

# Elk Shoulder Season Assessment Report

## 2016-2018



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Wildlife Division

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## Summary

Montana Fish Wildlife and Parks (FWP) is charged with managing elk as a public resource using public hunting as the primary management tool and is guided by the 2005 FWP Elk Management Plan. In some instances, elk populations have remained persistently over numerical population objectives set forth in the plan. Existing seasons and management policies were falling short of the statutory requirement to manage populations within numerical objective ranges. In some instances, elk seasons and management policies were not meeting sportsmen or landowner expectations or addressing their concerns. Failing to address these issues effectively could result in increased management by legislation, litigation, deterioration of landowner-sportsmen relationships, loss of science-based management, collateral damage to other FWP programs, loss of revenue, further loss of access, decreased hunter opportunity, increased liability for game damage, increased workloads, loss of cohesion, and poor morale within FWP. To address these shortcomings, extended firearms hunting seasons, termed “performance-based shoulder seasons”, were first implemented following the 2015-16 general rifle season to increase antlerless elk harvest, primarily on private lands, in over-objective elk management units. During the 2015-2018 hunting seasons, a total of 5, 45, 45, and 62 hunting districts had shoulder seasons, respectively. In addition to moving over-abundant elk populations toward population objectives, these seasons were designed to address several hunter, landowner, and logistical considerations, which were embodied as fundamental objectives that together define the ideal season structure.

At the outset, a 3-year assessment of the shoulder seasons was planned to determine how the strategy was meeting its 11 fundamental objectives. While evidence varied both within and among regions, at the statewide scale, there was modest suggestive evidence that shoulder seasons were beginning to move the needle on many of the fundamental objectives during the 2016-2019 period.

### **Statewide summaries of fundamental objectives**

#### ***Elk population considerations:***

##### **Obj 1. Increase the number of elk population units at numerical objectives as quickly as possible:**

The number of elk population survey units at or below objective increased 11% in 2019 compared to 2014-2016. Of the 58 population units remaining above objective in 2019, most (71%) will take >10 years to reach objective assuming harvest rates and elk vital rates remain similar, while the average predicted time until numerical objectives are reached for the remainder is approximately 3 years.

**Obj 2. Increase cow elk harvest in shoulder season hunting districts:** Statewide, cow harvest in shoulder season districts increased 29% from the 2011–2015 period to the 2016–2018 period. While harvest in districts with shoulder seasons increased in all regions, increases were most pronounced in regions 2, 3, and 6 (no shoulder seasons were implemented in region 7 during this period).

*Hunter and landowner considerations:*

**Obj 3. Decrease problem elk concentrations:** In 2019, problematic concentrations decreased 13% statewide compared to 2015. Problematic elk concentrations in 2019 decreased in regions 1, 2, 3, 4, 6 from 5–56%, whereas they increased in regions 5 and 7 (31 and 43%, respectively).

**Obj 4. Increase free public access on private lands:** For bulls, statewide access decreased 6% (258,803 acres) from 2015 to 2019, primarily in regions 5 and 7 (decreases of 325,194 and 365,429 acres, respectively), whereas there were modest gains in regions 3, 4, and 6 (increases of 177,110, 111,339, and 144,771 acres, respectively). For cows, access increased approximately 3% (147,905 acres) statewide with gains in regions 2, 3, 4, and 6, (increases of 39,694, 170,753, 303,656, and 175,065, respectively), little change in regions 1 and 5, and a 70% (522,313 acres) decrease in region 7.

**Obj 5. Decrease exclusive access to elk hunting on private lands:** For bulls, statewide exclusive access increased by 6% from 8,770,689 acres in 2015 to 9,261,343 acres from 2015 to 2019, with decreases in regions 1,3,4, and 6 (3,744; 61,316; 543,966; and 29,784 acres, respectively), outweighed by increases in regions 2, 6, and 7 (36,875; 553,212; and 661,126 acres, respectively). Increases in acreage of exclusive access were not necessarily at the expense of free public access on private land (Objective 4), for example there were overall declines in private acreage with no hunting access, meaning that some private lands without hunting access in 2015 began allowing exclusive access by 2019. For cows, exclusive access increased 14% from 7,215,114 to 8,243,827 acres in the same period (increased in all regions but region 4).

**Obj 6. Increase landowner satisfaction with flexibility to manage elk on their property:** Landowner satisfaction with flexibility to manage elk on their property increased from 41% to 46% statewide from 2015 to 2019. Increases of 5.1, 9.2, 11.0, 6.4, 3.0 percentage points occurred in regions 1–6, respectively, and only satisfaction only decreased in region 7 (-3.1 percentage points; there were no shoulder seasons in region 7).

**Obj 7. Decrease staff reporting elk game damage complaints:** The percent of FWP field wardens or biologists reporting  $\geq 1$  game damage complaint increased from 64% to 73% from 2015 to 2019, however increases occurred primarily in regions 4-6, whereas 1, 2, 3, 7 reported little change or modest decreases.

**Obj 8. Increase landowner satisfaction with time spent managing hunters and hunter behavior:** Statewide, landowner satisfaction with time spent managing hunters increased from 42% to 45% from 2015 to 2019 (in all regions increased except 5 and 7), and landowner satisfaction with hunter behavior increased from 63% to 74% (increases in all regions except 6).

**Obj 9. Increase portion of hunters finding regulations easily understandable:** Statewide, the percent of hunters reporting that regulations were understandable increased from 55% to 58% from 2015 to 2019.

*Logistical considerations:*

**Obj 10. Increase proportion of FWP staff finding rules, regulations and policies flexible:** Statewide, this proportion increased from 41% in 2015 to 65% in 2019. No regional summaries of this metric were available.

**Obj 11. Decrease FWP staff allocations of time and money to elk management:** Statewide, the proportion of FWP staff spending a substantial portion of their time or substantial resources on elk management decreased from 2015 to 2019, 21% to 18% and 22% to 14%, respectively, although both measures varied by region.

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## Introduction

FWP is charged with managing elk as a public resource using public hunting as the primary management tool guided by the 2004 elk management plan<sup>1</sup>. In some instances since this time, elk seasons and management policies were not meeting elk management objectives, legislative mandates, sportsmen expectations, and landowner concerns. During 2014-2015 a working group consisting of 17 regional supervisors, wildlife managers, biologists, and wardens was tasked with defining management alternatives to address elk management shortcomings. In addition to the working group members, 2 structured decision-making coaches ran the process, and a group of 6 science support staff were assembled.

To complete this task, the working group used a structured decision-making process to recommend a season structure to the Fish & Wildlife Commission. The working group completed this process in 5 multi-day meetings. They completed a statement that identified the scope of the issue and a list of fundamental objectives that comprehensively defined what elk seasons should accomplish. They also defined and evaluated several potential season structures most likely to achieve fundamental objectives (constrained by options available to the Commission as of August 2015) and defined quantitative metrics and methods for predicting and monitoring the effect of season structures on meeting fundamental objectives.

The working group identified fifteen fundamental objectives and ranked each alternative according to its likelihood of satisfactorily addressing the objectives<sup>2</sup>. The highest ranking alternative included performance-based “shoulder seasons”, i.e., extended firearms seasons outside the 5-week general season. Most shoulder seasons were meant to focus on antlerless elk harvest on private land in over-objective hunting districts (Figure i) and were not intended to replace or reduce harvest during the existing archery or 5-week general firearms seasons. For a hunting district to initially qualify for shoulder seasons, at least half of the antlerless elk harvest necessary to offset estimated recruitment needed to occur during the general season, and public hunting for bulls needed to occur on private land during the general season. Some shoulder seasons were meant to address specific problematic distributions of elk. Shoulder seasons varied in timing with some starting as early as August 15 and going as late as February 15, although they do not include early backcountry hunts, primitive weapon hunts, or season extensions in current administrative rules of Montana (ARM).<sup>3</sup>

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<sup>1</sup> “Montana Statewide Elk Management Plan”. 2004. FWP public document.

<sup>2</sup> “SDM Final Results: Effective Elk Harvest Management”. 2015. FWP internal document.

<sup>3</sup> <http://fwp.mt.gov/enforcement/laws/>

The fundamental objectives the shoulder seasons were meant to address were more concisely worded into 11 fundamental objectives for public communication (Box 1). A 3-year assessment occurred in 2019 to assess whether the strategy was having the desired impacts on these 11 fundamental objectives. The intent of this report is to document this assessment of the impacts shoulder seasons had on the 11 fundamental objectives from 2016-2019. The specific objectives, data used in assessment, and results as of 2019 are described in the ‘Outcomes’ section below. Specifics on the methodologies are included the ‘Data and Methodologies’ section.

**Box 1. Fundamental objectives for Montana elk shoulder seasons.**

**Elk considerations:**

1. Manage elk populations to 2005 Elk Plan objectives as rapidly as possible.
2. Increase harvest of cow elk, where appropriate.

