

STATE OF MONTANA

Survey & Inventory Protocols for Big Game in Montana

Elk

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Abstract

In 121 of 162 elk HDs there was some type of elk survey scheduled in 2010-2011. Elk surveys are almost always a complete coverage survey, where the biologist attempts to survey the entire range where they expect to see elk. The primary objective of a complete coverage survey is to enumerate all the visible elk in that area, using the same methods annually, in order to measure trends in the population. Complete coverage surveys often have the additional objectives of gathering data on the number of calves per 100 cows and bulls per 100 cows. Most elk surveys are conducted with a fixed-wing aircraft (74.4%), in the winter (75.8%) and on an annual basis (87.6%). All Regions have at least one check station where hunter harvested animals are checked for age, antler growth, sex and in some cases disease. Survey and Inventory (S&I) data are primarily used for season setting however biologists described many other uses for S&I data including: 1) informing sportsmen, FWP personnel, landowners and others in the general public about population trends, 2) descriptions of elk populations in land purchase and easement proposals, 3) in comments on proposed state and federal land exchange projects, 4) in comments on subdivisions, 5) for newspaper articles, 6) in comments on state land uses such as grazing changes or timber harvests, timber sales on forest service lands and 7) to inform comments on oil and gas leases and oil and gas drilling. Data collected in MFWP surveys are also used to speak towards potential effects of timber harvest, open road densities, refuge effects of private land and recreation on elk harvest. Biologists also stressed the importance of having long-term trend data available for informed comment on unforeseen developments into the future.

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INTRODUCTION

Montana Fish, Wildlife and Parks (FWP) has the authority and responsibility to manage wildlife in the state of Montana. There are over 500 species of mammals, birds, reptiles and amphibians and FWP regulates harvest of 55 of those species that are valued for their meat, fur or as “trophies” (Montana Fish, Wildlife and Parks, 2006). In addition, FWP has the responsibility to manage other nongame wildlife for human enjoyment, scientific purposes and to ensure their survival into perpetuity. FWP personnel survey and inventory (S&I) many species of wildlife, and the data collected provides the scientific basis for management of those species and their habitat. Data collected are used to inform decisions by the Legislature, FWP Commission, other organizations with wildlife interests and governmental agencies. S&I allows FWP to monitor trends in wildlife populations in order to inform management decisions that affect 1) population abundance, 2) wildlife conflicts, 3) hunting and harvest opportunity, 4) inform habitat management and land use decisions and 5) other recreational opportunities for diverse user groups. S&I is an important part of FWP’s mission which states that FWP, through its employees and citizen commission, provides for stewardship of the fish, wildlife, parks and recreational resources of Montana while contributing to the quality of life for present and future generations.

FWP has worked towards becoming more consistent with S&I protocols and has produced several documents that address protocols for individual species. The Montana Bighorn Sheep Conservation Strategy (Montana Fish, Wildlife and Parks, 2010); Management Plan and Conservation Strategies for Sage Grouse in Montana (Montana Sage Grouse Work Group, 2005); Montana Final Elk Management Plan (Montana Fish, Wildlife and Parks, 2005) and Adaptive Harvest Management (Montana Fish, Wildlife and Parks, 2001) address S&I protocols for bighorn sheep, sage-grouse, elk and deer, respectively.

In order to further improve our S&I protocols the 2004 Montana Legislature approved a new S&I specialist position for FWP which was not filled until December of 2010. The primary focus of this new position was to be on decision/operations analysis, wildlife monitoring protocols, and evaluation of data at local, regional, and statewide scales. In addition, the position was created to review existing survey protocols and provide recommendations that may modify those protocols to better meet program needs.

As a first step, this position was directed to catalog and summarize the current S&I programs for pronghorn antelope (antelope), elk and deer across the 7 FWP Regions of Montana. This effort was to focus on documenting the differences and similarities of protocols used in those surveys, and articulating how S&I data fit into wildlife management and conservation actions. Besides cataloging S&I protocols, this analysis may be used by FWP to increase efficiency and distribution of S&I dollars.

Since FWP is not centralized in its organizational structure, protocols for surveys have evolved over time and in some cases differ by Region or even within a Region by hunting district (HD). In most cases, exceptions to general S&I protocols were born out of necessity, such as requests for additional information from sportsmen or FWP commissioners; a need for data on a specific research project, research question or environmental impact statement; and/or a change in budgets or manpower availability. Often the changes in protocols involved how male animals were classified or where surveys were conducted. In many cases, once the change in protocol was made, over time, the “new protocol” became the “standard” for that area. On occasion, the reason(s) that changes were made to a “standard” protocol had been forgotten, however because long-term datasets collected in a specific format existed, new biologists often carried on the revised tradition of data collection.

FWP’s S&I program addresses a broad and complex array of subjects that vary from surveys that collect data on a statewide basis to surveys that are done on a local level by biologists in a specific area for a specific reason. Some very important aspects of the S&I program that will not be discussed in detail in this document are hunter harvest surveys and hunter preference surveys, which are conducted in a centralized fashion from the FWP headquarters office. FWP’s vegetation monitoring program for conservation easements and lands owned by the Department will not be discussed. Non-game monitoring by our native species biologists and wolf monitoring protocols will not be discussed. In addition, this document will not discuss in detail S&I efforts for game species other than antelope, deer and elk.

INFORMATION COLLECTION AND ASSEMBLY METHODS

To collect the necessary information on S&I protocols, interviews were conducted with most of the wildlife biologists responsible for game species management across the state. Each biologist was asked a series of questions about their S&I protocols. Biologists were asked to describe what species they surveyed, time-period for the survey, where the survey area was located, type of vehicle utilized, periodicity of the survey, and how the survey was done including time of day and flight patterns. Biologists were asked to classify their surveys to a specific type such as trend area counts, complete coverage surveys, or production counts which will all be discussed in more detail later in this document. Biologists were also asked to describe the classification data they collected, how the data were stored, and for what purposes the data were used. The primary emphasis of this undertaking was to gather information about FWP S&I protocols for deer, elk and antelope, although additional information on surveys of other species, including bighorn sheep, black bears, moose, mountain goats, furbearers, migratory game birds such as waterfowl, sandhill cranes and mourning doves, and upland game birds including sage-grouse, pheasants, and sharp-tailed grouse was gathered and may be summarized at a later date. Biologists were also asked whether or not they conducted hunter check stations, to describe what information was gathered at those check stations and how those data are stored. I also reviewed existing papers, conservation strategies, and management plans addressing S&I protocols in Montana, including but not limited to elk, mule deer, sage grouse and bighorn sheep.

In addition, each biologist was provided with a list of 20 questions that asked their opinions on the effectiveness of current survey protocols, needs they might have to improve S&I protocols and data analysis, opinions on which surveys might be eliminated, which species needed more S&I dollars for monitoring, and training needs for biologists and pilots.

The following report on elk is one of four separate reports covering survey and inventory protocols for 1) antelope, 2) elk, 3) mule and white-tailed deer, and 4) a summary of the answers to the 20 questions biologists were asked.

ELK

Elk Survey Methods

Elk surveys are conducted in all 7 Regions in Montana. Not all Regions have elk evenly distributed across the landscape; therefore number of surveys conducted varies by Region (R). A majority of the elk harvest in Montana occurs in R-3 and R-4, while R-2 and R-3 have the greatest numbers of elk hunters (Table 1). In 121 of 162 HDs (74.7%) there was some type of elk survey scheduled to be conducted in 2010-2011 (Figure 1). Elk surveys are almost always a complete coverage survey, where the biologist attempts to survey the entire range where they expect to see elk. The primary objective of a complete coverage survey is to enumerate all the visible elk in that area, using the same methods annually, in order to measure trends in the population. Complete coverage surveys often have the additional objectives of gathering data on the number of calves per 100 cows (calf:cow ratios) and bulls per 100 cows (bull:cow ratios). In some HDs, especially in R-1 where visibility is severely limited by tree cover, the primary survey objectives are to enumerate bull:cow and calf:cow ratios. Of the 121 HDs with surveys, 106 (87.6%) are scheduled for annual complete coverage surveys, 6 (5.0%) for complete coverage surveys every other year, 4 (3.3%) have complete coverage surveys that are flown as funding allows, 4 (3.3%) have complete coverage surveys scheduled to be flown every third year and 1 (0.8%) has a trend area (portion of the occupied elk habitat) that is scheduled to be flown annually (Figure 1). It should be noted that even though the surveys in HD 109 and 110 are classified as complete coverage surveys the results rarely can be used to monitor trends in total numbers of elk. In most cases elk surveys are done in the winter, late winter or during the spring green-up period, but in HDs 321 and 334 elk surveys are flown in July. Ninety-one (75.8%) of the 120 complete coverage elk surveys are normally done in the winter months, usually January or February. The timing of winter surveys is dependent upon weather conditions, pilot, biologist and aircraft availability; so winter surveys might be flown at anytime between January and April (Figure 2). In the winter biologists are looking for conditions which include complete snow cover and cold, clear days. Fresh snow allows biologists to track elk and helps in the location of

Table 1. Number of HDs, elk hunters, elk harvested and square miles of occupied habitat by FWP Administrative Region, 2010.

Region	Number HDs	Number of Elk Hunters 2010	Number Elk Killed 2010	Sq. Mi. Habitat ¹
1	19	15,989	1,732	10,965
2	28	23,001	3,974	9,885
3	45	41,955	11,385	15,022
4	36	16,969	4,448	9,356
5	12	6,705	1,578	4,968
6	16	2,947	863	2,575
7	6	2,701	745	6,788
Total	162	110,269	24,725	59,559

¹These data were taken from FWP general and winter distribution maps, updated last in August 2008.

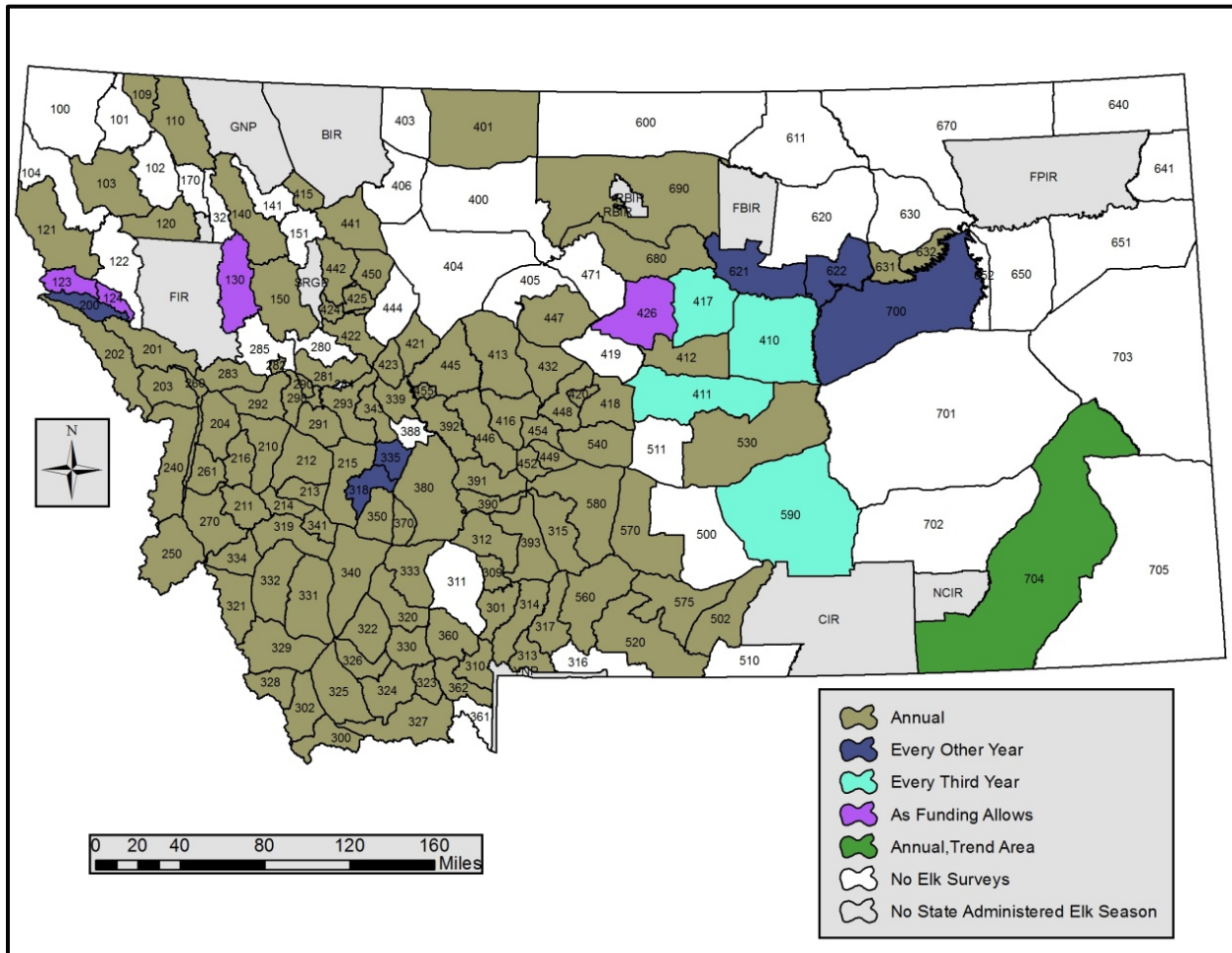


Figure 1. Scheduled periodicity of elk surveys, 2011 elk HD boundaries.

smaller groups, especially bachelor bull herds. Twenty-eight (23.3%) surveys are flown in March through May and are usually done on the winter range under green-up conditions. In green-up surveys biologists look for that early spring period when elk will seek open meadows that green-up well before areas that are shaded or that are at higher elevations. During this early green-up period elk tend to spend time feeding and loafing, and often they will bed in these open meadows on or near winter ranges. Two complete coverage surveys are flown on summer ranges, one in HD 321 and one in HD 334/270. In some years surveys are flown under less than ideal survey conditions, especially in the winter when

