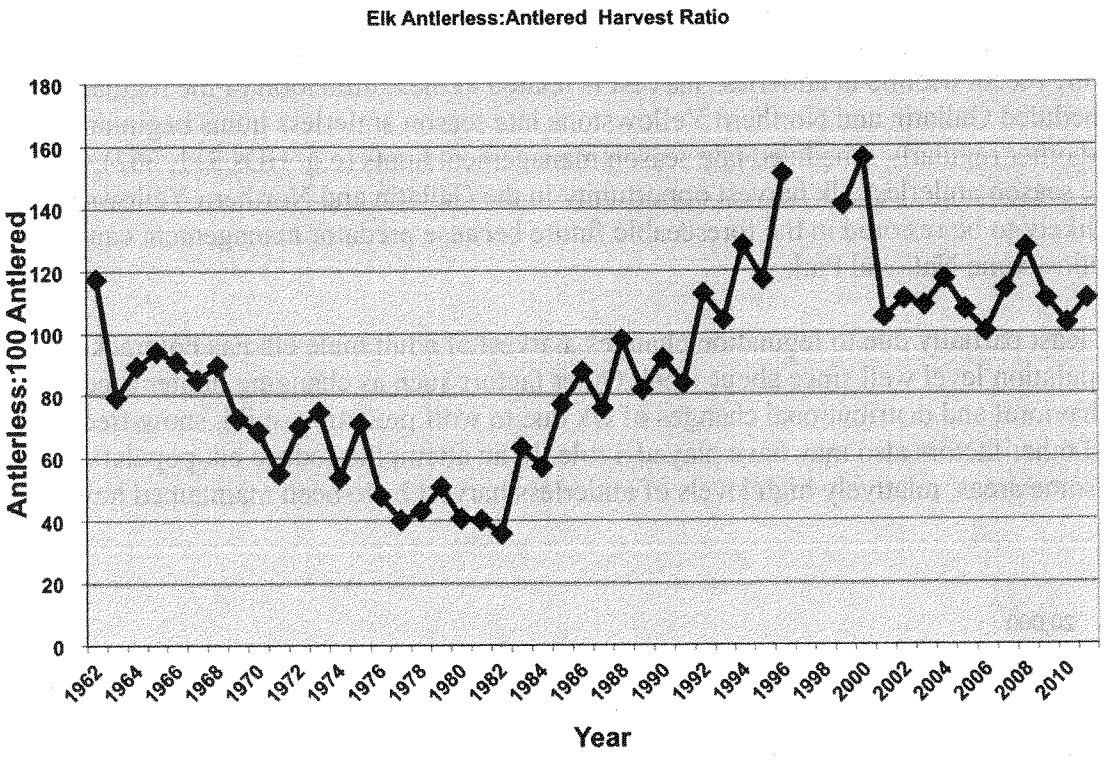


Figure 4. Antlerless elk harvested per 100 bull elk harvested in Montana, 1962-2011.

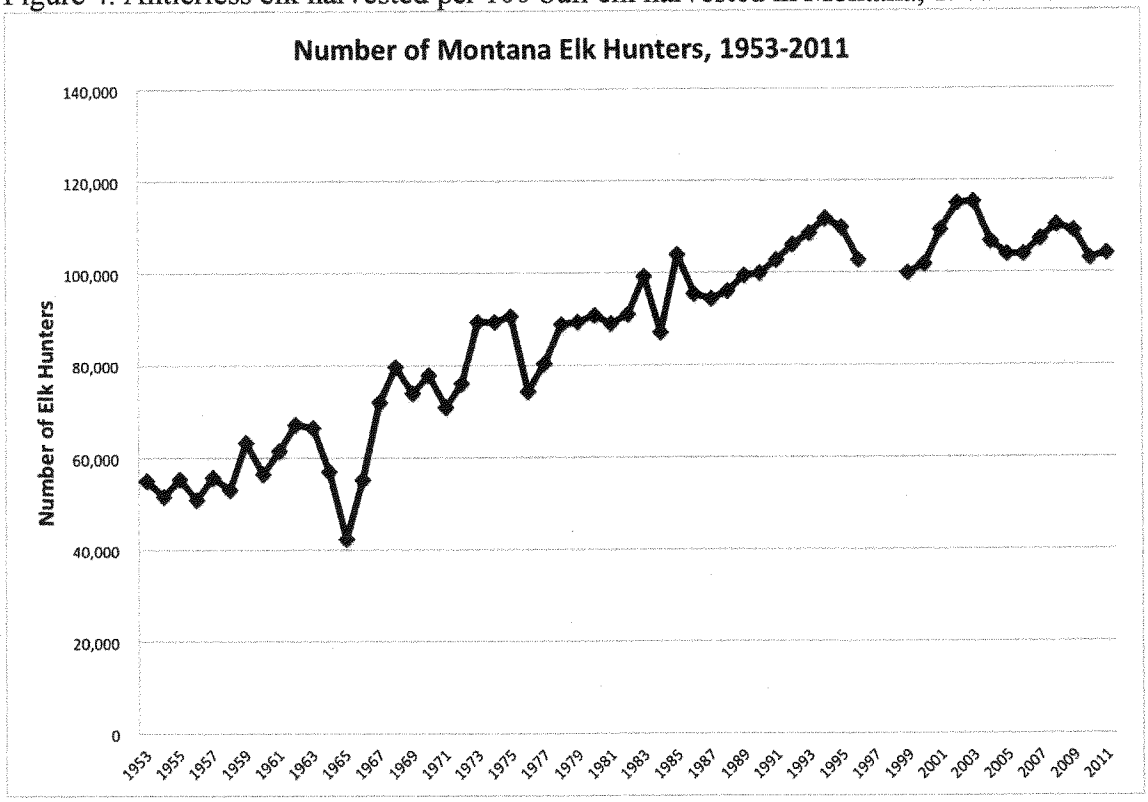


Figure 5. Number of Montana elk hunters, 1953-2011.

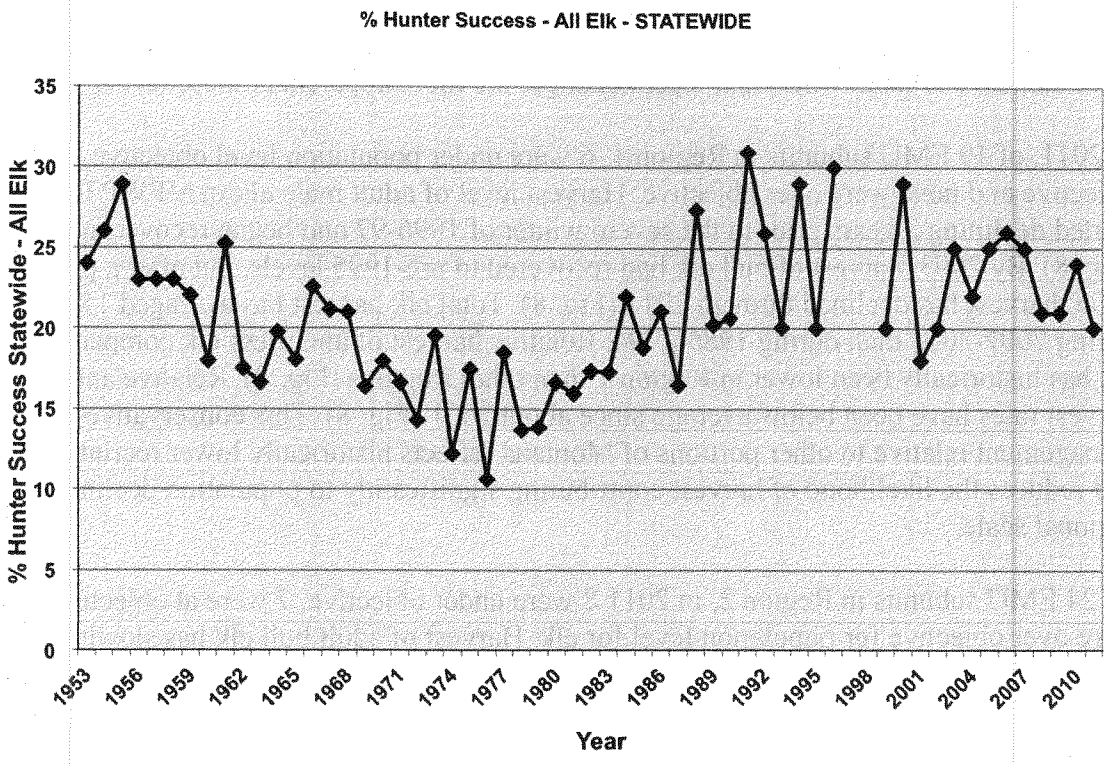


Figure 6. Annual percent hunter success for Montana elk hunters, 1953-2011.

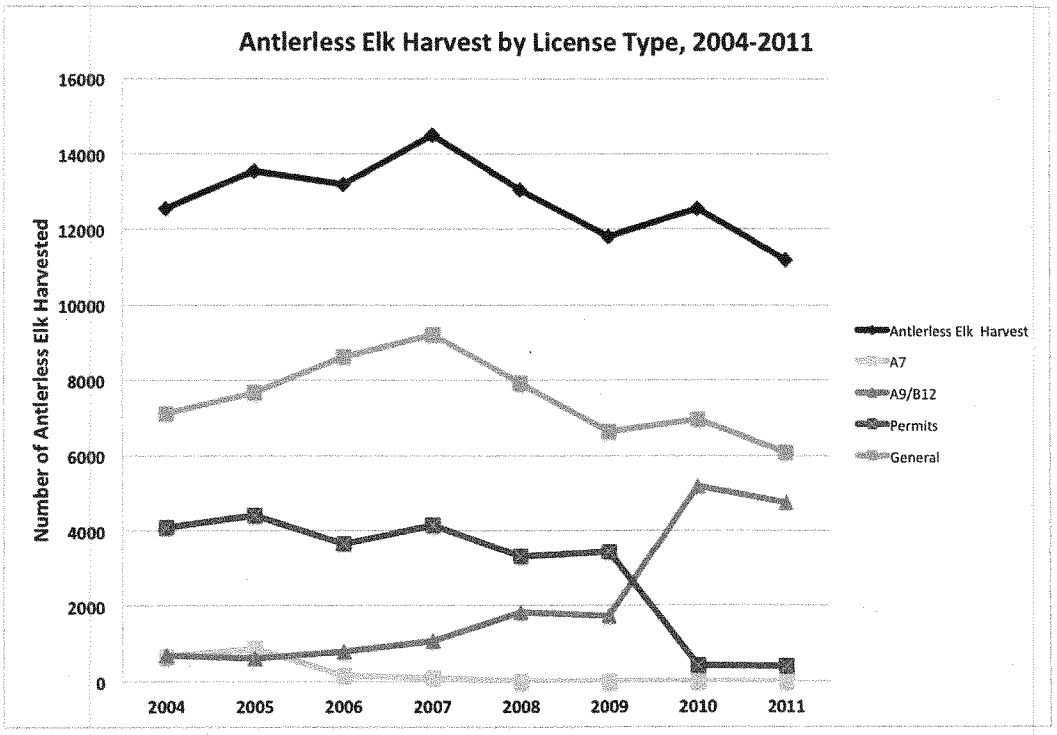


Figure 7. Antlerless Elk Harvest by License Type, 2004-2011.

Statewide, the combined evidence indicates that elk numbers have not declined in recent years, and may have increased. However, regional and local trends are more important to most hunters and landowners and recent changes are more apparent at these levels.

In 2011, of 19 EMU subunits in Region 1, 6 were under population level objective, 13 were at objective and none were over objective. Harvest level of adult male elk in MFWP Region 1 started declining 2 years prior to the severe winter of 1996-97 and began recovering in 1999 (Fig. 8). By 2003, harvest of bull elk had recovered to pre-1995 levels, but after a peak in 2006, harvest has declined through 2011 (Fig. 8). Total elk harvest has averaged 15% lower during 2007-2011 than during 1986-1994. Relative harvest of antlerless elk compared to bull elk has historically been lower in Region 1 than other Regions (Fig. 8). Relative antlerless harvest rates have been below average since about 2001 (Fig. 8). This conservative management relative to other portions of Montana reflects historically lower recruitment rates and reduces the likelihood of harvest contributing significantly to population declines on a regional scale.

Of 24 EMU subunits in Region 2, in 2011 8 were under objective, 7 were at objective, and 9 were over objective for population level for elk. Harvest of adult bull elk has slowly declined in Region 2 since 1988 (Fig. 9). Harvest level of antlerless elk has been higher than in Region 1 and increased considerably during 1996-2000. Harvest of antlerless elk remained higher than for bull elk during the period of declining bull harvests from 2003-2011. Relative antlerless harvest was only slightly greater than average during 2004-2008 (Fig. 9). Similar to Region 1, total harvest of elk averaged 18% lower during 2007-2011 than during 1986-1994 (Fig. 9).

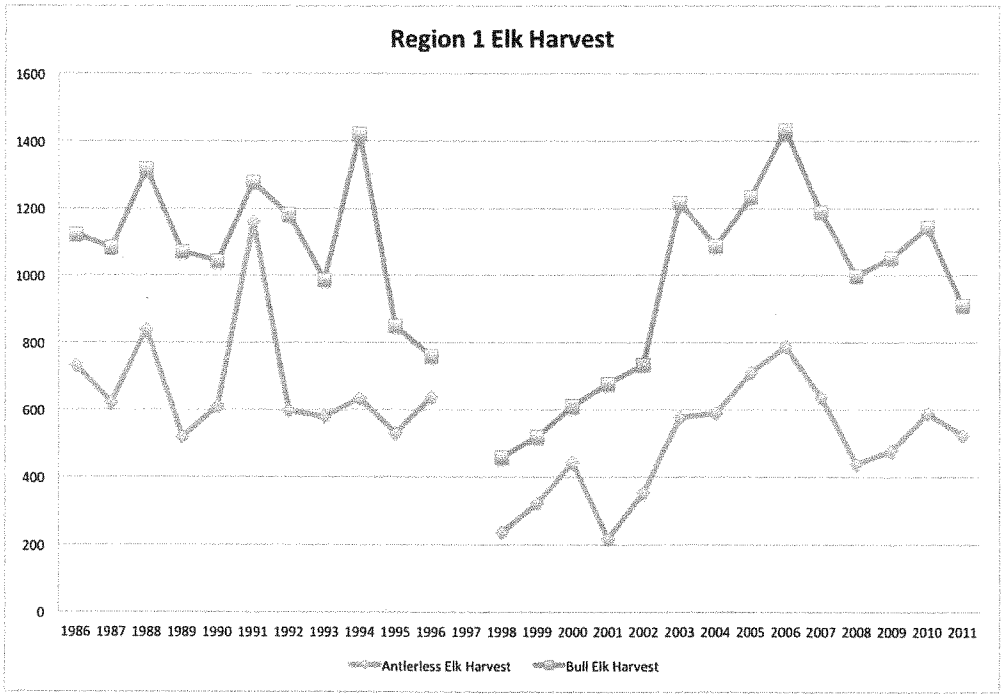


Figure 8. Bull and antlerless elk harvest n MFWP Region 1, 1986-2011.

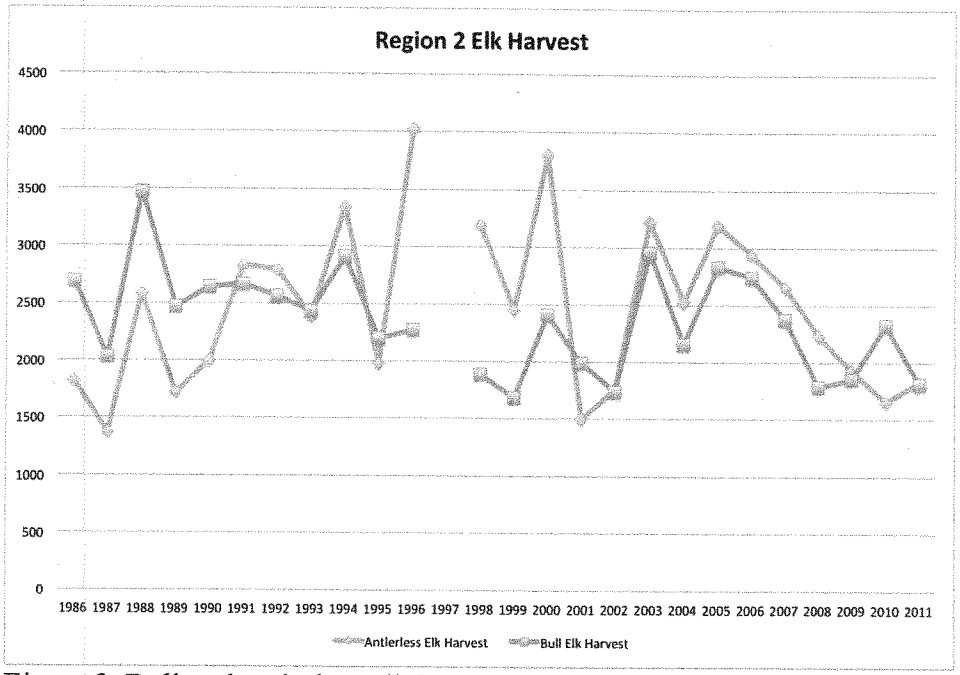


Figure 9. Bull and antlerless elk harvest in in MFWP Region 2, 1986-2011..

In 2011, of 32 EMU subunits in MFWP Region 3, 9 were below objective for elk population level, 11 were at objective, and 12 were above objective. Although bull harvest slightly declined from 1994 through 2011, because of maintenance of relatively high antlerless harvests, total elk harvest was relatively unchanged throughout the period and averaged only 5% lower during 2007-2011 than during 1986-1994 (Fig. 10). Recent antlerless harvests were only above average relative to bulls in 2008 and slightly so in 2009 (Fig. 10).

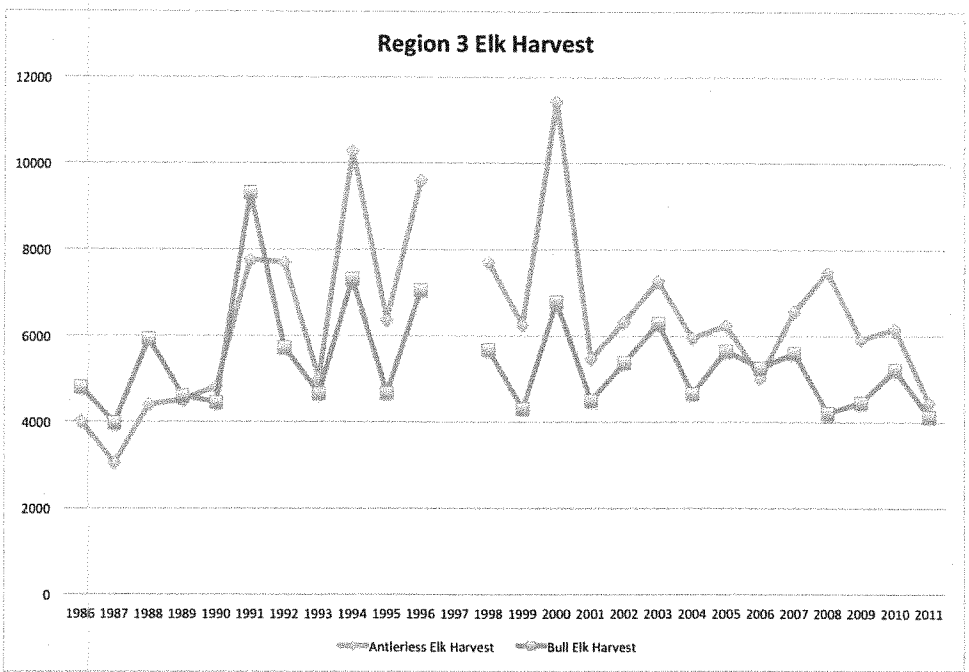


Figure 10. Bull and antlerless elk harvest in MFWP Region 3, 1986-2011.

Of 23 EMU subunits in MFWP Region 4, in 2011, 2 were under objective for elk population level, 5 were at objective, and 16 were over objective. Bull harvest increased slightly throughout 1986-2011. Similar to Region 3, relatively high antlerless harvests were maintained in Region 4 and total elk harvest averaged 12% higher during 2007-2011 than during 1986-1994 (Fig. 11). Recent antlerless harvests were at or below long-term averages relative to bulls (Fig. 11).

In 2011, of 10 EMU subunits in MFWP Region 5, one each was under and at objective, and 8 were above objective for elk population level. Both bull and antlerless elk harvest increased substantially throughout 1986-2011 and total elk harvest was 128% higher during 2007-2011 than during 1986-1994 (Fig. 12). Ratio of antlerless to antlered harvest was high, but slightly lower than in Regions 3 and 4. Harvest of antlerless elk relative to bull elk was high in 1996-2005 and 2011 (Fig. 12).

Because elk harvest is mostly by permit in MFWP Regions 6 and 7, additional interpretation problems exist in using bull harvest as a population level indicator. Harvest level of bulls and elk generally, increased during 1986-2011, however.

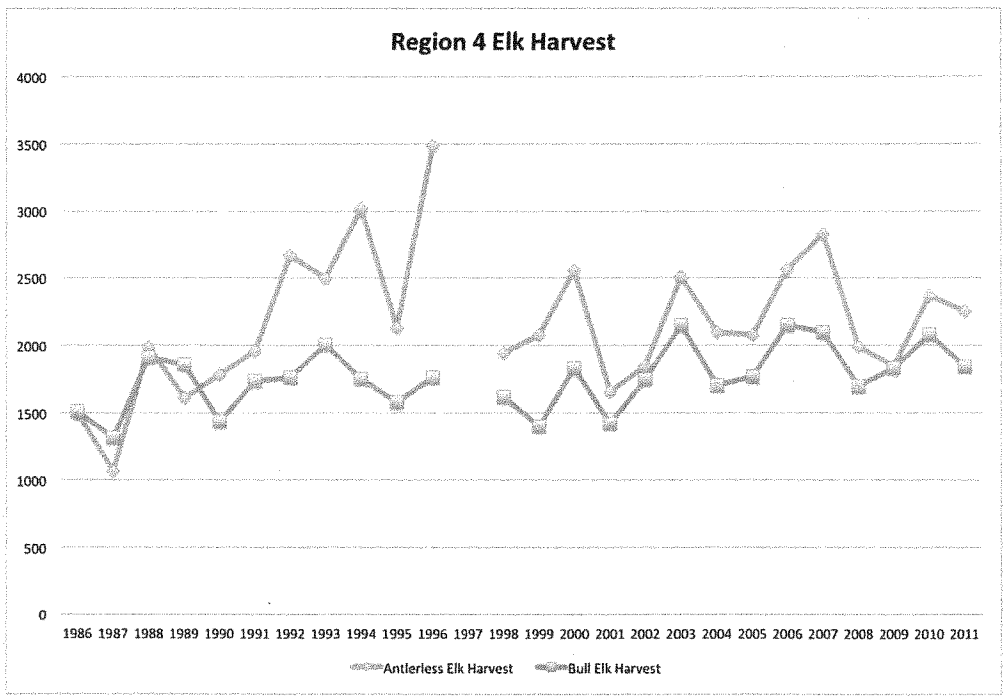


Figure 11. Bull and antlerless elk harvest in MFWP Region 4, 1986-2011.

