Montana Fish, Wildlife & Parks

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

*September 27, 2013*

# U.S. Forest Service and Montana Department of Fish Wildlife and Parks Collaborative Overview and Recommendations for Elk Habitat Management on the Custer, Gallatin, Helena, and Lewis and Clark National Forests


## Abstract:

A group of wildlife biologists from the Forest Service (FS) and Montana Department Fish, Wildlife, and Parks (MDFWP) have compiled recommendations, along with a discussion of their conversations and the relevant literature, for elk habitat management. These are recommendations only, and the group is not making decisions or setting policy for either agency in this effort. While we focus on elk habitat considerations in this effort, we do not advocate for single species management. We advocate for ecologically appropriate habitat management under an umbrella of landscape scale ecosystem management, which focuses on providing a range of habitats to support all fauna native to the landscape, including elk. These recommendations apply only on the Custer, Helena, Lewis and Clark, and Gallatin National Forests.

The recommendations are based on the most current available information and the collective experiences of these biologists. They considered contemporary issues and circumstances such as increases in recreation of all types on these National Forests, changes in the numbers and distribution of elk (including the use of private lands where hunting is limited or not allowed), the restoration of large predators, the current mountain pine beetle epidemic, and small and large fires on the Custer, Helena, Lewis and Clark, and Gallatin National Forests in the Northern Region of the Forest Service. The shared goal of the two agencies is to provide for elk and other big game on National Forest System (NFS) lands throughout the year, recognizing that overall agency missions differ. That is, within the multiple use mandate of the Forest Service, management for elk will be one of many considerations on NFS lands. The overview and recommendations address an appropriate elk analysis unit, management of cover and recreation on winter ranges, security during the archery and rifle hunting seasons, motorized route management relative to habitat effectiveness, cover on spring-summer-fall ranges, cover patch size, forage, calving areas, and migration corridors. The recommendations conclude with a short discussion of considerations for bighorn sheep.

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## INTRODUCTION

MDFWP elk population management focuses on maintaining numbers well above population viability thresholds, protecting certain sex and age classes from over-harvest, providing public hunting opportunity, and attempting to balance elk distribution across public and private lands. The FS strives to complement MDFWP's efforts through management of elk habitat on FS lands.

The two agencies share the goals of harvest, population, and other elk and habitat objectives being met (e.g. State Elk Plan, Forest Plan), as well as elk using FS lands in an acceptable way that is proportional to their availability. These goals are the topic of annual coordination meetings between the two agencies. If harvest, population or other elk objectives are not being met, then the two agencies should work together beyond meeting annually in order to identify whether any limiting factor relates to FS habitat management, MDFWP regulations, other factors (e.g., predation, winter kill, disease, climate change, stochastic events, inherent habitat differences between FS lands and other ownerships), or a combination of these.

Forest Plans, which provide overall management direction related to elk habitat, were developed for the Custer, Gallatin, Helena, and Lewis and Clark National Forests between 1982 and 1986. Three of the four forests (Helena, Lewis and Clark, Gallatin) have Forest Plan standards related to the management of roads and forested cover. The Custer National Forest does not have a specific, quantifiable elk standard in its Forest Plan.

Substantial changes have occurred between the 1980's and the present relative to elk numbers, elk distribution, habitat, and hunting season structures. There has also been on-going elk research efforts and published literature on the subject of elk habitat management that is important to consider. This overview and the recommendations reflect the efforts of wildlife biologists from the FS and MDFWP to use the best contemporary information and their collective experiences in managing elk and elk habitat to address current issues and conditions on the four National Forests.

## ACKNOWLEDGEMENTS

This effort took place over a nearly three year time period and involved a series of meetings and conference phone calls involving wildlife biologists from the FS and the MDFWP. While participation by individuals at meetings varied, there was a core group from both agencies that conducted literature reviews, and document writing and editing. This group also interfaced with academic elk experts and researchers (see list of editors, reviewers, and contributors at the conclusion of the paper), as well as corresponding managers, planners, and line officers. The contributions of all those who attended meetings and who completed assignments to provide information and/or analysis to help further the discussions were tremendous. While the effort incorporated scientific research, literature, and survey information, many of the recommendations were influenced by our collective years and experience with managing elk populations and elk habitat and were the product of our thoroughly discussed, professional judgments. We hope that this effort stimulates constructive criticism and new research that, along with a continuing evaluation of the utility and content of these recommendations, would be used in promoting adaptive changes in the management of elk and elk habitat. To keep up with

current science on elk and habitat management, this document is intended to be updated periodically through continued partnership between the FS and MDFWP.