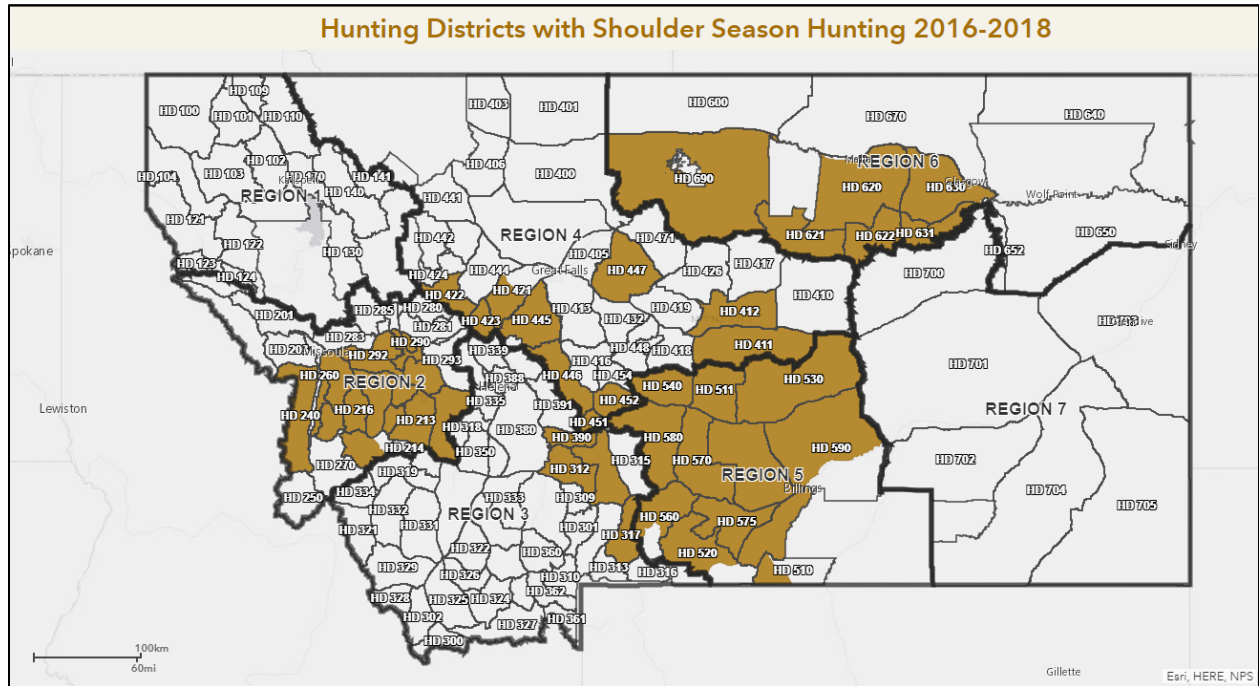
**Hunter and landowner considerations:**

3. Address problematic distributions of elk and elk harvest.
4. Enhance free public access to bulls and cows on private land during the general seasons.
5. Reduce exclusive access to elk.
6. Enhance landowner flexibility to manage elk hunting on their property.
7. Reduce game damage.
8. Reduce hunter impacts on landowners (e.g., cost of hiring additional staff, loss of productivity, property damage from hunters, etc.).
9. Simplify rules and regulations.

**Logistical considerations:**

10. Balance statewide consistency with local flexibility of regulations, rules, and policies.
11. Keep staff time and cost down.

**Figure i. Hunting districts which implemented shoulder seasons during  $\geq 1$  hunting season during the 2016-2018 period.**



## Outcomes

Shoulder seasons were implemented in 5, 45, 45, and 62 hunting districts during the 2015-2018 hunting seasons, respectively. Evidence for the efficacy of the shoulder season strategy varied both within and among regions (Table i). At the statewide scale, there was suggestive evidence that shoulder seasons were beginning to move the needle on many of the fundamental objectives during the 2016-2019 period. Results for individual objectives are discussed below.



**Table i. Regional summary of percent change in measurable attributes for each objective. Cells with red text show attributes where change was in the opposite direction as desired. Note that for objectives which measured percentages (Objectives 6, 7, 8, 9, 10, and 11), these values are percent changes in the measured percentages, not percentage point changes. For example, a change in a metric from 50% to 60% is reported here as a 20% change, rather than a 10 percentage point change.**

	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7	Statewide
Obj 1. Increase units at objective	4%	12%	-22%	31%	20%	0%	0%	11%
Obj 2. Increase harvest	-	65%	36%	1%	44%	8%	-	29%
Obj 3. Decrease problem herds	-56%	-27%	-24%	-5%	31%	-6%	43%	-13%
Obj 4. Increase public access (Bull)	-2%	3%	24%	11%	-61%	42%	-65%	-6%
Obj 4. Increase public access (Cow)	-1%	8%	19%	26%	-1%	51%	-70%	3%
Obj 5. Decrease exclusive access (Bull)	-4%	6%	-3%	-22%	38%	-11%	34%	6%
Obj 5. Decrease exclusive access (Cow)	21%	33%	3%	-18%	32%	9%	54%	13%
Obj 6. Increase landowner flexibility	10%	21%	26%	15%	7%	10%	-10%	11%
Obj 7. Decrease elk game damage	-8%	-8%	3%	33%	29%	250%	-10%	14%
Obj 8. Increase landowner satisfaction (time managing hunters)	2%	21%	35%	29%	20%	-6%	23%	14%
Obj 8. Increase landowner satisfaction (hunter behavior)	16%	7%	20%	9%	-8%	31%	-9%	4%
Obj 9. Increase hunter understanding of regulations	-3%	2%	7%	12%	-1%	25%	3%	3%
Obj 10. Increase FWP staff flexibility	-	-	-	-	-	-	-	59%
Obj 11. Decrease FWP staff costs related to elk	-38%	-62%	-58%	38%	0%	-100%	-100%	-36%
Obj 11. Decrease FWP staff time allocation to elk	71%	-51%	26%	-39%	183%	-100%	-100%	-14%

## Objective 1: Manage elk numbers to population objectives as rapidly as possible.

### *Quantitative measure.*—

- a) Change in the proportion of elk population units within their population objective ranges, 2019 vs. 2014-2016. Elk population units refer to regularly surveyed populations that fall within Elk Management Units (EMUs; defined in 2005 Statewide Elk Plan). An EMU may contain >1 population unit corresponding to biologically distinct populations therein. A population unit may encompass >1 elk hunting district, or in some cases, only a portion of a district.
- b) If not within objective range, estimated time until elk population unit reaches objective.

### *Data used.* —

- a) Population counts (further described in ‘Data and Methodologies’ section below).
- b) Age and sex classification data (usually collected in conjunction with counts).
- c) Harvest estimates (further described in ‘Data and Methodologies’ section below).

The assessment of whether a population unit was within the population objective range was based simply on whether the most recent representative elk count for the population survey unit (Objective 1 Appendix A; unadjusted for sightability), fell within the defined elk population objective range set in the 2005 Statewide Elk Management Plan (or as adjusted through Commission action since that time). We used an integrated population modeling approach to determine the estimated time until out-of-objective populations would fall within objective ranges<sup>4</sup>. The population model uses count and herd composition data along with observed and projected harvest to estimate the number of years before the population unit will fall within the objective range.

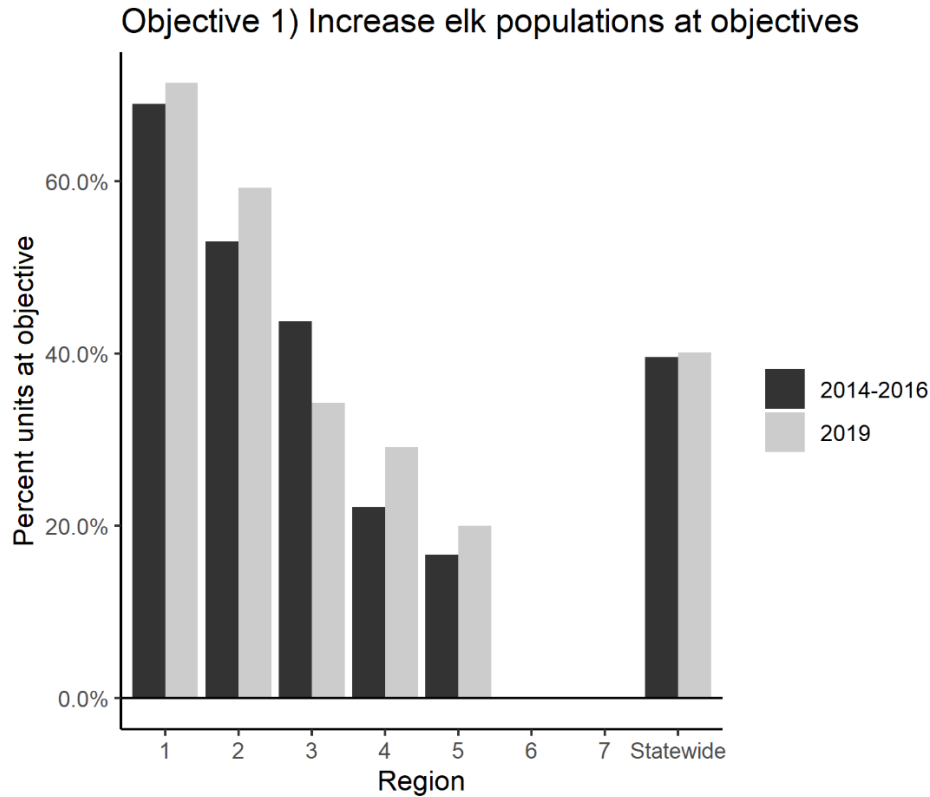
*Outcomes.* — There was a modest increase in the number of population units within population objective ranges by 2019 (Figure 1). In total there were 44 elk population units at or below the objective range during spring 2015 elk surveys and 47 at or below during spring 2019 surveys (Objective 1 Appendix A). Of the 57 population units remaining above objective in 2019, in most (71%) we estimated it will take >10 years to reach objective assuming harvest rates and elk vital rates remain similar to those observed during the 2016-2018 hunting seasons. The average time-to-objective for the remaining 29% of elk population units was approximately 3 years, meaning that in 2022 we expected 64 population units to be

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<sup>4</sup> Paterson, J. T., K. M. Proffitt, J. Rotella, and R. A. Garrott. 2019. An improved understanding of ungulate population dynamics using count data: insights from western Montana. PLoS ONE 14(12): e0226492.

within population objective ranges and 41 population units to remain above objective if similar season structures continued (Objective 1 Appendix B).

**Figure 1. Comparison of the percent of elk population units at or below population objective in survey year 2019 versus the average for survey years 2014–2016.**



**Table 1. Predicted time until elk population units reach population objective ranges assuming harvest and vital rates remain similar to those observed during the 2016-2018 shoulder season period. These predictions were made using an integrated population modeling approach<sup>5</sup>.**

	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7
<b>At objective</b>	5	10	8	5	2	0	0
<b>1-5 yrs</b>	1	3	5	5	1	0	1
<b>6-10 yrs</b>	0	1	0	0	0	0	0
<b>&gt; 10 yrs</b>	4	11	15	14	5	3	1

<sup>5</sup> Paterson, J. T., K. M. Proffitt, J. Rotella, and R. A. Garrott. 2019. An improved understanding of ungulate population dynamics using count data: insights from western Montana. PLoS ONE 14(12): e0226492.