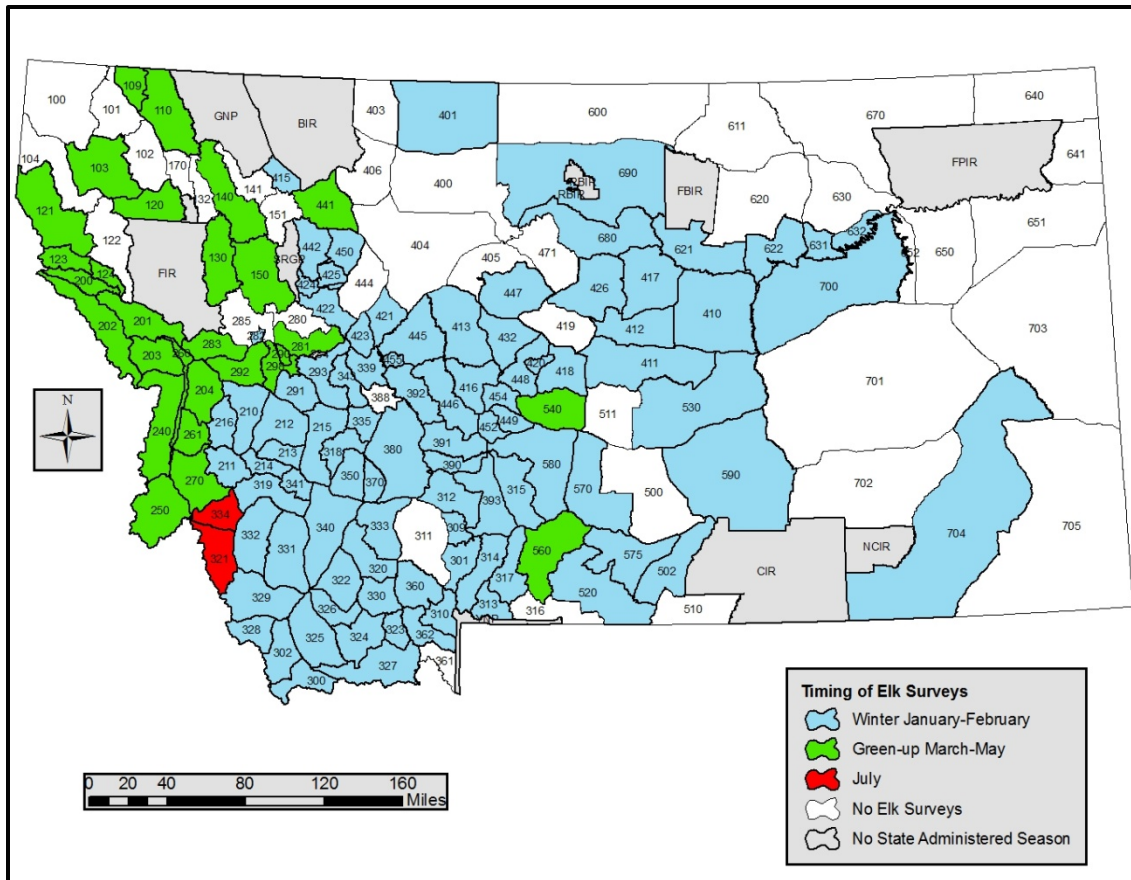


Figure 2. Timing of complete coverage elk surveys, 2011 elk HD boundaries.

severe weather conditions can delay flights. Biologists attempt to fly surveys under the same weather conditions, with the same pilot and aircraft, and at the same time of day year after year however it is often difficult to achieve this consistency. In most cases the same areas are searched for elk, however in areas that take multiple survey runs, spread out over multiple days, biologists will often prioritize and survey areas that are more likely to have the greatest numbers of elk first, followed by areas with decreasing probabilities of finding large groups of elk.

In addition to the more common surveys described above, there are other surveys conducted on elk during the year. Ground classification surveys are conducted on a regular basis in 19 HDs across the state (Figure 3). Often biologists will use aerial surveys to classify bulls and to count total numbers of elk while the ground surveys are used to classify cows and calves. There are 9 HDs where additional surveys are conducted in all or part of the HD (Figure 4). One of those HDs, 590, has two survey areas, one north of Interstate 94 (I-94) and one south. Because of game damage concerns south of I-94 and the length of time it takes to survey the area north of I-94, the herd unit which is south of I-94 is flown annually while the survey area north of I-94 is flown every 3 years. In HD 313 there are two surveys completed, one in the winter and one in early spring. The winter survey focuses on the numbers of elk that leave Yellowstone Park and is flown north of the Park boundary while the spring survey counts elk in and outside the Park. HDs 261, 270/334 and 442 all have additional flights conducted annually in July, designed to gather information on productivity of elk herds by looking at the calf:cow ratio. In HDs 310, 360 and 362 the same elk are surveyed twice a year, once in the winter and once in the early spring period. The winter surveys generally give the best estimate of total numbers while the spring surveys give the best estimate of winter calf survival. HD 700 has a survey that is flown in August with the objective of determining calf:cow ratios in anticipation of the upcoming hunting season. A portion of HD

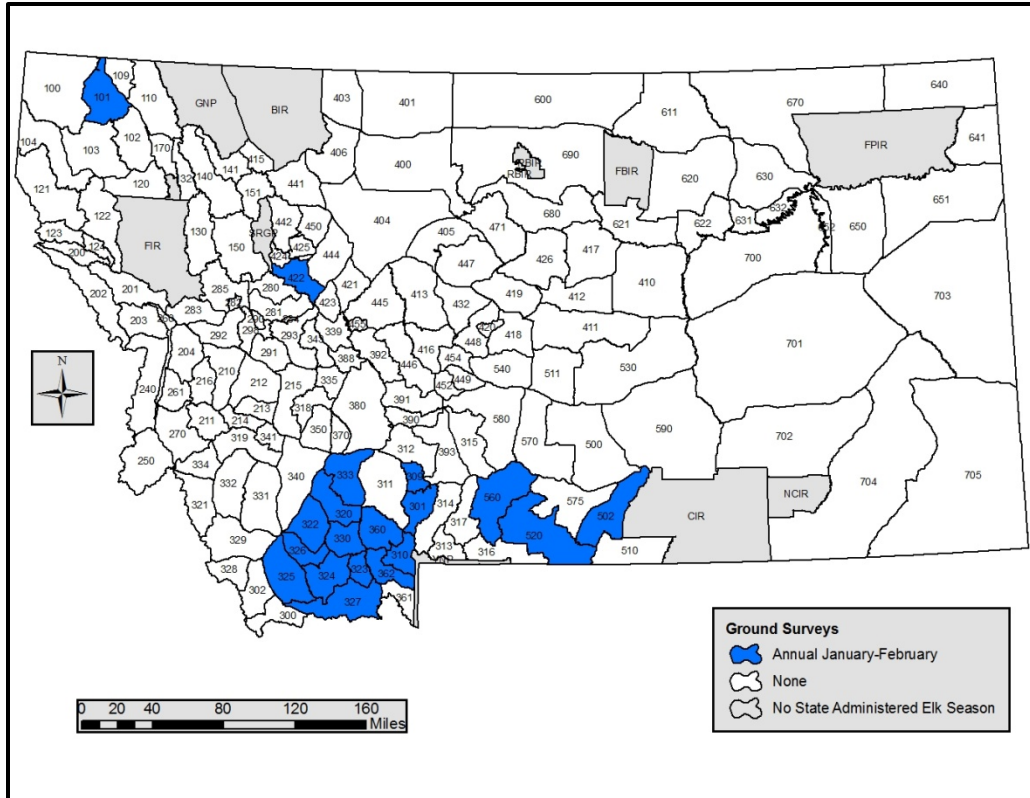


Figure 3. HDs where annual ground classification counts are done, 2010-11.

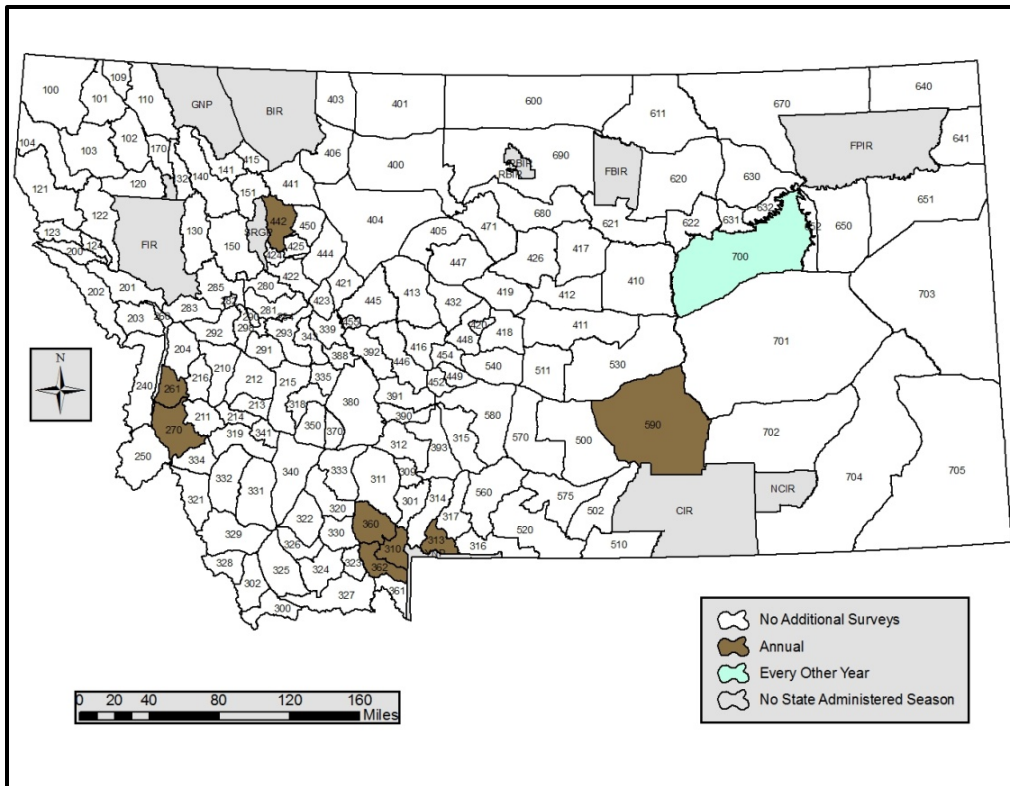


Figure 4. Locations of HDs where additional elk surveys are conducted, 2010-11.

270 is flown in October to determine the proportion of the 270 herd that is located on privately owned lands during the hunting period.

A majority of the elk surveys, 90 of 121 (74.4%) are flown with a fixed-wing aircraft usually a Super Cub or Husky (Figure 5). These airplanes have 2 seats, where the observer sits behind the pilot, and the wings are above the cockpit to facilitate wildlife observations. Twenty-six (21.5%) of 121 surveys are flown with a helicopter and 5 (4.1%) are flown with a combination of helicopter and fixed wing aircraft. In HDs 424, 425, 442 and 450 fixed wing flights are conducted to determine total numbers of cows and calves while helicopter flights are conducted to classify bulls.

In HDs where secondary surveys are completed, 5 surveys are completed with fixed-wing aircraft and 3 are flown with a helicopter. One of the helicopter flights is flown in conjunction with a goat survey.

Unlike antelope where nearly 100% of the biologists agreed that the best survey conditions were relatively cool, calm, and clear mornings, there was more variability in what biologists considered to be excellent survey conditions for elk. Many biologists believed that the best winter survey conditions for elk were days when the ground was 100% covered with fresh snow and temperatures were near or below 0^oF. On clear days with winds less than 15 MPH, elk tend to be out for longer periods of time during the day and bed in open areas where they feed. Under these conditions, biologists are able to track small groups of elk through the snow and counts tend to be excellent. When these winter survey conditions are met, surveys can be conducted at any time of the day, but many biologists feel that early morning surveys increase the odds of getting the best counts. Ideal conditions for spring surveys include ground cover with no snow except for in the timber and at higher elevations, along with cool morning temperatures around 30^o. On clear days with winds under 15 MPH, elk tend to be out for longer periods of time during the day and they may bed in meadows where they were feeding. Under these conditions elk can be surveyed any time during the day, however if it warms up too much elk seek shade. Surveys for elk are usually conducted in terrain that is much steeper than terrain flown for antelope so that most surveys are flown along contours usually up the side of one drainage and down the other (Figure 6). The distance between the tracks taken by the airplane is influenced by steepness of the terrain, amount of openings, density of trees and distance from one side of the drainage to the other side.

Even though most elk surveys are complete coverage surveys we know that the surveys don't result in 100% of the elk being counted; so biologists use the surveys as indices to population trends rather than to enumerate total population sizes. Limited information for estimating total population size from our trend counts is available (Montana Fish, Wildlife and Parks, 2005). Populations can be estimated from surveys in several ways; however costs and the increased time commitment usually make it impractical to estimate the sizes of all elk populations. One of the least complicated, but very expensive ways to estimate populations is to calculate a visibility index. This is done by marking animals, flying a survey and simply calculating the percentage of marked animals observed and then applying that percentage to the rest of the observed population. A second method used to estimate populations is through population reconstruction. Population reconstruction requires good data on harvest, age of animals harvested and excellent classification information. Another method, with the lowest associated costs, commonly used to estimate actual populations is through sightability indexes. When using sightability indexes the surveyor must assign each group of elk observed a probability of being sighted based on covariates such as group size, percent vegetation cover, percent snow cover and animal behavior. Table 2 contains information from all three methods of population estimation used in Montana and although the techniques are different the results illustrate the fact that observability is variable across the state and regardless of the technique used, variable among surveys. All three methods of population estimation would require increased effort and budgets directed at data collection versus the trend indices currently employed around Montana. For most populations it would be impractical, if not impossible, to estimate populations by calculating a visibility index or by trying to collect enough data to reconstruct populations. From a practical standpoint if Montana were to estimate populations, sightability indexes for each elk population or for groups of similar populations would have to be developed. For a more complete discussion on elk observability see the Montana 2005 statewide elk management plan (Montana Fish, Wildlife and Parks, 2005).