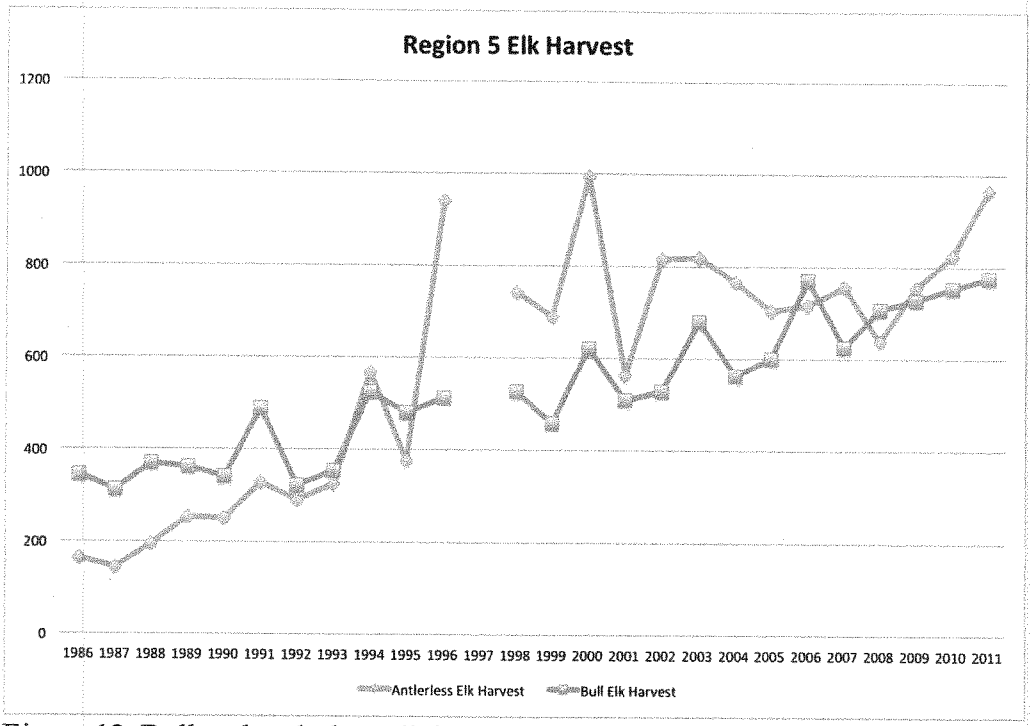


Figure 12. Bull and antlerless elk harvest in MFWP Region 5, 1986-2011.

In Summary, harvest level of elk generally increased in central and eastern Regions during 1986-2011 and remained stable or slightly declined in the 3 western Regions.

Mule and White-tailed Deer: Statewide harvest of mule deer bucks peaked in 1962, 1970, 1983, 1992, and 2003 with lows in 1976, 1998, and 2011. Since 1983, however, the trend has been downward (Fig. 13). The decline in the mid-1970s occurred throughout the range of mule deer in the western United States. Similarly, the recent declines in mule deer populations have occurred across much of the western US and not just in Montana.

Some of this decline of mule deer buck harvest in Montana, especially after 1996, can be attributed to increasing restricted regulations for harvest of mule deer bucks. Increasing number of hunting districts were set aside as special management areas with restrictions on antler points, permits only, shortened seasons, etc. This makes comparisons of pre- and post 1996 harvests problematic as representing population level. Concurrently, number of deer hunters in Montana declined in all Regions except Region 4 after 1995 (Fig. 14). The decline in hunters was most severe in Region 3. Despite that, with other evidence, mule deer harvest and populations appear to have declined significantly from 1960s levels. Mule deer buck harvest declined after 1995 in all Regions of Montana with the decline most severe in Region 3 (Fig. 15).

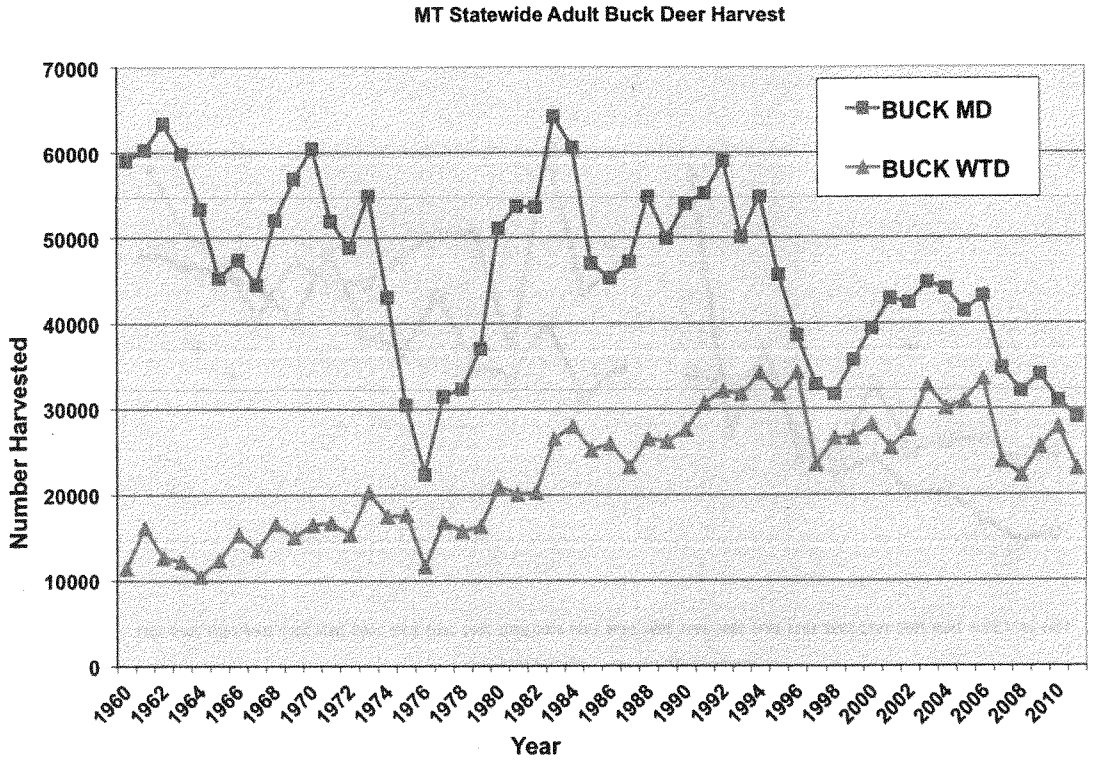


Figure 13. Harvest of buck mule deer and white-tailed deer in Montana, 1960-2011.

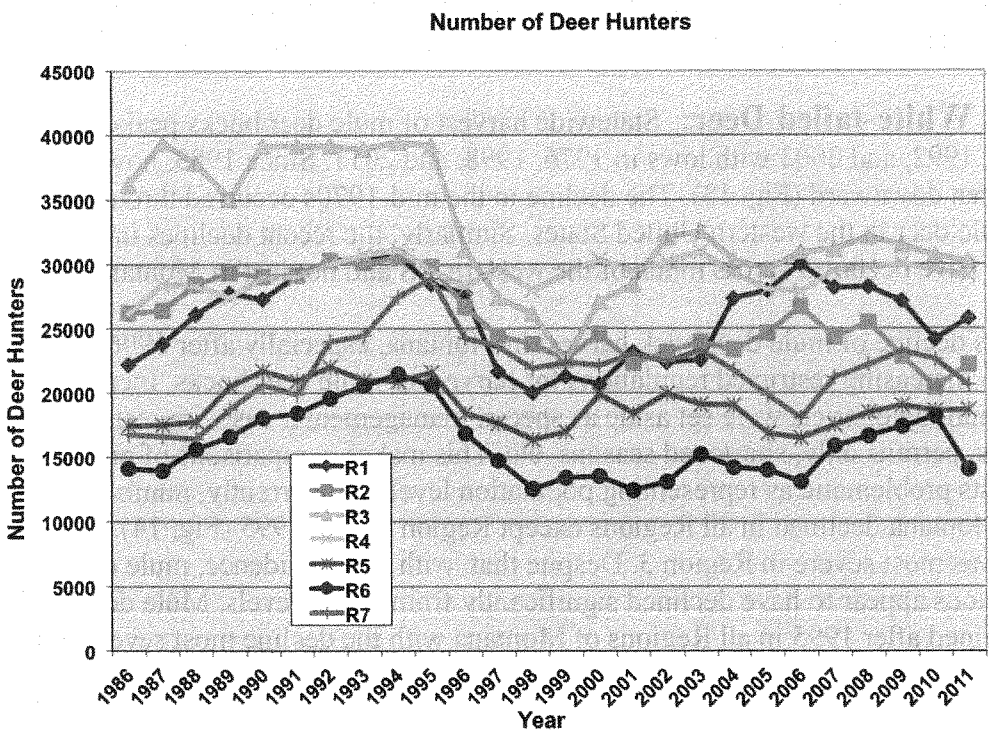


Figure 14. Number of Deer Hunters in Montana, 1986-2011 by MFWP Region.

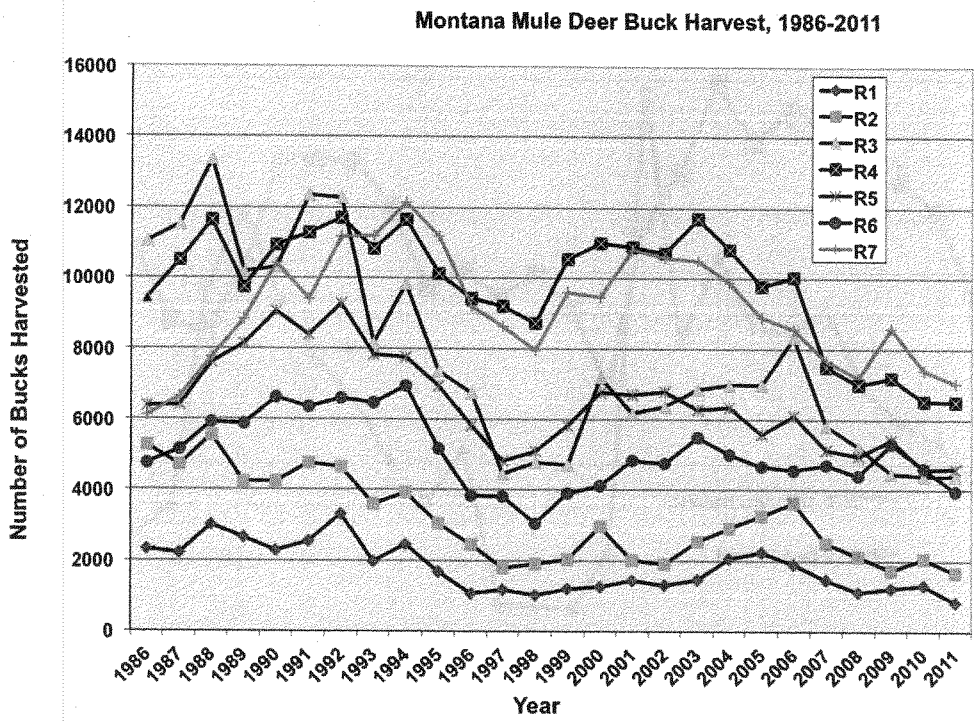


Figure 15. Mule Deer Buck Harvest in Montana, 1986-2011 by MFWP Region.

Harvest regulations for taking a single white-tailed deer buck have been generally unrestricted by area or hunters. Statewide harvest increased steadily from 1960 through a peak in 1996 (Fig. 13). The severe winter of 1996-97, primarily in northwestern and northeastern Montana and to a lesser extent in other areas, resulted in reduced harvests for several years, but harvest level then recovered to 2006. Harvest has declined since 2006 (Fig. 13). To varying extents among the eastern Regions (4-7), epizootic hemorrhagic disease (EHD) significantly reduced white-tailed deer populations in 2001 and 2011 and to a lesser extent in 2007.

A decline in white-tailed deer buck harvest in Region 1 that began in 1995 was accelerated by increased antlerless harvest in 1996 and the severe winter of 1996-97 (Fig. 16). With subsequent low antlerless harvests, populations and harvest of bucks increased to 2006, though not achieving previous highs (Fig. 16). Buck harvest has declined since 2006. Similar to elk, Region 1 has generally had conservative regulations for antlerless white-tailed deer as evidenced by low antlerless to antlered harvest ratios (Fig. 16).

Harvest of white-tailed deer bucks in MFWP Region 2 was relatively stable from 1986-2006 with the exception of a small decline in 1997, probably associated with effects of the severe winter of 1996-97, at least in the northern portions of the Region (Fig. 17). Harvest of antlerless white-tailed deer was also relatively high during 1994-96. Harvest level recovered, but then declined in 2007 and is near recent lows. This decline coincided with high antlerless harvests during 2006-2008 (Fig. 17).

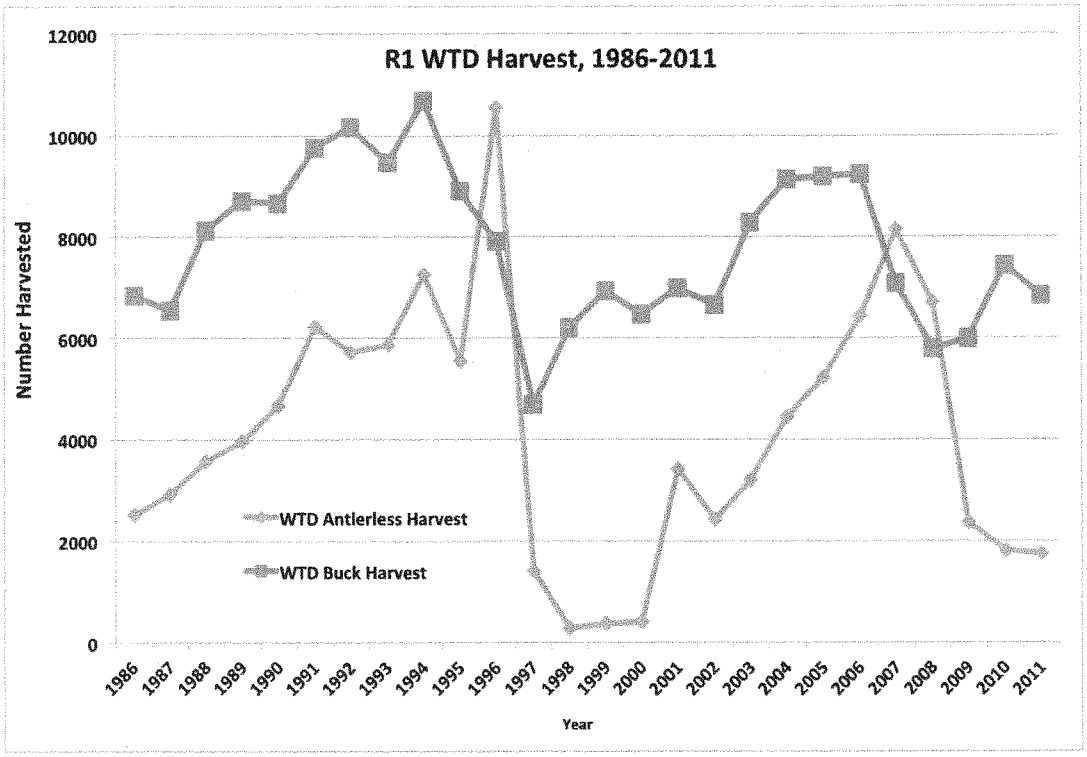


Figure 16. Harvest of Antlered and Antlerless White-tailed Deer in MFWP Region 1, 1986-2011.

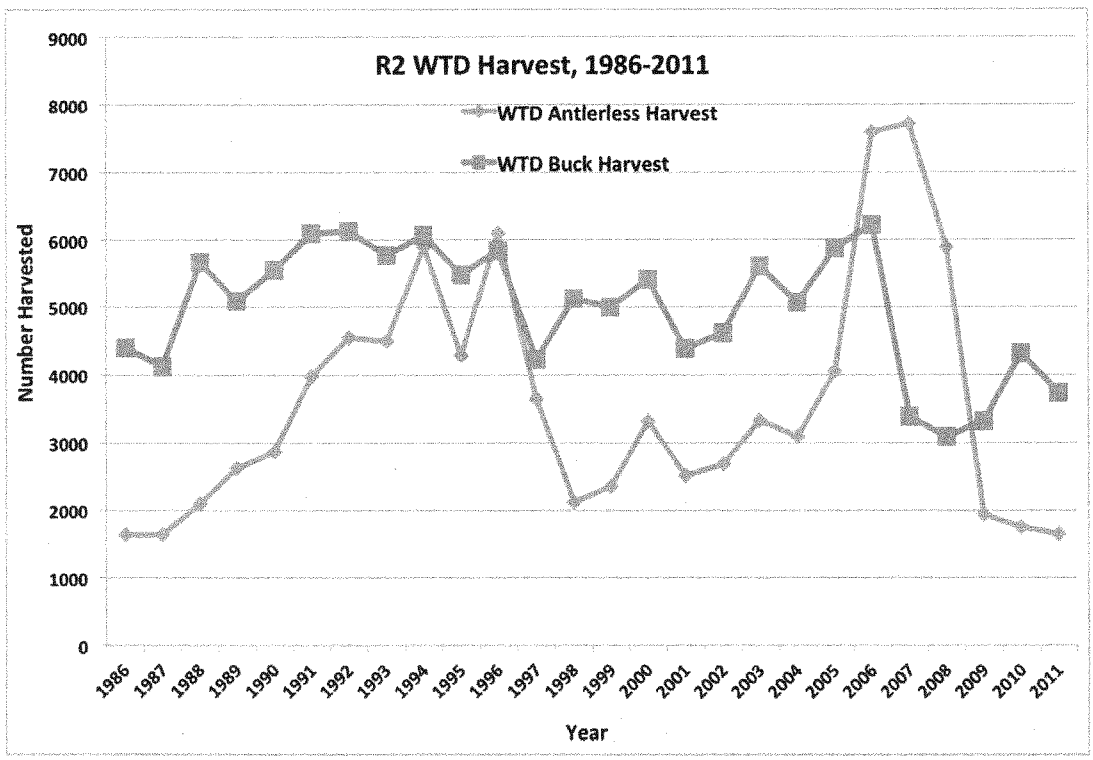


Figure 17. Harvest of Antlered and Antlerless White-tailed Deer in MFWP Region 2, 1986-2011.

Despite relatively high antlerless harvests, white-tailed buck harvest in Region 3 increased from 1986-2006 (Fig. 18). Harvest declined in 2007 to 1990s levels. The decline in 2007 coincided with high harvest of antlerless white-tailed deer from 2006-2011.

Region 4 has maintained consistently high harvests of antlerless white-tailed deer (Fig. 19). Despite this, harvests of white-tailed deer bucks, and presumably total populations, increased slowly from 1986 through 2003. Since 2003, white-tailed buck harvest declined slightly but remains equal to or above pre-1995 levels (Fig. 19). There is evidence of the effects of winters 1996-97, 2010-11 and EHD outbreaks of 2001, 2007 and 2011 on subsequent buck harvests (Fig.19).

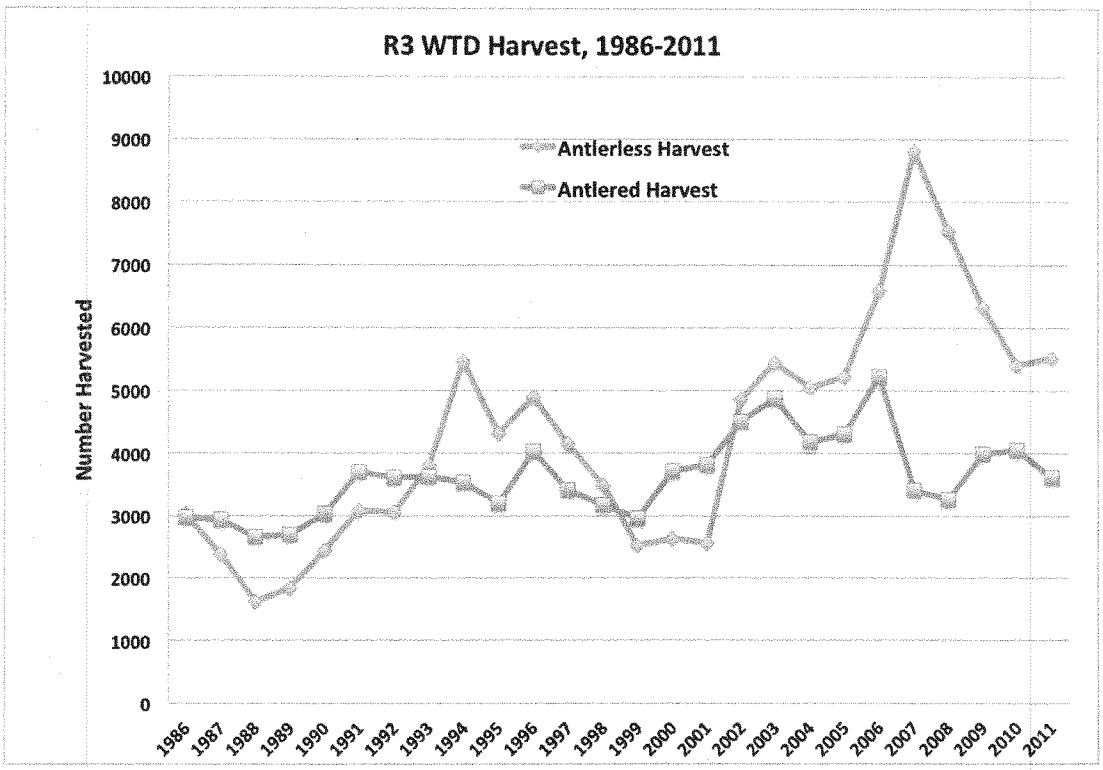


Figure 17. Harvest of Antlered and Antlerless White-tailed Deer in MFWP Region 3, 1986-2011.

With relatively high antlerless harvests, buck white-tailed deer harvests in MFWP Region 5 increased through 2000 (Fig. 20). Harvest declined in 2001, increased through 2006 and declined in 2007. The decline in 2007 and subsequent lower buck harvests coincided with very high antlerless harvests from 2006-2011 (Fig. 20). Only slight evidence for impacts of winters 1996-97 and 2010-11 exist for this southern Region (Fig. 20). However, impact of EHD outbreaks in 2001 and 2007 on subsequent buck harvest are clear.

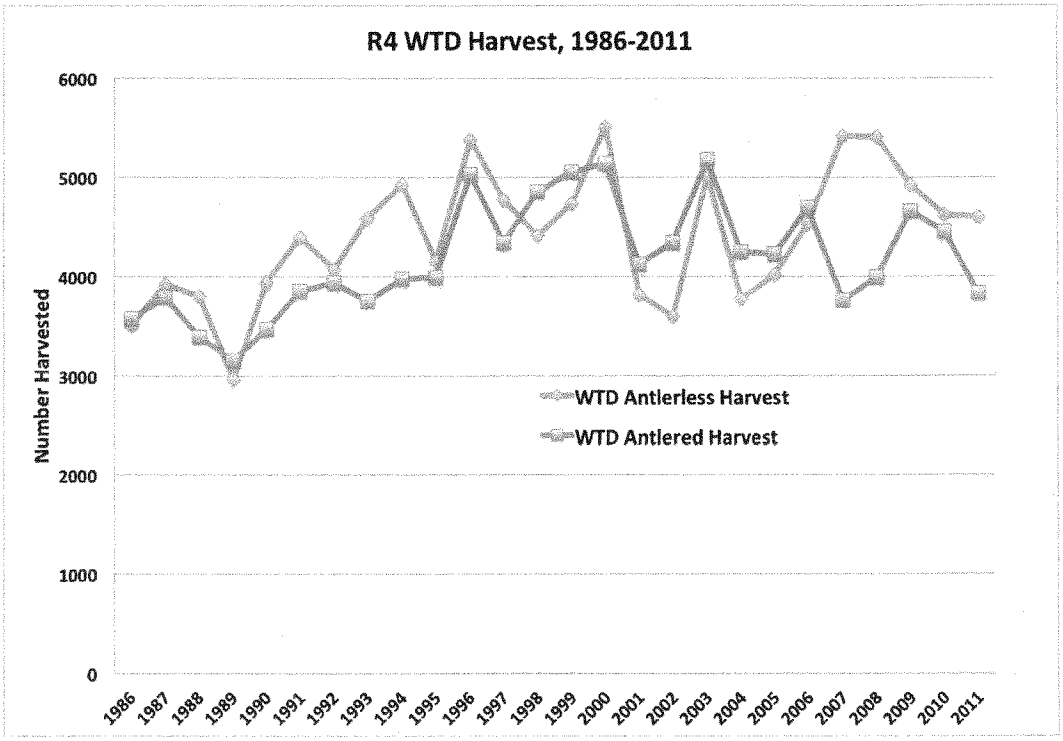


Figure 19. Harvest of Antlered and Antlerless White-tailed Deer in MFWP Region 4, 1986-2011.