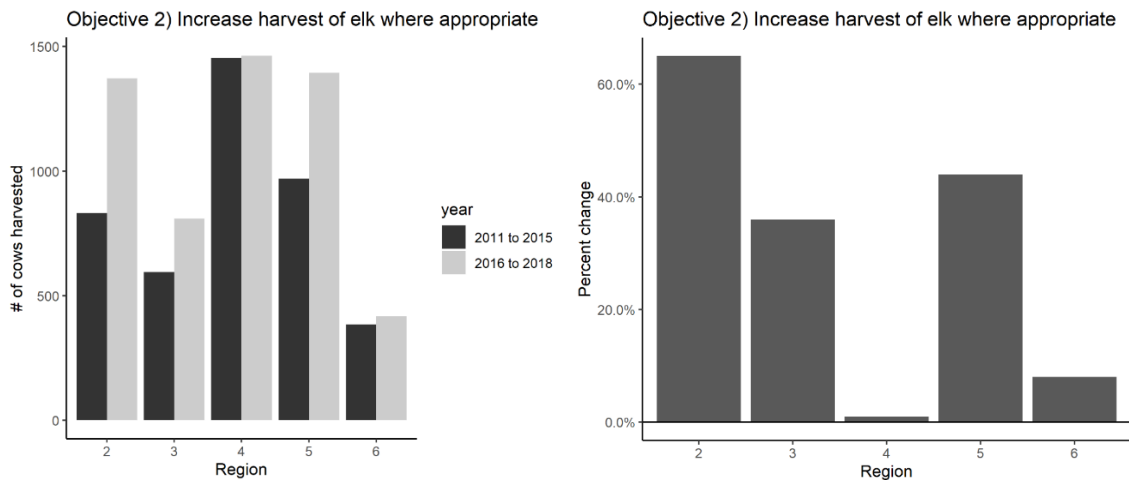
## Objective 2: Increase harvest of cow elk where appropriate.

*Quantitative measure.*— The estimated number of cow elk harvested in each shoulder season hunting district.

*Data used.*— Estimates of cow elk harvest during 2011-2018 from annual stratified random samples of elk license holders. The number of hunters contacted is targeted to achieve  $\leq 15\%$  precision at the 80% confidence level (more details below in ‘Data and Methodologies’ section). To account for typical annual variability in harvest, cow harvest estimates were averaged for 2011-2015 (pre-shoulder seasons) and 2016-2018 (during shoulder seasons) for the districts with shoulder seasons.

*Outcomes.*— While harvest in districts with shoulder seasons increased in all regions, increases were most pronounced in regions 2, 3, and 6. No shoulder seasons were implemented in region 7 during this time period.

**Figure 2. Changes in cow elk harvest in shoulder season hunting districts by region. No shoulder seasons were implemented in region 7 during this time period.**



## Objective 3: Address problematic distributions of elk and elk harvest.

*Quantitative measure.*—

- a) Number of problematic elk distributions.

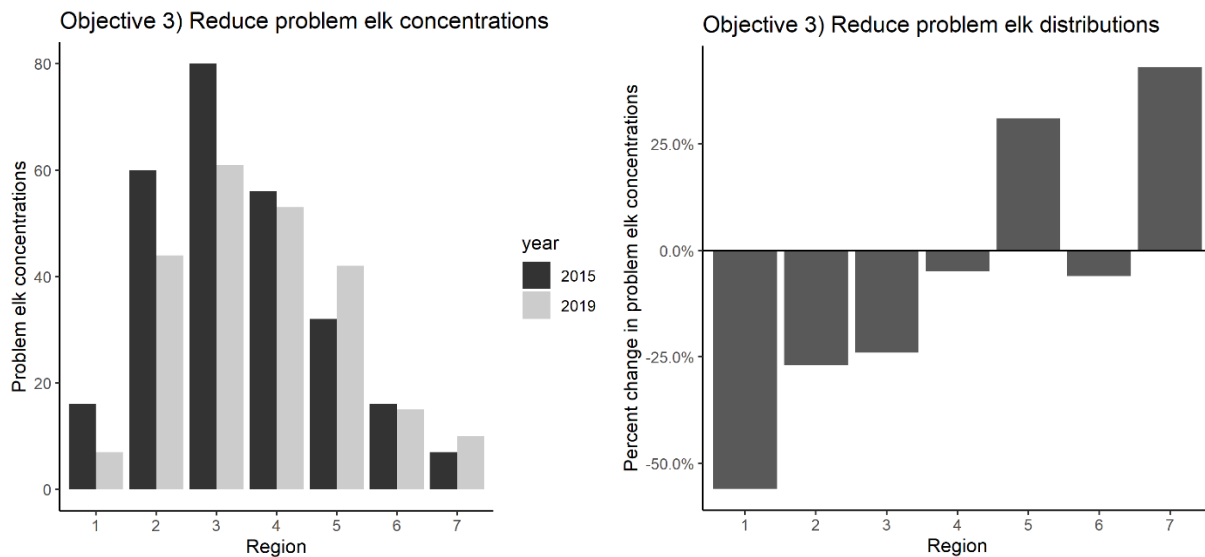
b) Private lands harvest odds ratio. An odds ratio is the odds that any given elk harvest will take place on private land vs public land, accounting for the relative acreages in each. An increasing private lands harvest odds ratio means the relative percent of harvest occurring on private lands is increasing.

*Data used.*—

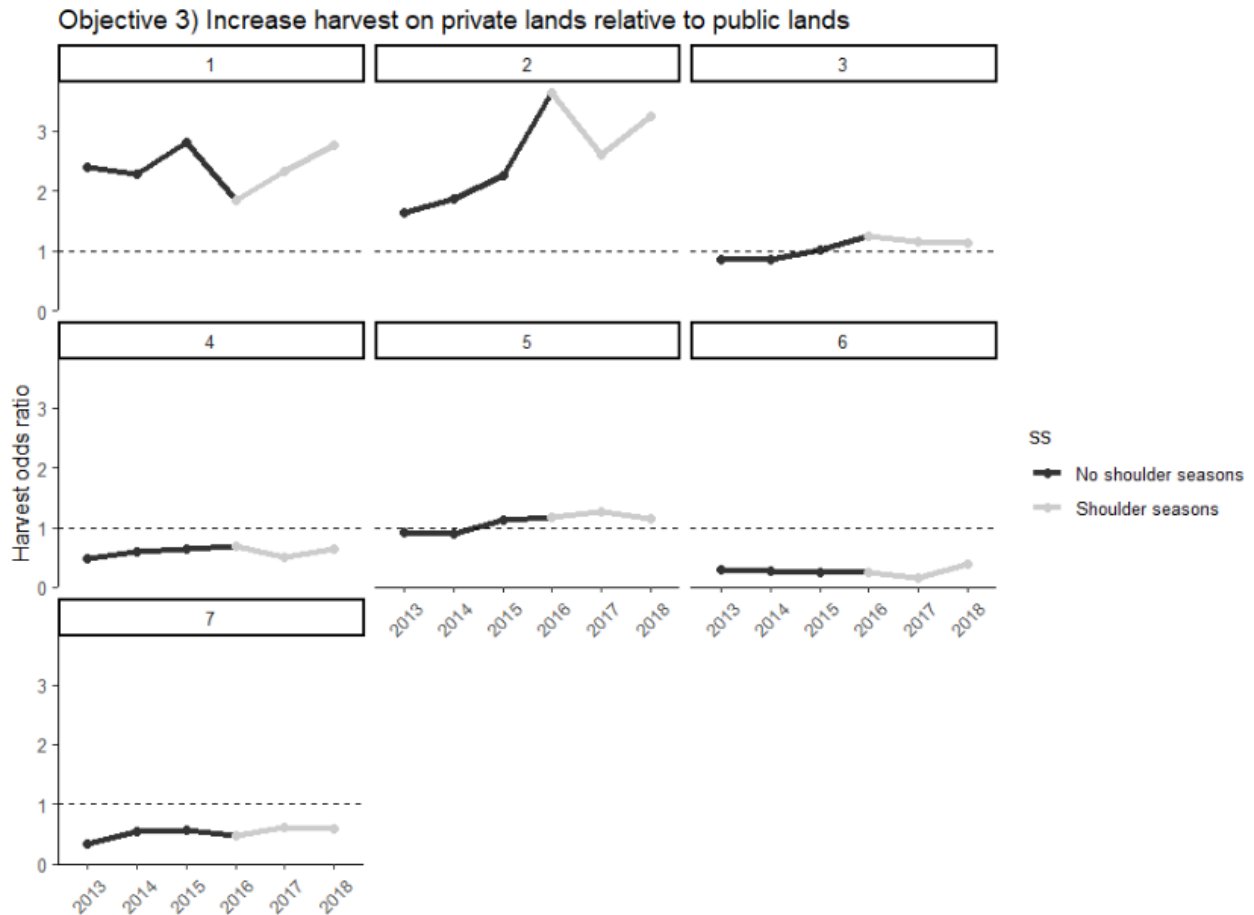
- a) Electronic survey of FWP field biologists and wardens on problematic elk distributions in their districts.
- b) Estimated elk harvest on private land based on responses to a postcard survey sent to all successful elk hunters that responded to the live-caller harvest survey, by region, and total acreages of each land ownership type by region.

*Outcomes.*— Compared to 2015, problematic elk distributions in 2019 decreased in regions 1, 2, 3, 4, 6 from 5–56%, whereas they increased in regions 5 and 7 (31 and 43%, respectively). This sums to a statewide 13% decrease in problematic concentrations of elk estimated by FWP staff, from 267 to 232. Statewide, the probability that harvest occurred on private versus public land increased 22% when comparing hunting seasons before and after shoulder seasons were widely implemented (2013–2015 vs. 2016–2018).