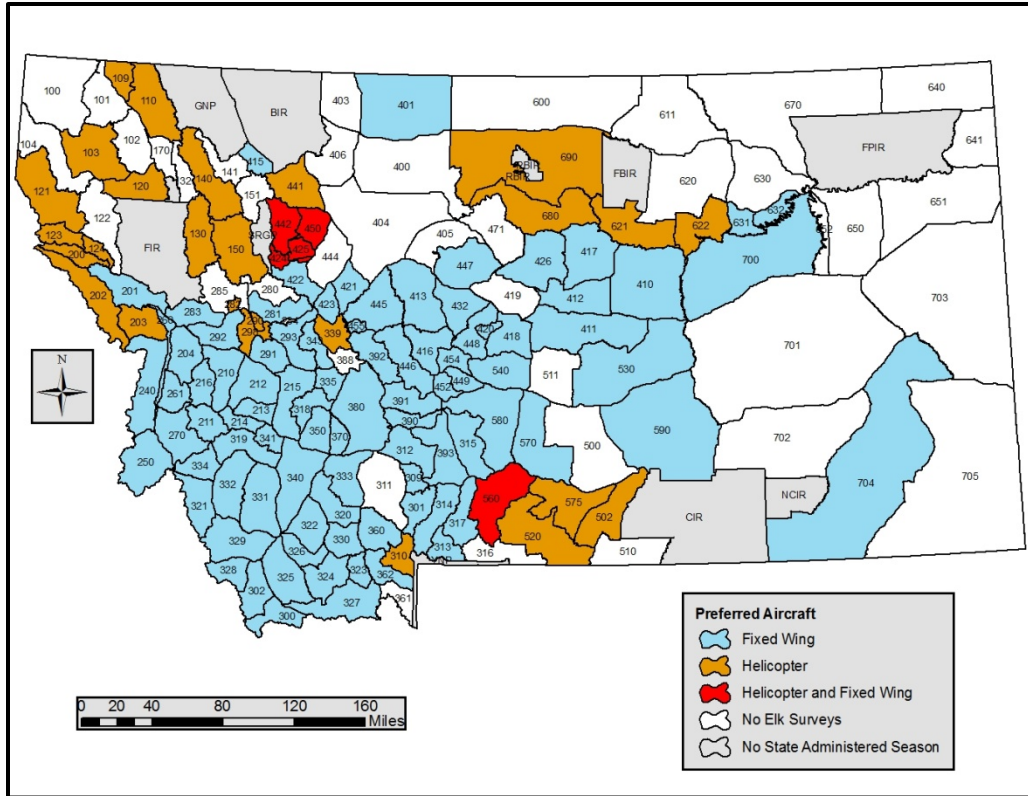


Figure 5. Aircraft type used in elk surveys, 2010-11.

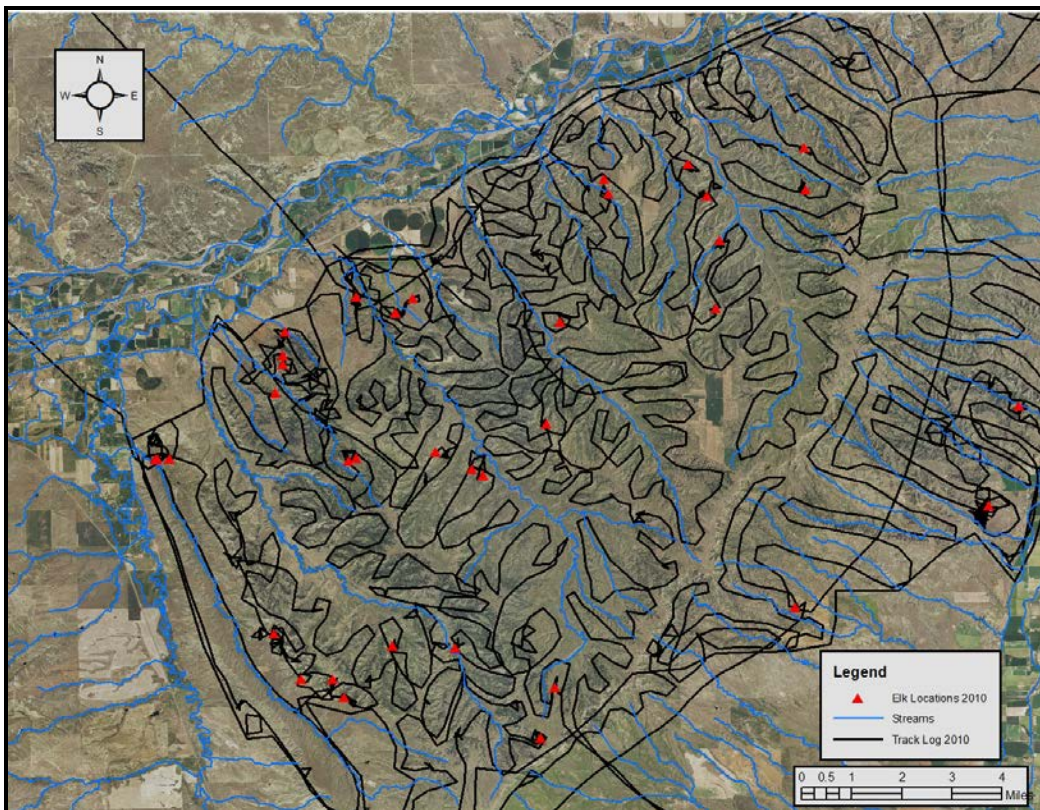


Figure 6. Typical track log for an elk winter survey.

Table 2. Visibility of elk in various habitats across the state of Montana from the 2005 Elk Plan.

Area	Number Flights or Years	Aircraft	Observability or Sightability		Author
			Mean	Range	
Hungry Horse	11 Flights	Fixed-Wing	30.5%	19-45%	Vore and Malta 1994
Hungry Horse	3 Flights	Helicopter	33%	22-46%	Vore and Malta 1994
HD 123	6 Flights	Helicopter	45.8%	25-67%	Henderson et.al.1993
HD 200	9 Flights	Helicopter	35%	25-45%	Henderson et.al.1993
Northern Yellowstone	12 years	Fixed-Wing	74%	53-91%	Singer et. al., 1997
Gravelly-Snowcrest	9 years	Fixed-Wing	71%	56-89%	Hamlin & Ross, 2002

In 2005 an elk management plan was completed for the state of Montana (Montana Fish, Wildlife and Parks, 2005). The entire state was divided into 44 Elk Management Units (EMUs) with one additional EMU added since 2005 (Figure 7). The EMUs combined HDs that had similar habitat, hunting season types, and land ownership patterns. Objectives were established for each EMU population and often for each HD or population segment within an EMU. Recognizing that aerial trend counts are not an exact population enumeration, objective numbers were presented in the plan as point targets for trend surveys with a range (often $\pm 20\%$) established around each point. In addition to total count objectives, total bull number objectives, percent bulls observed and/or bull:cow ratio objectives were set for each EMU or for each HD or population segment within an EMU. As with the count objectives bull number objectives were established with a range around an observed target, usually 20%, while bull:cow ratios and the

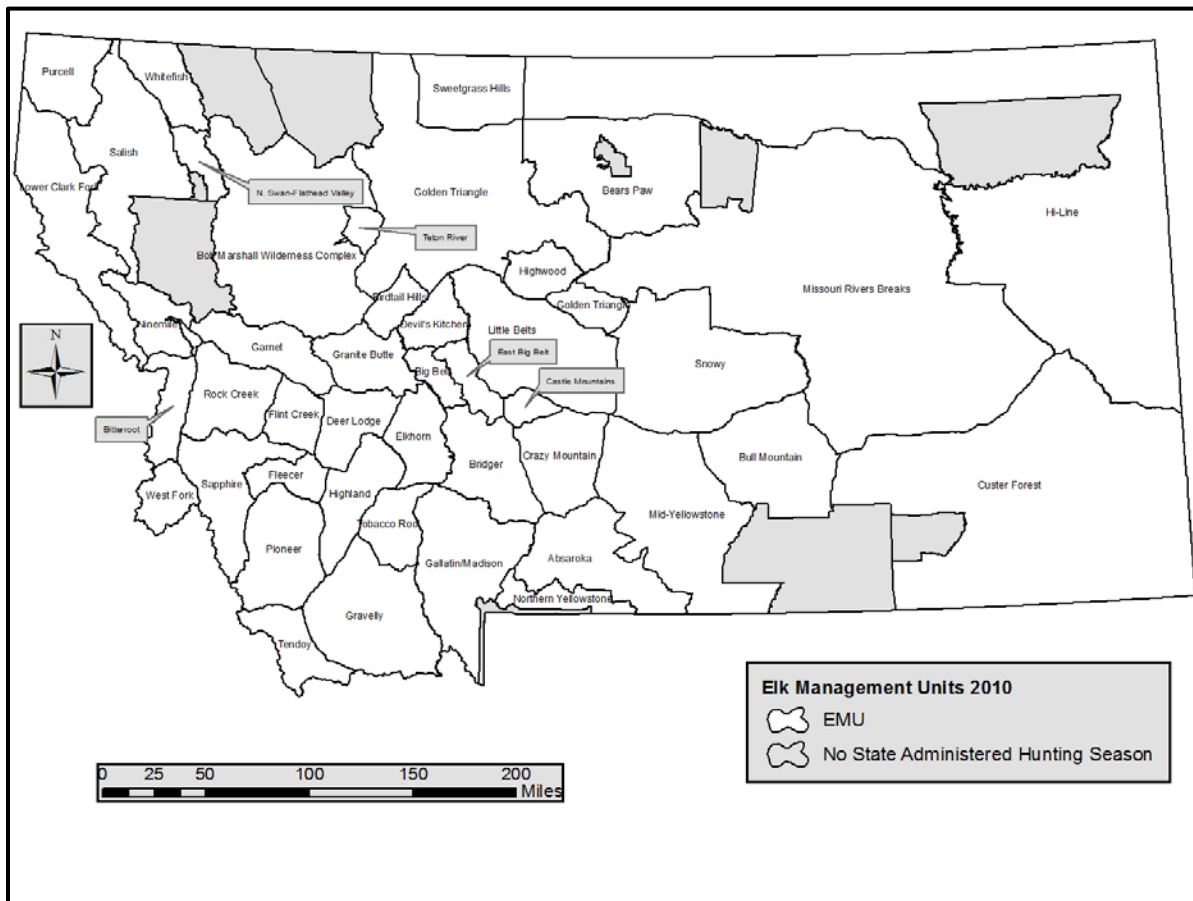


Figure 7. Montana elk EMUs 2011.

percentage of bulls in the count were usually stated as minimum objectives. Finally, some EMUs had additional objectives established for numbers of adult bulls harvested and/or observed in the count. Each EMU addressed how monitoring would be accomplished addressing periodicity of surveys, aircraft type and timing of surveys. In addition, most EMU discussions identified what classes of elk would be recorded on elk surveys, e.g. cows, calves, brow-tined bulls (BTB) and yearling (Yrl) bulls.

Elk Check Station Data

Check stations are run in all 7 Regions during the big game hunting seasons. Big game check stations are designed to collect information on all big game animals harvested, however the location of a check station determines whether more information will be gathered on elk or deer. In addition, the locations of some check stations, such as the Gallatin, were selected because nearly all hunters hunting a specific HD or group of HDs had to pass by the check station in route to their homes. Data collected at check stations vary somewhat by Region and within Regions, depending upon specific needs. Check station data can be broken into four broad categories; data collected describing the check station, the animal, the location of the kill, and the hunter and/or the hunting party. Data collected on the animal is the most consistent across the Regions with all Regions collecting information on species, sex, number of antler points and age of animals (Table 3). Age is determined by tooth eruption and wear for white-tailed deer (Severinghaus 1949) mule deer (Robinette et al. 1957) and elk (Quimby and Gaab 1957) or by collecting an incisor which is sent to Matson's Laboratory, Milltown, Montana where age is determined by cementum analysis for mule deer, white-tailed deer and elk (Hamlin et. al. 2000). The number of points on an animal is recorded differently, with R-5 and R-7 differentiating brow tines from the other points on white-tailed and mule deer. One of the check stations in R-3 and R-4 also differentiate the brow-tine from regular points. In R-6 brow-tines are differentiated for mule deer only. Five of 7 Regions measure the main beam on one or both antler and 4 of 7 measures an inside spread. R-5 measures only the main beam on yearling animals of elk, mule and white-tailed deer, but measures inside spread on all age classes of those same species. One Region measures antler circumference of all antlered animals, and measures diastema and weight of animals that are young of the year or yearlings. In the past, more check stations collected weights and diastema lengths however over time most dropped the measurements in part because of the amount of time it took to move hunters through the check stations.

Location of kill data is collected at all check stations. All but one Region collect the HD of kill, with R-7 recording only the Region of kill for R-7 animals only. All Regions, except for R-6, narrow down the area of kill to a drainage, landowner or in some cases Township, Range and Section (TRS). R-1 and R-2 do not collect data on land status however the other Regions do record land ownership status. R-5 and one check station each in R-3 and R-4 breaks land ownership status into eight categories; private (non-block management), private land enrolled in the Block Management Area (BMAs) program, Bureau of Land Management (BLM), United States Forest Service (USFS), US Fish and Wildlife Service (USFWS), state Wildlife Management Areas (WMAs), other state land, and unknown ownership. R-7 keeps track of 7 categories of land ownership status, including all of the categories listed above except USFWS and WMAs, they specify Custer National Forest instead of (USFS), and sometimes designate land as only public or private. R-6 keeps track of only the kills on BMAs, and the remaining Regions and check stations differentiate land status only as public or private.

The greatest variations in data collected are associated with describing the hunter and hunting party. All Regions collect information on the number of hunters in a party while 6 of 7 Regions collect information on the origin of the hunter or hunting party. Five of 7 Regions keep track of the number in the party that are successful and information about the license or permit type (LPT) that was placed on the animal following the kill. Three of 7 Regions assign each hunting party a group number record a date of kill, and whether the hunting party had an Off-Road Vehicle (ORV). Two of seven Regions keep track of the number of days hunted. R-2 and R-3 record whether or not the party had a horse trailer. The other parameters are collected either by only one Region or in some cases only one check station.

In addition to the previously described data collected, check stations have been used as a place to collect samples to be tested for Chronic Wasting Disease, to gather other biological samples, to interview

Table 3. Check station data collected, relative to elk.¹

Parameter	R-1	R-2	R-3	R- 4	R- 5	R-6	R-7
Check Station Description							
Check Station Name	X	X	X	X	X	X	X
Date of Check Station	X	X	X	X	X	X	X
Animal Description							
Species	X	X	X	X	X	X	X
Sex	X	X	X	X	X	X	X
Age	X	X	X	X	X	X	X
Number of Antler Points	X	X	X	X	X	X	X
Differentiate Brow-tines			X ²	X ²	X	X ³	X
Length of Main Beam 1 or 2 Sides			X	X ²	X ²	X	X
Inside Spread			X ²	X ²	X	X	
Horn Circumference				X ²			
Diastema				X ²			
Weight	X ⁴			X ²			
Location of Kill							
Hunting District	X	X	X	X	X	X	
Landowner/Location/Drainage/ TRS	X	X	X	X	X		X
Land Status ⁵			X ²	X ²	X	X	X
Hunter & Hunting Party							
Number in Party	X	X	X	X	X	X	X
Vehicle License/Origin of Hunter		X	X	X ²	X	X	X
Number in Party Successful		X	X	X		X	X
LPT			X	X ²	X	X ⁶	X
Hunter Name	X	X	X	X			
ALS Number	X	X	X	X			
Group Number		X				X	X
ORV		X	X	X			
Date of Kill		X	X	X			
Days Hunted			X	X ²			
Horse Trailer		X	X				
Resident/Nonresident/Youth		X					
Fee Charged							X
Packer				X ²			
Comments	X	X	X	X	X	X	X

¹ Some questions on the check station forms were relevant to only antelope and are discussed in the chapter on Antelope.