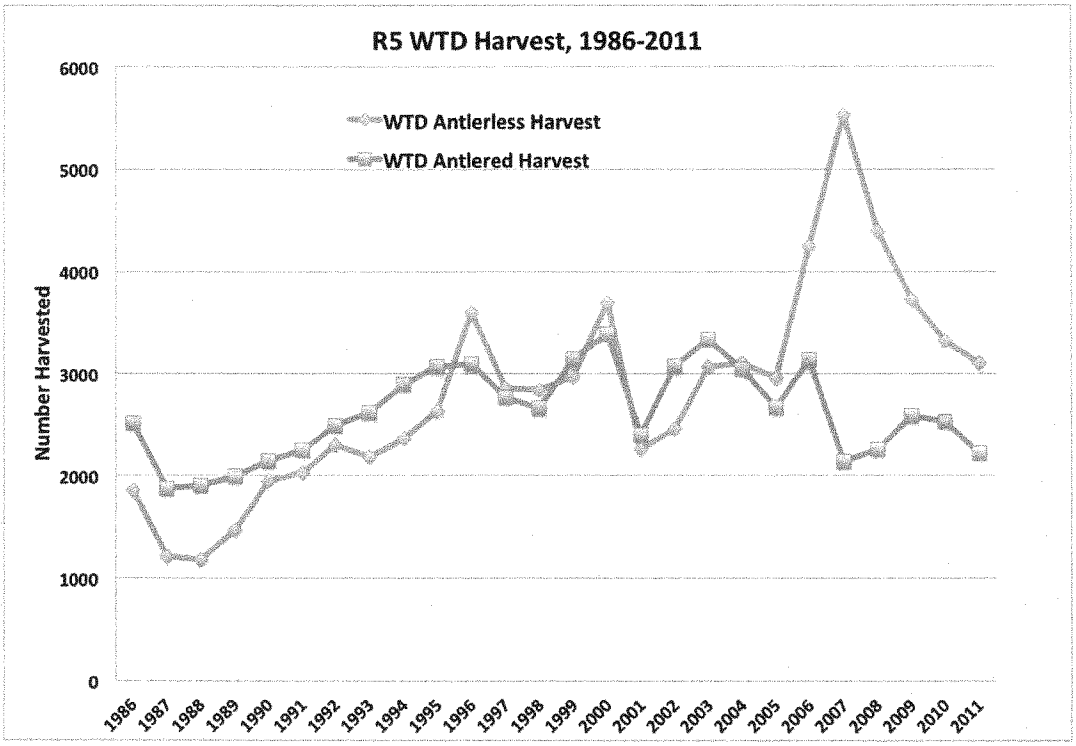


Figure 20. Harvest of Antlered and Antlerless White-tailed Deer in MFWP Region 5, 1986-2011.

Harvest of white-tailed deer bucks in Region 6 increased from 1986 through 1996, but has declined more than any other Region since then (Fig. 21). Impact of the severe winter of 1996-97 and EHD outbreaks of 2001 and 2007 on subsequent buck harvest are clear (Fig. 21). The sharp decline in 2011 was influenced by both the severe winter of 2010-11 and an outbreak of epizootic hemorrhagic disease (EHD) in autumn 2011. Antlerless harvests are relatively high.

Harvest of white-tailed deer bucks in Region 7 also increased during 1986-1996 and has gradually declined since then (Fig. 22). As with all Regions except Region 3, harvest declined in 1997 after the severe winter of 1996-97. Similarly, harvest declined in 2001 and 2011 and to a lesser extent in 2007 likely for the reasons discussed for other eastern Regions.

In summary, similarities in weather patterns, recurring outbreaks of EHD, and antlerless harvest level contributed to similar patterns of white-tailed deer buck harvest in all eastern Regions, with the most dramatic declines in Region 6.

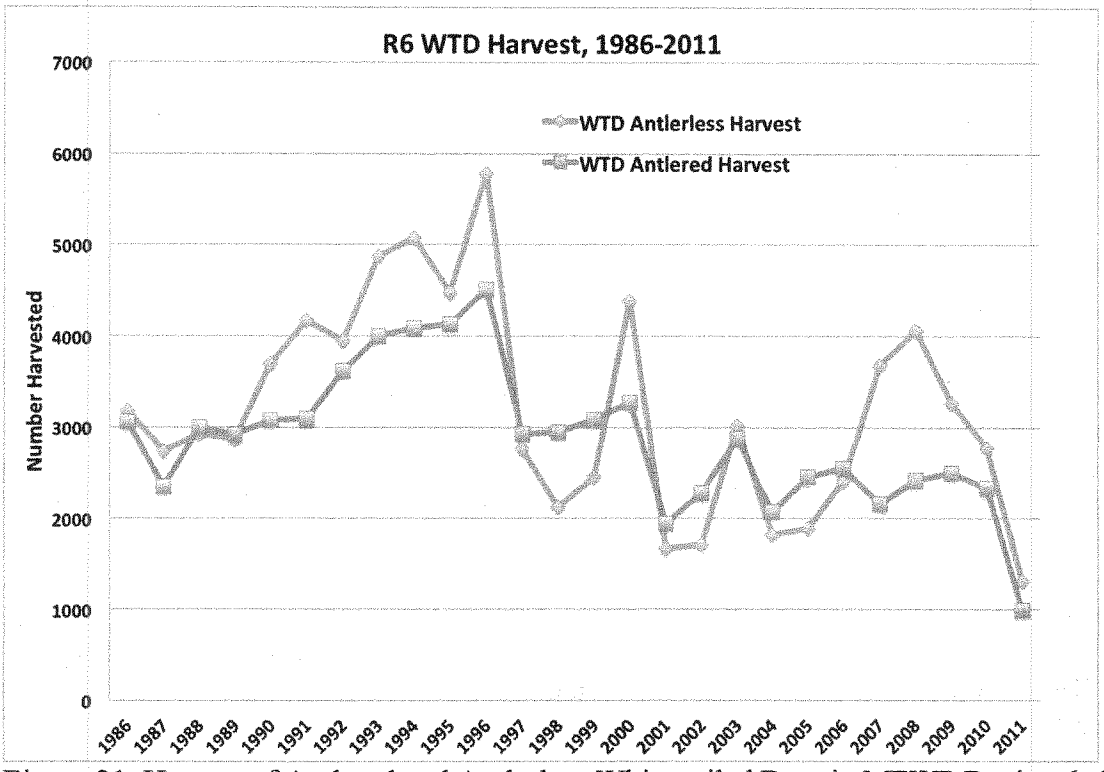


Figure 21. Harvest of Antlered and Antlerless White-tailed Deer in MFWP Region 6, 1986-2011.

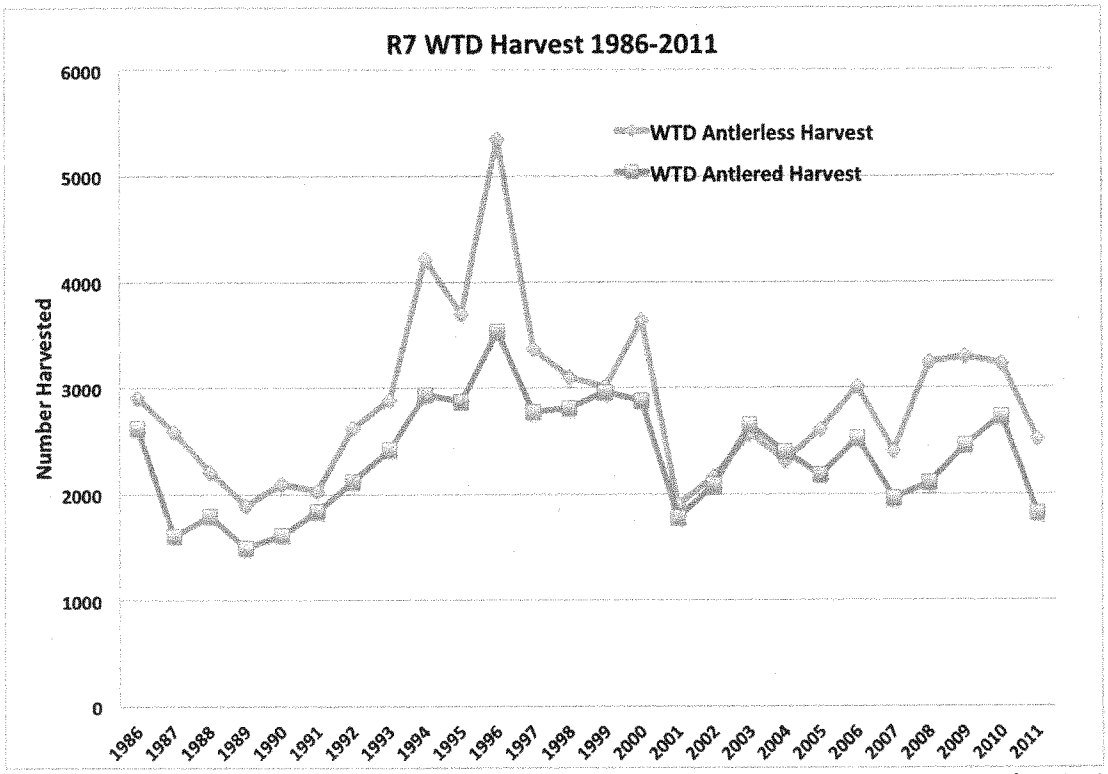


Figure 22. Harvest of Antlered and Antlerless White-tailed Deer in MFWP Region 7, 1986-2011.

Moose: Moose are hunted entirely by permit in Montana, thus harvests are largely controlled by permits issued and are not a direct reflection of population level. However, permits issued reflect moose counted in very limited survey areas and biologists impressions of moose numbers from their general observations and discussions with hunters. As lagging measures, harvest, success rates of hunters, and effort (days hunted/harvested moose) are also used to set quotas.

Statewide total moose harvest peaked in 1992-94 and declined since (Fig. 23). Harvest of bulls in 2011 was about half of peak levels and harvest of antlerless moose was about 25% of peak levels. Similar trends occurred in the 3 major Montana moose Regions, though the peak was earlier in MFWP Region 3 (Figs. 24, 25, and 26).

Number of permits issued declined substantially in 1996 in Region 1 and this decline accelerated to 1999, perhaps in response to the perceived effects of the severe winter of 1996-97. Permits issued were stable in Region 1 from 2000-2009 and declined in 2010 and 2011 (Fig. 24). Except for 1993-96, when success rates were lower than usual (Figs. 24 and 27), moose harvest in Region 1 generally follow permits issued well, indicating population tracking. However, success rates have declined substantially since 2007 (Fig. 27), possibly indicating further moose population decline.

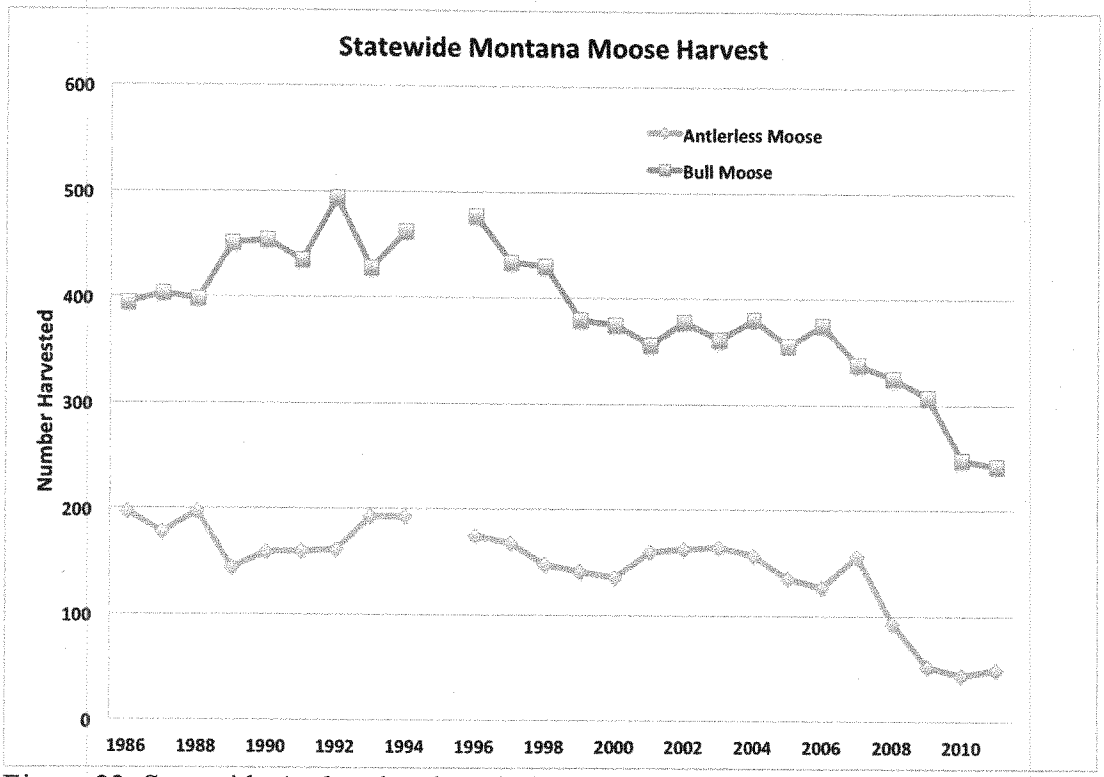


Figure 23. Statewide Antlered and Antlerless Moose Harvest in Montana, 1986-2011.

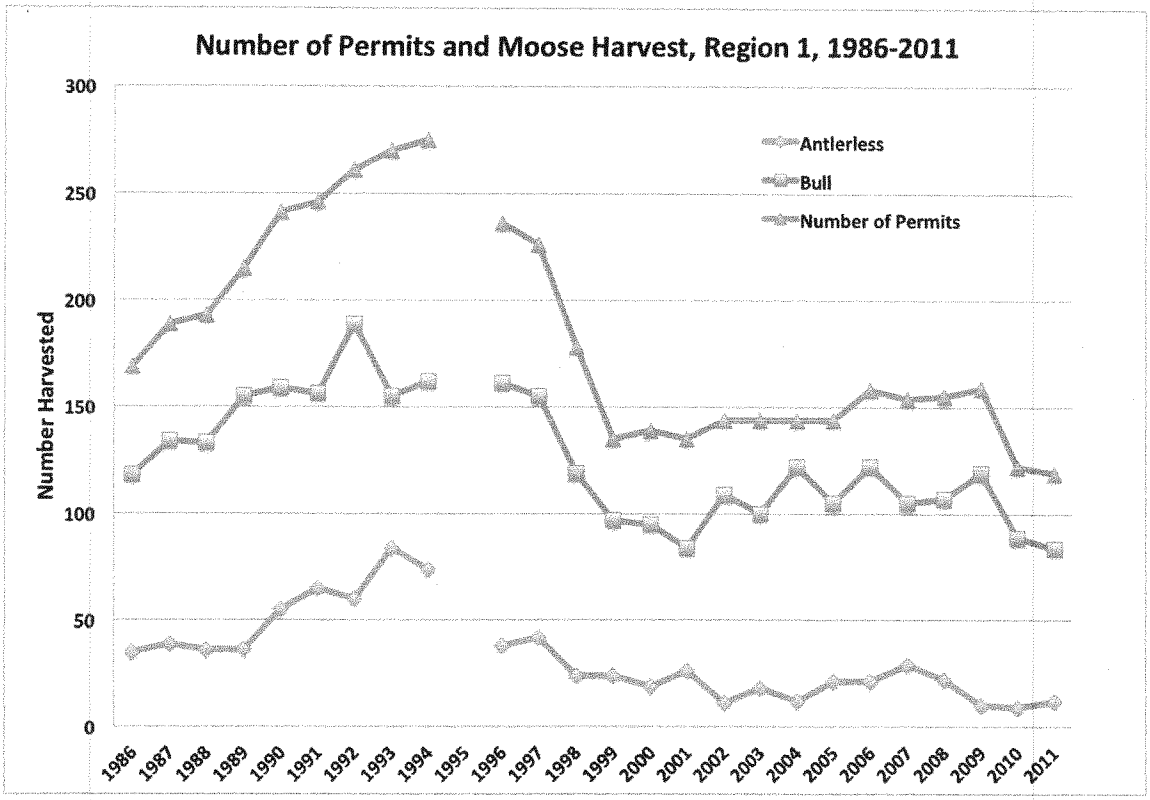


Figure 24. Number of Permits and Moose Harvest in MFWP Region 1, 1986-2011.

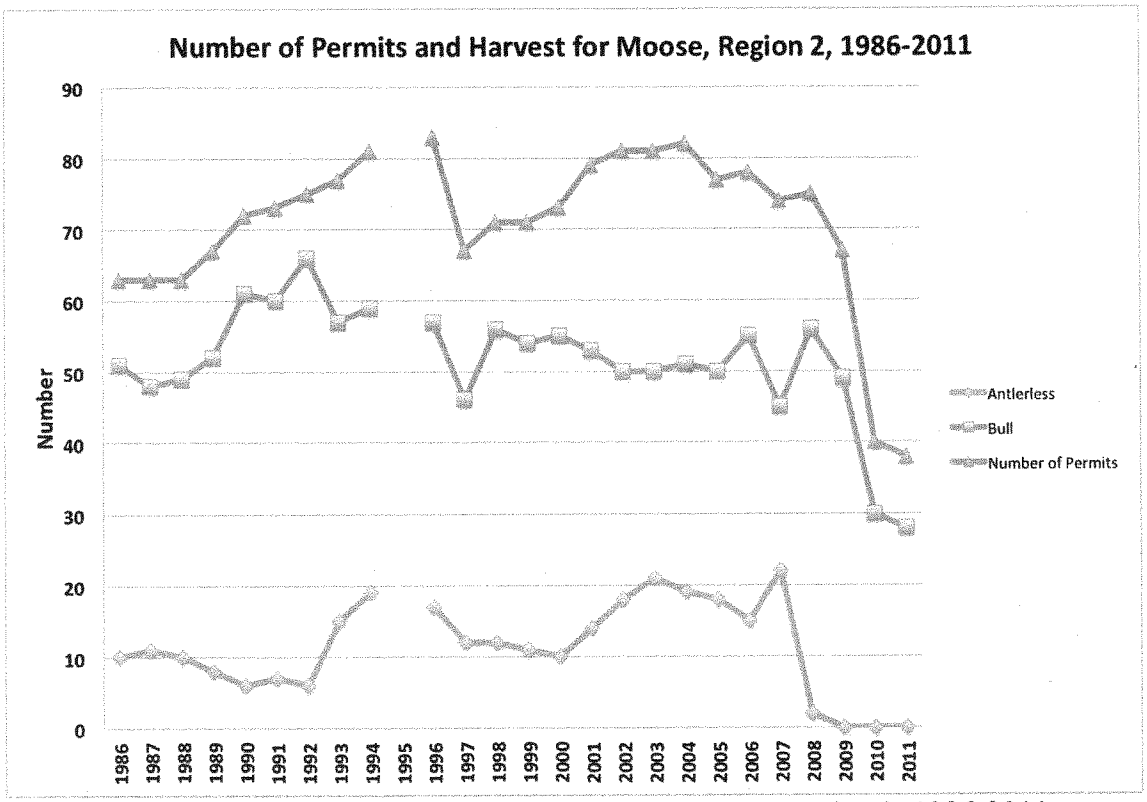


Figure 25. Number of Permits and Moose Harvest in MFWP Region 2, 1986-2011.

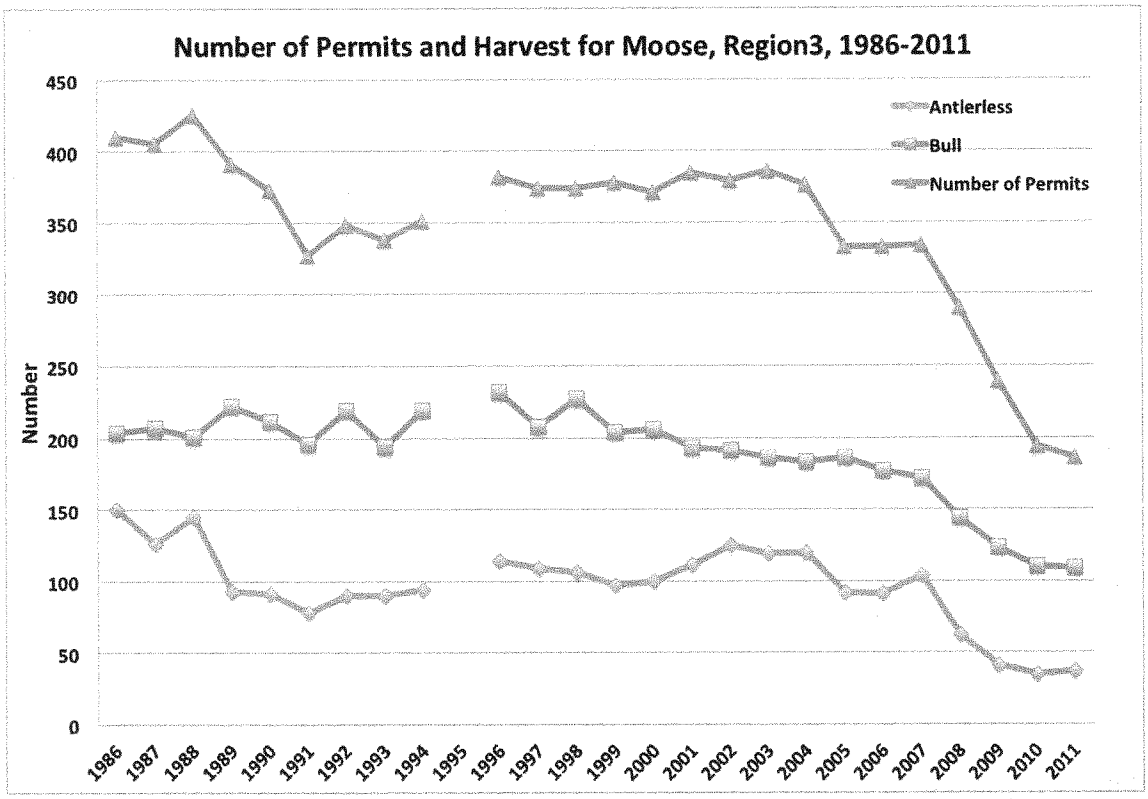


Figure 26. Number of Permits and Moose Harvest in MFWP Region 3, 1986-2011.

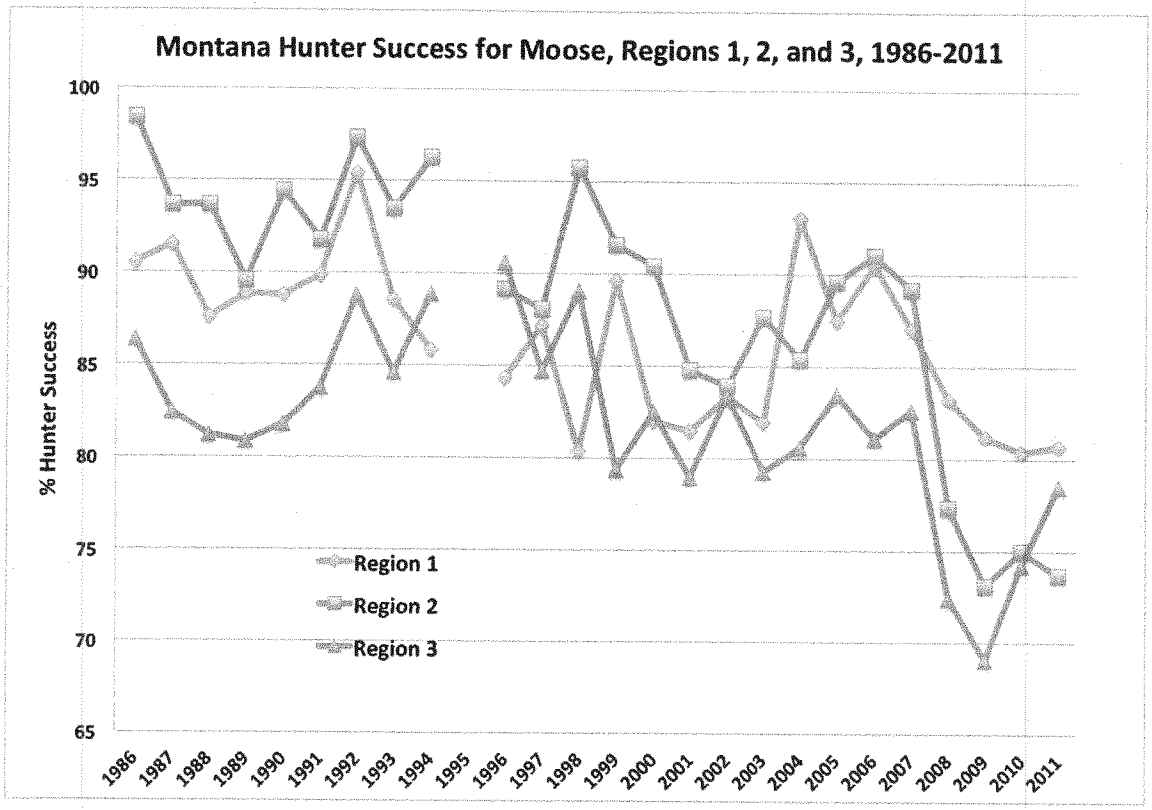


Figure 27. Hunter Success Rates for Moose in MFWP Regions 1-3, 19986-2011.