**Figure 3A. Changes in the number of problematic elk distributions between 2015 and 2019, by region.**



**Figure 3B. Changes in private lands harvest odds ratio over time, controlling for total acreage in each ownership type. Increasing odds ratios mean that the relative percent of harvest occurring on private lands is increasing. Values greater than 1 (indicated by dashed line) indicate that harvest on private land occurs more than expected based on the amount of private and public land in the region.**



**Objective 4: Enhance free public access to elk on private land during general seasons**

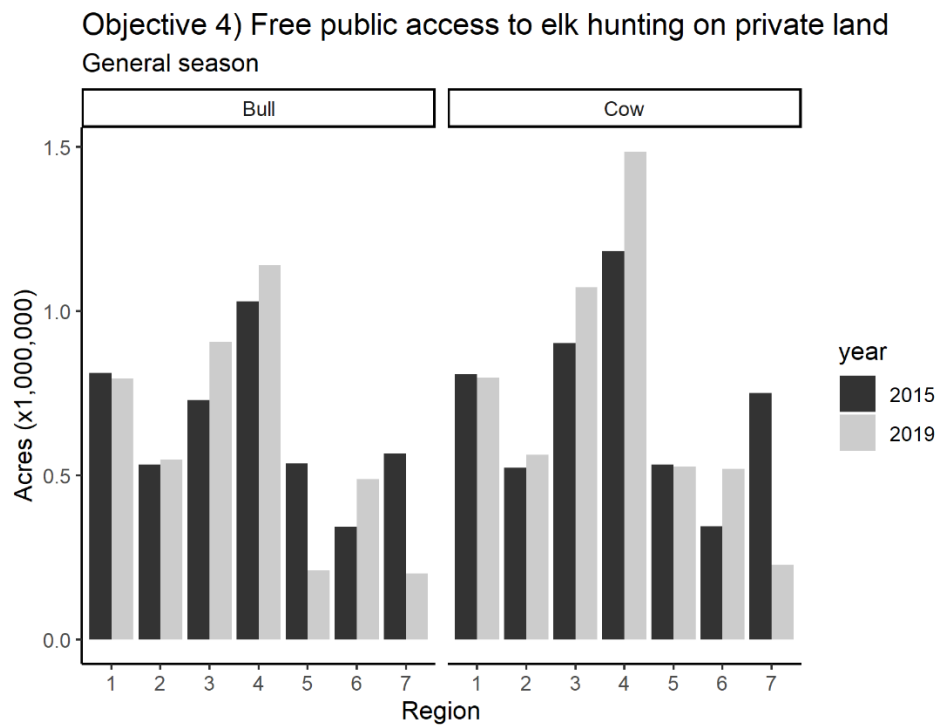
*Quantitative measure.*— Change in estimated acres of private land with free public access to bull and cow elk hunting in 2019 vs 2015.

*Data used.*— Mail surveys of private landowners conducted in 2015 and 2019 regarding the types of hunting access they allow on their land for elk.

*Outcomes.*— Statewide, free public access to bulls on private land decreased approximately 6% (258,803 acres) from 2015 to 2019, although decreases occurred primarily in regions 5 and 7 (decreases of 325,194

and 365,429 acres, respectively), whereas there were gains in regions 3, 4, and 6 (increases of 177,110; 111,339; and 144,771 acres, respectively). For cows, access increased approximately 3% (147,905 acres) statewide with gains in regions 2, 3, 4, and 6, (increases of 39,694; 170,753; 303,656; and 175,065, respectively) little change in regions 1 and 5, and a 70% (522,313 acres) decrease in region 7. It should be noted there were no shoulder seasons in regions 1 or 7 during the 2016-2019 period.

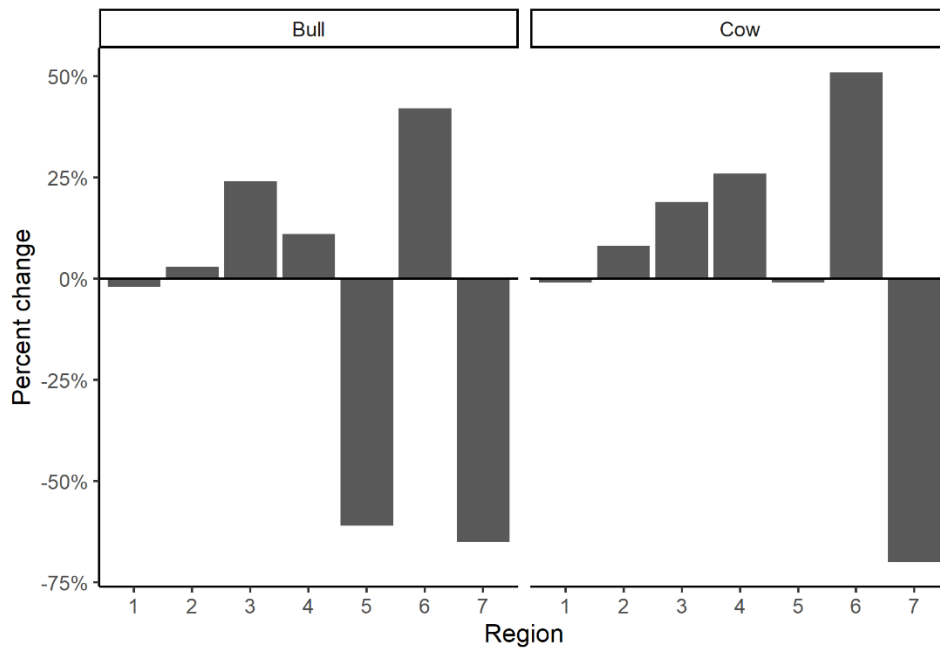
**Figure 4A. Changes in acreages of free public access to bull and cow elk hunting between 2015 and 2019, by region.**



**Figure 4B. Percent changes in acres of free public access to bull and cow elk hunting between 2015 and 2019, by region.**

## Objective 4) Free public access to elk hunting on private land

General season



## Objective 5: Reduce exclusive access to elk.

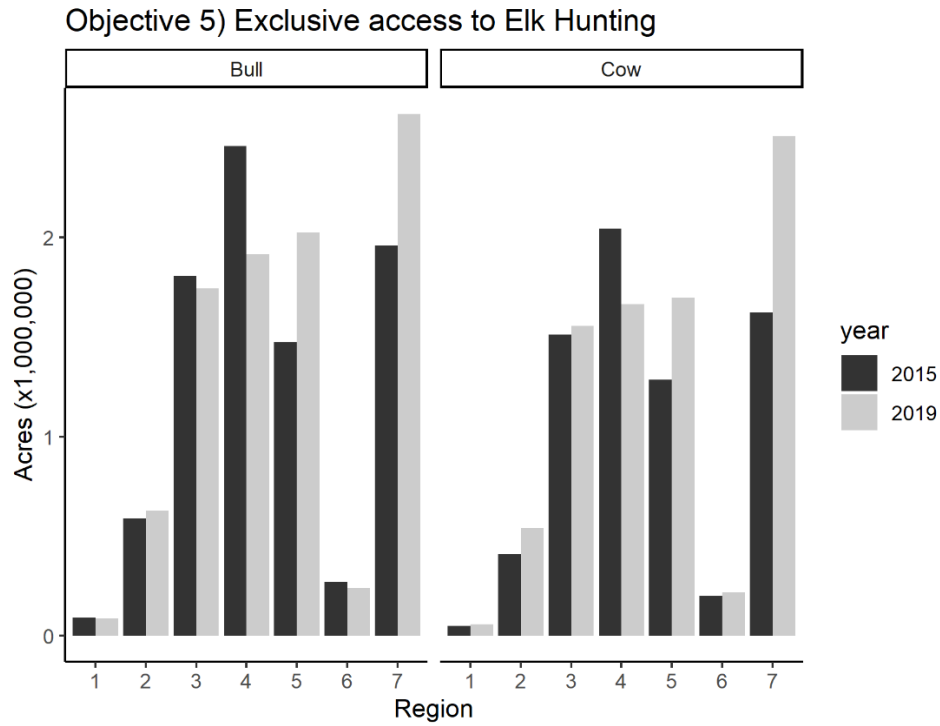
*Quantitative measure.*— Change in acres of private land with exclusive access to bull and cow elk hunting in 2019 vs 2015.

*Data used.*— Mail surveys of private landowners conducted in 2015 and 2019 regarding the types of elk hunting access they allow on their land.

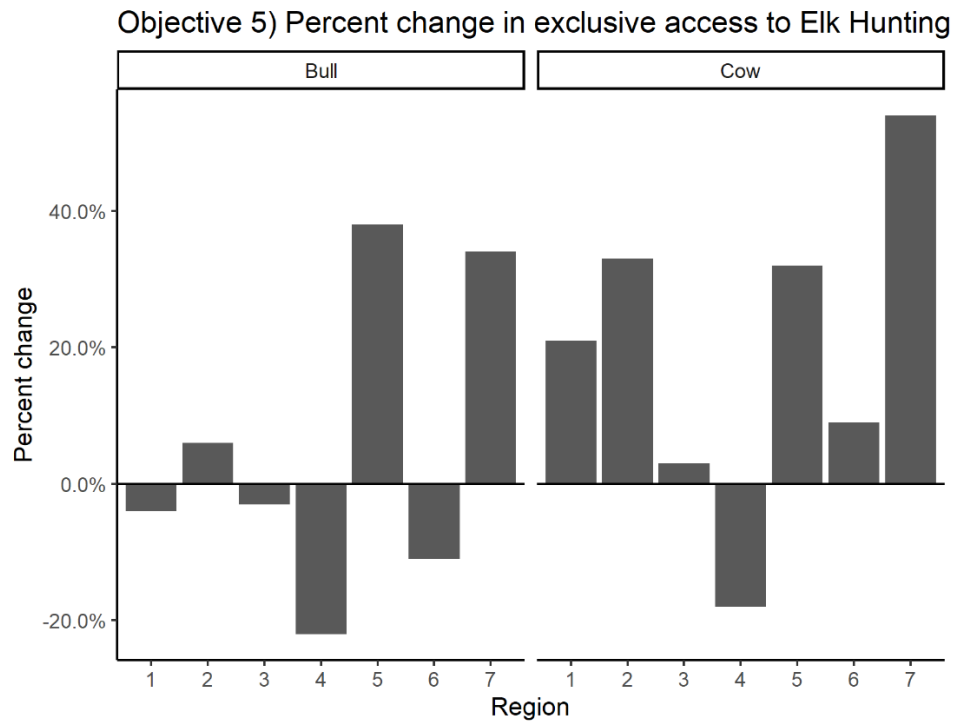
*Outcomes.*— Compared to 2015, exclusive access to bull hunting statewide increased by 6% from 8,770,689 acres in 2015 to 9,261,343 acres in 2019, with decreases in regions 1,3,4, and 6 (3,744; 61,316; 543,966; and 29,784 acres, respectively), outweighed by increases in regions 2, 6, and 7 (36,875; 553,212; and 661,126 acres, respectively). It should be noted that these increases in exclusive access are not necessarily at the expense of free public access on private land (Objective 4). For example, there were overall declines in private acreage with no hunting access, meaning that in many regions, private lands without hunting access in 2015 began allowing exclusive access by 2019. Statewide, exclusive access to cows increased 14% from 7,215,114 to 8,243,827 acres in the same period (increased in all regions but 4), and free public access to hunt cows also increased (see Objective 4 above). Notably, Region 4 saw substantial decreases in exclusive access for both bulls (-22% or -543,966 acres) and cows (-18% or -377,492 acres) from 2015 to 2019.