² Varies by check station within the Region.

³ Differentiates brow-tines on mule deer only.

⁴ Up until recently some biologists in R-1 took weights of fawns and yearlings at check stations

⁵ Varies by Region, see text.

⁶ R-6 keeps track of whether the license was valid for either-sex or for antlerless. The other Regions collect an actual LPT number off the license used to harvest an animal.

hunters about specific issues, and by game wardens to check for regulation compliance. Most Regions have an electronic database or databases that hold the check station data. Most Regions keep track of unsuccessful hunters at the check stations; however data associated with unsuccessful hunters are not always entered into the electronic check station databases.

Elk Classification

During elk surveys biologists categorize elk into sex and age classes. Classification categories that are common across Regional and HD boundaries are for cows, calves, unclassified antlerless elk (cows and calves), and unclassified elk - all (bulls, cow and calves). When it comes to bull classification there is a

wide variety of classes used. The following is a brief description of those classes. Yearling bulls are usually synonymous with spikes however there are biologists that classify yearling bulls into two categories, spikes and branched yearlings. There are yearling bulls that have branched antlers however because of their smaller antler and body size they can readily be identified as yearling bulls. Adult bulls are bulls older than 2.5 and are usually bulls that have more than two points on each side of their rack. Brow-tined bulls (BTBs) are bulls that have a brow-tine on the lower ½ of their main beam that is 4 inches long or longer. In most instances a BTB is the same as an adult bull. Non-BTBs are bulls that are adults but do not have a brow-tine.

Some biologists classify bulls into antler classes such as raghorns, 5x5 and >=6x6. The definition of 5x5 and 6x6 bulls is straight-forward with the bull having at least that number of points on both antlers; however the definition of raghorn bull varies amongst biologists. Most biologists define a raghorn as a very small 5x5 bull or a bull which has less than 5 points on at least one antler.

Some biologists classify elk into age classes from yearling up to >=4.5 years old. The definitions for these animals are somewhat subjective and are based on antler and body size with 2.5 year old elk having small 5x5 antlers or 3 or 4 points on each antler. The 3.5 year old bulls are bulls that have larger 5x5 or smaller 6x6 antlers. Bulls having very large antlers and body size, usually with 6 or more points on each antler, are then classified as >=4.5 years old.

Region 1

R-1 has 19 HDs covering an estimated 10,965 sq. mi. of elk habitat. There are 4 biologists with responsibilities for flying 1 or more elk surveys in 10 HDs (Table 4). R-1 personnel have a very difficult

Table 4. Region 1 elk surveys by HD, 2011.

HD	Survey Type ¹	Periodicity	Classification Data Collected ²	General License, Rifle-2011 ³
100	None	None	None	BTB
101	None	None	None	BTB
102	None	None	None	BTB
103	CC	Annual	Cows, Calves, Bulls	BTB
104	None	None	None	BTB
109 ⁴	CC	Annual	Cows, Calves, Yrl & Ad Bulls	BTB
110 ⁴	CC	Annual	Cows, Calves, Yrl & Ad Bulls	BTB
120	CC	Annual	Cows, Calves, Yrl & Ad Bulls	BTB
121	CC	Annual	Cows, Calves, Yrl & Ad Bulls	BTB
122	None	None	None	BTB
123	CC	As Funding Allows	Cows, Calves, Yrl & Ad Bulls	BTB
124	CC	As Funding Allows	Cows, Calves, Yrl & Ad Bulls	BTB
130	CC	As Funding Allows	Cows, Calves, Yrl & Ad Bulls	BTB
132	None	None	None	BTB
140	CC	Annual	Cows, Calves, Yrl & Ad Bulls	BTB
141	None	None	None	BTB
150	CC	Annual	Cows, Calves, Yrl & Ad Bulls	BTB
151	None	None	None	BTB
170	None	None	None	BTB or Ant-

¹ CC=Complete coverage survey.

² Biologists occasionally have groups of elk that are unclassified cows and calves, unclassified all (cows, calves & bulls) or groups of bulls that are unclassified, Yrl=yearling bull, Ad=adult bull.

³ BTB=brow-tined bull, ANT=antlerless. Season type for general license holders in the rifle season, not including youth hunters or those with a permit to hunt from a vehicle.

⁴ Classified as complete coverage surveys however rarely can the counts be used to monitor trends in total numbers of elk.

time surveying elk because the elk often winter in heavily timbered areas and are difficult to find, count and classify. Biologists in the Region count on getting good information on calf:cow and bull:cow ratios in order to set seasons, and complete coverage surveys in R-1 may or may not yield valid estimates of population trends. Most R-1 surveys are scheduled to be completed on an annual basis, but poor weather conditions and a continual shortage of qualified pilots often interfere with scheduled flights. Biologists in R-1 classify elk to yearling and adult bulls, cows and calves. Waypoint locations for each group of elk are recorded, although one biologist does not mark individual elk or very small groups of elk, and track logs showing the survey flight pattern are collected and stored. Two biologists download waypoint and track log data from their GPS units through MapSource and the other 2 biologists use DNR Garmin. Classification and waypoint data are combined into data tables which are stored in Excel or shapefiles on 2 of the 4 biologists' computers (Table 5).

Table 5. Data collection and storage of elk survey data by Region 1 biologists.

Biologist	Upload Wpts & Track Logs	Classification Data Collected ¹	Program Used to Combine Classification & Location Data
Chilton-Radandt	DNR Garmin	Cows, Calves, Bulls	Excel
Sterling	Map Source	Cows, Calves, Yrl & Ad Bulls	No
Thier	Map Source	Cows, Calves, Yrl & Ad Bulls	No
Vore	DNR Garmin	Cows, Calves, Yrl & Ad Bulls	Shape Files for ArcMap

¹ Biologists occasionally have groups of elk that are unclassified cows and calves, unclassified all (cows, calves & bulls) or groups of bulls that are unclassified, Yrl=yearling bull, Ad=adult bull.

Because it is so difficult to survey animals in R-1 biologists rely heavily on harvest information to monitor big game populations. R-1 has 6 check stations scattered across the Region which are all open both weekend days throughout the deer and elk hunting season, resulting in 72 check station-days (Figure 8).

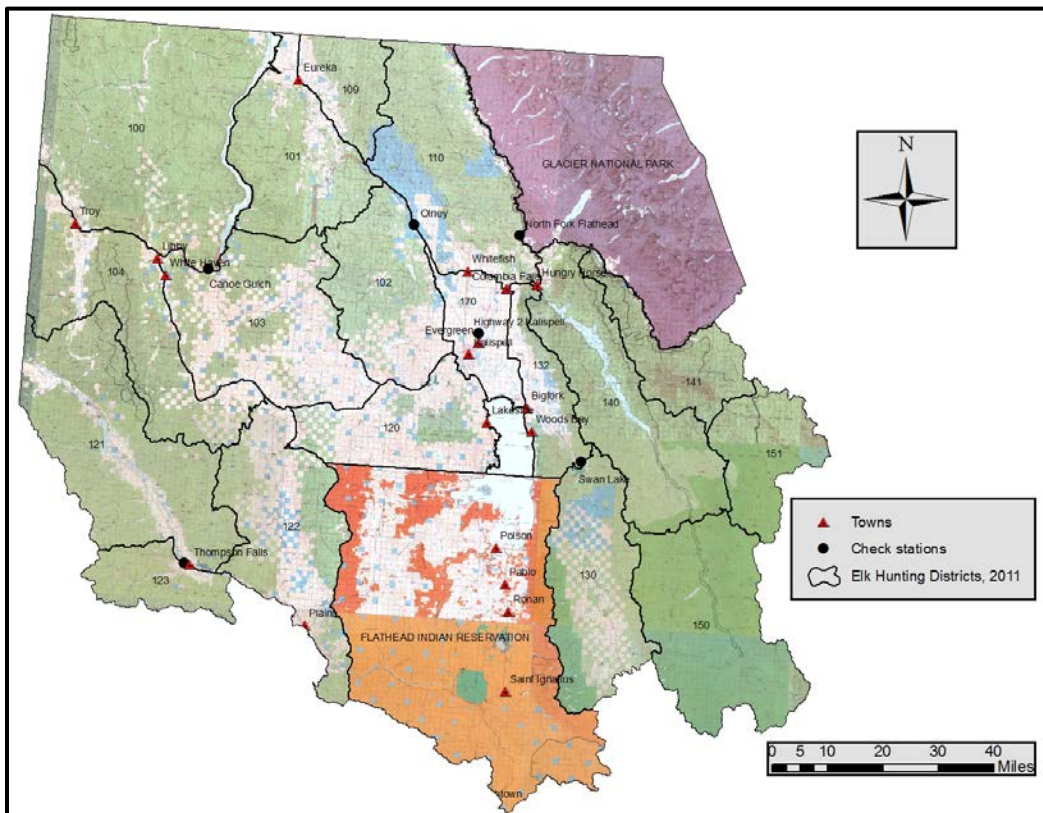


Figure 8. Location of check stations R-1, 2011 hunting season.

Region 2

R-2 has 28 HDs covering an estimated 9,885 sq. mi. of elk habitat. There are 4 biologists with responsibilities for flying 1 or more elk surveys in 27 HDs. Biologists in the Region have 27 aerial surveys to complete on elk, with every HD except 3, receiving at least one survey (Table 6). Of the 27 surveys, 25 are scheduled annually and 2 biennially. The primary surveys in each HD are complete coverage surveys.

Table 6. Region 2 elk surveys by HD.

HD	Survey Type ¹	Periodicity	Classification Data Collected ²	General License, Rifle-2011 ³
200	CC	Biennial	Cows, Calves, Yrl & BTB	BTB
201	CC	Biennial	Cows, Calves, Yrl & BTB	BTB
202	CC	Annual	Cows, Calves, Yrl & BTB	BTB
203	CC	Annual	Cows, Calves, Yrl & BTB	BTB
204	CC	Annual	Cows, Calves, Yrl & BTB	BTB
210	CC	Annual	Cows, Calves, Yrl & BTB	BTB
211	CC	Annual	Cows, Calves, Yrl & BTB	BTB
212	CC	Annual	Cows, Calves, Yrl & BTB	BTB
213	CC	Annual	Cows, Calves, Yrl & BTB	BTB
214	CC	Annual	Cows, Calves, Yrl & BTB	BTB
215	CC	Annual	Cows, Calves, Yrl & BTB	BTB
216	CC	Annual	Cows, Calves, Yrl & BTB	BTB
240	CC	Annual	Cows, Calves, Yrl & BTB	BTB
250	CC	Annual	Cows, Calves, Yrl & BTB	BTB
260	CC	Annual	Cows, Calves, Yrl & BTB	BTB
261	CC	Annual	Cows, Calves, Yrl & BTB	BTB
	July	Annual		
	CC	Annual		
270	July	Annual	Cows, Calves, Yrl & BTB	BTB
	October	Annual		
280	No Surveys	NA	NA	BTB or Ant-
281	CC	Annual	Cows, Calves, Yrl & BTB	BTB
282	CC	Annual	Cows, Calves, Yrl & BTB	BTB
283	CC	Annual	Cows, Calves, Yrl & BTB	BTB
284	No Surveys	NA	NA	Other ⁴
285	No Surveys	NA	NA	BTB
290	CC	Annual	Cows, Calves, Yrl & BTB	ANT-
291	CC	Annual	Cows, Calves, Yrl & BTB	BTB
292	CC	Annual	Cows, Calves, Yrl & BTB	BTB
293	CC	Annual	Cows, Calves, Yrl & BTB	BTB
298	CC	Annual	Cows, Calves, Yrl & BTB	BTB or Ant-

¹ CC=Complete coverage survey.

² Biologists occasionally have groups of elk that are unclassified cows and calves, unclassified all (cows, calves & bulls) or groups of bulls that are unclassified, Yrl=yearling bull, BTB=brow-tined bull.

³ BTB=brow-tined bull, ANT-=antlerless. Season type for general license holders in the rifle season, not including youth hunters or those with a permit to hunt from a vehicle (PTHV).

⁴ No general season type for most hunters using a rifle, however there may be permits, a general rifle season for youth hunters or those with a (PTHV) and/or archery seasons.

All 4 biologists in R-2 classify elk to brow-tined-bull and yearling bull classes, cows and calves. Waypoint locations for each group of elk and track logs showing the survey flight pattern are collected and stored. The waypoint and track log data are downloaded from the GPS units through MapSource by 1 biologist and through DNR Garmin by the other 3 biologists. Classification and waypoint data are combined into data tables which are stored in Excel or shapefiles on 3 of the 4 biologists' computers (Table 7).

Table 7. Data collection and storage of flight data by R-2 biologists.

Biologist	Upload Wpts & Track Logs	Classification Data Collected ¹	Program Used to Combine Classification & Location Data
Edwards	DNR Garmin	Cows, Calves, Yrl & BTB	ArcMap
Jourdonnais	DNR Garmin	Cows, Calves, Yrl & BTB	No
Kolbe	DNR Garmin	Cows, Calves, Yrl & BTB	Excel, ArcMap
Vinkey	MapSource	Cows, Calves, Yrl & BTB	Excel

¹ Biologists occasionally have groups of elk that are unclassified cows and calves, unclassified all (cows, calves & bulls) or groups of bulls that are unclassified, Yrl=yearling bull, BTB=brow-tined bull.

There are 3 check stations open in R-2 during the deer and elk hunting season (Figure 9). The Darby check station is open every day of the deer and elk season (37 days) while the Anaconda and Bonner check stations are each open for 12 days resulting in a total of 61 check station-days.