Number of moose permits issued in Region 2 peaked in 1996 with a reduction in 1997, possibly in response to the severe winter of 1996-97 (Fig. 23). However, after that, permits issued increased to 2004, while bull harvest was slowly declining, antlerless harvest increased, and success rates decreased (Figs. 25 and 27). Permits issued and harvest declined dramatically after 2008. Hunter success rates have declined most in Region 2 (Fig. 27) indicating a less successful permit/population tracking strategy there.

Declines in permits issued in Region 3 from 1989 to 1991, were primarily in the upper Gallatin and Madison drainages and in response to the widespread fires of 1988 and the fires and logging effects on moose winter habitat in high snow accumulation areas (Fig. 26). Bull harvest remained relatively stable through 1999 and has slowly declined since. Permits issued began declining again in 2005, accelerating in 2008-2011. Most of the recent decline in permits issued occurred in the Big Hole and Gravelly Mountain areas. Hunter success rates dropped substantially in 2008-09, but have rebounded in 2010-11 (Fig. 27). Possibly, reduced permits issued are starting to more closely track a recent population decline that has occurred.

Estimates of Predator Abundance

Wolves: Wolves naturally recolonized northwestern Montana near Glacier National Park beginning about 1979 and a breeding pack was confirmed in 1985-86. By about 1990, wolves

had colonized the Nine-Mile area in HD 201 and soon after that established in adjacent HD 202. Wolves were reintroduced to Yellowstone National Park and Central Idaho in 1995 and began to spread into Montana. The goals for numbers and breeding pairs were reached by 2000 and the 3-year criterion for delisting was met at the end of 2002. Wolf numbers and packs continue to increase. Federal approval of Montana's Wolf Management Plan occurred in 2004. **Minimum** estimates for Montana alone (Fig. 28) were 130 packs and 653 wolves in 2011. **Minimum** estimates were 85 packs and 372 wolves in northwestern Montana, 22 packs and 134 wolves in the Montana portion of the Greater Yellowstone Area, and 23 packs and 147 wolves in the Montana portion of the Central Idaho Experimental Unit in December 2011 (Fig. 28).

Wolf population growth rate since 2000 was about 26% for the Montana portion of the Central Idaho Experimental Unit (CID), 17% for the Northwestern Montana Endangered Area (NWMT), and 14% for the Montana portion of the Greater Yellowstone Area (GYA) (Fig. 29). Higher levels of control actions and harvest in portions of the GYA (Beaverhead and Madison Counties are 2 of the major livestock producing counties in Montana) have likely reduced wolf population growth rate in the Montana portion of the GYA.

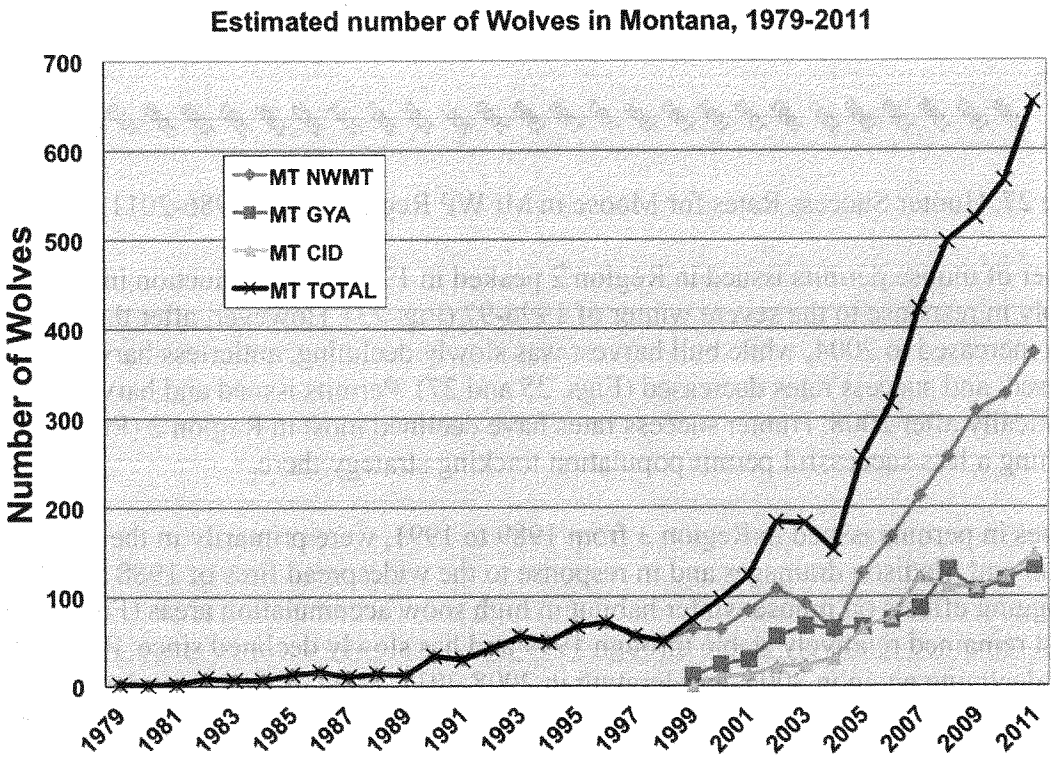


Figure 28. Estimated **minimum** number of wolves in Montana, 1979-2011.

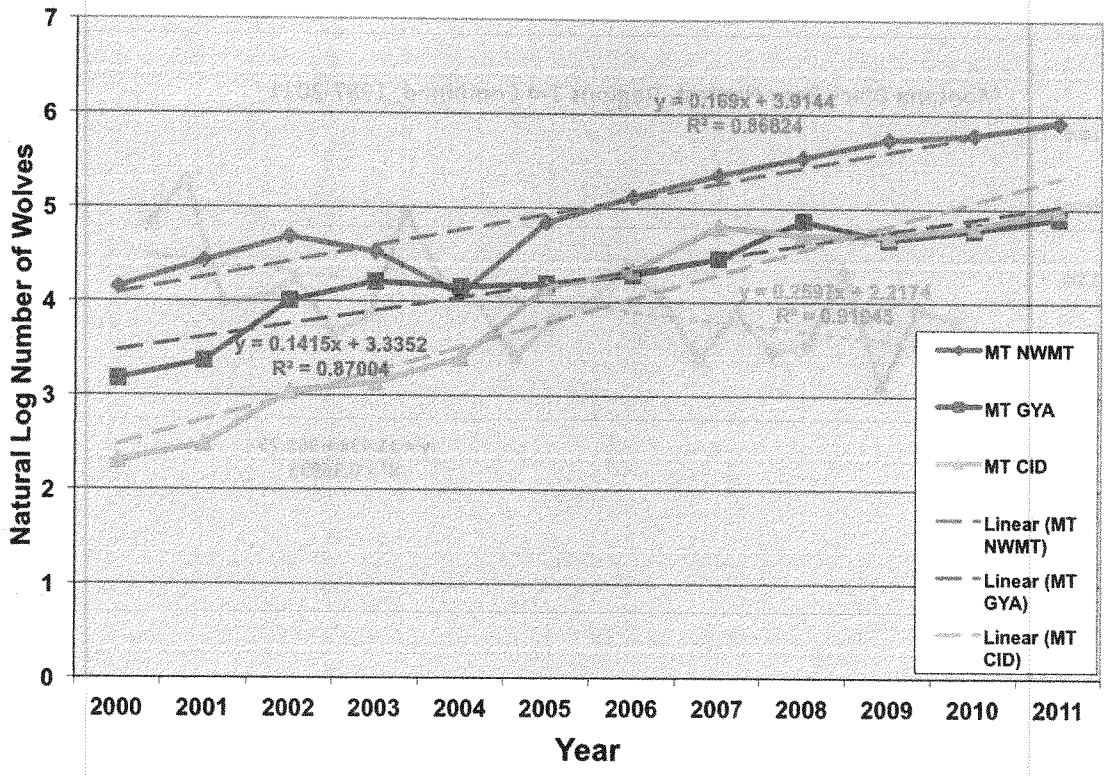


Figure 29. Population growth rate for estimated number of wolves in three portions of Montana, 2000-2011.

Black Bear: Mace and Chilton-Radandt (2011) estimated about 13,307 black bears in Montana (range, 9,868 – 16,758). Number of black bears harvested annually in MFWP Regions 1-4, as an index of populations (Fig. 30) increased at an annual rate of about 1% from 1987-2011 (Black bear harvest increased by about 11-12 bears/year over the period). The significance of this increase is marginal but it is unlikely that black bear numbers in Montana have declined during the period. Of 20 BMUs in Montana Regions 1-4, 3 showed a decreasing harvest trend during the period, 7 a stable trend, and 13 an increasing harvest trend.

Estimates of black bear numbers by BMU (Fig. 31) indicate higher numbers and density in the more moist northwestern portions of the state and fewer bears in drier south and eastern BMUs (Mace and Chilton-Radandt 2011). Similar conclusions result when black bear populations are portrayed by density per unit of habitat (Fig. 32).

Relative harvest intensity by BMU (Fig. 33) is not intended to imply under- or over-harvest rates in the sense of impacting populations. However, relative to average harvest intensity for all BMUs, it may indicate that BMUs 105, 106, 108, 290, 316, 319, 341, 440, and 510 have relatively high harvest rates and BMUs 107, 240, and 280 have relatively low harvest rates. Given overall stability in black bear harvests and populations, this implies little opportunity to increase harvests if maintaining black bear population stability is the goal.

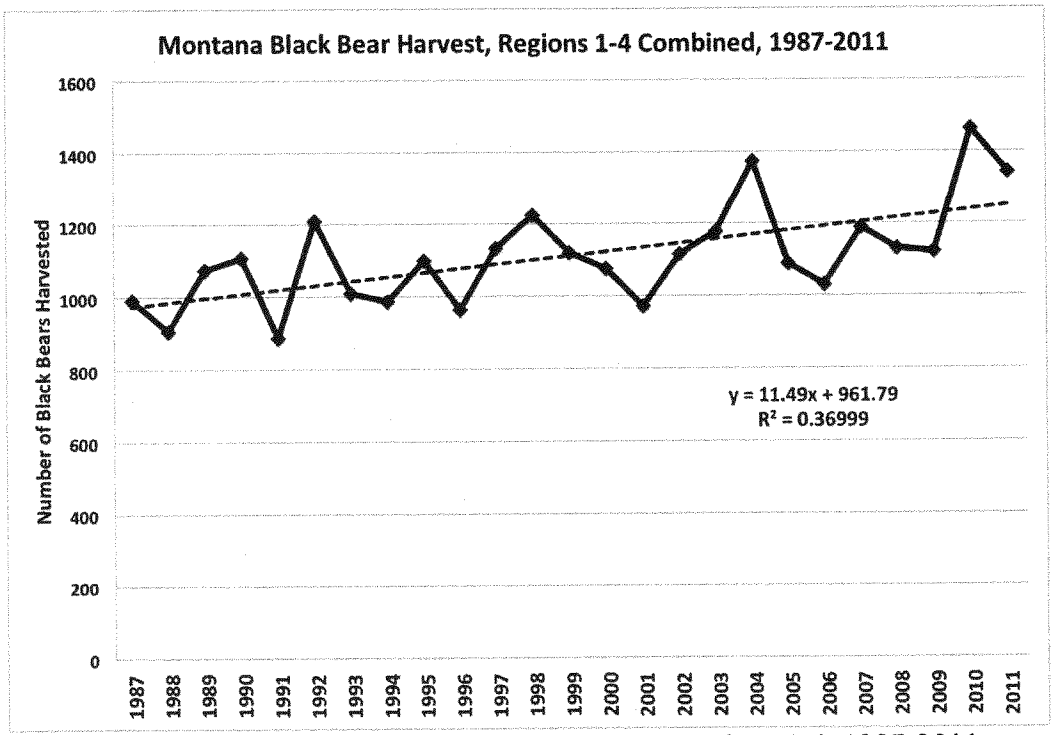


Figure 30. Harvest trend for Black Bear in Montana Regions 1-4, 1987-2011.

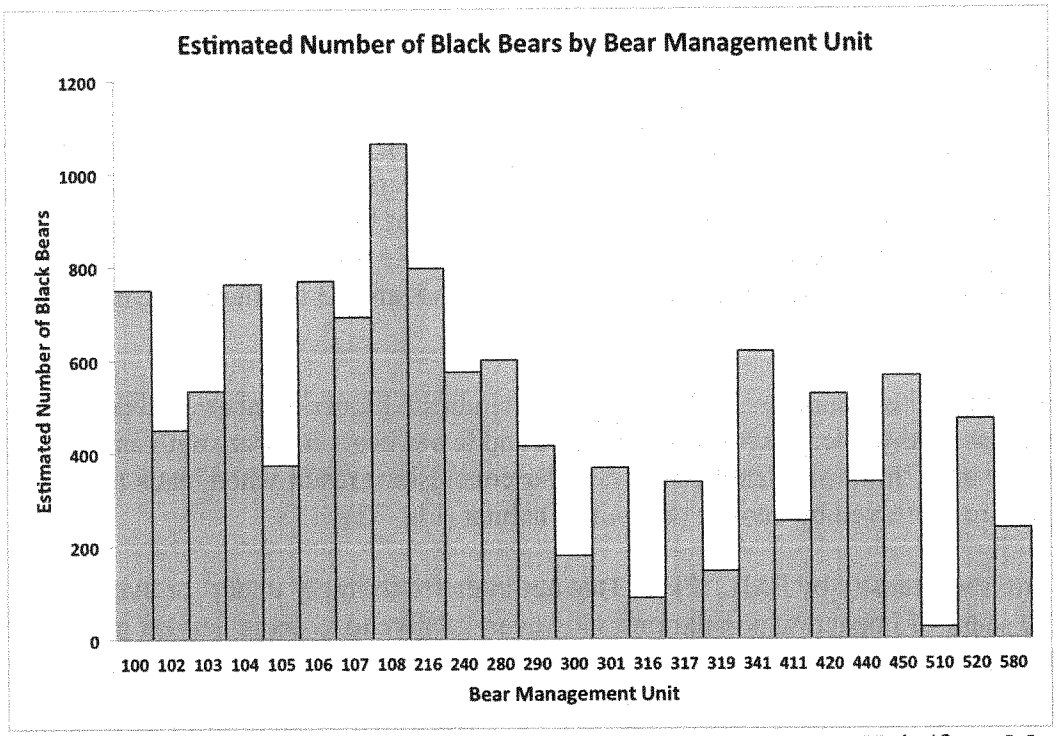


Figure 31. Estimated number of Black Bears by Bear Management Unit (from Mace and Chilton-Radandt 2011).

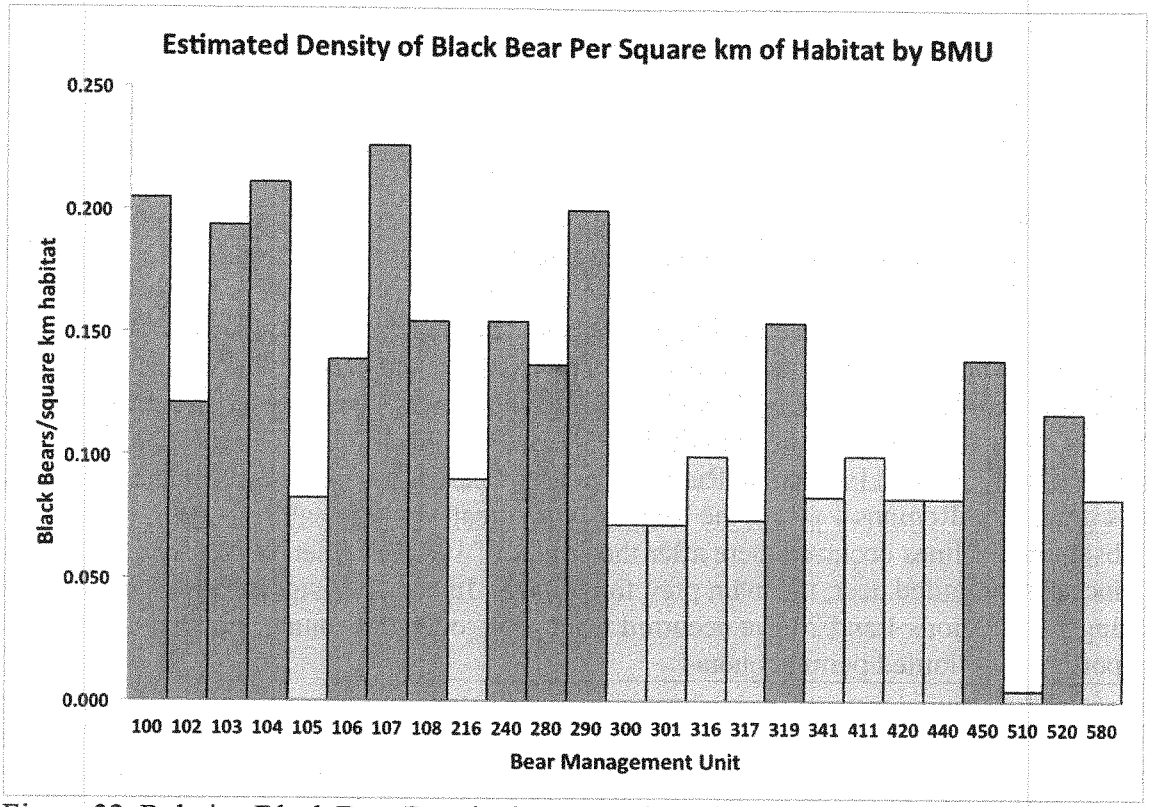


Figure 32. Relative Black Bear Density by square km of habitat by BMU Unit (from Mace and Chilton-Radandt 2011).

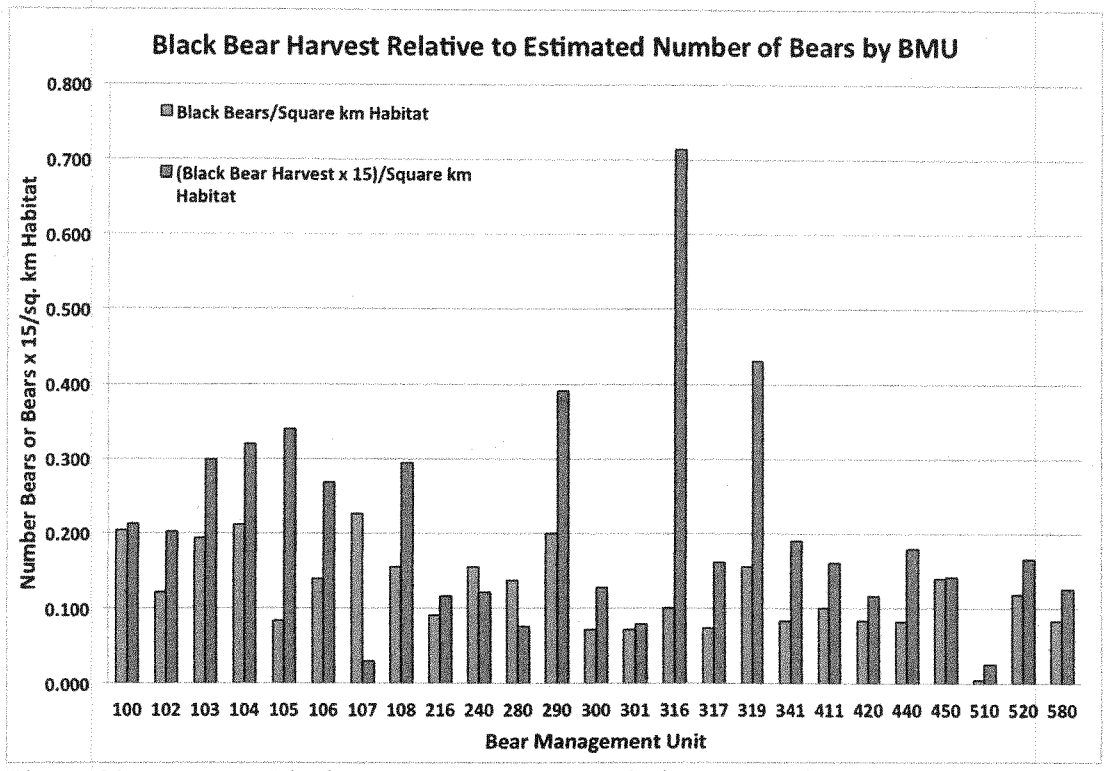


Figure 33. Montana Black Bear Harvest Rates relative to Density.

Cougar (Mountain Lion): Based on published reports of mountain lion density (2.2-5/100 square km), I estimate Montana's mountain lion population at about 3,668 lions (range, 2,305-5,240). **Because much of Montana's lion populations would likely be at the higher end of these reported density ranges or above, this estimate is likely conservative.**

Cougar harvest is now controlled entirely by permit/quota and is only a very general, delayed indicator of population level. Biologists assess relative numbers and trend of lions based on their and houndsmens experience and observations, deer population trends, lion/human encounters, and relative speed of filling quotas to determine recommended quotas. There is some preference by houndsmen to maintain conservative harvest regulations that result in an early closure of the general season and a subsequent lengthy chase season. Statewide harvest of cougars peaked in 1998 and then declined through 2006 (Fig. 34). Harvest has increased slowly from 2006-2011 except in Regions 3 and 5 where it has been stable. Change in harvest was greatest in Regions 1 and 2, the Regions with greatest historical harvest (Fig. 35). Substantial declines occurred there after the winter of 1996-97 when winter loss substantially reduced white-tailed deer, the main prey for cougars. In addition, significant regulation changes in Regions 1 and 2 have occurred from open, over-the-counter lion hunting opportunity to limited permits/quotas.

Research in northwestern Montana indicated that mortality of adult female white-tailed deer was related to a 1-year lag in estimates of lion harvest (greater lion harvest = more lions = more adult female white-tailed deer mortality). Reduced lion harvest, which may not reflect lower lion numbers, occurred in all Regions during 2001-2009 (Fig. 35). Harvest trend for lions has been slightly up since 2009 and probably lags actual increase in lion populations.

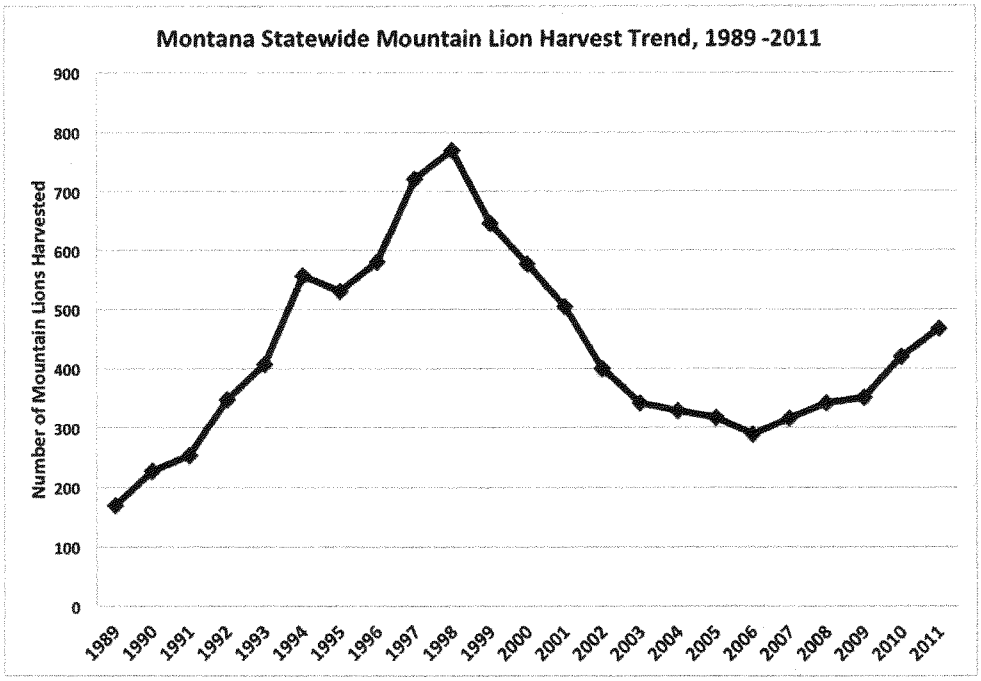


Figure 34. Mountain Lion Harvest Trend in Montana, 1989-2011.