**Figure 5A. Acreage of exclusive hunting access for bull and cow elk in 2015 and 2019, by region.**



**Figure 5B. Percent change in acreage of exclusive hunting access for bull and cow elk by region.**



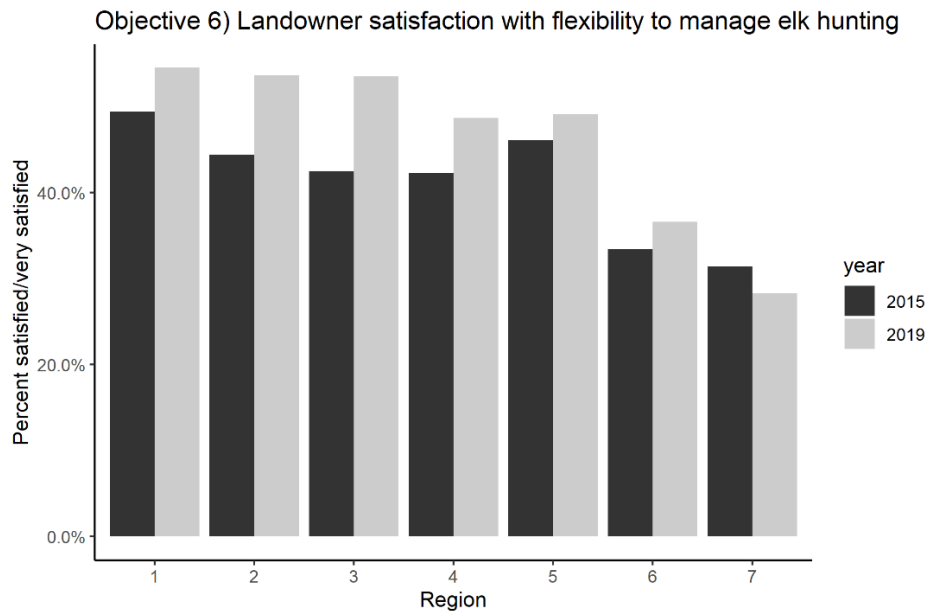
## Objective 6: Enhance landowner flexibility to manage elk hunting on their property

*Quantitative measure.*— Percentage of landowners ‘satisfied’ or ‘very satisfied’ with ability to manage elk hunting on their own property.

*Data used.*— Mail surveys of private landowners conducted in 2015 and 2019 regarding their satisfaction with ability to manage elk hunting on their property (1-5 scale).

*Outcomes.*— Landowner satisfaction increased from 2015 to 2019 in all regions with shoulder seasons (regions 1–6). Statewide the percentage of landowners saying they were satisfied with flexibility to manage elk hunting on their property increased from 41 to 46% (increase of 5.1, 9.2, 11.0, 6.4, 3.0 percentage points, in regions 1–6, respectively), and only decreased in region 7 (-3.1 percentage points). It should be noted there were not hunting districts with shoulder seasons in regions 1 or 7.

**Figure 6. Percentage of landowners satisfied with flexibility to manage elk hunting on their property in 2015 and 2019, by region.**



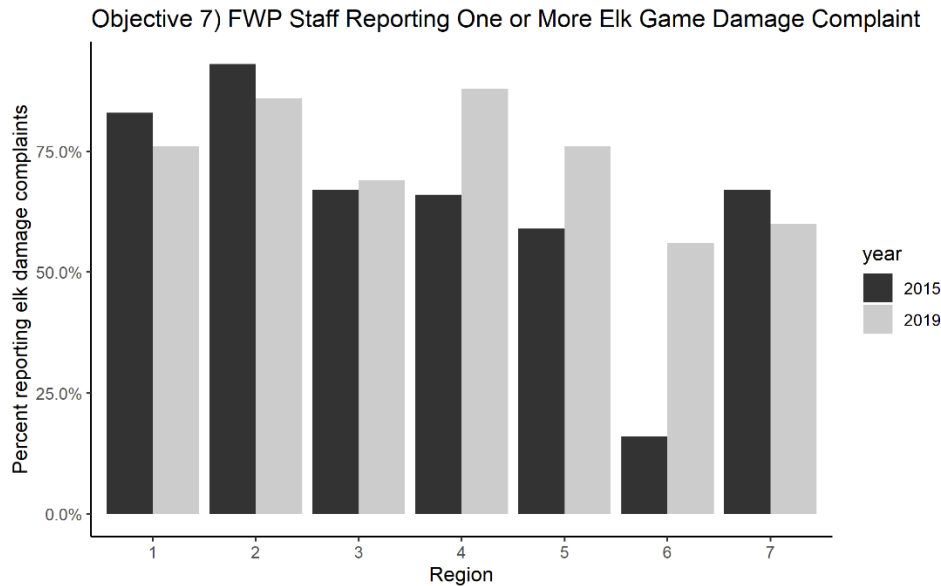
## Objective 7: Reduce game damage

*Quantitative measure.*— Percentage of FWP staff reporting  $\geq 1$  game damage complaint in their district.

*Data used.*— Electronic survey of FWP staff (biologists and wardens) on game damage complaints in their districts.

*Outcomes.*— The percentage of FWP staff reporting  $\geq 1$  elk damage complaint increased from 64% in 2015 to 73% in 2019, however increases occurred primarily in regions 4-6, whereas regions 1, 2, 3, and 7 reported little change or modest decreases.

**Figure 7A. FWP staff reporting one or more elk damage complaints in 2015 and 2019, by region.**



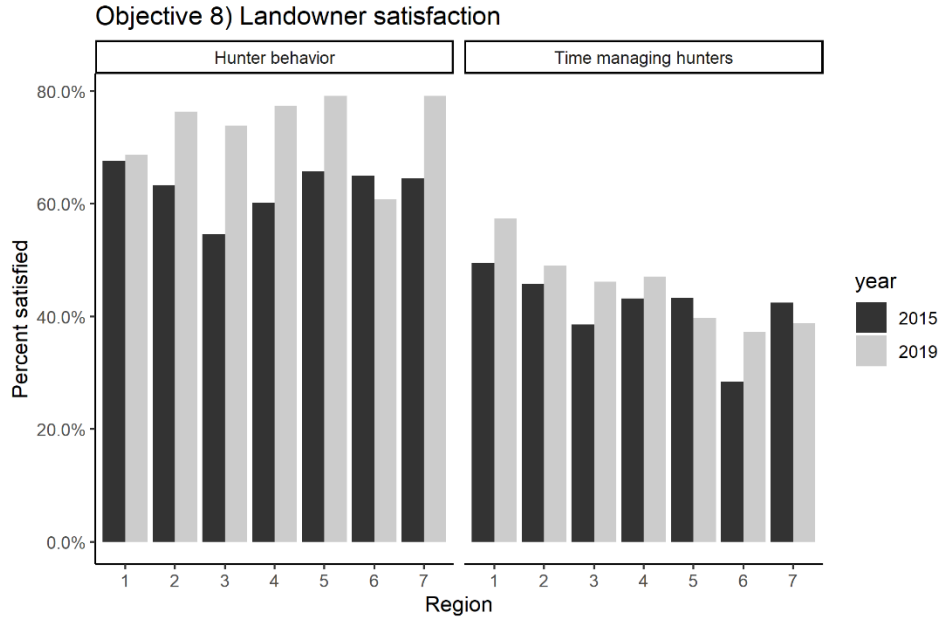
### Objective 8: Reduce hunter impacts on landowners

*Quantitative measure.*— Percentage of landowners ‘satisfied’ or ‘very satisfied’ with hunter behavior and time managing hunters on their property (1-5 scale).

*Data used.*— Mail surveys of private landowners conducted in 2015 and 2019 regarding their satisfaction with ability hunter behavior and time managing hunters (1-5 scale).

*Outcomes.*— Landowners were more satisfied with hunter behavior in 2019 compared to 2015 in all regions except 6. Statewide, an average of 74% of landowners reported being satisfied with elk hunter behavior in 2019 compared to 63% in 2015. Over the same time period, landowner satisfaction with time managing hunters increased from 42 to 45%, with only regions 5 and 7 reporting modest decreases in the percent of landowners satisfied with the amount of time they dedicated to managing elk hunters.