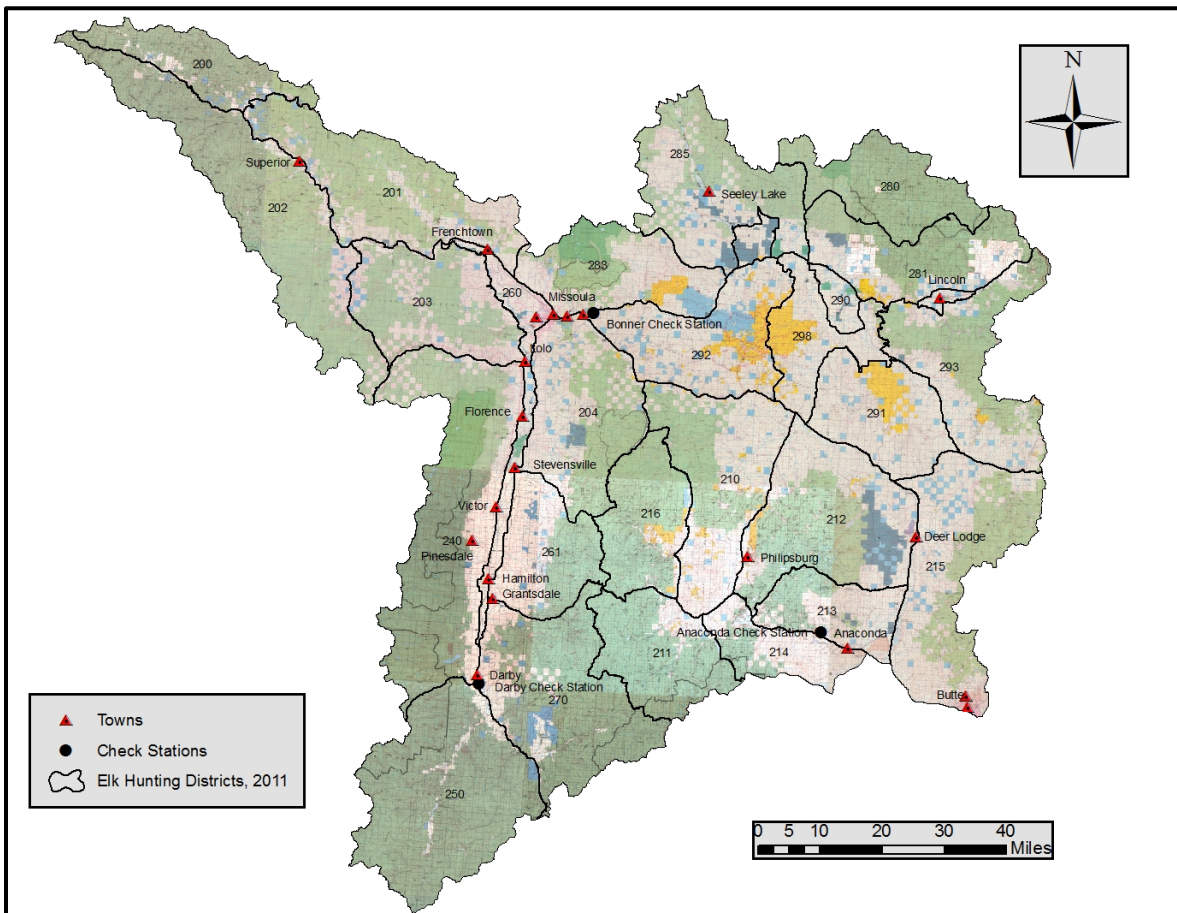


Figure 9. Location of check stations R-2, 2011.

Region 3

R-3 has 45 HDs covering an estimated 15,022 sq. mi. of elk habitat. There are 7 biologists with responsibilities for flying 1 or more elk surveys in 41 HDs. Biologists in the Region have 45 aerial elk surveys to complete with every HD except 4 receiving at least one survey. Of the 45 surveys, 43 are scheduled to be flown annually and 2 biennially (Table 8). The primary surveys in each HD are complete coverage surveys.

All 7 biologists classify cows and calves when possible and they will also try to classify bulls in the large cow/calf groups even if they can't classify cows and calves. Four of the 7 biologists classify bulls to Yrl and BTBs. One biologist classifies bulls to Yrl, raghorn, and Ads \geq to 3.5 years old. One biologist classifies bulls to Yrl, 2.5, 3.5 and \geq 4.5 years old and one biologist classifies spike yearlings, branched yearlings and BTBs. Waypoint locations for each group of elk and track logs showing the survey flight pattern are collected and stored by all 7 biologists. The waypoint and track log data are downloaded from the GPS units through the program All-Topo by 1 biologist and through DNR Garmin by the other 6 biologists. Classification and waypoint data are combined into data tables which are stored in Excel or Shapefiles on 2 of 7 biologists' computers, combined and stored in Microsoft Word on 2 biologists' computers and 3 biologists do not combine classification and waypoint data (Table 9).

There are 5 check stations open in R-3 during the deer and elk hunting season (Figure 10). All 5 check stations are open each weekend day of the season (12 days) for a total of 60 check station-days. The Gardiner check station has not been open since the late-season elk hunt in HD 313 was eliminated in 2010. In addition, the Ruby and Blacktail check stations were permanently closed in 2011.

Table 8. Region 3 elk surveys by HD, 2011.

HD	Survey Type ¹	Periodicity	Classification Data Collected ²	General License, Rifle-2011 ³
300	CC	Annual	Cows, Calves, Yrl & BTB	BTB or Ant- ²
301	CC	Annual	Cows, Calves, Yrl & BTB	BTB or Ant-
302	CC	Annual	Cows, Calves, Yrl & BTB	ANT-
309	CC	Annual	Cows, Calves, Yrl & BTB	Either-Sex
310	CC, Winter	Annual	Cows, Calves, Yrl, 2.5, 3.5 and 4.5+ year old bulls,	Other ⁴
	CC, Spring	Annual		
311	No Survey	NA	NA	BTB or Ant-
312	CC	Annual	Cows, Calves, Yrl & BTB	BTB or Ant-
313	CC, Winter	Annual	Cows, Calves, Yrl & BTB	BTB
	CC, Spring	Annual		
314	CC	Annual	Cows, Calves, Yrl & BTB	BTB or Ant-
315	CC	Annual	Cows, Calves, Yrl & BTB	BTB or Ant-
316	No Surveys	NA	NA	Any Bull
317	CC	Annual	Cows, Calves, Yrl & BTB	BTB or Ant- ⁵
318	CC	Biennial	Cows, Calves, Yrl & BTB	BTB
319	CC	Annual	Cows, Calves, Yrl & BTB	BTB
320	CC	Annual	Cows, Cows, Calves, Yrl, Raghorn, & Ad \geq 3.5 years	BTB or Ant-
321	CC, July	Annual	Cows, Calves, Yrl & BTB	BTB or Ant-
322	CC	Annual	Cows, Cows, Calves, Yrl, Raghorn, & Ad \geq 3.5 years	BTB or Ant- ⁵
323	CC	Annual	Cows, Cows, Calves, Yrl, Raghorn, & Ad \geq 3.5 years	BTB or Ant- ⁵
324	CC	Annual	Cows, Cows, Calves, Yrl, Raghorn, & Ad \geq 3.5 years	BTB or Ant- ⁵

Table 8. (cont.)

HD	Survey Type ¹	Periodicity	Classification Data Collected ¹	General License, Rifle-2011 ²
325	CC	Annual	Cows, Cows, Calves, Yrl, Raghorn, & Ad >=3.5 years	BTB or Ant- ⁵
326	CC	Annual	Cows, Cows, Calves, Yrl, Raghorn, & Ad >=3.5 years	BTB or Ant- ⁵
327	CC	Annual	Cows, Cows, Calves, Yrl, Raghorn, & Ad >=3.5 years	BTB or Ant- ⁵
328	CC	Annual	Cows, Calves, Yrl & BTB	BTB or Ant- ⁵
329	CC	Annual	Cows, Calves, Yrl & BTB	BTB
330	CC	Annual	Cows, Cows, Calves, Yrl, Raghorn, & Ad >=3.5 years	BTB or Ant- ⁵
331	CC	Annual	Cows, Calves, Yrl & BTB	BTB
332	CC	Annual	Cows, Calves, Yrl & BTB	Any Bull
333	CC	Annual	Cows, Cows, Calves, Yrl, Raghorn, & Ad >=3.5 years	BTB or Ant-
334	CC, July	Annual	Cows, Calves, Yrl & BTB	BTB
335	CC	Biennial	Cows, Calves, Yrl & BTB	BTB
339	CC	Annual	Cows, Calves, Yrl & BTB	Spk Bull ³ or Ant-
340	CC	Annual	Cows, Calves, Yrl & BTB	BTB
341	CC	Annual	Cows, Calves, Yrl & BTB	BTB
343	CC	Annual	Cows, Calves, Yrl & BTB	BTB or Ant- ⁵
350	CC	Annual	Cows, Calves, Yrl & BTB	BTB
360	CC, Winter	Annual	Cows, Calves, Yrl, 2.5, 3.5 and 4.5+ year old bulls,	BTB or Ant-
	CC, Spring	Annual		
361 ⁶	No Survey	NA	NA	BTB or Ant-
362 ⁶	CC, Winter	Annual	Cows, Calves, Yrl, 2.5, 3.5 and 4.5+ year old bulls,	BTB or Ant-
	CC, Spring	Annual		
370	CC	Annual	Cows, Calves, Yrl & BTB	BTB
380	CC	Annual	Cows, Calves, Spike & Branched Yrls & BTB	Spk Bull or Ant-
388	No Survey	NA	NA	Spk Bull or Ant-
390	CC	Annual	Cows, Calves, Yrl & BTB	BTB or Ant-
391	CC	Annual	Cows, Calves, Yrl & BTB	BTB
392	CC	Annual	Cows, Calves, Yrl & BTB	BTB
393	CC	Annual	Cows, Calves, Yrl & BTB	BTB or Ant-

¹ CC=Complete coverage survey.

² Biologists occasionally have groups of elk that are unclassified cows and calves, unclassified all (cows, calves & bulls) or groups of bulls that are unclassified, Yrl=yearling bull, Ad=adult bull.

³ BTB=brow-tined bull, ANT-=antlerless. Season type for general license holders in the rifle season, not including youth hunters or those with a permit to hunt from a vehicle (PTHV).

⁴ No general season type for most hunters using a rifle, however there may be permits, a general rifle season for youth hunters or those with a (PTHV) and/or archery seasons.

⁵ BTB and ANT- for portion of season and BTB only for portion of season or BTB and ANT- on private land.

⁶ When flying 362, some elk are often observed in 361 however there is no dedicated survey for 361.

Table 9. Data collection and storage of flight data by Region 3 biologists.

Biologist	Upload Wpts & Track Logs	Classification Data Collected ¹	Program Used to Combine Classification & Location Data
Boccardori	DNR Garmin	Cows, Calves, Yrl & BTB	Microsoft Word
Brannon	All-Topo	Cows, Cows, Calves, Yrl, Raghorn, & Ad ≥ 3.5	No
Carlsen	DNR Garmin	Cows, Calves, Spk & Branched Yrls & BTB	No
Cunningham	DNR Garmin	Cows, Calves, Yrl, 2.5, 3.5 and Ad ≥ 4.5	Excel, & Shape Files for ArcMap
Fager	DNR Garmin	Cows, Calves, Yrl & BTB	Microsoft Word
Loveless	DNR Garmin	Cows, Calves, Yrl & BTB	No
Sika	DNR Garmin	Cows, Calves, Yrl & BTB	Access & Shape Files for ArcMap

¹ Biologists occasionally have groups of elk that are unclassified cows and calves, unclassified all (cows, calves & bulls) or groups of bulls that are unclassified, Spk=spike yearling, Yrl=yearling bull, BTB=brow-tined bull, Ad=adult bull.

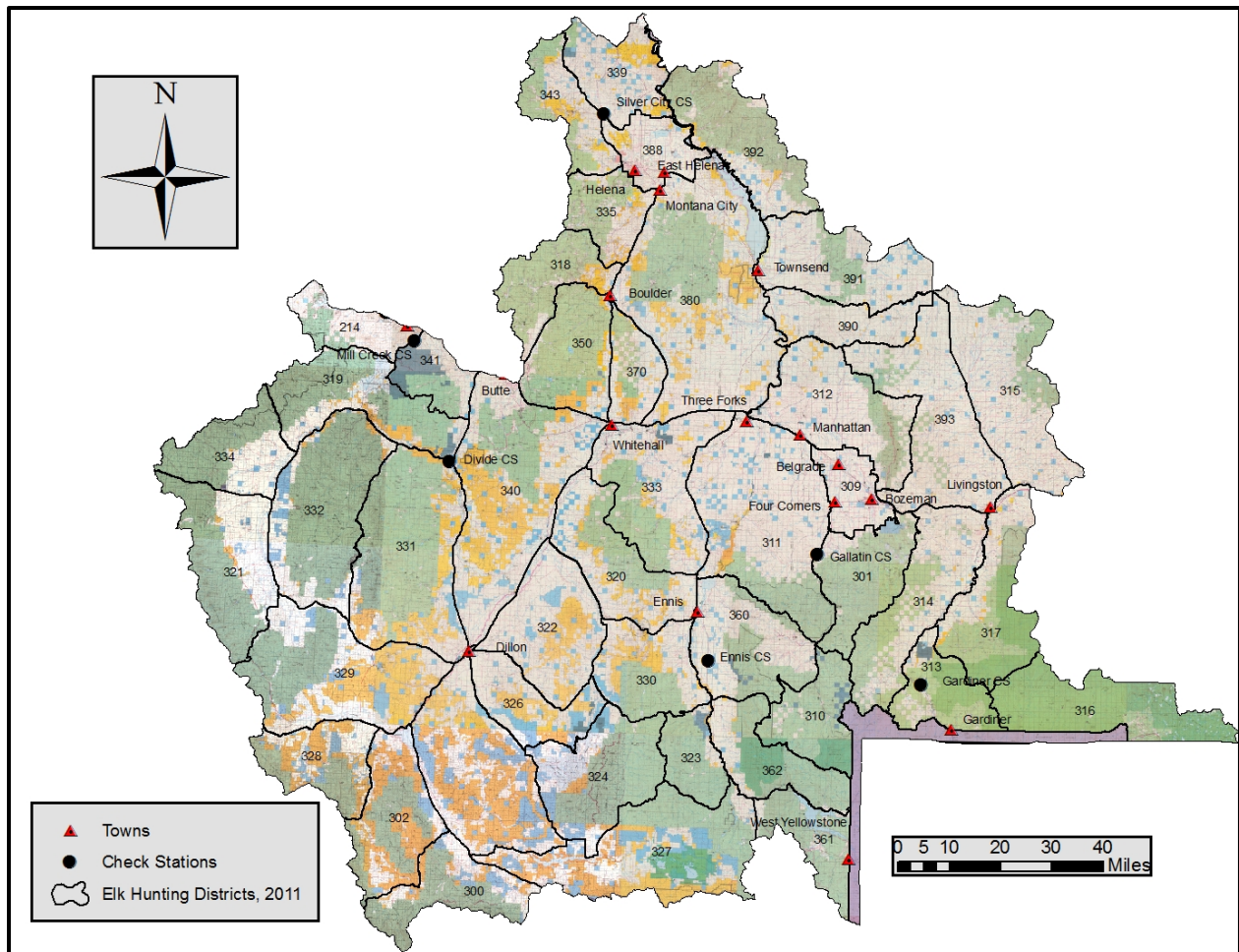


Figure 10. Location of check stations R-3, 2011 hunting season. Gardiner check station currently closed.