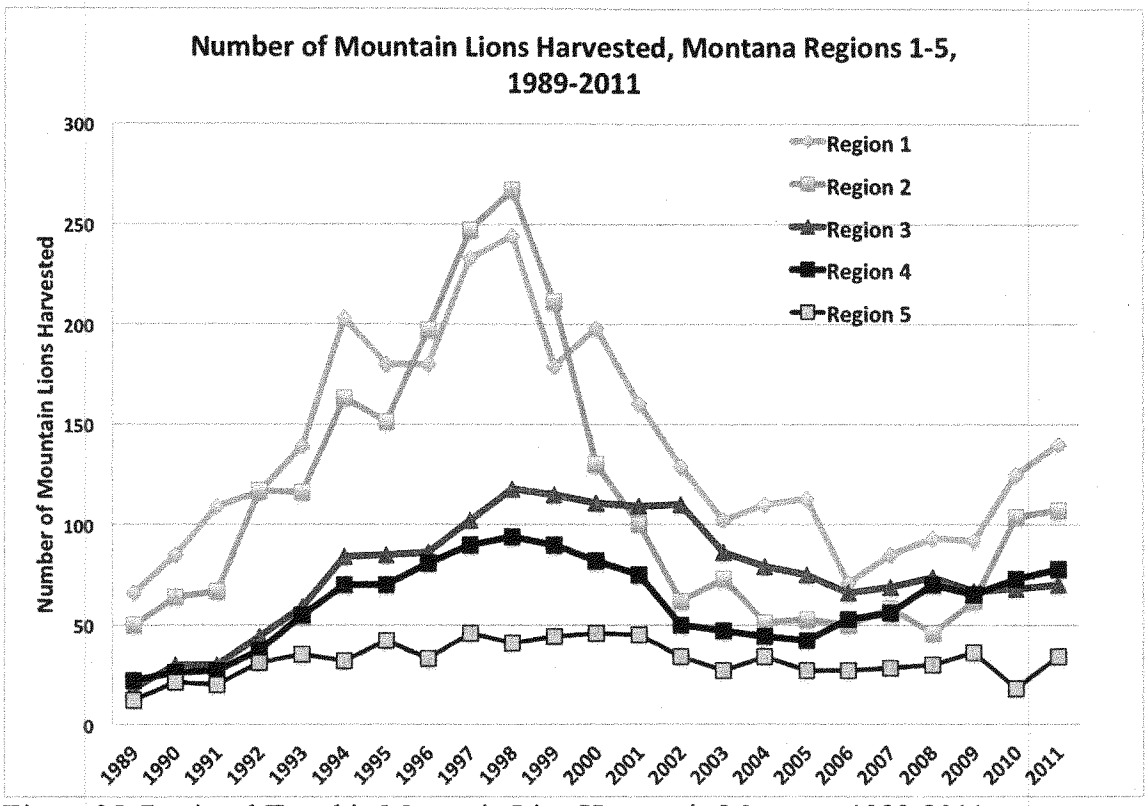


Figure 35. Regional Trend in Mountain Lion Harvest in Montana, 1989-2011.

Grizzly Bears: An estimated 1,000 Grizzly bear inhabit the Northern Continental Divide Ecosystem (NCDE). Of these, **at least** 400 likely impact Montana's hunted elk populations (Glacier National Park and Blackfoot Reservation not included). Additionally another 30-40 Grizzly Bears are estimated to inhabit the Cabinet-Yaak Ecosystem. Recent population growth rate was estimated at 2.5-3% annually.

An estimated 602 Grizzly Bears were present in the Greater Yellowstone Ecosystem in 2010. Of these, **at least** 200+ likely impact Montana elk populations in the Gallatin, Madison, Absaroka, Gravelly-Snowcrest, and Centennial Mountain ranges and Northern Yellowstone area. Population growth rate was estimated at about 4% annually, but may have declined to about 2% annually in the last few years.

In total, **at least** 650 Grizzly Bear may prey on newborn Montana elk calves (and some adults) in limited areas of the State. These numbers have increased substantially since about 1975.

Local Trends in Populations and Interaction of Factors

In 2011, estimated minimum numbers for Montana were 653 wolves, 13,307 black bear, 3,668 mountain lions, and 650 grizzly bear. Thus wolves are currently a relatively small numerical portion of the total predation pressure, but were added to what was likely the highest existing abundance of large predators in the lower 48 States.

I created a predation pressure Index that ranked each Deer and Elk Hunting District from 0 to 12 based on combined Indexes for wolves during the last 5 years, mountain lions, black bears, and grizzly bears. Number estimates for each species by hunting district (see earlier) were divided by number of 100 square km per hunting district. These figures were then given a score of 0-3 for each species. A score of 3 was assigned if species density for the hunting district was ≥ than 50% above the mean for the species, 2 if within 50% of the mean, 1 if more than 50% below the mean, and 0 if the estimate was no predators of that species occurred. The species scores were combined for hunting district scores and hunting districts with total scores of 4 or above were considered to represent significant baseline predation pressure (Fig. 36). Wolf pressure may be underestimated for some HDs because wolves removed by control actions during the year were not included and because wolves are not uniformly surveyed. Coyotes were considered equal in all areas.

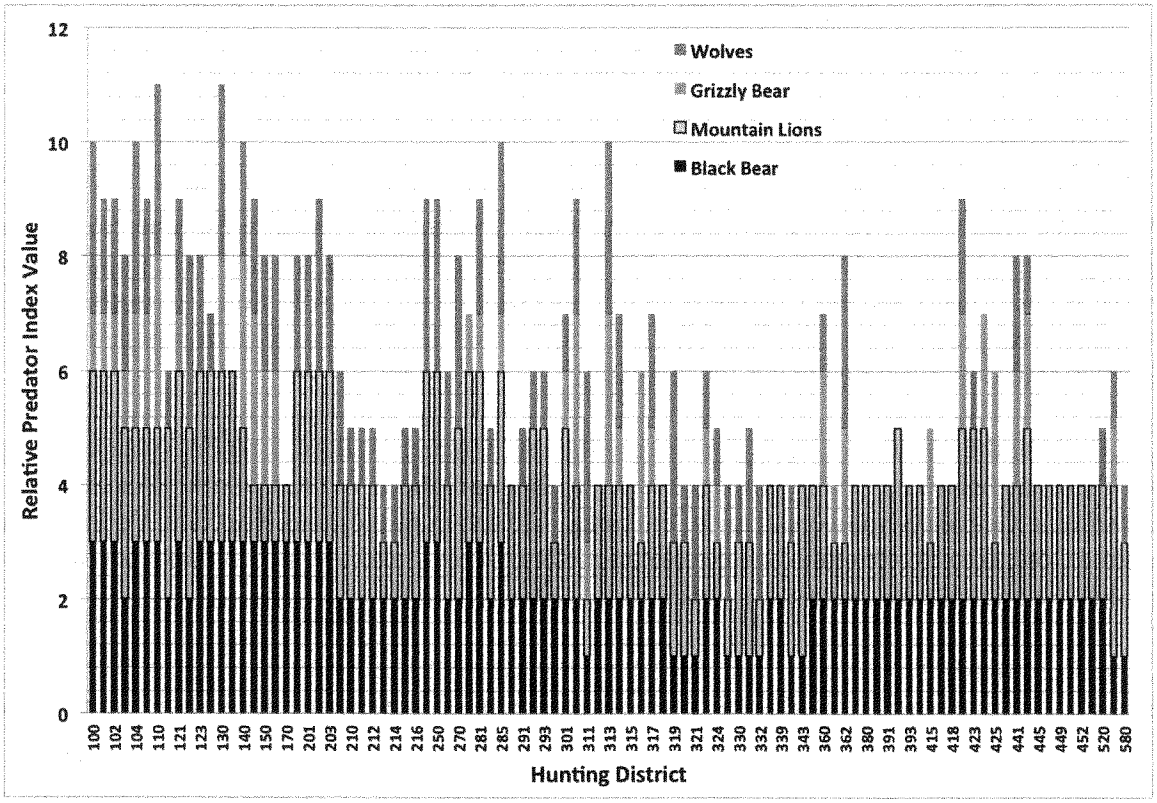


Figure 36. Relative predation pressure by Hunting District for those HDs with an Index ranking 4 or more out of a maximum of 12.

Considerable predation pressure from just those species present **before** wolf reintroduction exists for hunting districts 100, 101,102, 104, 109, 110, 121, 130, 140, 141, 280, 281, 285, 310, 313/316, 422, 424/425, and 442 (≥ 7, Fig. 36). The addition of wolves increased total predation pressure in most of these districts and also resulted in substantial new predation pressure in HDs 103, 122, 123, 124, 150, 151, 200, 201, 202, 203, 240, 250, 270, 301, 314, 317, 360, and 362 (≥ 7). Because hunter access restrictions likely result in my underestimate of black bear and mountain lion numbers in HD 311, that HD also should probably be included.

Although bear and mountain lion numbers may have increased slightly since 2005, the major change during that period was in increased wolf numbers, packs, and extent of distribution (Figs. 37 and 38). Wolf pack distribution and numbers have varied considerably since 1996 in southwest Montana near Yellowstone National Park (YNP) compared to that portrayed for only 2011 in Fig. 38. Further, wolves in much of YNP not displayed also affect Montana elk. The greatest increase in numbers and distribution of wolves, 2005-2011 was in western and northwestern Montana (Figs. 37 and 38).

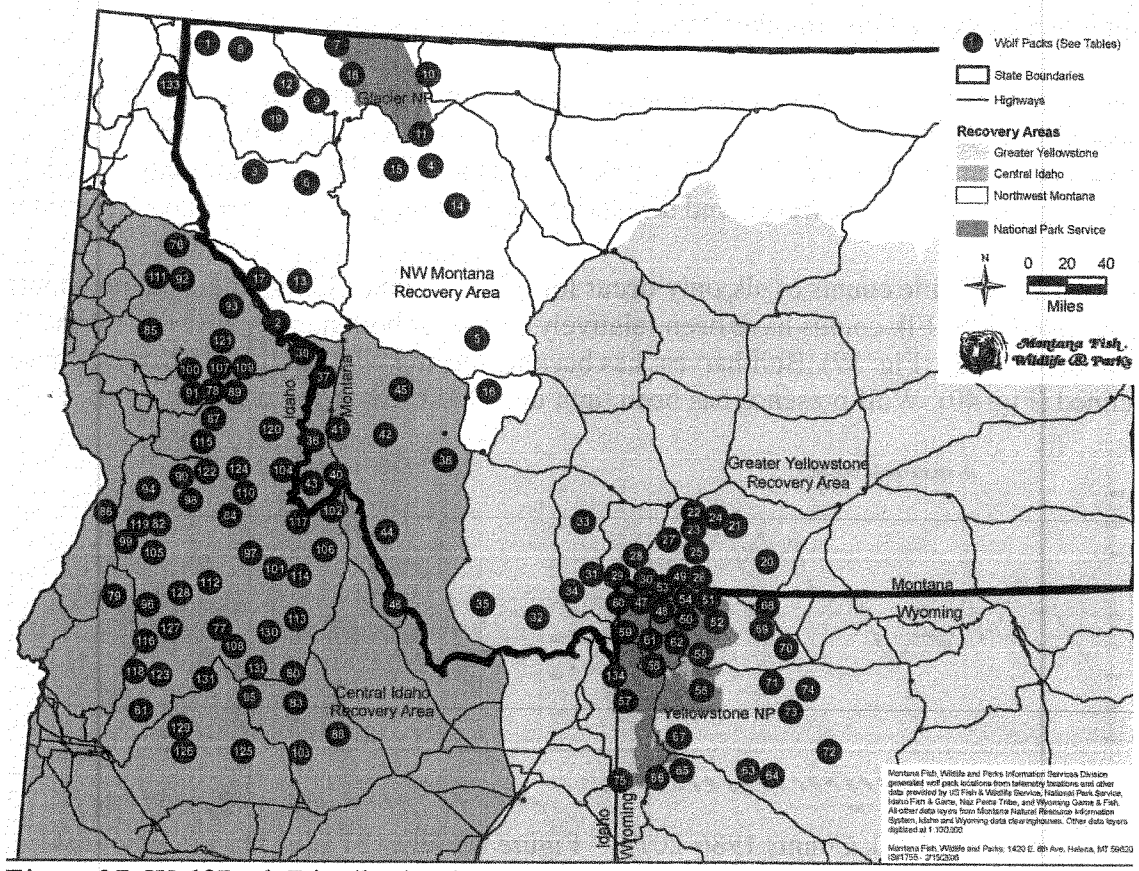


Figure 37. Wolf Pack Distribution in 2005 (Montana Fish, Wildlife & Parks).

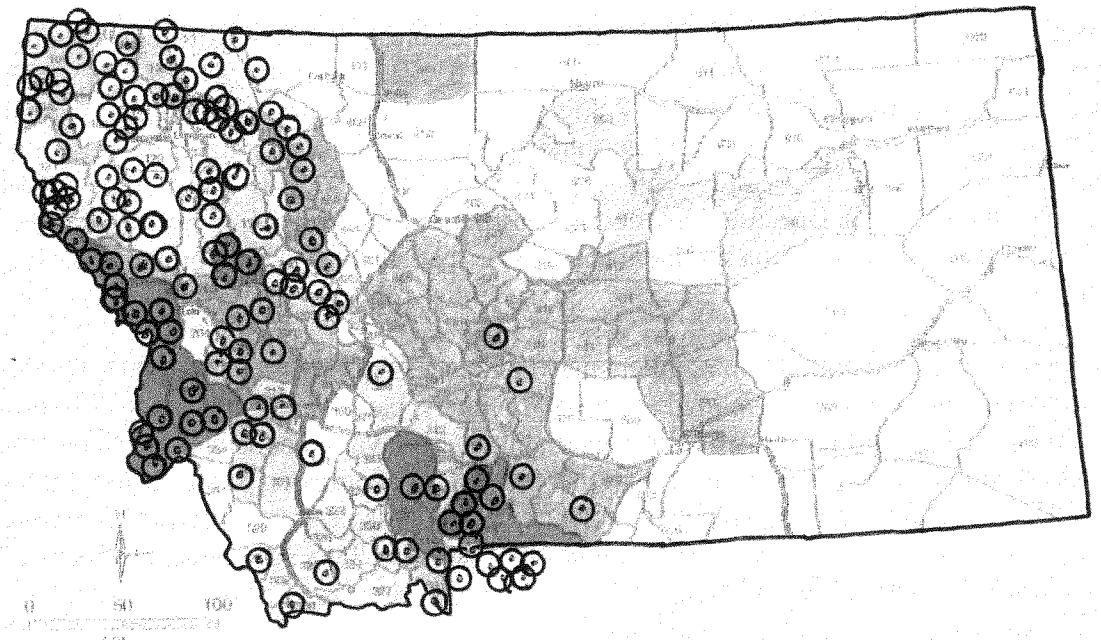


Figure 38. Elk Count and Objective Status Relative to 2011 Wolf Pack Distribution (See Fig. 2 for legend, circles represent wolf packs).

Generally, high numbers of wolves and wolf packs overlap areas where elk counts have declined since 2005 (Fig. 38). Similarly, few wolves are present where elk counts have increased or remained stable (Fig. 38). Similar conclusions can be made for white-tailed deer. Some exceptions occur, however, and discussion of individual areas of decline is warranted.

Region 1: Reliable counts of elk only occur for HDs 121 and 123 and there are no counts of white-tailed deer. Elk counts have been relatively stable for both hunting districts recently (example HD 121, Fig. 39). Bull harvest has been increasing while antlerless harvests have declined (Fig. 40). Wolf presence has been light until 2011, when it increased.

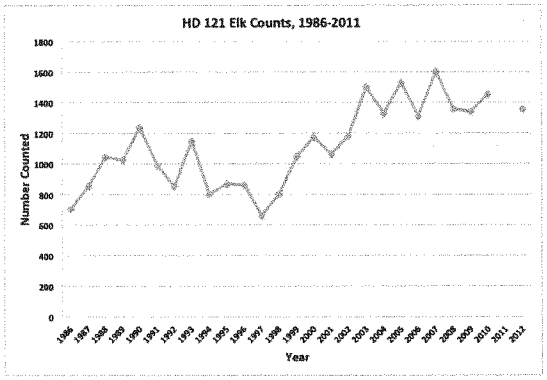


Figure. 39. HD 121 Elk Counts,1986-2012.

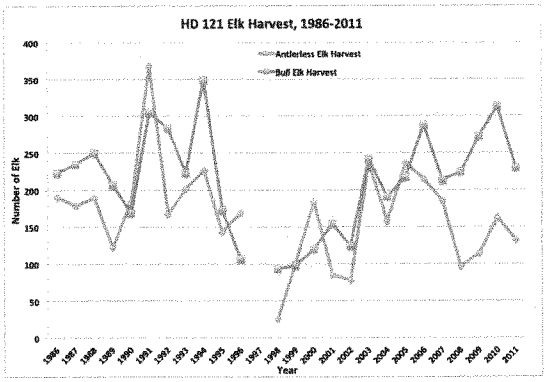


Figure 40. HD 121 Elk Harvest,1986-2011.

For Region 1 hunting districts listed as under objective for elk (Fig. 2), harvest data do not indicate declines in HDs 101/109, but recent declines are apparent for HDs 100, 104, 110, and

150. Very few elk are harvested in HD 151. These are all hunting districts with substantial predator pressure, including wolves (Fig. 36), and should be monitored closely.The long-term trend in elk recruitment is down in Region 1, increasing somewhat in the early 2000s, but declining since then. Replacement for adult mortality is reduced.

White-tailed deer are numerically the major game animal harvested and also are probably the major prey for wolves in Region 1. Harvest trend for most all Region 1 hunting districts show the impacts of antlerless harvest level and the winter of 1996-97 on subsequent buck harvest trend (examples, Figs. 41 and 42). Reduced white-tailed deer buck harvest followed the severe winter of 1996-97 in almost all areas. Higher than average antlerless harvests during 1993-97 and 2006-08 also resulted in subsequent declines in buck harvest (Figs. 41 and 42) and likely total populations as well.

In addition to the effects of winter and antlerless harvest level, some hunting districts show other long-term and more recent trends in white-tailed deer buck harvest. With relatively light antlerless harvests, buck harvest has been relatively stable at lower than historical peaks in HDs 100, 122, 123, 124, and 130 (Example, Fig. 43). Buck harvest has been in a general long-term decline in HDs 102 and 103 (Example, Fig. 44). In HD 110, buck harvest has been in cyclical decline since 2004 despite very low antlerless harvests (Example Figs. 45). The harvest trend for HD 170, a Valley floor agricultural/suburban area with low predator numbers, very controlled hunter access, and high nutritional level has been steadily upward despite relatively high antlerless harvests (Fig. 46).

For hunting districts 100, 102, 103, 110, 122, 123, 124, and 130, something additional to antlerless harvest level and weather seem likely to be reducing buck harvest (population) level. Those factors may include increased predation or landscape changes affecting nutrition or hunter access. Lower recruitment of white-tailed deer fawns may have contributed as it recently declined in much of Region 1 (but increased in 2011). Wolf numbers and distribution are increasing in these areas. However, with only harvest trend and recruitment as tools for monitoring white-tailed deer, detection of population changes and management response will be delayed.

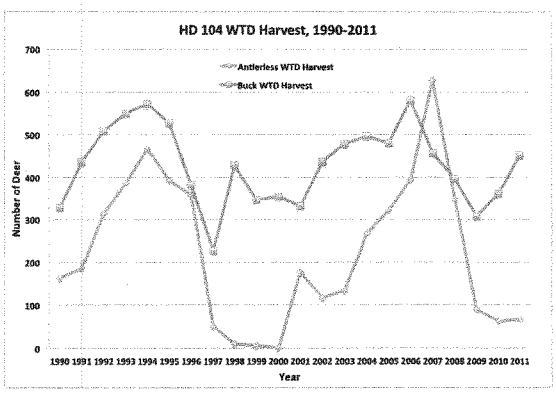


Figure 41. HD 104 white-tailed deer harvest, 1986-2011.

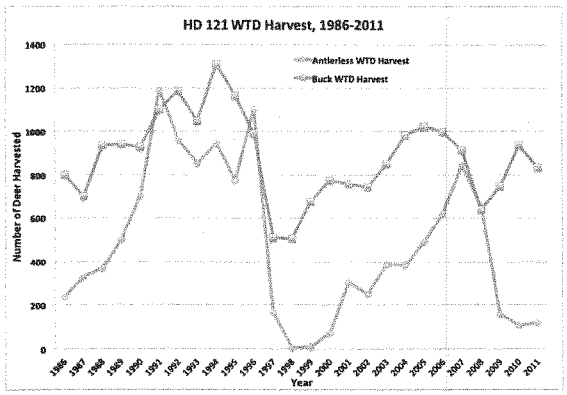


Figure 42. HD 121 white-tailed deer harvest, 1986-2011.

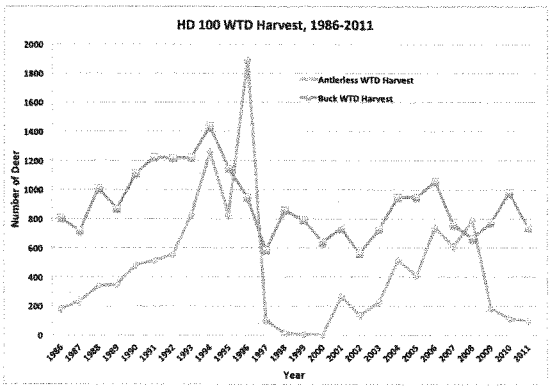


Figure 43. HD 100 white-tailed deer harvest, 1986-2011.

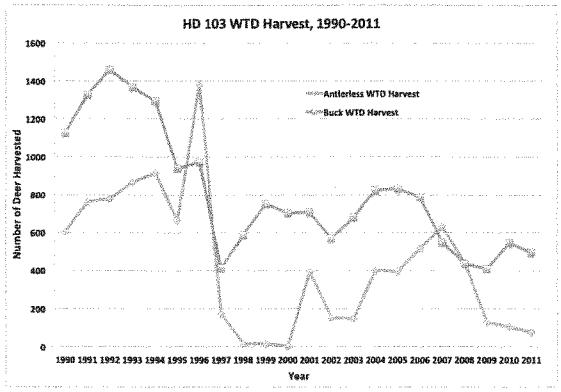


Figure 44. HD 103 white-tailed deer harvest, 1986-2011.

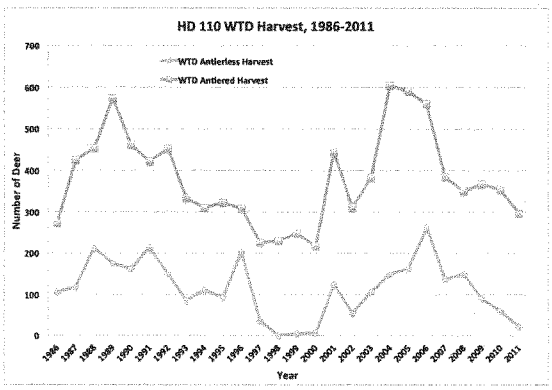


Figure 45. HD 110 white-tailed deer harvest, 1986-2011.