**Figure 8. Percentage of landowners ‘satisfied’ or ‘very satisfied’ with hunter behavior and time spent managing hunters in 2015 and 2019, by region.**



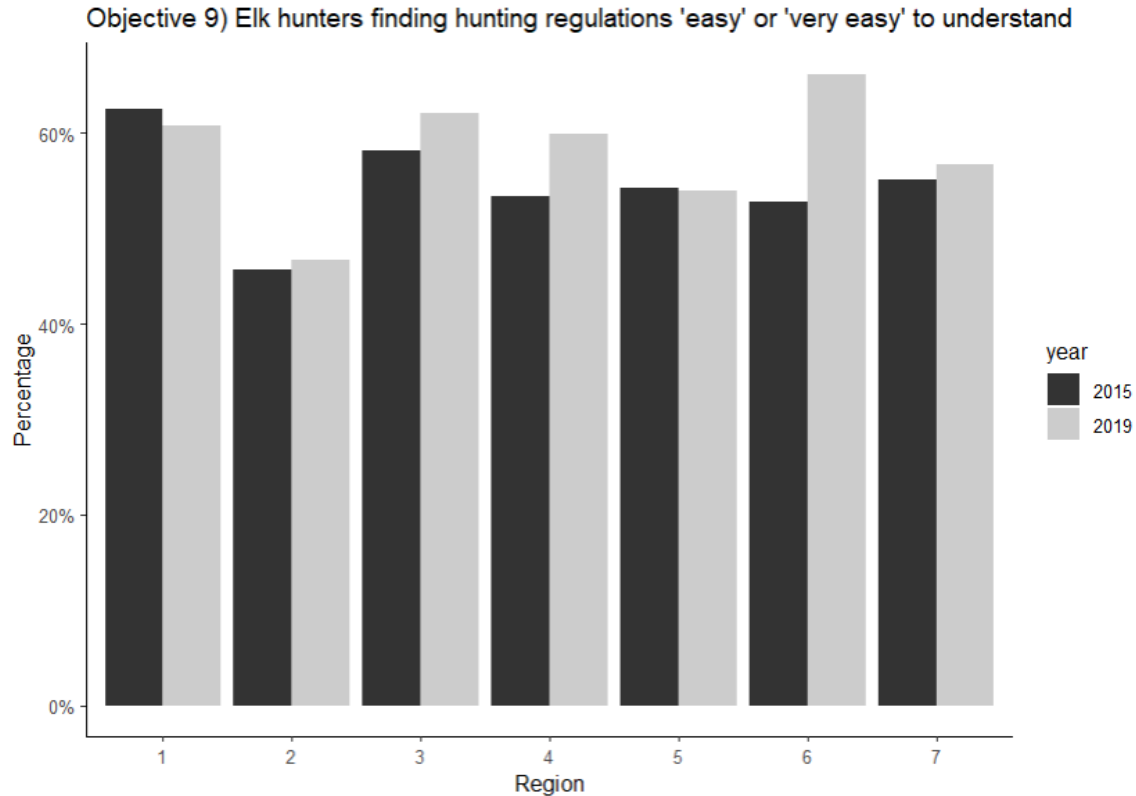
### Objective 9: Simplify rules and regulations

*Quantitative measure.*— Change in percentage of hunters finding regulations ‘easy’ or ‘very easy’ to understand.

*Data used.*— Mail survey of elk license holders completed for 2015 and 2019 hunting seasons.

*Outcomes.*— Overall, most hunters report that elk hunting regulations are easy or very easy to understand. There were modest increases in hunters reporting that they found regulations easy or very easy to understand. The statewide average increased from 55% of elk hunters finding regulations easy or very easy to understand in 2015 to 58% in 2019.

**Figure 9. Percentage of elk hunters finding regulations ‘easy’ or ‘very easy’ to understand in 2015 and 2019, by region.**



**Objective 10: Balance statewide consistency with local flexibility of regulations, rules, and policies.**

*Quantitative measure.*— Change in percent of FWP staff finding rules, regulations, and policies in their districts ‘flexible’ or ‘very flexible’.

*Data used.*— Electronic survey of FWP staff (biologists and wardens) on flexibility of rules, regulations, and policies in their districts.

*Outcomes.*— The percent of FWP staff finding regulations, rules, and policies flexible increased from 41 to 65%. No regional summaries of this metric were available.

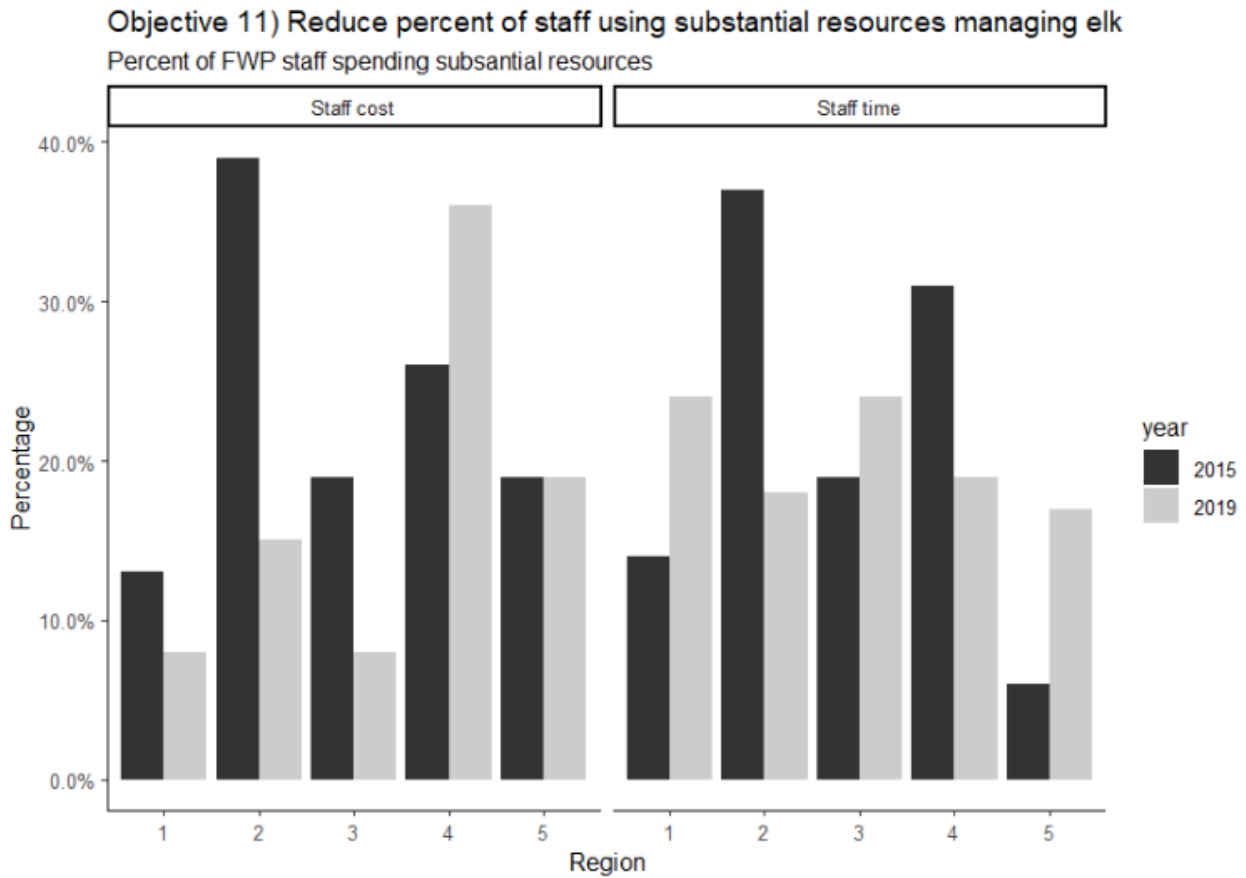
**Objective 11: Keep FWP staff time and costs down.**

*Quantitative measure.*— Change in percent of FWP staff using ‘substantial’ or ‘a lot’ of time or money managing elk in 2015 versus 2019.

*Data used.*— Electronic survey of FWP staff (biologists and wardens) on use of resources to manage elk in their districts 2015 versus 2019.

*Outcomes.*— Statewide, the percent of FWP staff spending a substantial amount of time managing elk decreased slightly from 21 to 18%, while the percent spending a substantial amount of money managing elk decreased slightly more substantially from 22 to 14%. However, both measures varied considerably by region.

**Figure 11. Percentage of FWP staff using staff cost and time to manage elk in 2015 vs 2019. There were not sufficient responses in regions 6 and 7 to provide summaries of change.**



## Data and Methodologies

Data were collected on elk populations, landowner satisfaction, hunter satisfaction, FWP resource allocation, and game damage to evaluate the degree to which shoulder seasons accomplished fundamental objectives outlined above.

### Elk surveys and population modeling

Elk survey counts and a population model were used to evaluate fundamental objectives related to current population status relative to elk plan objectives, the estimated time until elk populations would be within objectives under current season structures, and the harvest rate experience by elk populations. Elk population monitoring is an ongoing activity in Montana and was not initiated solely for the shoulder season assessment. Most elk surveys are conducted with a fixed-wing aircraft (74%), in the winter (76%) and on an annual basis (88%). The surveys are primarily “complete coverage”, in which area wildlife biologists attempt to survey the entire range where they expect to see elk. The primary objective of complete coverage surveys is to enumerate all the visible elk in the surveyed area, using the same methods annually, to measure trends in the population. Complete coverage surveys typically record age and sex classification data as the ratio of calves per 100 cows and bulls per 100 cows.

We used elk count and classification data and fall harvest data (described below) to construct a population model with two separated processes: 1) a model for the biological processes of survival, recruitment and harvest, and 2) the observation process that gives rise to the observed counts and classification ratios in surveys (Paterson et al. 2019). Following Eacker et al. (2017), we defined the annual population cycle from the birth pulse (in May-June) to the following spring (March-April) when calves recruit to the population as 1-year-olds. We estimated the parameters of the population model using a Bayesian framework that allowed estimation of the vital rates while separately accounting for the observation (i.e., population and ratio count) components of the model. Our approach also accommodated incomplete time series of counts (missing data), as well as allowed population projections into the future.

### Literature Cited

Eacker D. R., P. M. Lukacs, K. M. Proffitt, M. Hebblewhite. 2017. Assessing the importance of demographic parameters for population dynamics using Bayesian integrated population modeling. *Ecological Applications* 27: 1280–1293.

Paterson, J. T., K. M. Proffitt, J. Rotella, and R. A. Garrott. 2019. An improved understanding of ungulate population dynamics using count data: insights from western Montana. *PLoS ONE* 14(12): e0226492.

## Elk harvest surveys

Elk harvest estimates were used to evaluate fundamental objectives related to the harvest rate of elk populations, the amount of time until each elk population would meet population objectives, and the distribution of harvest across available habitat. Elk harvest monitoring is an ongoing activity in Montana and was not initiated solely for the shoulder season assessment. Harvest is estimated using stratified random sampling of elk license and permit holders contacted by live callers. For each license or permit issued, sample sizes were drawn to estimate harvest with a target of  $\leq 15\%$  precision at the 80% confidence level. This precision is achieved when harvest is  $\geq 50$  elk for licenses or permits issued to  $\geq 500$  people, or  $\geq 10\%$  of the number issued for licenses or permits issued to  $\leq 500$  people.