Region 4

R-4 has 36 HDs covering an estimated 9,356 sq. mi. of elk habitat. There are 5 biologists with responsibilities for flying 1 or more elk surveys in 28 HDs. Biologists in the Region have 29 aerial elk surveys to complete, with every HD except 8 receiving at least one survey. Of the 29 surveys, 23 are scheduled to be flown annually, 3 every 3 years, 2 biennially and 1 is surveyed only if funding and time allow (Table 10). The primary surveys in each HD are complete coverage surveys.

All 5 biologists break out cows and calves when possible and they will also try to classify bulls in the large cow/calf groups even if they can't classify cows and calves. Three of the 5 biologists classify bulls to BTB and Yrl bulls. One biologist classifies bulls to Yrl, raghorn, and Ads and one biologist classifies bulls to Yrl, raghorn, 5x5 and 6x6. Waypoint locations for each group of elk and track logs showing the survey flight pattern are collected and stored by all 5 biologists. The waypoint and track log data are downloaded from the GPS units through DNR Garmin. Classification and waypoint data are combined into data tables which are stored in Excel, Word or Shapefiles on 4 of 5 biologists' computers and 1 biologist doesn't combine classification and waypoint data (Table 11).

Table 10. Region 4 elk surveys by HD.

HD	Survey Type ¹	Periodicity	Classification Data Collected ²	General License, Rifle-2011 ³
400	None	NA	NA	Either-Sex
401	CC	Annual	Cows, Calves, Yrl, Raghorn, Ad	Other ⁴
403	None	NA	NA	Other ⁴
404	None	NA	NA	Either-Sex
405	None	NA	NA	Either-Sex
406	None	NA	NA	Either-Sex
410	CC	Every 3 Years	Cow, Calves, Yrl, Ad, 5x5 &=>=6X6 Bulls	None
411	CC	Every 3 Years	Cow, Calves, Yrl, Ad, 5x5 &=>=6X6 Bulls	Ant-
412	CC	Annual	Cow, Calves, Yrl, Ad, 5x5 &=>=6X6 Bulls	Other ⁴
413	CC	Annual	Cows, Calves, Yrl & BTB	Either-Sex
415	CC	Annual	Cows, Calves, Yrl, Raghorn, Ad	Either-Sex ⁵
416	CC	Annual	Cows, Calves, Yrl & BTB	Either-Sex
417	CC	Every 3 Years	Cow, Calves, Yrl, Ad, 5x5 &=>=6X6 Bulls	Other ⁴
418	CC	Annual	Cows, Calves, Yrl & BTB	Either-Sex
419	None	NA	NA	Either-Sex
420	CC	Annual	Cows, Calves, Yrl & BTB	Other ⁴
421	CC	Annual	Cows, Calves, Yrl & BTB	Either-Sex
422	CC	Annual	Cows, Calves, Yrl & BTB	Either-Sex
423	CC	Annual	Cows, Calves, Yrl & BTB	BTB or Ant-
424	CC	Annual	Cows, Calves, Yrl & BTB	BTB or Ant- ⁶
425	CC	Annual	Cows, Calves, Yrl & BTB	Ant-
426	CC	As Funding Allows Very Rarely	Cow, Calves, Yrl, Ad, 5x5 &=>=6X6 Bulls	Other ⁴
432	CC	Annual	Cows, Calves, Yrl & BTB	Either-Sex
441	CC	Annual	Cows, Calves, Yrl, Raghorn, Ad	Any Bull
442	CC Partial, July	Annual	Cows, Calves, Yrl & BTB	BTB or Ant- ⁶
444	None	NA	NA	Either-Sex
445	CC	Annual	Cows, Calves, Yrl & BTB	Either-Sex ⁵

Table 10. (cont)

HD	Survey Type ¹	Periodicity	Classification Data Collected ²	General License, Rifle-2011 ³
446	CC	Annual	Cows, Calves, Yrl & BTB	BTB or Ant-
447	CC	Annual	Cows, Calves, Yrl & BTB	Other ⁴
448	CC	Annual	Cows, Calves, Yrl & BTB	Any Bull ⁶
449	CC	Annual	Cows, Calves, Yrl & BTB	Either-Sex
450	CC	Annual	Cows, Calves, Yrl & BTB	None
452	CC	Annual	Cows, Calves, Yrl & BTB	Either-Sex
454	CC	Annual	Cows, Calves, Yrl & BTB	Either-Sex
455	CC	Annual	Cows, Calves, Yrl & BTB	None
471	None	NA	NA	Either-Sex

¹ CC=Complete coverage survey.

² Biologists occasionally have groups of elk that are unclassified cows and calves, unclassified all (cows, calves & bulls) or groups of bulls that are unclassified, Yrl=yearling, Ad=adult, BTB=brow-tined bulls.

³ BTB=brow-tined bull, ANT=antlerless. Season type for general license holders in the rifle season, not including youth hunters or those with a permit to hunt from a vehicle (PTHV).

⁴ No general season type for most hunters using a rifle, however there may be permits, a general rifle season for youth hunters or those with a (PTHV) and/or archery seasons.

⁵ Either-sex for portion of season and any bull for portion of season.

⁶ Special restrictions apply.

Table 11. Data collection and storage of flight data by R-4 biologists.

Biologist	Upload Wpts & Track Logs	Classification Data Collected ¹	Program Used to Combine Classification & Location Data
Grove	DNR Garmin	Cows, Calves, Yrl & BTB	Shape Files for ArcMap
Loecker	DNR Garmin	Cows, Calves, Yrl & BTB	Excel, Word, Shapefiles for ArcMap
Lonner	DNR Garmin	Cows, Calves, Yrl & BTB	Excel & Word
Olson	DNR Garmin	Cows, Calves, Yrl, Raghorn, Ad	None
Smith	DNR Garmin	Cow, Calves, Yrl, Ad, 5x5 & >=6X6 Bulls	Excel

¹ Biologists occasionally have groups of elk that are unclassified cows and calves, unclassified all (cows, calves & bulls) or groups of bulls that are unclassified, Yrl=yearling bull, BTB=brow-tined bull, Ad=adult bull.

There is 1 permanent big game check station open in Region 4 during the big game hunting season (Figure 11). The check station is located in Augusta and is open every day (37 days) of the general deer and elk season. There is also a check station open in the White Sulphur Springs area although it is not permanent and is usually open for only one or two days at the beginning of the season.

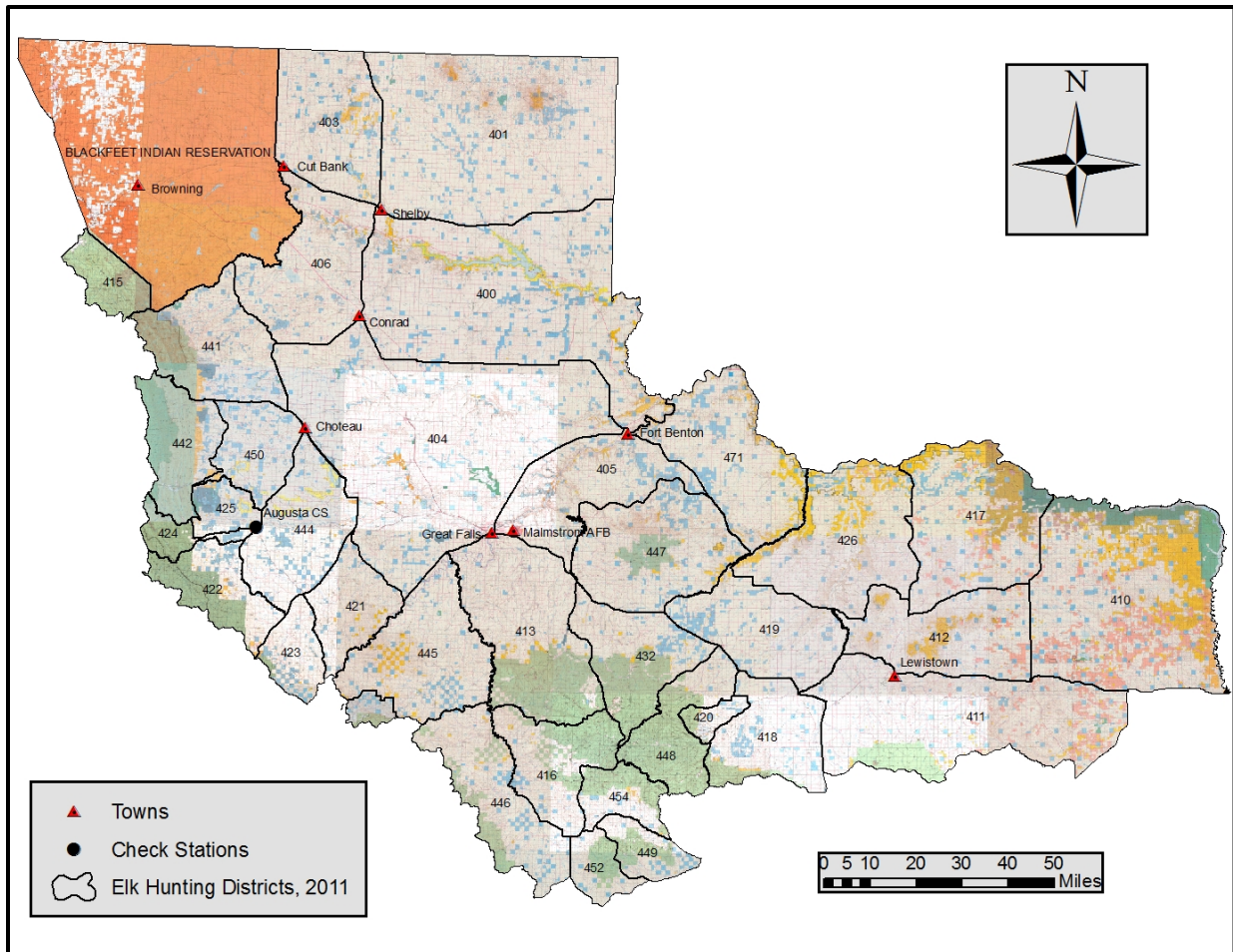


Figure 11. Location of permanent check stations R-4, 2011 hunting season.

Region 5

R-5 has 12 HDs covering an estimated 4,968 sq. mi. of elk habitat. There are 3 biologists with responsibilities for flying 1 or more elk surveys in 9 HDs. Biologists in the Region have 10 aerial elk surveys to complete. Of the 10 surveys, nine are scheduled to be flown annually, and one is flown every three years (Table 12). The primary surveys in each HD are complete coverage surveys. All 5 biologists break out cows and calves when possible and they will also try to classify bulls in the large cow/calf groups even if they can't classify cows and calves. All 3 biologists classify bulls to BTB and Yrl bulls. Waypoint locations for each group of elk and track logs showing the survey flight pattern are collected and stored by all 3 biologists. The waypoint and track log data are downloaded from the GPS units through DNR Garmin. Classification and waypoint data are combined into data tables which are stored in Excel, or Shapefiles on 2 of 3 biologists' computers and 1 biologist doesn't combine classification and waypoint data (Table 13).

There are 4 permanent big game check stations open in R-5 during the deer and elk hunting season (Figure 12). The Big Timber, Columbus, Laurel and Lavina check stations are open 8, 12, 6 and 8 days, respectively for a total of 34 check station-days during the deer and elk hunting season.

Table 12. Region 5 elk surveys by HD.

HD	Survey Type ¹	Periodicity	Classification Data Collected ²	General License, Rifle-2011 ³
500	None	NA	NA	ANT-
502	CC	Annual	Cows, Calves, Yrl & BTB	ANT-
510	None	NA	NA	ANT-
511	None	NA	NA	ANT-
520	CC	Annual	Cows, Calves, Yrl & BTB	Any Bull ⁴
530	CC	Annual	Cows, Calves, Yrl & BTB	ANT-
540	CC	Annual	Cows, Calves, Yrl & BTB	Either-Sex
560	CC	Annual	Cows, Calves, Yrl & BTB	Either-Sex ⁴
570	CC	Annual	Cows, Calves, Yrl & BTB	ANT-
575	CC	Annual	Cows, Calves, Yrl & BTB	ANT-
580	CC	Annual	Cows, Calves, Yrl & BTB	Either-Sex ⁴
	CC	Annual		
		South of I-90		
590			Cows, Calves, Yrl & BTB	ANT-
	CC	Every 3 years		
		North of I-90		

¹ CC=Complete coverage survey.

² Biologists occasionally have groups of elk that are unclassified cows and calves, unclassified all (cows, calves & bulls) or groups of bulls that are unclassified, Yrl=yearling bull, BTB=brow-tined bull.

³ BTB=brow-tined bull, ANT=antlerless. Season type for general license holders in the rifle season, not including youth hunters or those with a permit to hunt from a vehicle (PTHV).

⁴ Portion of HD.