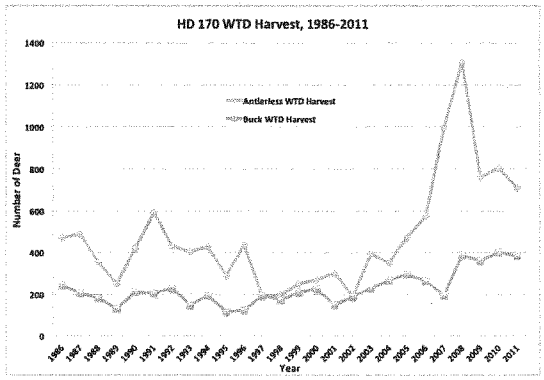
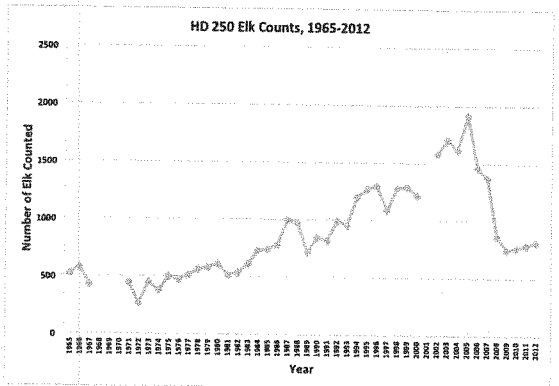


Figure 46. HD 170 white-tailed deer harvest, 1986-2011.

Region 2: Elk population trend in Region 2 is generally as displayed in Figure 2, with bull harvest trends matching population count trends. Both counts and bull harvest trends were down in recent years in HDs: 202, 203, 204, 211, 216, 240, 250, 261, 270, and 285 (Examples, Figs. 47 and 48). By management design, high antlerless harvests during 2004-2007 were intended to reduce elk populations in some Bitterroot hunting districts (e.g.HDs 204, 240, 250, 261, 270) and were successful. Both counts and harvest trends were relatively stable recently in HD 213 and in HDs 290/291/292/298 counts were stable to slightly up and bull harvests were relatively stable. Both count and harvest trends were up in HD 215. Exceptions occurred in HDs 201, 210, and 283 where counts were up recently and bull harvest trends were down. In HD 212, count trend was up and bull harvest relatively stable. Portions of both HDs 201 and 283 have seen increased residential development and restricted hunter access and also increased road closures affecting access for some hunters. These developments have led to increased "refuge areas", likely contributing to decreased harvests and increased elk population growth in these areas (Figs. 49 and 50).



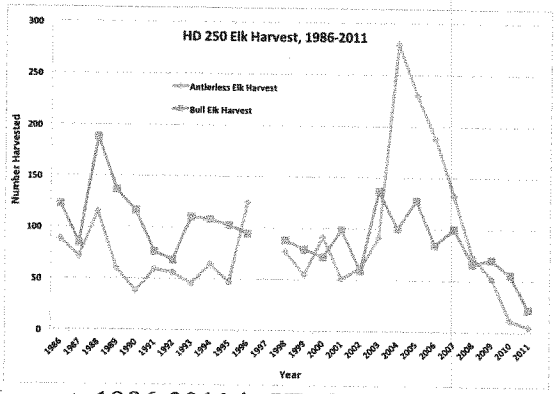
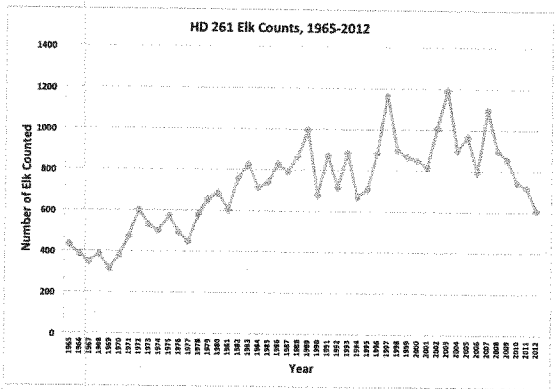


Figure 47. Elk Counts, 1965-2012 and Elk Harvest, 1986-2011 in HD 250.



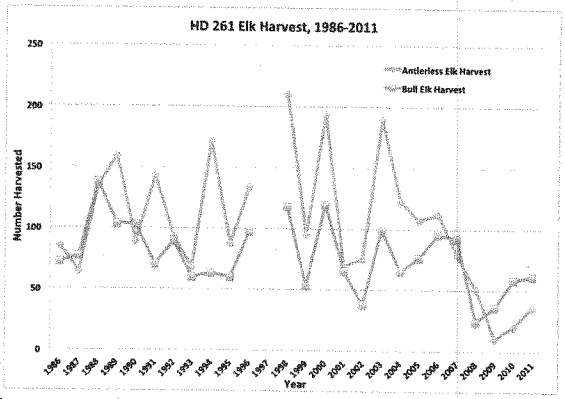
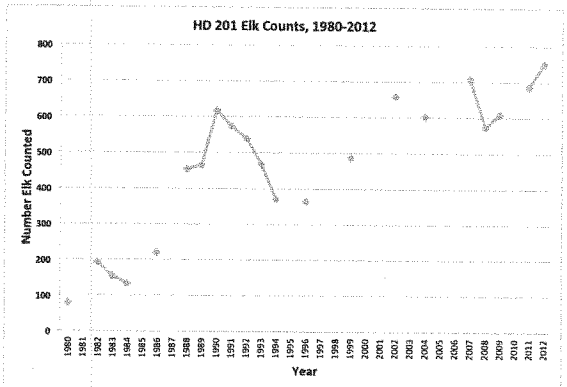


Figure 48. Elk Counts, 1965-2012 and Elk Harvest, 1986-2011 in HD 261.



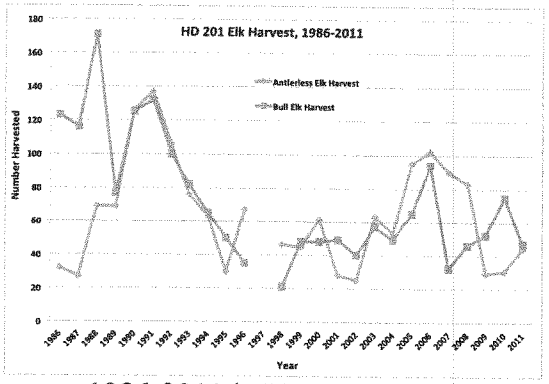
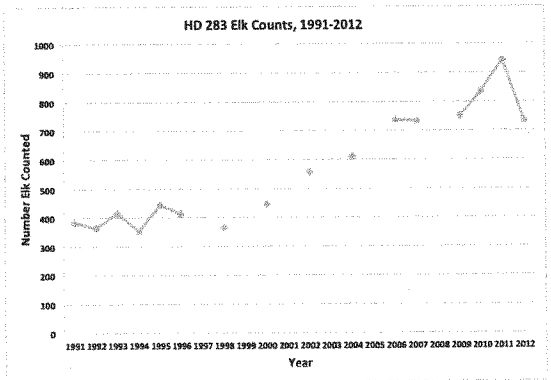


Figure 49. Elk Counts, 1980-2012 and Elk Harvest, 1986-2011 in HD 201.



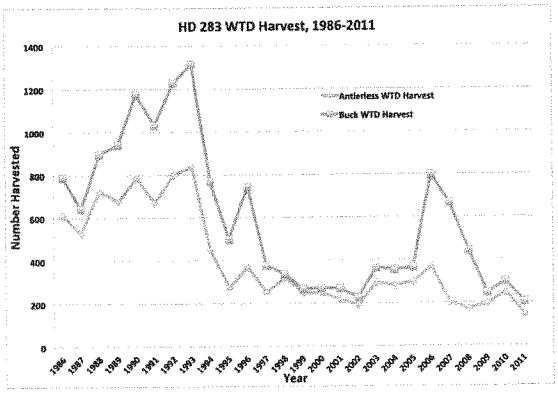


Figure 50. Elk Counts, 1991-2012 and Elk Harvest, 1986-2011 in HD 283.

Generally, the elk populations in Region 2 where counts have recently declined (Fig. 2, Figs. 47 and 48) had high antlerless harvest during 2004-2007 and recent high total predation pressure indexes (Fig. 36) and high wolf numbers (Fig. 38). Declines have continued beyond the initial declines resulting from temporarily increased antlerless harvests in 2004-2007. Much lower than historically traditional calf survival has also coincided with recent population declines in the Bitterroot and Blackfoot-Clearwater areas. Population decline may have slowed or stopped with recent large reductions in antlerless harvest.

Almost all Region 2 hunting districts show evidence of declining white-tailed deer buck harvests since 2006. Similar to Region 1, antlerless harvest level may have contributed to initial declines in some, such as HDs 200, 201, 202, 203, 240, and 250 (Fig. 51). However, declines in buck harvest have continued or remained at historically low levels after reduction in antlerless harvest. Also, declines have occurred in hunting districts with relatively low antlerless harvest (Fig. 52). There are little data available to assess the role of recruitment in the overall decline of white-tailed deer buck harvest. Declining numbers of deer hunters may play some role (Fig. 14), but there also is evidence that white-tailed deer populations have declined.

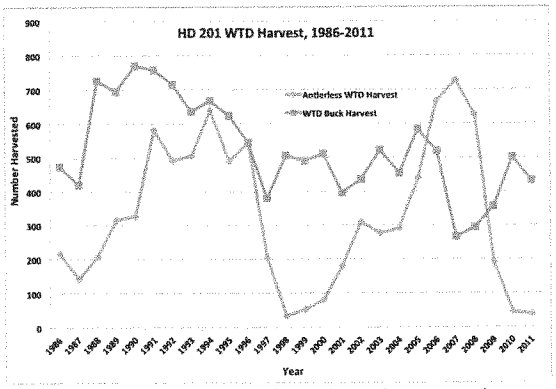


Figure 51. White-tailed deer harvest in HD 201, 1986-2011.

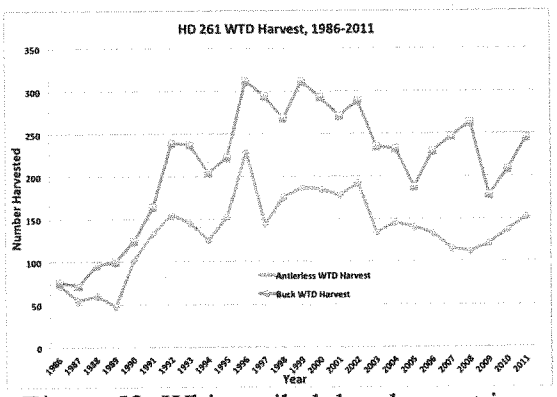


Figure 52. White-tailed deer harvest in HD 261, 1986-2011.

Region 3: Region 3 epitomizes statewide elk management issues of hunter access related to suburban development, private landownership (especially amenity ownership), and private land outfitting as well as effects of wolf restoration. Hunter harvest levels, both high and low, as well as predation have all clearly affected Region 3 elk population level.

Examples of the effect of predation (Hamlin and Cunningham 2009, Hamlin et al. 2009) include HD 310 (The Gallatin Canyon, Figs. 53 and 54) and the Northern Yellowstone Elk Herd (HDs 313 and 316, Figs. 55, 56, 57, and 58). Despite almost elimination of antlerless harvest, the numbers of elk wintering in the Gallatin has continued to decline. As a result, the ratio of wolves:1000 elk has actually increased. There is also a likelihood that redistribution of elk has occurred, with more moving to the Madison Valley (more subject to harvest) and moving into portions of the Canyon in HD 360 near human habitation.

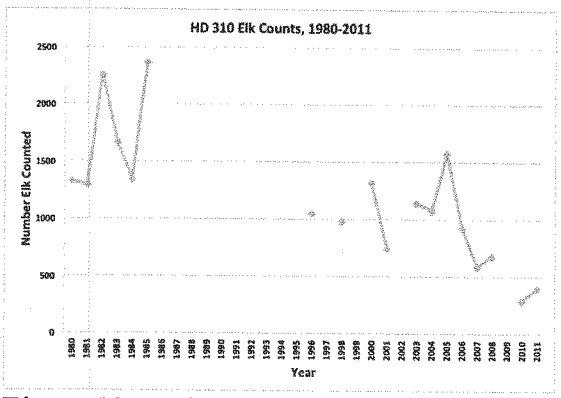


Figure 53. Early Winter Elk Counts in HD 310, 1980- 2011.

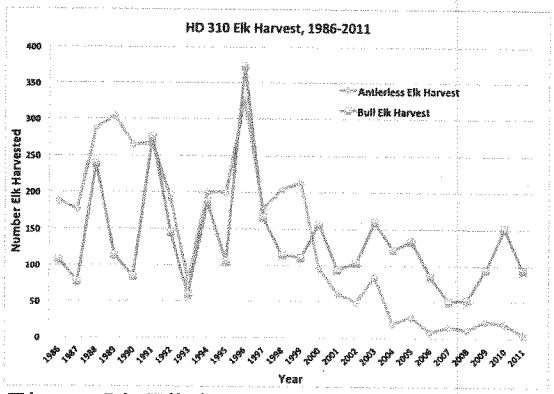


Figure 54. Elk harvest in HD 310, 1986-2011.

The Northern Yellowstone elk population has continued to decline as predicted (Hamlin and Cunningham 2009, Figure 55). Antlerless harvest has not been a factor since 2005 (and not much for a few years before that). Late season antlerless permits were reduced to 100 in 2006 and eliminated in 2010. Although wolf numbers have declined, the decline in the elk population has been proportionally at least as great and wolf:1000 elk ratios are as high as prior to 2008. An old age female population susceptible to all forms of mortality and with low recruitment (few young replacements) is a factor in the continuing decline.

Although counts for the total population have declined at about 7.7% per year since 1994, the portion wintering within YNP has declined at a faster rate of 12.8% per year (Fig. 56) with fewer elk wintering within YNP during the last 3 years than outside YNP. Counts for the hunted portion of the population wintering in Montana have declined at a non-significant 1.3% per year (Fig. 56). This may be due to greater direct predation loss within YNP and also, more elk may be moving outside YNP to winter despite relatively mild winters recently (indirect predation pressure).

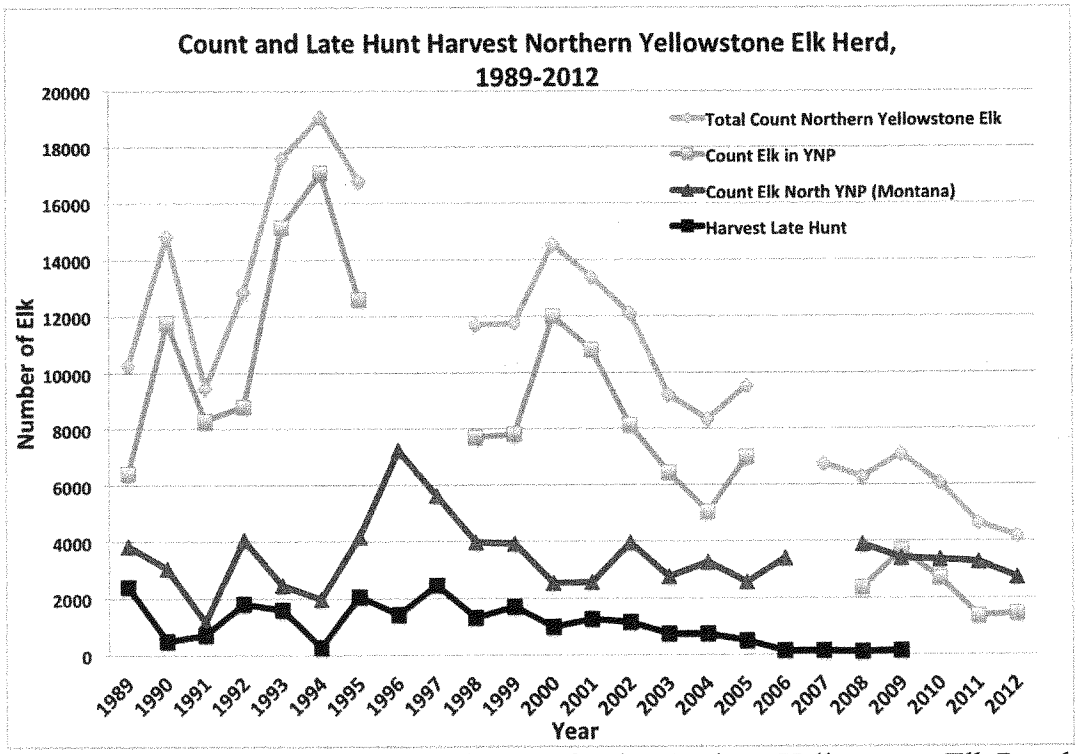


Figure 55. Elk Counts and late hunt harvest for the Northern Yellowstone Elk Population, 1989-2012.

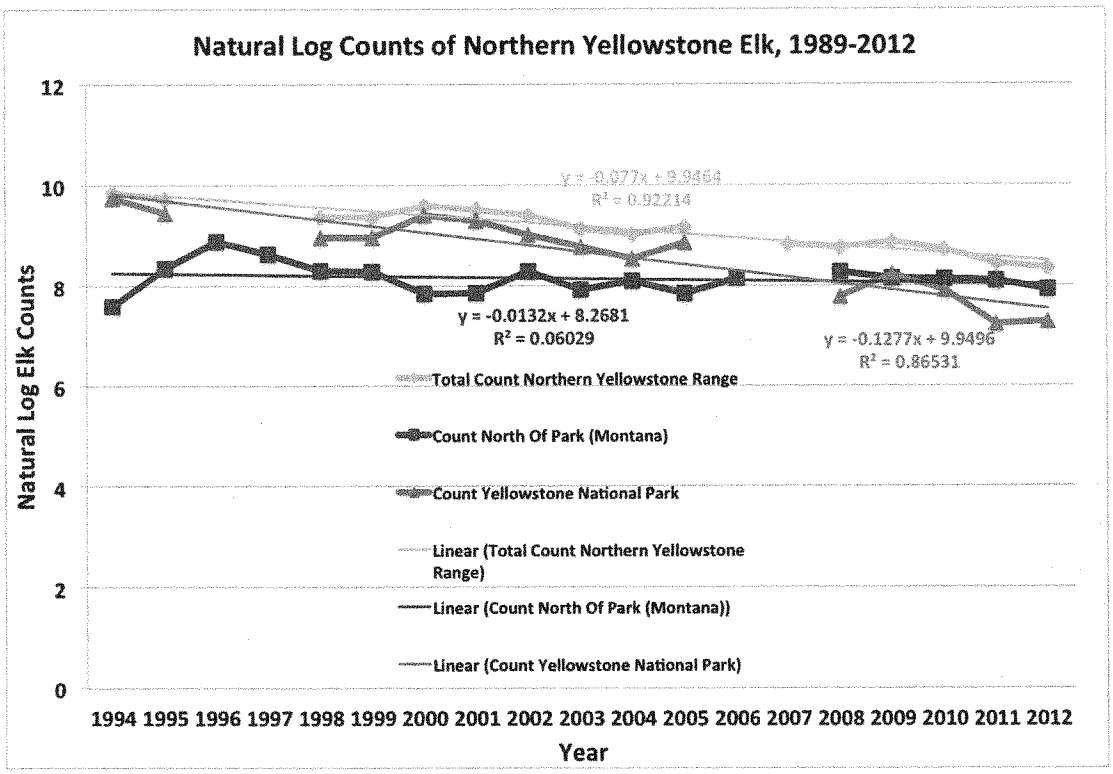


Figure 56. Trend and rate of annual change for counts of total and segments of the Northern Yellowstone Elk Population, 1994-2012.

There has been a dramatic decline in hunter harvest of antlerless elk in HDs 313/316, especially after 2004 (Figs. 57 and 58). The decline in bull harvest has been the greatest of anywhere in the state for backcountry HD 316, where annual bull harvest declined from 182 in 1994 to 3 in 2011.

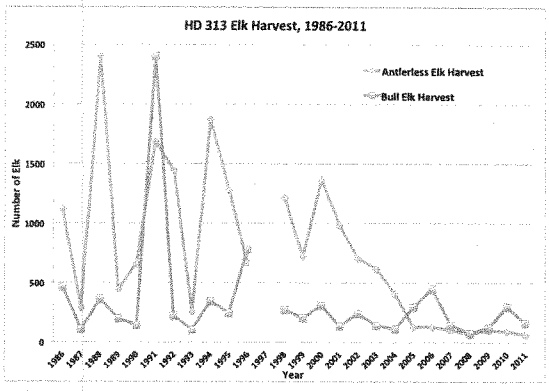


Figure 57. Elk harvest in HD 313, 1986-2011.

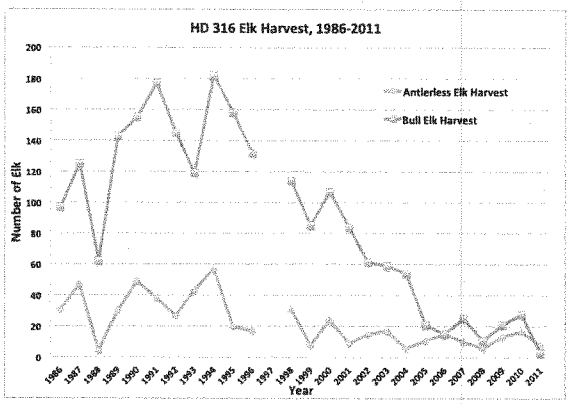


Figure 58. Elk Harvest in HD 316, 1986-2011.

HDs 301/309 and 393 are examples of hunting districts where suburban development (301/309) and large private landownerships affect hunting access. Hunter harvest remains low despite efforts to increase it and elk populations continue to grow (Figs. 59, 60, 61, and 62). Elk have learned how to use private land as a "refuge" in HDs 301/309.

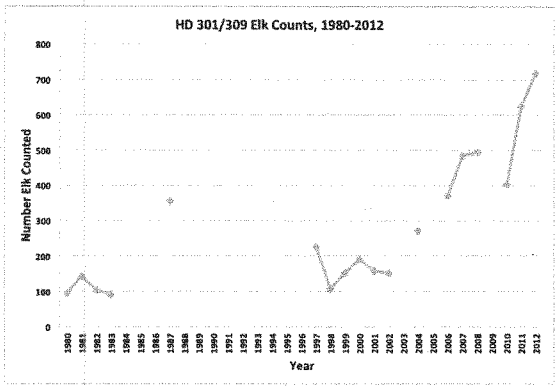


Figure 59. Elk Counts in HDs 301/309.

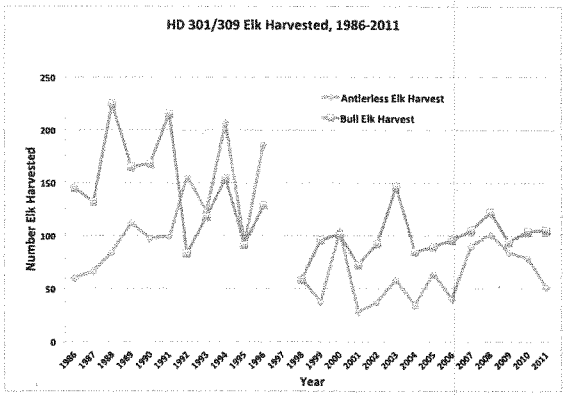


Figure 60. Elk harvest in HDs 301/309.

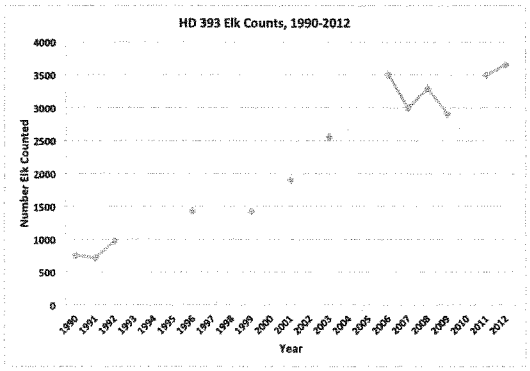


Figure 61. Elk Counts in HD 393.

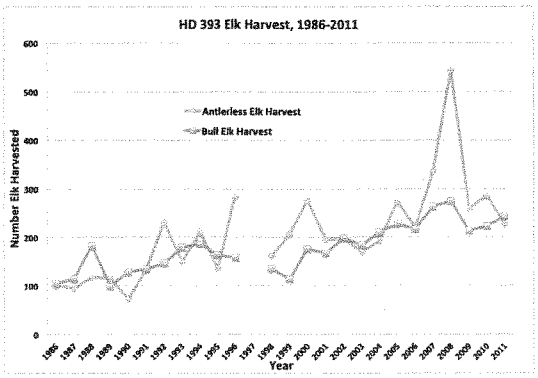


Figure 62. Elk harvest in HD 393.