To estimate the distribution of harvest across land ownership and access management types, a follow-up survey was conducted of responding hunters who indicated that they harvested an elk. Harvest survey response rates varied between 60-65% annually. Harvest estimates for each license and permit type were summed for each hunting district or time period of interest.

## Landowner surveys

In 2014, FWP conducted a survey of private landowners in Montana. Private landowners were asked how they manage elk hunting access on their lands regarding the following access management systems commonly used by private landowners:

1. Block Management Hunting Access Program.
2. Non-Block Management hunting without a fee involving mostly hunters who are NOT family/friends.
3. Non-Block Management hunting without a fee involving mostly hunters who are family/friends.
4. Outfitting by the landowner.
5. Outfitting by a licensed outfitter other than the landowner.
6. Lease agreement with a non-outfitting business that markets hunting opportunities.
7. Lease agreement with a hunter or group of hunters.
8. Access fees (non-lease) charged per hunter or group of hunters.

The first two of these eight systems are hunting access systems open to common or general use, which we defined as public hunting. The remaining six systems hunting access systems intended for or restricted to the use of a particular person or group of people, or those that are willing to pay access fees directly to landowners, which we defined as exclusive hunting.



Surveys were successfully mailed to 6,741 randomly selected private landowners who own land in rural parts of Montana. The sample was pulled from the Montana State Cadastral Database and was stratified by county to ensure representation of landowners from each of the state's 56 counties and from each of seven FWP Administrative Regions. A probability-proportional-to size sampling scheme was used to ensure that larger landowners had a higher likelihood of being included in the study, while at the same time sampling some landowners who own smaller acreages of land. Two separate replacement mailings of the survey were mailed to non-respondents. A total of 3,261 responses were received, for a response rate of just under fifty percent. This response rate is very good for a survey of this nature. Responses regarding how landowners manage elk hunting access on their lands were used in combination with property size information (e.g., acreage data from Montana's State Cadastral Database) to estimate the acreage for each of the eight systems that private landowners use to manage hunting access on their lands, which were then summed into the more general categories of public and exclusive hunting access.

In 2016, FWP again surveyed private landowners in Montana to learn about the impacts of elk hunting to private landowners and how current elk hunting regulations affect the ability of landowners to manage elk hunting on their property. The survey was mailed to a deliverable list of all 5,531 private landowners owning at least 160 acres in locations where elk are known to be found in Montana according to FWP's elk distribution map. Approximately three weeks following the initial mailing of the survey, a replacement survey was mailed to survey nonrespondents. A total of 2,974 responses were received, resulting in 56% response rate, which is excellent for a survey of this kind.

In 2019, FWP conducted another survey of private landowners in Montana. This was a near replication of the private landowner survey conducted in 2014. Again, private landowners were asked how they manage elk hunting access on their land for the same eight access management systems described in the 2014 study.

There were some modifications to the methodology for the 2019 survey which differed from the 2014 survey. The survey was mailed to a deliverable list of all 6,580 private landowners owning at least 160 acres in locations where elk are known to be found in Montana according to FWP's elk distribution map. Again, the sample was pulled from the Montana State Cadastral database. A total of 3,311 responses were received, for a response rate of 53%. This response rate is very good for a survey of this nature. Again, responses regarding how landowners manage elk hunting access on their lands were used in combination with property size information (e.g., acreage data from Montana's State Cadastral Database) to estimate the acreage for each of the eight systems that private landowners use to manage hunting access on their lands, which were then summed into the more general categories of public and exclusive hunting access.

Results from these surveys were used to evaluate fundamental objectives related to the area open to public hunting of bull and cow elk, the area open to exclusive hunting access for elk, hunter impacts on landowners, and landowner flexibility to manage elk hunting on their property.

### Hunter surveys

During 2016, FWP surveyed resident elk hunters in Montana to learn more about their perceptions of elk hunting regulation complexity. A one-page survey questionnaire was mailed to 4,861 randomly selected resident elk license holders from the 2015 general hunting season. Approximately three weeks following the initial mailing of the survey, a replacement survey was mailed to survey nonrespondents. A total of 2,700 survey responses were received, resulting in a 56% response rate for the survey, which is excellent for a survey of this kind.

During spring 2019, FWP completed a near replication of the elk hunter survey conducted in 2016. Surveys were successfully mailed to 4,837 randomly selected resident elk license holders from the 2018 hunting season. A replacement survey was mailed out to non-respondents four weeks after the initial mailing of the survey. A total of 2,222 survey responses were received for a 46% survey response rate, which is considered very good.

The results of these surveys were used to evaluate the fundamental objective related to simplifying elk hunting rules and regulations.

### FWP staff surveys

During 2015, a survey was conducted of all FWP area wildlife biologists and game wardens regarding the fundamental objectives for performance-based elk shoulder seasons. The initial survey was sent out in July with follow-up reminders in August and October. A total of 26 of 32 area biologists (81.3%), 31 of 102 game wardens (30.4%), and 9 individuals that didn't identify whether they were a biologist or warden responded to the survey.

During 2019, a replication of the 2015 FWP staff survey was conducted of all FWP area wildlife biologists and game wardens regarding the fundamental objectives for performance-based elk shoulder seasons. The initial survey for this effort was sent out in March with follow-up reminders in April and early May. A total of 27 of 31 area biologists (87.1%) and 37 of 86 game wardens (43%) responded to the survey. Staff survey responses were used to evaluate fundamental objectives related to the number of problematic elk distributions, the number of game damage complaints, and the amount of staff time and cost required to manage elk. To estimate the number of problematic elk distributions, estimated mean numbers of problematic elk distributions per hunting district were multiplied by the total number of hunting districts in each FWP Administrative Region.

Appendices

Objective 1 Appendix A – 2019 Elk population counts

**Montana 2019 Elk Counts**

Elk are counted in the winter or spring by aircraft. It is not possible to count all elk in a hunting district and elk plan objectives are based on "Observed Elk", which may be elk observed on trend areas in some cases. Counting elk is an inexact exercise subject to a multitude of weather and timing variables and elk movements between hunting districts. Therefore, counts in some years may not accurately reflect elk numbers and better counts from previous years are reported here.

Hunting District(s)	Elk Management Unit (EMU)	Elk Plan Objective	Objective Range	Most Recent Representative Elk Count	Year of Count	Status - Over, At or Below Objective
100	PURCELL	300	240-360	138	2009	Below
101	SALISH	No stated objective, no wintering elk or no survey flown.				
102	SALISH	No stated objective, no wintering elk or no survey flown.				
103	SALISH	260	208-312	230	2017	At
104	LOWER CLARK FORK	225	180-270	128	2008	Below
109, 110	WHITEFISH	600	480-720	452	2005	Below
120	SALISH	110	88-132	125	2010	At
121	LOWER CLARK FORK	1355	1084-1626	1418	2019	At
122	SALISH	No stated objective, no wintering elk or no survey flown.				
123	LOWER CLARK FORK	365	292-438	428	2019	At
124	LOWER CLARK FORK	130	104-156	138	2008	At
132, 170	NORTH SWAN	No numerical objective. The Elk Plan objective is "a small elk population"				
130, 140, 141	BOB MARSHALL	150-320	150-320	102	2019	Below
150, 151	BOB MARSHALL	310-500	310-500	198	2019	Below
<b>Region 1 Total</b>		<b>3805-4165</b>	<b>3136-4834</b>	<b>3,313</b>		<b>At</b>
200	LOWER CLARK FORK	300	240-360	266	2019	At
201	NINEMILE	600	480-720	832	2019	Over
N Portion of 202	LOWER CLARK FORK	350	280-420	291	2019	At
203	NINEMILE	950	760-1140	853	2019	At
204	ROCK CREEK	600	480-720	891	2019	Over
210, 211	ROCK CREEK & SAPPHIRE CREEK	1450	1160-1740	1901	2017	Over
212	FLINT CK	400	320-480	1200	2019	Over
213	FLINT CK	750	600-900	661	2019	At
214	SAPPHIRE	450	360-540	331	2017	Below
215	DEER LODGE	1400	1120-1680	2650	2018	Over
216	ROCK CREEK	325	260-390	445	2017	Over
217	FLINT CK	600	480-720	648	2019	At
240	BITTERROOT	1000	800-1200	1010	2019	At
250	WEST FORK	1400	1120-1680	901	2019	Below
260	BITTERROOT	50	40-60	123	2019	Over
261, 262	ROCK CREEK	700	560-840	857	2019	Over
270	SAPPHIRE	3,800	3040-4560	4069	2019	At

280	BOB MARSHALL	No wintering elk				
281	BOB MARSHALL	500-700	500-700	370	2019	Below
W Portion of 283(N. Hills/Evaro)	GARNET	300	240-360	146	2019	Below
Central Portion of 283 (Jumbo)	GARNET	90	72-108	89	2019	At
E Portion of 283 (Gold-Belmont)	GARNET	300	240-360	119	2019	Below
282, 285	BOB MARSHALL	900-1100	900-1100	1139	2018	Over
291	GARNET	600	480-720	519	2019	At
292	GARNET	800	640-960	691	2019	At
284, 293	GRANITE BUTTE	750	600-900	272	2019	Below
290, 298	GARNET	600	480-720	865	2019	Over
Region 2 Total		19965-20362	16252-24078	22,139		Over
300	TENDOY	800	700-900	1112	2019	Over
301, 309	GALLATIN/MADISON	500	400-600	555	2019	At
302	TENDOY	625	550-700	1295	2019	Over
310	GALLATIN/MADISON	1500	1200-1800	636	2019	Below
311	GALLATIN/MADISON	2500	2000-3000	2592	2019	At
312	BRIDGER	600	480-720	1301	2019	Over
313	NORTHERN YELLOWSTONE	4000	3000-5000	5738	2018	Over
314	GALLATIN/MADISON	3000	2400-3600	3704	2019	Over
315	CRAZY MOUNTAINS	1000	800-1200	1085	2018	At
316	NORTHERN YELLOWSTONE	No wintering elk				
317	ABSAROKA	900	720-1080	1414	2019	Over
318	DEER LODGE	500	400-600	562	2019	At
319	FLEECER	955	812-1100	1041	2018	At
320, 333	TOBACCO ROOT	1000	800-1200	1541	2019	Over
321	SAPPHIRE	No wintering elk				
322, 323, 324, 325, 326, 327, 330	GRAVELLY	8,000	6400-9600	10690	2019	Over
328	TENDOY	625	550-700	796	2019	Over
329	PIONEER	830	760-900	1112	2019	Over
331	PIONEER	1290	1180-1400	753	2019	Below
332	PIONEER	830	760-900	742	2019	Below
334	SAPPHIRE	No wintering elk				
335	DEER LODGE	600	480-720	780	2018	Over
339, 343	GRANITE BUTTE	1400	1120-1680	1695	2019	Over
340 <sup>1</sup>	HIGHLAND	1000	850-1150	1224	2019	Over
350, 370	HIGHLAND	600	510-690	799	2019	Over
341	FLEECER	525	438-600	446	2019	At
N 360	GALLATIN-MADISON	1200	960-1440	1715	2019	Over
S 360, 362 <sup>2</sup>	GALLATIN-MADISON	3500	2800-4200	4187	2019	At
361	GALLATIN-MADISON	No stated objective.				
380	ELKHORN	2000	1700-2300	2086	2018	At
388	GRANITE BUTTE	No stated objective, no wintering elk or no survey flown.				