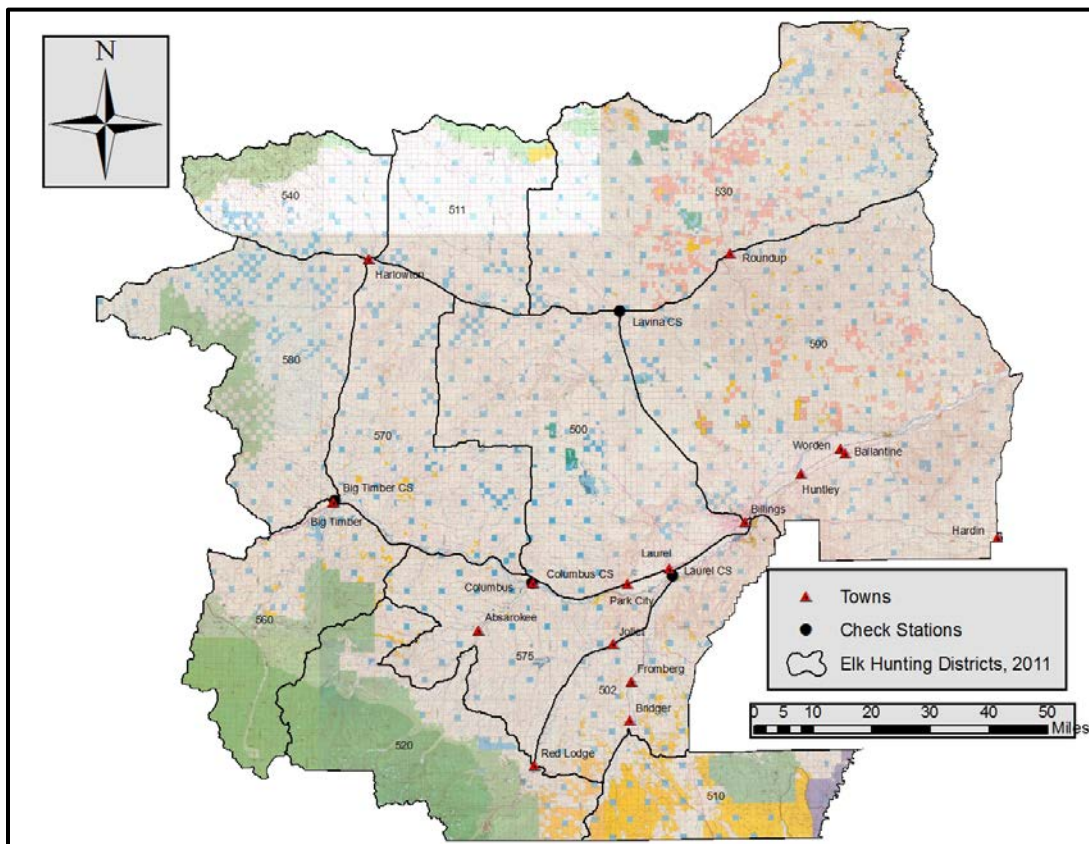


Figure 12. Location of check stations R-5, 2011 hunting season.

Table 13. Data collection and storage of flight data by Region 5 biologists.

Biologist	Upload Wpts & Track Logs	Classification Data Collected ¹	Program Used to Combine Classification & Location Data
Beyer	DNR Garmin	Cows, Calves, Yrl & BTB	Excel & Shape Files for ArcMap
Paugh	DNR Garmin	Cows, Calves, Yrl & BTB	Excel
Stewart	DNR Garmin	Cows, Calves, Yrl & BTB	None

¹ Biologists occasionally have groups of elk that are unclassified cows and calves, unclassified all (cows, calves & bulls) or groups of bulls that are unclassified, Yrl=yearling bull, BTB=brow-tined bull.

Region 6

R-6 has 16 HDs covering an estimated 2575 sq. mi. of elk habitat. There are 4 biologists in the Region, three of which have responsibilities for flying 1 or more elk surveys in 6 HDs. Biologists in the Region have 6 aerial elk surveys to complete. Of the 6 surveys, 4 are complete coverage surveys scheduled to be flown annually, and two are complete coverage surveys flown biennially (Table 14).

All 3 biologists break out cows and calves when possible and they will also try to classify bulls in the large cow/calf groups even if they can't classify cows and calves. One of 3 biologists classify bulls to adult and yearling bulls while the other two classify bulls to adult and yearling bulls, and adults with 6 or more points on both antlers. Waypoint locations for each group of elk and track logs showing the survey flight pattern are collected and stored by all 3 biologists. The waypoint and track log data are downloaded from the GPS units through DNR Garmin. Classification and waypoint data are combined into data tables which are stored in Excel, Access or shapefiles for ArcMap (Table 15).

There is one permanent big game check station open during the elk hunting season (Figure 13). The check station, located near Havre, is open every weekend of the deer and elk season for a total of 12 check station-days.

Table 14. Region 6 elk surveys by HD.

HD	Survey Type ¹	Periodicity	Classification Data Collected ²	General License, Rifle-2011 ³
600	None	NA	NA	Either-Sex
611	None	NA	NA	Either-Sex
620	None	NA	NA	None
621	CC	Biennial	Cow, Calves, Yrl, Ad, & >=6X6 Bulls	None
622	CC	Biennial	Cow, Calves, Yrl, Ad, & >=6X6 Bulls	None
630	None	NA	NA	None
631	CC	Annual	Cows, Calves, Yrl & Ad	None
632	CC	Annual	Cows, Calves, Yrl & Ad	None
640	None	NA	NA	Either-Sex
641	None	NA	NA	Either-Sex
650	None	NA	NA	Either-Sex
651	None	NA	NA	Either-Sex
652	None	NA	NA	Either-Sex
670	None	NA	NA	Either-Sex
680	CC	Annual	Cow, Calves, Yrl, Ad, & >=6X6 Bulls	None
690	CC	Annual	Cow, Calves, Yrl, Ad, & >=6X6 Bulls	None

¹CC=Complete coverage survey.

² Biologists occasionally have groups of elk that are unclassified cows and calves, unclassified all (cows, calves & bulls) or groups of bulls that are unclassified, Yrl=yearling bull, Ad=adult bull.

³ BTB=brow-tined bull, ANT=-antlerless. Season type for general license holders in the rifle season, not including youth hunters or those with a permit to hunt from a vehicle (PTHV).

Table 15. Data collection and storage of flight data by Region 6 biologists.

Biologist	Upload Wpts & Track Logs	Classification Data Collected ¹	Program Used to Combine Classification & Location Data
Hemmer	DNR Garmin	Cow, Calves, Yrl, Ad & $\geq 6 \times 6$ Bulls	Excel & Shape Files for ArcView
Henry	NA	No Elk Surveys	None
Johnson	DNR Garmin	Cows, Calves, Yrl & Ad	Excel
Thompson	DNR Garmin	Cow, Calves, Yrl, Ad & $\geq 6 \times 6$ Bulls	Access

¹ Biologists occasionally have groups of elk that are unclassified cows and calves, unclassified all (cows, calves & bulls) or groups of bulls that are unclassified, Yrl=yearling bull, Ad=adult bull.

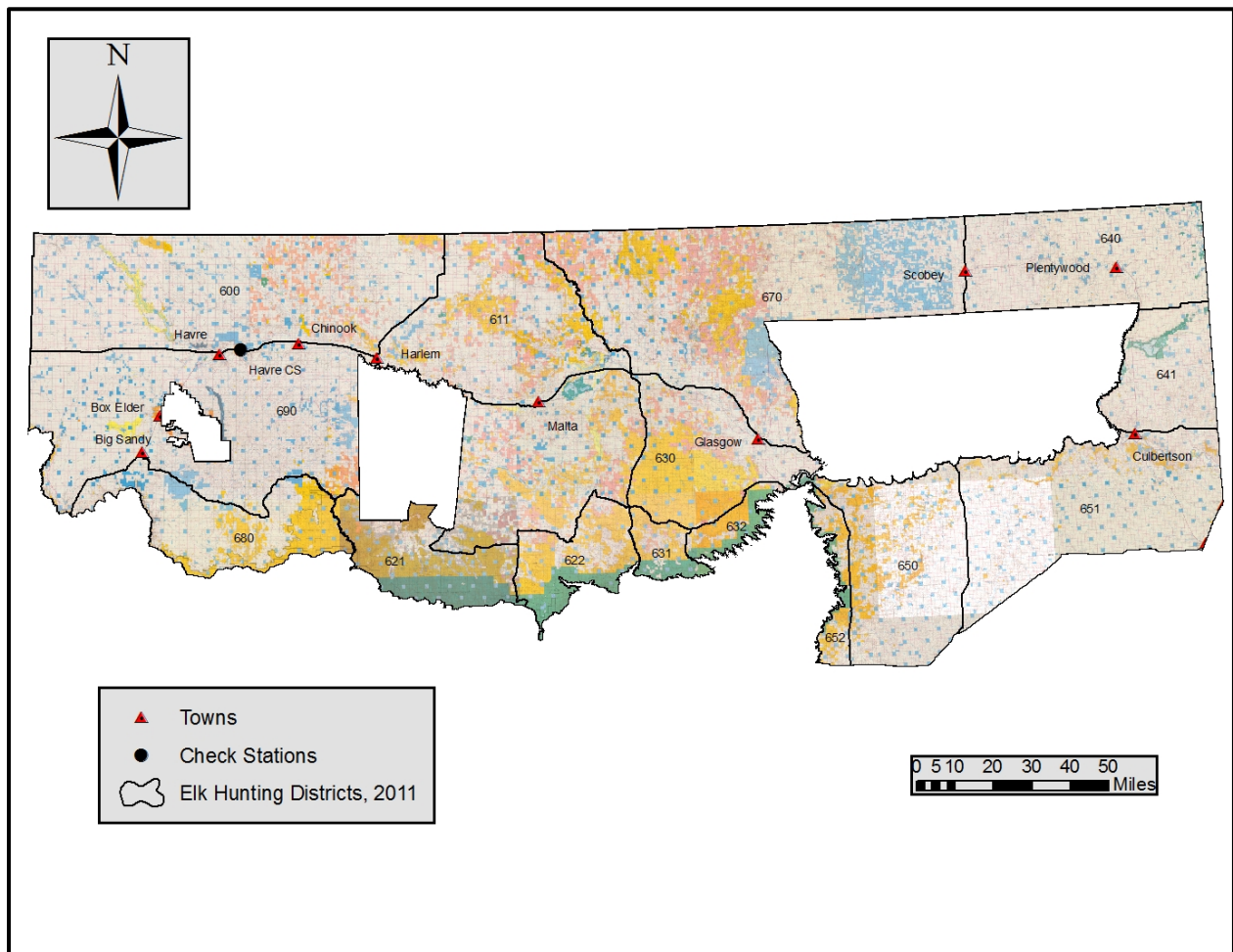


Figure 13. Location of deer and elk check station R-6, 2011 hunting season.

Region 7

R-7 has 6 HDs covering an estimated 6788 sq. mi. of elk habitat. There are 4 biologists in the Region, two of which have responsibilities for flying 1 or more elk surveys in 6 HDs. Biologists in the Region have 3 aerial surveys to complete on elk. Of the 3 surveys, 2 are complete coverage surveys scheduled to be flown biennially, and one is a partial coverage survey, flown annually. The partial coverage survey is in

an area with a large amount of oil and gas development and is funded with monies from outside the Department's S&I survey budget (Table 16).

Both biologists break out cows and calves when possible and they will also try to classify bulls in the large cow/calf groups even if they can't classify cows and calves. Both biologists classify bulls to adult and yearling bulls, and adult bulls with 6 or more points on both antlers (Table 17). Waypoint locations for each group of elk and track logs showing the survey flight pattern are collected and stored by both biologists. The waypoint and track log data are downloaded from the GPS units through DNR Garmin. Classification and waypoint data are combined into data tables by one biologist and stored in Excel files (Table 17).

There are 3 permanent big game check stations in R-7 located near Hysham, Glendive and Ashland during the deer and elk hunting season (Figure 14). These check stations are open a total of 18 days during the deer and elk season, 2 days at Ashland, 4 days at Glendive and 12 days at Hysham .

Table 16. Region 7 elk surveys by HD.

HD	Survey Type ¹	Periodicity	Classification Data Collected ²	General License, Rifle-2011 ³
700	CC	Biennial, Winter	Cow, Calves, Yrl, Ad, & >=6X6 Bulls	None
701	CC	Biennial, July		
701	None	NA	NA	Either-Sex
702	None	NA	NA	Ant- ⁴
703	None	NA	NA	Either-Sex
704	Partial Coverage	Annual	Cow, Calves, Yrl, Ad, & >=6X6 Bulls	Ant- ⁴
705	None	NA	NA	Ant- ⁴

¹ CC=Complete coverage survey.

² Biologists occasionally have groups of elk that are unclassified cows and calves, unclassified all (cows, calves & bulls) or groups of bulls that are unclassified, Yrl=yearling bull, Ad=adult bull.

³ BTB=brow-tined bull, ANT=antlerless. Season type for general license holders in the rifle season, not including youth hunters or those with a permit to hunt from a vehicle (PTHV).

⁴ Portion of HD outside Custer National Forest.

Table 17. Data collection and storage of flight data by Region 7 biologists.

Biologist	Upload Wpts & Track Logs	Classification Data Collected ¹	Program Used to Combine Classification & Location Data
Burt	NA	No Elk Surveys	None
Denson	NA	No Elk Surveys	None
Hildebrand	DNR Garmin	Cow, Calves, Yrl, Ad, & >=6X6 Bulls	None
Waltee	DNR Garmin	Cow, Calves, Yrl, Ad, & >=6X6 Bulls	Excel

¹ Biologists occasionally have groups of elk that are unclassified cows and calves, unclassified all (cows, calves & bulls) or groups of bulls that are unclassified, Yrl=yearling bull, Ad=adult bull.