A cooperative attempt to increase antlerless elk harvests in HD 393 in 2007 and 2008 (Fig. 62) appears to have slightly reduced elk populations for a few years (Fig. 61), but this harvest was not maintained and elk population numbers are again increasing (Fig. 61). Similarly, attempts were made to increase harvests to reduce elk populations in the Madison Valley, but most of the harvest occurred in southwestern HD 360, where less harvest was needed (Figs. 63 and 64) and little occurred in HD 362 where a desired decrease in elk numbers did not occur (Fig. 65 and 66).

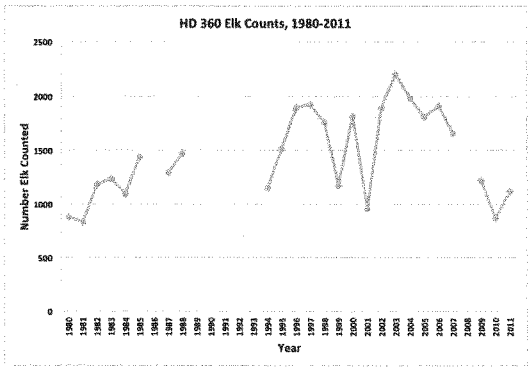


Figure 63. Elk Counts in HD 360.

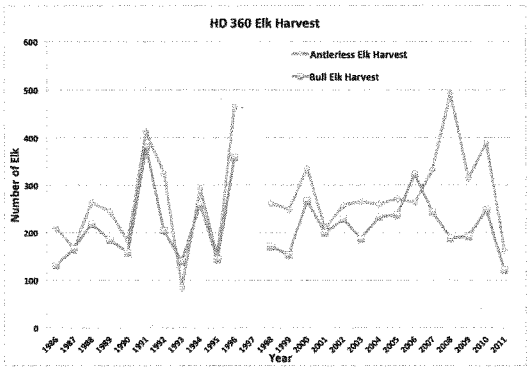


Figure 64. Elk harvest in HD 360.

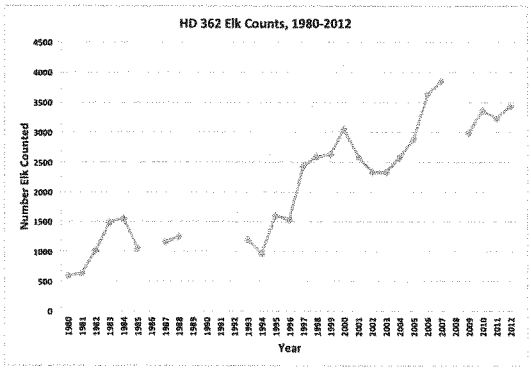


Figure 65. Elk Counts in HD 362.

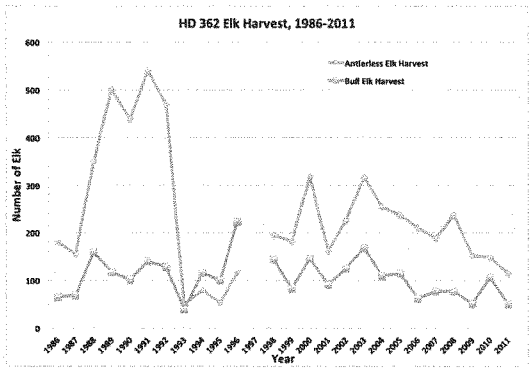


Figure 66. Elk harvest in HD 362.

Other attempts to reduce elk numbers by increasing antlerless harvest (at least temporarily) have been successful in HD 314 (Figs. 67 and 68) and HD 315 (Figs. 69 and 70). Information for HD 317 is similar to that for HDs 314 and 315.

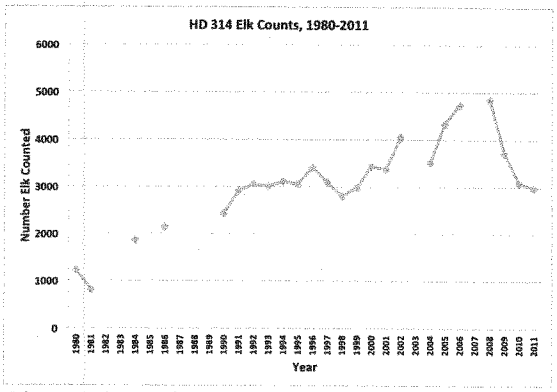


Figure 67. Elk Counts in HD 314.

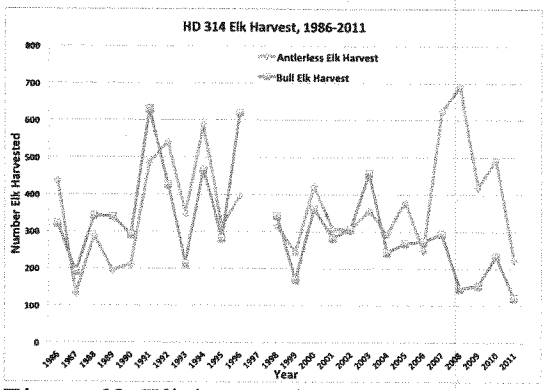


Figure 68. Elk harvest in HD 314.

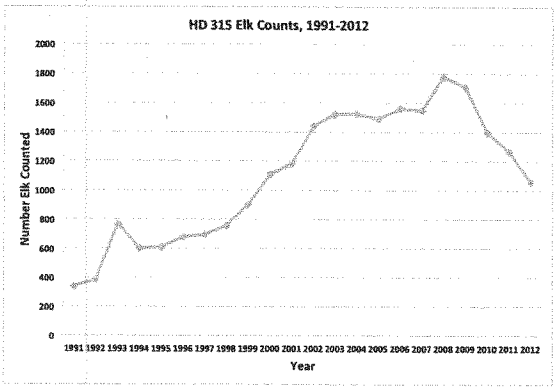


Figure 69. Elk Counts in HD 315.

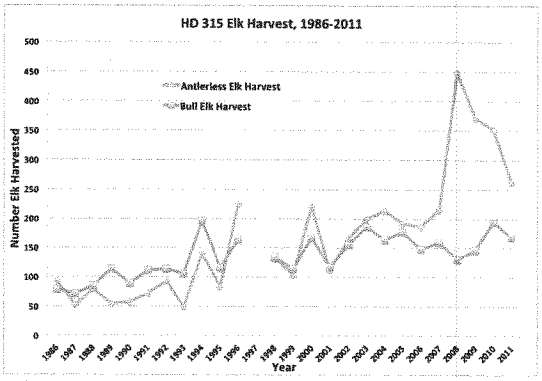


Figure 70. Elk harvest in HD 315.

Much hunter access to elk in HD 311 is privately controlled and after high antlerless harvests in 2000-2003 that reduced elk numbers, antlerless harvests have been light, but elk numbers did not increase with reduction in antlerless harvest (Figs. 71 and 72). This has coincided with an increase in the wolf population in the area, with wolf:1000 elk ratios reaching 7-9:1000 in 2008-2011.

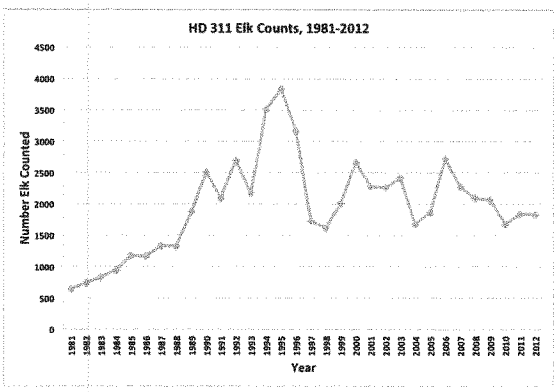


Figure 71. Elk Counts in HD 311.

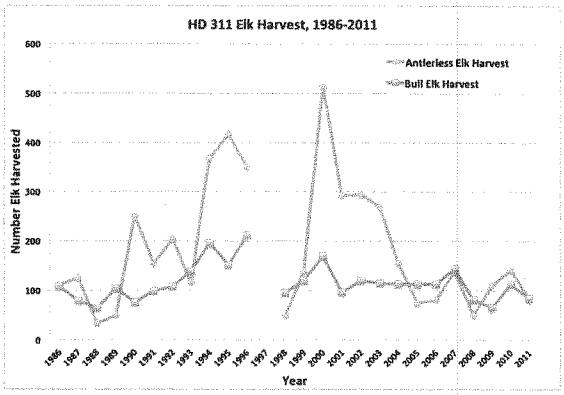


Figure 72. Elk harvest in HD 311.

The Gravelly-Snowcrest hunting districts (HDs 322, 323, 324, 325, 327, and 330) perhaps provide an interesting picture of elk, wolf, and hunter **behavior** influencing outcomes. Although wolves have inhabited this area for some time, control actions related to livestock depredations have held wolf numbers low relative to elk population numbers (0.3 – 3 wolves:1000 elk). Elk numbers have remained relatively stable, but hunter harvest has declined substantially (Figs. 73 and 74). As a result of relatively mild weather during hunting seasons recently, many elk in this population have remained in Idaho and YNP during the season and at high elevations within the Gravelly-Snowcrest Mountains and are not available to or seen by hunters. Also, enough wolves are present that hunters see them and their sign in this relatively open habitat and many hunters have stopped hunting there **(one half of previous hunter numbers)** because of perceived or real wolf "effects" (Fig. 75).

The fact that the Gravelly-Snowcrest elk population has not increased despite a 50% reduction in hunter harvest indicates that recruitment has declined, adult mortality has increased from factors other than hunting, or both. There is some indication that recruitment has declined in recent years. Total predation pressure from all species may be greater than estimated and wolves removed in control actions by Wildlife Services perhaps should also be included in estimates.

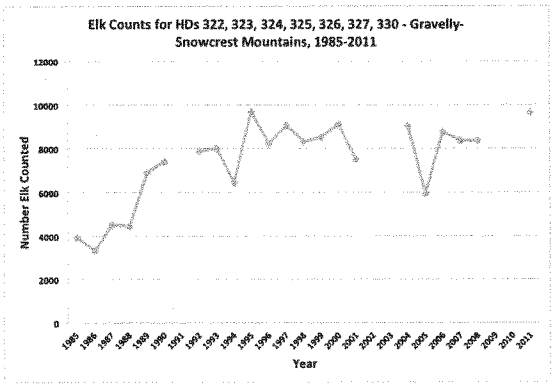


Figure 73. Elk Counts in the Gravelly-Snowcrest EMU, 1985-2011.

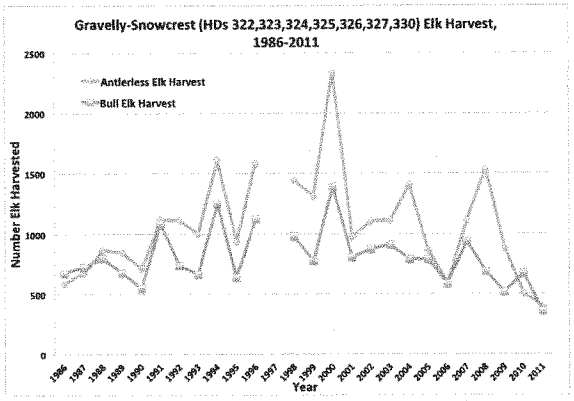


Figure 74. Elk harvest in the Gravelly-Snowcrest EMU, 1986-2011.

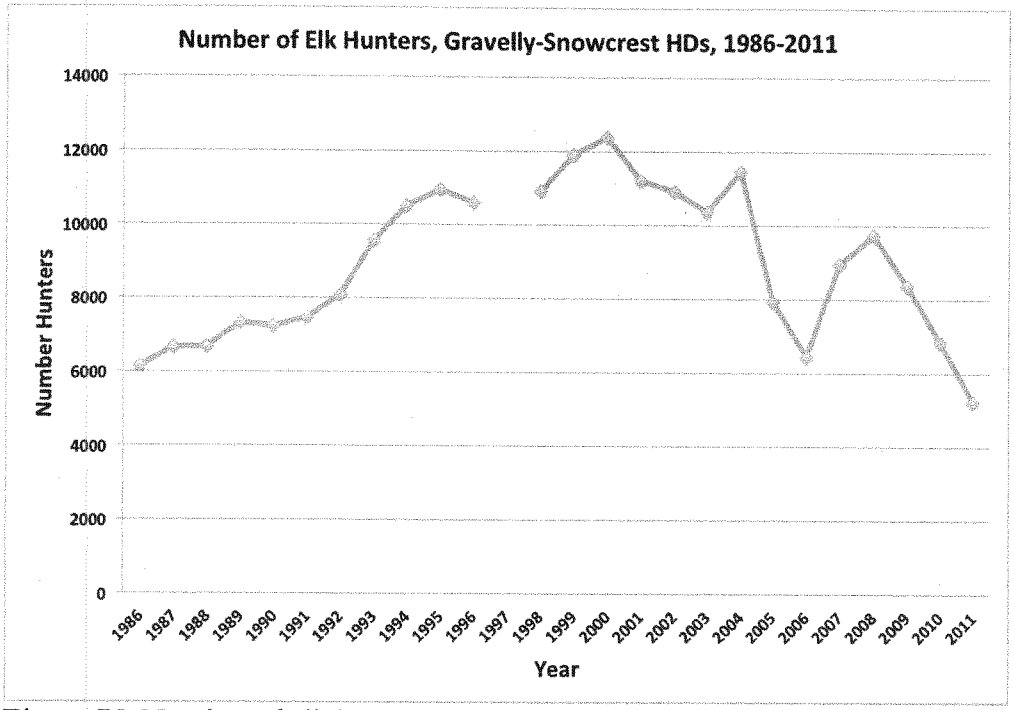


Figure 75. Number of elk hunters in the Gravelly-Snowcrest EMU, 1986-2011.

After a large reduction in antlerless harvest, elk counted may be starting to slowly increase in HDs 319/341 (Figs. 76 and 77) despite relatively high wolf numbers in recent years.

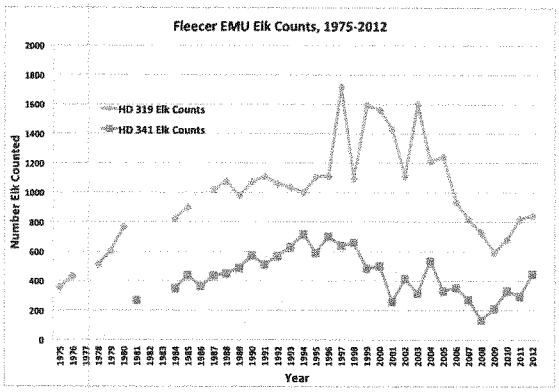


Figure 76. Elk Counts in Fleecer EMU (HDs 319 & 341),1975-2012.

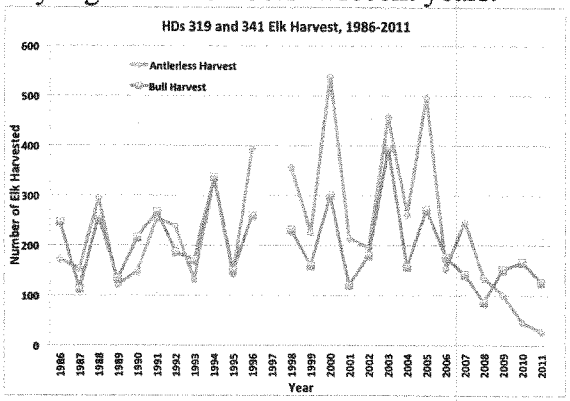


Figure 77. Elk harvest in Fleecer EMU (HDs 319 & 341),1986-2011.

Although HD 380 is shown as Under Objective in Fig. 2, it is unclear if a real decline in elk numbers has occurred and the only recently established wolf pack is unlikely to have affected elk numbers to this time.

Regions 4 and 5: Elk populations in Regions 4 and 5 are increasing or remain stable. Antlerless harvests are relatively light in some areas, and wolf packs and numbers and total predator numbers have not occurred at levels that would potentially affect elk populations at current harvest levels.

Elk Distribution: There is evidence that elk distribution has changed in some areas, possibly as a result of wolf presence. In HD 202, total numbers of elk counted are down, but since the late 1990s, increasing numbers of elk are observed in areas where they were not observed before or were not surveyed. Similarly, in the Gallatin Canyon, a greater portion of wintering elk seem to winter in the Madison Valley and in portions of the Gallatin Canyon near human habitation. Possibly, a greater portion of Northern Yellowstone elk may winter out of the Park despite mild winters. In the Gravelly-Snowcrest Mountains, some changes in calving distribution and winter distribution were observed. Other examples may occur. These distributional changes may affect perception of elk numbers, hunter harvest, elk counts, and occupation of private land.

Elk Reproduction: Creel et al. (2007) suggested that low levels of progesterone in elk feces in areas with high wolf:1000 elk ratios indicated low pregnancy rates. Low pregnancy was presumably an indirect effect of wolves due to increased stress or reduced nutrition due to changes in foraging behavior and location. Stress was determined not to be a problem (Creel et al. 2009. Hamlin et al. (2009) and Hamlin and Cunningham 2009) found normal pregnancy rates in the Gallatin, Northern Yellowstone and Madison elk herds; both through direct observation and through levels of pregnancy specific protein B (PSPB) in adult female elk blood samples. At continuing high wolf:1000 elk ratios, 93% of 45 Northern Yellowstone elk were pregnant during winters 2011 and 2012 as determined by PSPB (P. J. White, pers. comm.). Further, White et al. (2010) found that Northern Range elk had as high or higher ingesta-free body fat than elk throughout the northwestern U. S (no nutritional problem). Studies in high-density wolf areas of Idaho also determined normal pregnancy rates (Zager et al. 2007) and recent studies in Wyoming (Middleton et al., *in press*) did not detect indirect effects of wolves on elk pregnancy and nutrition. Directly observed mortality of calves after birth accounted for low observed elk calf recruitment on most areas (Hamlin et al. 2009 and Hamlin and Cunningham 2009).

Elk Mortality: Neonatal (birth – 3 months-of-age) mortality of elk calves has varied from about 15% to 72% where it has been measured in Montana, Idaho, and Wyoming. This mortality has varied by area, year, and with the total complement of predators. Generally, neonatal elk calf mortality has been highest in areas with the greatest number and diversity of predators. The primary predator has varied by area, but even in areas with wolves, black and grizzly bears and mountain lions were the major predators of neonatal calves. Wolves usually killed 15% or fewer of neonatal elk calves, being primarily a sight oriented predator. Mortality caused by wolves usually increases as the calves age and become more active. Evidence indicates that neonatal mortality of elk calves has increased over the last 20 years with the increase of all predators. Some mortality also occurs at all times and areas from accidents, disease, hunting, and nutritional deficiency. In combination, recently in many areas, fewer calves are recruited to adulthood as replacements for adults harvested or dying of other causes.

Annual mortality of adult elk where recorded in Montana through radio-collared animals has generally ranged from 25-75% for males and 10–25% for females. The majority of this mortality, even in the presence of wolves and other predators, has been by hunter harvest.

Hunter harvest mortality of adult females has ranged from 5-20% annually for southwestern Montana populations. Annual mortality of adult females by predation has generally been under 10%, usually under 4%, even within YNP. Wolves and cougars have been important predators of adult elk and bears have killed a few.

Depending upon recruitment sex ratio, recruitment of 15-20 calves:100 cows is necessary to replace annual adult female mortality of 10% and 50-55 calves:100 cows to replace annual adult female mortality of 25%. Thus, populations with high predation loss of adults and recruitment of calves at less than 20:100 cows can withstand very little hunting mortality and remain stable. Conversely, if reduced predation pressure results in calf recruitment of 40-50 calves:100 cows, substantial hunting mortality of adult females can be sustained (15%+). Recent declining elk populations have generally had calf recruitment of 20 calves:100 cows or less (some 8-10:100).

Wolf:Elk Ratios: Hamlin et al. (2009) indicated that elk calf recruitment was lower in areas where the wolf:1000 elk ratio or combined wolf+grizzly bear:1000 elk ratio was above 4:1000. Although correlation does not prove causation, this relationship seems to have continued after 2007. I used observability percentages of 30-80% by habitat as listed in the 2005 Montana Elk Plan to estimate elk numbers by hunting district or EMU closer to actual than from simple counts. I then compiled wolf numbers for the same areas (likely underestimated) and calculated updated wolf:1000 elk ratios for areas with substantial numbers of wolves or for which elk counts were recently down. I made no attempt to include grizzly bears or other predators of elk.

The results (Table 1) indicate that predation pressure has increased in HD 310 and the Northern Range, especially if grizzly bear predation is also considered. Although wolf numbers have declined on the Northern Range, elk populations have declined more, maintaining or increasing predation pressure and wolf:1000 elk ratios. This pressure is probably underestimated because we have learned from post-2007 elk movements studies that Northern Range elk are affected by wolves and grizzly bear in all portions of YNP except the southwest corner, not just those on the Northern winter range that are included in the estimates.

The results also indicate that at current wolf numbers, low elk calf survival may be expected in HDs 202, 240, 250, 282/285, 310, 311, 313, 317, and 319/341. These results will vary annually by area with wolf and elk numbers and areas other than those listed could have reduced calf recruitment and some of those listed could see increases. Results must be tempered in Region 1 and northern parts of Region 2 with the knowledge that white-tailed deer are likely the main prey of wolves there and are at much higher numbers than elk. Except for HDs 121 and 123, Wolf:1000 elk ratios can not be estimated for Region 1. It might be possible to VERY ROUGHLY estimate wolf:1000 white-tailed deer ratios for Regions 1 and 2, but I will not attempt that here.

Table 1. Wolf:1000 Elk Ratios for selected Hunting Districts / EMUs with significant wolf numbers.

Year	HD 121	HD 201	HD 202	HD 240	HD 250	HD 261	HD 270	HDs 282/ 285	
1992		1.1							
1993		1.3							
1994		1.6							
1995									
1996									
1997									
1998				0.8					
1999		9.8		8.5					
2000									
2001	1.1		3.3				0.6		
2002	3.0	4.5	10.5	13.1	1.9			0.8	
2003	0.4		5.7	7.1	1.4			2.1	
2004		3.0			2.2				
2005			12.4	10.2	3.4				
2006			8.6	8.5	4.5	0.9	1.2		
2007		5.1	20.4	19.4	6.1	5.7	0.7		
2008	1.3	5.2	15.5	7.8	13.2		2.1	12.3	
2009	2.2	9.8	41.2	10.2	19.4	3.3	3.2		
2010	2.9			13.0	23.6	3.8	4.0	11.6	
2011		5.2	45.1	16.7	21.4	3.9	3.5	24.1	

	HD 310	HD 311	HDs 313/ 316	HD 314	HD 317	Gravelly-Snowcrest HDs	HDs 319/341	HD 360	HD 362
1995			1.3						
1996									
1997									
1998	0.7		3.6						
1999			3.7						
2000			5.0						1.3
2001	10.3		5.7	1.2		1.0	1.4		0.9
2002		1.4	7.2	1.6	5.2				1.7
2003	7.3		11.5		2.0			1.8	1.4
2004	1.3		11.2	3.9	6.2	1.6		1.2	
2005	2.7	3.4	6.3	1.3	1.9	1.5	1.0		1.9
2006	7.6	2.3		1.3	3.0	0.3	1.9	0.4	1.3
2007	8.3	4.6	16.0		12.0	1.7	5.9	1.9	
2008	10.3	7.3	8.9	0.8	13.1	2.9	13.9		
2009		8.5	5.6	1.5	11.1		11.9	2.0	4.8
2010	21.7	8.6	6.3		6.3		8.7	3.7	3.6
2011	21.2	9.1	10.6	5.6	5.3	0.7	12.9		2.2

Management: Management of all species must remain flexible and responsive and viable populations of all species should be maintained. Montanans prefer that wolf management remain in State hands and do not want Federal control of wolf management.

For responsive, timely management of predators relative to ungulates and ungulate hunting opportunity, continued and improved trend counts of elk must continue. Additionally, increased efforts should be made to record recruitment ratios (calf:100 cow ratios) in all areas. Accurate ratios are more difficult to make during mid- to late winter than most realize and accuracy should be emphasized.

For areas in northwestern Montana where counts of ungulates are not feasible or accurate, hunting regulations must be relatively conservative at current predator population and ungulate recruitment levels to maintain stable ungulate populations.

Harvest is the primary tool that MDFWP can employ to address both over-abundant and under-abundant species (and there is much difference of opinion on appropriate abundance levels). Consideration should be given to managing wolves in a more area-targeted manner similar to mountain lions. Removal of wolves, lions or bears from areas of ungulate over abundance does not help increase ungulate populations in areas of under abundance, nor does it help with reduction of ungulate numbers in areas of over abundance.