390	BRIDGER	900	720-1080	1803	2019	Over
391	BRIDGER	975	780-1170	1539	2018	Over
392	WEST BIG BELT	400	320-480	289	2018	Below
393	BRIDGER	1500	1200-1800	3038	2018	Over
<b>Region 3 Total</b>		44,055	35,940-52,390	56,270		Over
400, 403, 404, 405, 406, 419, 444, 471	GOLDEN TRIANGLE	No stated objective, no wintering elk or no survey flown.				
401	SWEETGRASS HILLS	350	280-420	480	2019	Over
410	MISSOURI RIVER BREAKS	2000-2300	2000-2300	3677	2018	Over
W 411, 511	SNOWY	400	320-480	580	2019	Over
E 411 <sup>3</sup> , 530	SNOWY	400	320-480	6624	E 411 = 2018, 530 = 2019	Over
412	SNOWY	300	240-360	528	2019	Over
413	LITTLE BELT	500	400-600	485	2019	At
415	BOB MARSHALL	200	160-240	319	2019	Over
416	LITTLE BELT	475	380-570	819	2019	Over
417	MISSOURI RIVER BREAKS	375	350-400	1970	2019	Over
418	LITTLE BELT	150	120-180	298	2019	Over
420, 448	LITTLE BELT	1200	960-1440	1104	2019	At
421, 423	BIRDTAIL	500	400-600	661	2019	Over
422	BOB MARSHALL	500	450-550	983	2019	Over
424, 425, 442	BOB MARSHALL	2500	2250-2750	2107	2019	At
426	MISSOURI RIVER BREAKS	75	75-75	287	2019	Over
432	LITTLE BELT	325	260-390	384	2019	At
441	BOB MARSHALL	500	400-600	568	2019	At
445, 455	DEVIL'S KITCHEN	2500	2000-3000	4029	2019	Over
446	EAST BIG BELT	950	760-1140	2184	2019	Over
447	HIGHWOOD	700	560-840	1781	2019	Over
449, 452	CASTLE MOUNTAIN	600	480-720	1207	2019	Over
450	TETON	87	75-100	538	2019	Over
451	BRIDGER <sup>6</sup>	275	220-330	210	2019	Below
454	LITTLE BELT	250	200-300	121	2019	Below
<b>Region 4 Total</b>		16,263	13660-18865	31,944		
500	MID-YELLOWSTONE	60	48-72	270	2018	Over
502,510	MID-YELLOWSTONE	60	48-72	164	2019	Over
511	SNOWY	Counted with W 411 - see above				
520	ABSAROKA	1050	840-1260	1247	2019	At
530	SNOWY	Counted with E 411 - see above				
540	LITTLE BELT	600	480-720	1915	2019	Over
560	ABSAROKA	700	560-840	1872	2019	Over
570	MID-YELLOWSTONE	100	80-120	398	2018	Over
575	MID-YELLOWSTONE	225	180-270	1148	2019	Over
580	CRAZY MOUNTAINS	975	780-1170	4170	2019	Over
590 Bull Mtns	BULL MOUNTAINS	750	600-900	2690	2019	Over
590 Pine Ridge	BULL MOUNTAINS	300	240-360	353	2018	At

<b>Region 5 Total</b>		4,820	3,856-5,784	14,227		
<b>600, 611, 640, 641, 650, 651, 652, 670</b>	<b>HI LINE</b>	Elk Plan Objective is "As low as possible"		No surveys are flown		
<b>620, 621, 622</b>	<b>MISSOURI RIVER BREAKS</b>	1400-1650	1400-1650	1662	2018	Over
<b>630, 631, 632</b>	<b>MISSOURI RIVER BREAKS</b>	300-350	300-350	632	2018	Over
<b>680,690</b>	<b>BEARS PAW</b>	250	225-275	647	2018	Over
<b>Region 6 Total</b>		1950-2500	1,925-2,275	2,941		At
<b>700, 701</b>	<b>MISSOURI RIVER BREAKS</b>	200-300	200-300	1571	2016	Over
<b>702, 704, 705</b>	<b>CUSTER FOREST</b>	500	400-600	2152	2019	Over
<b>703</b>	<b>HI LINE</b>	No stated objective, no wintering elk or no survey flown.				
<b>Region 7 Total</b>		700-800	600-900	3,723		Over
<b>STATE TOTAL</b>		92,138		134,557		

<sup>1</sup> Counts for 340 had been summed with 350 & 370 in previous reports.

<sup>2</sup> Counts for S 360 and 362 now combined; populations are no longer independent and brucellosis hazing program moves elk from S 360 into 362

<sup>3</sup> E 411 was referred to as 411 North in previous reports and is surveyed every other year.

## Objective 1 Appendix B – Predicted years to objective

Region	EMU	Years to objective	2019 Objective status
1	100: PURCELL	>10	Below
1	104: LOWER CLARK FORK	>10	Below
1	109, 110: WHITEFISH	>10	Below
1	130, 140, 141: BOB MARSHALL	>10	Below
1	150, 151: BOB MARSHALL	3.5	Below
2	201: NINEMILE	>10	Above
2	204: ROCK CREEK (new for 2015-16)	>10	Above
2	210, 211: ROCK CREEK & SAPPHIRE CREEK	>10	Below
2	212: FLINT CK (new for 2015-16)	>10	Above
2	214: SAPPHIRE	>10	Below
2	215: DEER LODGE	1.8	Above
2	216: ROCK CREEK	>10	Below
2	250: WEST FORK (new for 2015-16)	2.1	Below
2	260: BITTERROOT (new for 2015-16)	>10	Above
2	261, 262: ROCK CREEK (new for 2015-16)	<1	At
2	281: BOB MARSHALL	6.3	Below
2	282, 285: BOB MARSHALL	>10	Below
2	284, 293: GRANITE BUTTE	>10	Below
2	290, 298: GARNET	>10	Above
3	300: TENDROY	>10	Above
3	302: TENDROY	>10	Above
3	310: GALLATIN/MADISON	>10	Below
3	312: BRIDGER	3.3	Above

3	314: GALLATIN/MADISON	>10	Above
3	317: ABSAROKA	3.9	Above
3	320, 333: TOBACCO ROOT	1.9	Above
3	322, 323, 324, 325, 326, 327, 330: GRAVELLY	>10	Above
3	328: TENDOY	>10	Above
3	329: PIONEER	2.8	Above
3	331: PIONEER	>10	Below
3	332: PIONEER	>10	At
3	335: DEER LODGE	>10	Above
3	339, 343: GRANITE BUTTE	>10	Above
3	340: HIGHLAND	>10	Above
3	350, 370: HIGHLAND	>10	Above
3	390: BRIDGER	>10	Above
3	391: BRIDGER (new for 2015-16)	3.7	Above
3	392: WEST BIG BELT (new for 2015-16)	>10	Below
3	393: BRIDGER	>10	Above
4	401: SWEETGRASS HILLS	>10	Above
4	410: MISSOURI RIVER BREAKS	>10	Above
4	412: SNOWY	<1	Above
4	415: BOB MARSHALL	>10	Above
4	416: LITTLE BELT	2.2	Above
4	417: MISSOURI RIVER BREAKS	>10	Above
4	418: LITTLE BELT	>10	Above
4	421, 423: BIRDTAIL	<1	Above
4	422: BOB MARSHALL	>10	Above
4	424, 425, 442: BOB MARSHALL	<1	At
4	426: MISSOURI RIVER BREAKS	>10	Above
4	445, 455: DEVIL'S KITCHEN	>10	Above
4	446: EAST BIG BELT	>10	Above
4	447: HIGHWOOD	>10	Above
4	449, 452: CASTLE MOUNTAIN	3.3	Above
4	450: TETON	>10	Above
4	451: BRIDGER (new for 2015-16)	>10	Below
4	454: LITTLE BELT	>10	Below
5	502, 510: MID-YELLOWSTONE	>10	NA
5	540: LITTLE BELT	>10	Above
5	560: ABSAROKA	>10	Above
5	570: MID-YELLOWSTONE	4.7	Above
5	575: MID-YELLOWSTONE	>10	NA
5	580: CRAZY MOUNTAINS	>10	Above
6	620, 621, 622: MISSOURI RIVER BREAKS	>10	Above
6	630, 631, 632: MISSOURI RIVER BREAKS	>10	Above
6	680, 690: BEARS PAW	>10	Above
7	700, 701: MISSOURI RIVER BREAKS	3.5	Above
7	702, 704, 705: CUSTER FOREST	>10	Above

2	E Portion of 283 (Gold-Belmont): GARNET	>10	NA
2	W Portion of 283(N. Hills/Evaro): GARNET	>10	NA
	W portions of 411, 511, E portion 411, 530:		
4	SNOWY	>10	NA
	W portions of 411, 511, E portion 411, 530:		
5	SNOWY	>10	NA