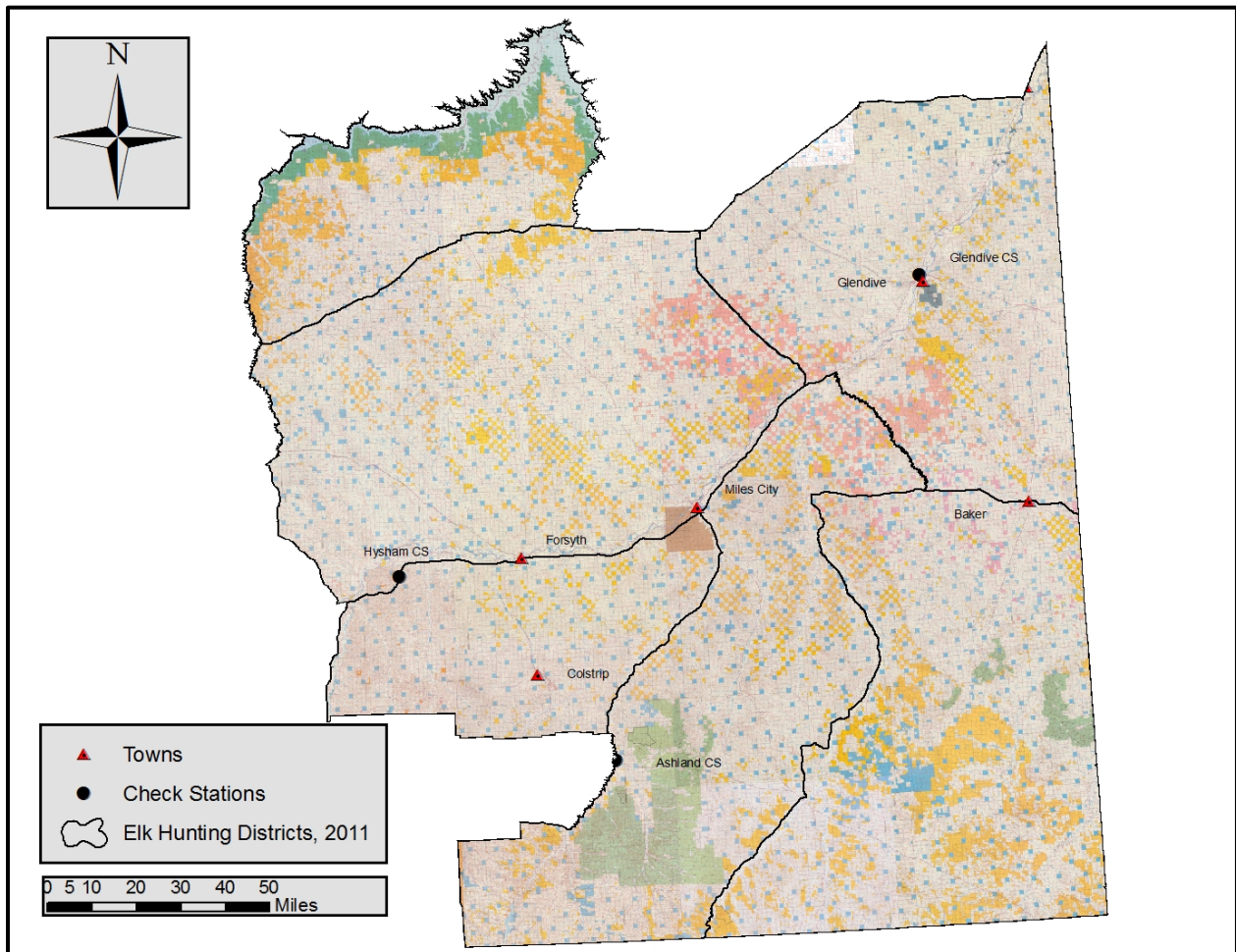


Figure 14. Location of deer and elk check stations R-7, 2011 hunting season.

Uses of Elk S&I Data

The primary use for elk survey and check station data is to provide information for managers to make annual and biennial recommendations for season setting. Season setting for elk is done on a biennial basis although permit and antlerless license numbers can be adjusted annually. Every other year adjustments can be made to the structure of the season, for example whether or not general license holders can harvest any bull, either-sex elk, antlerless elk or a brow-tined bull, adjustments to elk HD boundaries, to antlerless license numbers and to either-sex permit numbers. In the off years, adjustments to season structure, other than for emergencies, can only be made to the permit and b-license numbers. As with antelope season setting, biologists use a combination of flight survey data, check station data, harvest survey estimates and discussions with landowners, sportsmen and game wardens to support their season recommendations for Commission decisions. In some cases, not all of these sets of data are available for the decision making process. In the best-case season setting situation, biologists would have an estimate of how many animals were going to be available to harvest at the time the rifle season (when a majority of the animals will be harvested), 7-10 months after most surveys are conducted. Biologists would also know how many licenses issued would result in 1 elk being harvested, the success rates of hunters, and the number of landowners that were going to allow access to the animals and/or the numbers of elk on public lands. In addition, they would be able to accurately predict survival rates through the rest of the winter, spring and summer, emigration and immigration rates and the number of calves produced in the spring after surveys are completed. Biologists rarely encounter

the best-case scenario for season setting, and the S&I program has evolved over time to gather information that gives the best estimate of the parameters needed to set seasons within a limited budget, under existing manpower limitations and in a timely fashion. Season setting is difficult, and biologists and game managers are charged with using their observations to predict the future for large complex systems that are under a continual state of change.

Biologists have pointed out the difficulty in estimating actual populations of big game animals (MDFWP, 2005), and they use complete coverage surveys to index the relative change in population numbers over long time periods. Biologists know that complete coverage surveys of entire HDs, usually undercounts the actual numbers of animals. However, by conducting surveys under similar weather conditions, at specific times of the year, and with trained biologists and pilots, biologists try to eliminate as much sampling variability as possible. Even though care is taken to reduce sampling variability, sometimes survey conditions necessitate cautious treatment of particular counts. When considering season changes biologists look for trends in various population parameters that point in the same direction. Interpretation of data collected is not always straightforward, and in some cases trends that should logically be headed in the same direction are not.

Elk season setting justifications contain a variety of information, somewhat dependent upon what data are collected in the given year and the proposed change. In addition, some data collected on an annual basis may not be applicable to the proposed season change and therefore may not be included in the justification. For example, consider 5 individual HDs and one group of 3 HDs where changes to elk seasons for the 2012 hunting season were proposed (Table 18). In all cases the manager that submitted the recommended change looked at more than 1 trend when justifying the change in the season. However, depending upon the proposal, biologists chose to present different types of data most applicable to the particular change. For all 6 proposals a specific population "trend" objective (based on animals observed) had been established, and in all 6 areas managers took into consideration the change in population trend in the area. When reading through season justifications it is apparent that trend count data are one of, if not the most important, piece of information collected by biologists when survey conditions and habitat allow gathering of this parameter. The reason these data are so important is that when the counts are high or above average, it is likely that the population is doing well and quota levels and season structure can be maintained or liberalized. Conversely, when total numbers are low and declining, quota levels and season structure will probably be more conservative. It is also apparent that calf:cow ratios are very important to informing hunting season decisions. In 5 of the 6 justifications managers discuss the observed calf:cow ratio (Table 18). Calf:cow ratios are so important because the numbers of calves in the population speaks not only to the productivity in a given year but to the productivity of the habitat, winter severity and possibly the effects of predation where the population resides. In addition, calf:cow ratios collected in the winter or spring can help predict how many elk may be recruited into the population. By knowing what will be recruited into the population one can then estimate how many elk in each class may be available for the next year's hunting season.

Bull:cow ratios or the raw number of bulls are also calculated or counted by biologists. All 6 justifications discuss the number of bulls in the population however three justifications look at bull:cow ratios while the other three look at the raw number of bulls (Table 18). Biologists use bull:cow ratios or bull numbers to monitor trends in bull numbers which is of interest to that portion of the hunting public that wants to kill a bull. In addition, some HDs have specific objectives set for minimum observed bull:cow ratios or bull numbers. Some HDs like 620, 621 and 622 are managed for older bulls so monitoring bull numbers, especially mature males, in the population may be very important to the hunting public.

Finally, changes in seasons are also affected by what has happened in years prior to the current season change. In HD 270, even though the number of elk observed was at the established population objective the calf:cow ratio had been poor for 3 consecutive years. The author of the justification explains: "**while the population trend information suggests a strong and stable position, this elk herd is on a third consecutive year of very poor calf recruitment averaging 16 calves/100 cows during this time period. The 10-year average is 29 calves/100 cows. If this level of calf recruitment continues over the next 4-6 years, this herd will experience a severe population decline.**" Previous season setting changes had already been aimed at reducing antlerless harvests in 270 so the current adjustment

Table 18. Typical data analyzed to inform elk hunting season change justifications for the 2012 season.

Parameter	Hunting Districts					
	270	332	339	425	570	620, 621, 622
Population Obj.	3600	900	700	2500	100	1400-1650
Number observed	3595	385	1024	3165	273	1935
Record High Count	NU ¹	NU	1186 (1989-2011)	3165 (1982-2011)	273	3149
Record Low Count	NU	NU	610 (1989-2011)	1431(1982-2011)	52	NU
\bar{x} =Calf:Cow Ratio ²	=29:100	NU	35:100	19:100	42:100	NU
Observed Ratio ³	16:100	17:100	55:100	28:100	30:100	NU
Bull:Cow Ratio ²	Obj.≥10:100	Obj.≥10:100	NU	NU	NU	Obj.≥30:100
Observed Ratio ³	8:100	6:100	NU	NU	NU	28:100
OR						
\bar{x} =Bull Numbers ²	NU	NU	NU	191 (BTB)	20 (obj)	817 (High Count)
Observed Numbers ³	NU	NU	156 (Very good)	330 (BTB)	91	424
\bar{x} =Bull Harvest ²	NU	NU	NU	NU	NU	NU
Observed Harvest ³	NU	NU	NU	NU	NU	NU
\bar{x} =Ant- Harvest ²	360	NU	NU	NU	NU	NU
Observed Ant- Harvest ³	95	NU	123 (Very High)	2	NU	NU
Success ²	NU	NU	NU	Obj.=35%		67-79% (ES Permits)
Observed Success ³	NU	NU	NU	2%		59% (ES Permits)
Check Station Data	NU	NU	Used	Used	NU	NU
2011 Season	BTB	Any Bull	First 3 weeks Spk Bull Elk, Last 2 weeks Spk Bull or Ant- Elk ⁴	125 B – licenses valid 4 – 1 week time periods	35 ES permits	60 ES Permits HD 620 and 622
2012 Season	Unlimited Permits BTB	BTB	All 5 weeks Spk Bull or Ant- Elk ⁴	195 b-licenses valid 6-1 week time-periods	50 ES permits	45 ES Permits 620 & 30 ES Permits 622

¹NU= Not used in justification but available, NC=Not collected.

²Mean values, objective, or range for the HD.

³Values observed in 2011-12 for the HD.

⁴Spk = Spike, Ant- = Antlerless

addressed a declining bull:cow ratio and what was expected to happen in the future if calf:cow ratios remained low.

Check stations are also a part of the S&I program and data are collected on an annual basis. Check station data, when sample sizes are large enough, are used to verify the accuracy of the hunter harvest survey data and to provide real-time information about harvest during the hunting season (harvest estimates are not released until several months after the rifle season closes). Sample sizes of elk at many of the check stations are small and it is often difficult to draw conclusions with confidence, about age structure of an individual population of animals. Many of the check stations, especially in the eastern part of the state collect much larger samples from deer and antelope than elk. In the 6 season justifications presented in Table 18 only HD 339 and 425 had check station information in the justifications, HD 425 because nearly 100% of the elk killed in that HD go through the check station and 339 because a large sample of elk from that HD is checked.

Many of the biologists interviewed calculated an expected kill rate from each of the special licenses issued in a HD. These expected kill rates were used to estimate the total number of bulls, cows and/or calves one might expect to be killed in a given season. This expected kill could then be compared to the current calf:cow ratio and a prediction could be made as to whether one would expect a decline or increase in the following year's population based only on harvest rates. Because predictions of future populations rely on so many assumptions, the predictions are usually not included in season justifications. The comparison of harvest to recruitment allows biologists to understand if the harvest rate has the potential to allow for population growth, population declines or stability in the population, outcomes which depend upon the status of the population relative to established objectives.

Most biologists discussed how important hunter contacts were and how check stations gave them an opportunity to talk to a large number of hunters, hunting in a wide variety of habitats. Hunters helped to confirm or dispel observations made in the previous year from the air. Check station data also provides an alternative index to recruitment (if samples are large enough) as the proportion of female yearlings in the female harvest, a general age structure of the population, and an index to hunter success. In addition, check stations are sometimes used to gather biological information that includes parameters on health. Check stations have been used as a place to survey hunters about their preferences for hunting, and other wildlife observations (e.g., wolf or moose observations). In recent years check stations in the western part of state have become a place for hunters to vent their frustrations with increasing populations of wolves into areas that they hunt. Many hunters are now blaming wolves for their lack of success and many believe that they are the cause for perceived or real population declines in elk.

Check station data also informs biologists on where animals are being harvested and hunter access problems; many check stations gather data on private versus public land use and/or how many hunters are hunting on BMAs.

Besides using survey and check station data, managers rely on statewide harvest survey data collected through telephone surveys to help set seasons on an annual basis. Harvest estimates are used by biologists to help confirm trends that they are observing in the field. Antlerless harvest was used to justify license quota changes in 1 of the 6 justifications compared (Table 18). Success rates are an important factor in season setting as they may indicate an increasing or decreasing availability of elk or change in the numbers of elk in the population. In some cases, success rates might indicate environmental conditions that increased or decreased harvest. In addition, information about numbers and classes of animals harvested gives biologists additional data to estimate how many harvested animals are likely to result for each license issued, which helps to inform recommendations for season changes.

Finally, season setting also has to take into consideration hunter access to the animals, hunter preferences and land-owner tolerance of both hunters and animals. Data on land-owner tolerance of both hunters and elk may be the most difficult data to gather and often there is no systematic method to collection and use of those data. Elk can cause severe crop and fence damage, especially in irrigated croplands. In many cases the assumption is made that data collected, such as success rates are surrogates for things such as land-owner tolerance of hunters or availability of elk to hunters. In some cases parameters like this can mean one thing in one area and something different in another. Interpretation of these data can be difficult and is open to more criticism than other data we collect. In many populations of elk, harvest has minimal influence on population trends because so many elk have found refuge on private lands. Because of this refuge effect, changes made in the season structure may really only affect a handful of landowners and a portion of the elk population that are accessible to hunters. Care must be taken to not overwhelm the system with additional hunters that may end up hunting in a very small area.

Most biologists believed that the second most important use of the S&I data, beyond season-setting, was for informing sportsmen, FWP personnel, landowners and others in the general public about elk population trends. The public has an expectation that our management of wildlife populations is based on scientific knowledge of wildlife populations. In the areas of the state where wolf populations have become well established, declines in elk populations or calf:cow ratios are being used to justify more liberal wolf, lion, and black bear seasons in some areas. There were many other diverse uses for the survey data

collected including descriptions of elk populations in lands proposals, in comments on proposed state and federal land exchange projects, in comments on subdivisions, for newspaper articles, in comments on state land uses such as grazing changes or timber harvests, timber sales on forest service lands and to inform comments on oil and gas leases and oil and gas drilling. The relationship between bull elk security on public lands and timber harvests and road construction are well documented (Lyon et. al., 1985, Canfield et.al. 1999, Wisdom et.al., 2004). Because many populations of elk are over objective and there is a need to reduce numbers through antlerless harvests recent research (Proffitt et.al. in press) has focused more on describing the relationship between public hunting access and habitat selection by female elk. Data collected in MFWP surveys are used to speak towards potential effects of timber harvest, open road densities, refuge affects of private land and recreation on elk harvest. In some cases funding for our survey flights comes from sources such as the oil and gas industry and may be used to describe potential impacts or to inform mitigation. Finally, biologists stressed the importance of having long-term trend data available for informed comment on unforeseen developments into the future.

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