SUMMARY AND CONCLUSIONS

As of 2011, estimates of Statewide elk populations in Montana are 24% above Objective, White-tailed deer are 8% below Objective, and mule deer are 29% below Objective. For elk, 7 EMUs are below Objective, 11 are at Objective, and 24 are above Objective. By subunit for elk, 26 are below Objective, 38 at Objective, and 50 above Objective. Statewide, elk numbers are up. Areas under Objective are generally in western and northwestern Montana and those above Objective are generally in central and eastern Montana.

Despite increased numbers of hunting districts allowing harvest of antlerless elk on the general license and also issuing a 2nd license for antlerless elk (A9/B12), statewide antlerless elk harvest has declined. Recent harvest restrictions in portions of Regions 1 and 2 and declining hunter access and participation in portions of the State may have contributed to this. Harvest restrictions due to reduced elk numbers in some areas related to predation has also contributed.

Areas with substantial recent declines in elk numbers are not numerous, but where they have occurred, some population declines have been substantial and hunter harvest has been reduced to historically low levels.

Mule deer populations numbers have been in long-term (50 year) decline in Montana and much of the western U.S. Causes are unclear.

White-tailed deer numbers have been in a long-term (50 year) increasing trend in Montana, but have stabilized or recently declined in some areas. Declines of white-tailed deer in portions of Regions 1 and 2 can generally be tied to effects of the severe winter of 1996-97 and high antlerless harvest during 1993-97 and 2006-08. However declines have continued in some areas after 2008, populations and harvest level has not recovered and it is likely that recent increase in predation loss from wolves is contributing. White-tailed deer numbers have generally been increasing to stable in the agricultural, low predation pressure valleys of Region 3 as they have in the limited similar environments in Regions 1 and 2. Declines in white-tailed deer numbers in eastern Regions 4, 5, 6, and 7 can primarily be tied to periodic severe winter weather, epizootic hemorrhagic disease outbreaks in 2001, 2007, and 2011, and occasional contributions by high antlerless harvest.

Moose harvest and probably populations have declined by about 50% since 1990. Reasons for this are unclear and probably multiple. However, in areas where high numbers of wolves are maintained by white-tailed deer and elk, moose as a low- density species may be particularly vulnerable to predation loss.

Wolves have increased substantially in Montana since 1995 and were conservatively estimated at 130 packs and 653 wolves in 2011. These wolves are almost entirely in western Montana. Although wolf numbers are low relative to other native predators, they are added to what was likely the richest abundance of large predators in the lower 48 States. Statewide estimates of other predators are 13, 307 black bear, 3,668+ mountain lions, and 650+ grizzly bear. Grizzly bear have generally been increasing in number over the last 25 years, black bear have been stable to slightly increasing, and mountain lion numbers appeared to increase to 1997, declined, and now appear to be in an increasing trend.

Currently, significant baseline predation pressure exists for the following Montana hunting districts: 100, 101, 102, 103, 104, 109, 110, 121, 122, 123, 124, 130, 140, 141, 150, 151, 200, 201, 202, 203, 240, 250, 270, 280, 281, 282/285, 301, 310, 311, 313/316, 314, 317, 360, 362, 422, 424/425, and 442. Some of these areas can no longer support traditional hunter harvest levels and remain at stable numbers. It will likely be necessary to reduce harvest in the others as well to maintain stability at current predator numbers.

Generally, high numbers of wolves and wolf packs overlap areas where elk counts have declined since 2005. Similarly, few wolves are present where elk counts have increased or remained stable. Similar conclusions can be made for white-tailed deer. Some exceptions occur. Unfortunately, there is limited evidence to determine population trend for both elk and white-tailed deer in Region 1 and white-tailed deer in parts of Region 2.

For many areas of Montana, there are relatively low levels of predators and/or low levels of hunter access to private lands. Elk numbers have temporarily been reduced in a few of these areas, but numbers are generally above Objective and increasing in most. The level

of antlerless harvest that has been achieved and sustained (low or high) can generally explain elk population trend in these areas.

Two major trends have occurred in Montana since the 1970s that have had significant impact on status and management of Montana's wildlife and hunting. With the banning of Compound 1080 and other toxicants for killing predators in the early 1970s and a more environmentally conscious public, all predators began to increase in numbers. Although coyotes were the species most immediately impacted, non-target species such as bears, mountain lions, bobcats, eagles, and others benefitted as well. The increase in predator numbers was immediately apparent for coyotes, but was more gradual and not noticed by many for the other species. Further protection for predators by statute and by management intent followed. Restoration of wolves to Montana, Idaho, and Wyoming occurred beginning in 1995. In Montana, this addition occurred to the most large predator rich environment in the lower 48 States. Predators kill and eat ungulates to survive. Only a portion of this kill is "compensatory mortality" as recent studies have determined. Thus, to maintain stable ungulate populations in the areas where natural predation is high, hunter harvest must necessarily be reduced from earlier levels. In some areas (limited thus far), hunter harvest has significantly declined and may do so in other areas, depending on predator population levels maintained.

Secondly, landownership status and development changed significantly in Montana over the same time period. As traditional, hunter friendly land owners aged, their children became less able for economic and tax concerns to assume ownership and some had less inclination to assume the sometimes arduous, economically unrewarding, and isolated existence of traditional ranchers and farmers. Increasingly, large ranches began to be sold to amenity owners and developers. Amenity owners did not need to try to "make a living" from the land and either did not like hunters or purchased the land in part for their own private hunting reserve. As opposed to traditional landowners who often desired fewer ungulates competing with their livestock for forage, many amenity owners wanted even more elk, deer, etc.

"Harboring" of wildlife has developed on some landownerships and once hunting season is over, increased elk numbers used neighboring traditional owners grazing lands and crops. These increased numbers and large winter groups may also contribute to spread of disease, including brucellosis and potentially even more concerning diseases such as chronic wasting disease and tuberculosis. Some land remained in old family hands, but to increase income, these traditional landowners began to lease hunting rights to individual and groups of hunters or outfitters. This effectively reduced general public hunter access and harvest, increasing ungulate populations in many cases. Ranches sold to developers were often subdivided into many parcels for individual homes. In many cases, this did not reduce habitat for elk and deer substantially, but rather created "refuges" from hunting of which the elk and deer soon took advantage. These "refuges" were necessary for human safety reasons as well as being the choice of the new landowners. In total over the last 40 years, much more habitat for elk and deer is unavailable for general hunter access and harvest and elk populations have increased in these areas beyond management control.

The two overriding trends have led to increased and often conflicting management demands and reduced management options. Public lands where more ungulates and hunter harvest are desired and could be supported are the areas with the highest predator populations competing for prey with hunters. Areas with traditional landowners trying to convert grass to pounds of livestock may suffer overabundance of native ungulates because of their own or neighboring amenity owner's reductions in hunter access and harvest. Similarly, hunting "refuges" created by housing/ranchette development result in growing ungulate populations and damage complaints there and on neighboring lands.

REFERENCES

Anderson, C. R., and F. G. Lindzey. 2005. Experimental evaluation of population trend and harvest composition in a Wyoming cougar population. Wildlife Society Bulletin 33:179-188.

Arnaud, R., and J. Doran. 2102. Flying D Ranch 2011 Annual Wildlife Report. Bozeman, Montana.

Atwood, T. C., E. M. Gese, and K. E. Kunkel. 2007. Comparative patterns of predation by cougars and recolonizing wolves in Montana's Madison Range. Journal of Wildlife Management 71: 1098-1106.

Barber-Meyer, S. M., L. D. Mech, and P. J. White. 2008. Elk calf survival and mortality following wolf restoration to Yellowstone National Park. Wildlife Monograph No. 169.

Barmore, Jr., W.J. 2003. Ecology of ungulates and their winter range in northern Yellowstone National Park: research and synthesis, 1962-1970. National Park Service, Mammoth Hot Springs, Wyoming. 524pp.

Becker, M. S., R. A. Garrott, P. J. White, C. N. Gower, E. J. Bergman, and R. Jaffe. 2009. Wolf prey selection in an elk-bison system: choice or circumstance. Chapter 16 *in* R. A. Garrott, P. J. White, and F. G. Watson, eds. The Ecology of Large Mammals in Central Yellowstone. Elsevier, Inc.

Bergman, E. J., R. A. Garrott, S. Creel, J. J. Borkowski, R. Jaffe, and F. G. R. Watson. 2006. Assessment of prey vulnerability through analysis of wolf movements and kill sites. Ecological Applications 16:273-284.

Creel, S., and J.A.Winnie, Jr.,. 2005. Responses of elk herd size to fine-scale spatial and temporal variation in the risk of predation by wolves. Animal Behaviour 69:1181-1189.

Creel, S., J. A. Winnie,Jr., , B. Maxwell, K. Hamlin, and M. Creel. 2005. Elk alter habitat selection as an antipredator response to wolves. Ecology 86:3387-3397.

Creel, S., D. Christianson, S. Lily, J. A. Winnie Jr. 2007. Predation risk affects reproductive physiology and demography of elk. Science 315:960.

Creel, S., J. A. Winnie, Jr., and D. Christianson. 2009. Glucocorticoid stress hormones and the effect of predation risk on elk reproduction. Proceedings of the National Academy of Sciences USA 106:12388–12393.

Cunningham, J. A., K. L. Hamlin and T. O. Lemke. 2007. Northern Yellowstone elk (HD 313) 2007 annual report. Montana Fish, Wildlife and Parks. 14p.

Cunningham, J. A., K. L. Hamlin, and T. O. Lemke. 2009. Northern Yellowstone elk (HD 313) 2008 annual report. Montana Fish, Wildlife and Parks, Helena. 26 pages

Dusek, G. L., A. Wood, S. Hoekman, C. Sime, and J. Morgan. 2006. Ecology of white-tailed deer in the Salish Mountains, Northwest Montana. Montana Fish, Wildlife, and Parks, Helena.

Eberhardt, L. L. 1997. Is wolf predation ratio-dependent? Canadian Journal of Zoology. 75: 1940-1944.

Eberhardt, L. L. 2002. A paradigm for population analysis of long-lived vertebrates. Ecology 83:2841-2854.

Eberhardt, L. L., P. J. White, R. A. Garrott, and D. B. Houston. 2007. A seventy-year history of trends of Yellowstone's northern elk herd. Journal of Wildlife Management 71:594-602.

Evans, S. B., L. D. Mech, P. J. White, and G. A. Sargeant. 2006. Survival of adult female elk in Yellowstone following wolf restoration. Journal of Wildlife Management 70:1372-1378.

Fowler, C. W. 1981. Density dependence as related to life history strategies. Ecology 62:602-610.

Gaillard, J. M., M. Festa-Bianchet, and N. G. Yoccoz. 1998. Population dynamics of large herbivores:variable recruitment with constant adult survival. Trends in Ecology and Evolution 13:58-63.

Garrott, R. A., J. A. Gude, E. J. Bergman, C. Gower, P. J. White, and K. L. Hamlin. 2005. Generalizing wolf effects across the greater Yellowstone area: a cautionary note. Wildlife Society Bulletin 33:1245-1255.

Garrott, R. A., P. J. White, and J. J. Rotella. 2009. The Madison Headwaters Elk Herd: transitioning from bottom-up regulation to top-down limitation. Chapter 23 *in* R. A. Garrott, P. J. White, and F. G.Watson, eds. The Ecology of Large Mammals in Central Yellowstone. Elsevier, Inc.

Gower, C. N., R. A. Garrott, and P. J. White, S. Cherry, and N. G. Yoccoz. 2009a. Elk group size and wolf predation: a flexible strategy when faced with variable risk. Chapter 19 *in* R. A. Garrott, P. J. White, and F. G. Watson, eds. The Ecology of Large Mammals in Central Yellowstone. Elsevier, Inc.

Gower, C. N., R. A. Garrott, and P. J. White. 2009b. Elk foraging behavior: Does predation risk reduce time for food acquisition? Chapter 20 *in* R. A. Garrott, P. J. White, and F. G. Watson, eds. The Ecology of Large Mammals in Central Yellowstone. Elsevier, Inc.

Gower, C. N., R. A. Garrott, P. J. White, F. G. Watson, S. Cornish, and M. S. Becker. 2009c. Spatial responses of elk to wolf predation risk: using the landscape to balance multiple demands. Chapter 18 *in* R. A. Garrott, P. J. White, and F. G. Watson, eds. The Ecology of Large Mammals in Central Yellowstone. Elsevier, Inc.

Gude, J. A., R. A. Garrott, J. Borkowski, and F. King. 2006. Prey risk allocation in a grazing ecosystem. Ecological Applications 16:285-298.

Hamlin, K. L. 2006. Monitoring and assessment of wolf-ungulate interactions and trends within the greater Yellowstone ecosystem and associated areas of southwestern

Montana. Montana Fish, Wildlife, and Parks, Federal Aid in Wildlife Restoration Project, Helena, Montana, USA.

Hamlin, K. L., and R. J. Mackie. 1989. Mule deer in the Missouri River Breaks, Montana: a study of population dynamics in a fluctuating environment. Montana Fish, Wildlife, and Parks, Federal Aid in Wildlife Restoration Project W-120-R-, Helena, Montana, USA.

Hamlin, K. L., and M. S. Ross. 2002. Effects of hunting regulation changes on elk and hunters in the Gravelly-Snowcrest Mountains, Montana. Montana Department of Fish, Wildlife, and Parks, Federal Aid in Wildlife Restoration Project W-120-R-, Helena, Montana, USA.

Hamlin, K. L., R. A. Garrott, P. J. White, and J. A. Cunningham. 2009. Contrasting wolf-ungulate interactions in the Greater Yellowstone ecosystem. Chapter 25 *in* R. A. Garrott, P. J. White, and F. G.Watson, eds. The Ecology of Large Mammals in Central Yellowstone. Elsevier, Inc.

Haroldson, M. A. 2010. Assessing trend and estimating population size from counts of unduplicated females. Pages 10-15 *in* C. C. Schwartz, M. A. Haroldson, and K. West editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2010. U. S. Geological Survey, Bozeman, Montana, USA.

Harris, N. C. 2007. Monitoring survival of young in ungulates: a case study from Rocky Mountain elk. Thesis. University of Montana, Missoula.

Houston, D. B. 1982. The northern Yellowstone elk. Macmillan, New York, New York, USA.

Kunkel, K. E. 1997. Predation by wolves and other large carnivores in northwestern Montana and southeastern British Columbia. Thesis. University of Montana, Missoula.

Kunkel, K. E., T. K. Ruth, D. H. Pletscher, and M. G. Hornocker. 1999. Winter prey selection by wolves and cougars near Glacier National Park, Montana. Journal of Wildlife Management 63:901-910.

Kunkel, K. E., and D. H. Pletscher. 1999. Species-specific population dynamics of cervids in a multipredator system. Journal of Wildlife Management 63:1082-1093.

Leopold, A. S., S. A. Cain, C. M. Cottam, I. N. Gabrielson, and T. L. Kimball. 1963. Study of wildlife problems in national parks. Transactions of the North American Wildlife and Natural Resource Conference. 28: 29-44.

Mace, R. D., and T. Chilton-Radandt. 2011. Black bears harvest, research, and management in Montana – 2011 Final Report. Montana Fish Wildlife, and Parks Federal Aid in Wildlife Restoration Project W-154-R, Helena.

Mace, R. D., D. W. Carney, T. Chilton-Radandt, S. A. Courville, M. A. Haroldson, R. B. Harris, J. Jonkel, B. McClellan, M. Madel, T. L. Manley, C. C. Schwartz, C. Servheen, J. S. Waller, E. Wenum. 2011. Grizzly Bear Population Vital Rates and Trend in the Northern Continental Divide Ecosystem, Montana. Journal of Wildlife Management 76: (1)119-28.

Mao, J. S., M. S. Boyce, D. W. Smith, F. J. Singer, D. J. Vales, J. M. Vore, and E. H. Merrill. 2005. Habitat selection by elk before and after wolf reintroduction in Yellowstone National Park. Journal of Wildlife Management 69:1691-1707.

Messier, F. 1994. Ungulate population models with predation: a case study with the North American moose. Ecology 75:478-488.

Middleton, A.D., M.J. Kauffman, D.E. McWhirter, J.G. Cook, R.C. Cook, A.A. Nelson, M.D. Jimenez, and R.W. Klaver. In press. Animal migration amid changing patterns of phenology and predation: Lessons from a Yellowstone elk herd. *Ecology*.

Montana Department of Fish Wildlife, and Parks. 2001. Adaptive harvest management. D. Pac, R. Mule, and S. Stewart, eds. Montana Department of Fish Wildlife, and Parks, Helena.

Montana Department of Fish Wildlife, and Parks. 2005. Montana Final Elk Management Plan. K. Hamlin, ed., Montana Department of Fish Wildlife, and Parks, Helena.

Montana Department of Fish Wildlife, and Parks. 2007-2011. Montana Gray Wolf and Conservation 2006-2010 annual report. C. Sime and others. Helena, Montana.

Montana Department of Fish Wildlife, and Parks. 2010. Region Two Deer and Elk Survey and Inventory Progress Report, July 1, 2005-June 30, 2010. Missoula, Montana.

Montana Department of Fish Wildlife, and Parks. 2011. Region Two Deer and Elk Survey and Inventory Progress Report, July 1, 2010-June 30, 2011. Missoula, Montana.

Montana Department of Fish Wildlife, and Parks. 2012. Montana Gray Wolf and Conservation 2011 annual report. Hanauska-Brown, L., L. Bradley, J. Gude, N. Lance, K. Laudon, A. Messer, A. Nelson, M. Ross, and J. Steuber. Helena, Montana.

Montana Department of Fish Wildlife, and Parks. 2012. Region One 2012 White-tailed Deer Report. John Vore., Kalispell, Montana.

Montana Department of Fish Wildlife, and Parks. 2012. Region One 2012 Elk Report. Bruce Sterling, Kalispell, Montana

Proffitt, K. M., J. L. Grigg, K. L. Hamlin, and R. A. Garrott. 2009. Contrasting effects of wolves and human hunters on elk behavioral responses to predation risk. Journal of Wildlife Management 73:345-365.

Raithel, J. D., M. J. Kauffman, and D. H. Pletscher. 2007. Impact of spatial and temporal variation in calf survival on the growth of elk populations. Journal of Wildlife Management 71:795-803.

Robinson, H. S., R. B. Wielgus, H. S. Cooley, and S. W. Cooley. 2008. Sink populations in carnivore management: Cougar demography and immigration in a hunted population. Ecological Applications 18:1028-1037.

Robinson, H. S. and R. M. DeSimone. 2011. The Garnet Range Mountain Lion Study: Characteristics of a Hunted Population in West-central Montana. Final Report, Montana Department of Fish, Wildlife & Parks, Wildlife Bureau, Helena, MT.

Schlegel, M. 1976. Factors affecting calf elk survival in north central Idaho. A progress report. Proceedings of the Western Association of State Game and Fish Commissioners. 56:342-355.

Schwartz, C.C., M. A. Haroldson, and K. West, editors. 2007. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2006. U.S. Geological Survey, Bozeman, Montana, USA.

Schwartz, C.C., M. A. Haroldson, and K. West, editors. 2008. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2007. U.S. Geological Survey, Bozeman, Montana, USA.

Schwartz, C.C., M. A. Haroldson, and K. West, editors. 2009 (*in press*). Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2008. U.S. Geological Survey, Bozeman, Montana, USA.

Sime, C. A., V. Asher, L. Bradley, K. Laudon, M. Ross, J. Trapp, M. Atkinson, and J. Steuber. 2008. Montana gray wolf conservation and management 2007 annual report. Montana Fish, Wildlife, and Parks. Helena.

Singer, F. J., A. Harting, K. K. Symonds, and M. B. Coughenour. 1997. Density dependence, compensation, and environmental effects on elk calf mortality in Yellowstone National Park. Journal of Wildlife Management 61:12-25.

Smith, B. L., E. S. Williams, K. C. McFarland, T. L. McDonald, G. Wang, and T. D. Moore. 2006*b*. Neonatal mortality of elk in Wyoming: environmental, population, and predator effects. U.S. Department of Interior. U.S. Fish and Wildlife Service, Biological Technical Publication, BTP-R6007-2006, Washington, D.C.

Smith, D. W. 2005. Ten years of Yellowstone wolves. 1995-2005. Yellowstone Science 13:7-33.

Smith, D. W., T. D. Drummer, K. M. Murphy, D. S. Guernsey, and S. B. Evans. 2004a. Winter prey selection and estimation of wolf kill rates in Yellowstone National Park, 1995-2000. Journal of Wildlife Management 68:153-166.

Smith, D. W., and others. 1997-2011. Yellowstone wolf project: annual report, YCR-NR-, USDI National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, USA.

Taper. M. L, and P. J. P. Gogan. 2002. The Northern Yellowstone elk: density dependence and climatic conditions. Journal of Wildlife Management 66:106-122.

U. S. Fish and Wildlife Service, Nez Perce Tribe, National Park Service, and USDA Wildlife Services. 2000-2004. Rocky mountain wolf recovery 1999-2003 annual reports. T. Meier, editor. United States Fish and Wildlife Service, Ecological Services, Helena, Montana, USA.

U. S. Fish and Wildlife Service, Nez Perce Tribe, National Park Service, Montana Fish, Wildlife and Parks, Idaho Fish and Game, and USDA Wildlife Services. 2005. Rocky mountain wolf recovery 2004 annual report. D. Boyd, editor. United States Fish and Wildlife Service, Ecological Services, Helena, Montana, USA.

U. S. Fish and Wildlife Service, Nez Perce Tribe, National Park Service, Montana Fish, Wildlife and Parks, Idaho Fish and Game, and USDA Wildlife Services. 2006. Rocky mountain wolf recovery 2005 annual report. C. A. Sime and E. E. Bangs, editors. United States Fish and Wildlife Service, Ecological Services, Helena, Montana, USA.

Varley, N., and M. S. Boyce. 2006. Adaptive management for reintroductions: Updating a wolf recovery model for Yellowstone National Park. Ecological Modeling193:315-339.

Vore, J. M. 1990. Movements and distribution of some northern Yellowstone elk. Thesis, Montana State University, Bozeman.

Vucetich, J. A., D. W. Smith, and D. R. Stahler. 2005. Influence of harvest, climate, and wolf predation on Yellowstone elk, 1961-2004. Oikos 111:259-270.

White, P.J., Garrott, R.A., Eberhardt, L.L., 2003. Evaluating the consequences of wolf recovery on northern Yellowstone elk, YCR-NR-2004-02, USDI National Park Service, Yellowstone Center for Resources, Yellowstone National Park, WY.

White, P. J., and R. A. Garrott. 2005. Yellowstone's ungulates after wolves – expectations, realizations, and predictions. Biological Conservation 125:141-152.

White, P. J., D. W. Smith, J. W. Duffield, M. Jimenez, T. McEneaney, and G. Plumb. 2005. Yellowstone after wolves – environmental impact statement predictions and ten-year appraisals. Yellowstone Science 13:34-41.

White, P. J., R. A. Garrott, S. Cherry, F. G. R. Watson, C. N. Gower, M. S. Becker, and E. Meridith. 2009a. Changes in elk resource selection and distribution with the reestablishment of wolf predation risk. Chapter 21 *in* R. A. Garrott, P. J. White, and F. G. Watson, eds. The Ecology of Large Mammals in Central Yellowstone. Elsevier, Inc.

White, P. J., R. A. Garrott, J. J. Borkowski, K. L. Hamlin, and J. G. Berardinelli. 2009b. Elk nutrition after wolf recolonization of central Yellowstone. Chapter 22 *in* R. A. Garrott, P. J. White, and F. G. Watson, eds. The Ecology of Large Mammals in Central Yellowstone. Elsevier, Inc.

White, P. J., Robert A. Garrott, Kenneth L. Hamlin, Rachel C. Cook, John G. Cook, and Julie A. Cunningham. 2011. Body Condition and Pregnancy in Northern Yellowstone Elk: Evidence for Predation Risk Effects? Ecological Applications – Communications. 21:3-8.

Zager, P., C. White, and G. Pauley. 2007. Study IV. Factors influencing elk calf recruitment. Federal Aid in Wildlife Restoration, Job Progress Report, W-160-R-33, Subproject 31. Idaho Department of Fish and Game, Boise, Idaho, USA.