A significant aspect of this effort is the recognition of the importance of on-going collaboration between the two agencies regarding the management of elk populations and habitat. As used here, collaboration refers to at least one annual meeting between the FS (Forest level) and MDFWP (Regional level). For the FS this will include a line officer representative and the Forest Biologist. **Appendix A** includes some decision diagrams intended to facilitate collaboration between the two agencies and to identify limiting factors that would inform elk herd specific strategies.

We also recognize the importance of frequent dialogue between personnel from the two agencies at the local level. This interchange needs to be proactive and occur before, during, and after specific management actions are proposed, implemented, and monitored.

## INTENDED GEOGRAPHIC AREA

The area of applicability includes all of the four National Forests mentioned above within the state of Montana. There is a portion of the Custer National Forest within South Dakota. While elk occur on the South Dakota portion of the Sioux District, there currently is no hunting season, so recommendations that revolve around hunting would not apply there. Non-hunting recommendations could be considered in conjunction with the South Dakota Department of Game, Fish, and Parks biologist for that area.

This area ranges from just west of the continental divide on a portion of the Helena National Forest to the southern and eastern borders of the state and encompasses the island mountain ranges of central Montana. The area includes both sizeable continuous blocks of National Forest lands as well as scattered smaller blocks. Habitats include alpine coniferous forests, shrublands, grasslands, and riparian areas. Coniferous forests on these four National Forests tend to be more open and dry than coniferous forests west of the Continental Divide. Disturbances such as fire and insect-caused mortality of trees are major influences on the vegetation dynamics of this geographic area. In addition, these National Forests are interspersed with large areas of private land.

The proportion of FS lands in a Hunting District (HD) or Elk Management Units (EMU) varies greatly. As the amount of FS lands varies substantially within the geographic units that MDFWP uses as a basis for setting population objectives and other metrics, it is sometimes difficult to make inferences about elk numbers, distribution, and/or seasonal use of habitat within the administrative boundaries of NFS lands. Trending from west to east, NFS lands are a smaller portion of the land ownership matrix, and often receive hunting pressure and general recreational use disproportionate to their occurrence on the landscape, which may contribute to the displacement of elk from public to private lands.

## OBJECTIVES

The objective of this document is to capture the extensive discussion and collaboration that took place between wildlife biologists and managers (FS), and area biologists and managers (MDFWP) on matters related to elk and other big game, and the habitat needs for maintaining these species on public lands represented by these four national forests.

The shared goal of the biologists involved in this effort is to maintain and provide for big game wildlife species on NFS land throughout the year. The agencies also recognize the differences in their missions and that the management of big game does not always take precedence in the management of NFS lands. However, it was agreed that some considerations for big game habitat are valid both programmatically (Forest Plans) and at the project level to help achieve this mutual goal.

The recommendations are intended to also serve the public's strong interest in big game management and enjoyment of wildlife (a publicly owned resource) on public land for the purposes of hunting, wildlife viewing, and for other values and ecological roles (e.g. herbivory, predator prey dynamics, a source of carrion, etc.) of wild ungulates. Although the objective applies broadly to most big game species, the content of the recommendations refers specifically to elk. It was recognized, that in some cases, big game species other than elk will be as, or more important to consider relative to site-specific project level impacts.

These recommendations and the discussions around which the agency participants arrived at consensus provide a foundation to account for current understanding of issues, management emphases, and the body of knowledge represented in the literature relative to elk and habitat management. The agency participants recognize that their recommendations do not address all types of management actions (e.g. energy development).

## CURRENT ISSUES RELATED TO ELK MANAGEMENT

Elk numbers have been increasing across the west and in Montana since the early to mid-1900s. Statewide, post-season elk numbers increased from 8,000 in 1922 to 55,000 in 1978 and to about 141,000 in 2011. As such, there are no viability concerns for Rocky Mountain elk in Montana or on any of the four Forests. This is supported by their global status of "G5" and the statewide status of 'S5" which are both defined as "common, widespread, and abundant…" However, elk remain a management indicator species, as well as an economically and socially important species with large public interest. They continue to provide hunting, wildlife viewing, and photography opportunities, and to fill ecological roles associated with having this native species on the landscape.

Elk inhabit much of the area covered by these four Forests. Elk populations are dynamic, but have generally expanded and increased in numbers since the Forest Plans were adopted in the late 1980's. Some elk populations are above State Elk Plan objectives for the respective Elk Management Unit (MDFWP 2005). Populations above the State Elk Plan objective represent non-compliance with the management plan and should not be generally interpreted as a positive condition based on state law.

Currently, in some areas of Montana, the distribution of elk has become a primary management issue. In some areas elk are present and spending significant amounts of time on private lands. Issues with displacement from public lands to private lands, or disproportionate use of private lands are widely recognized, and there are multiple contributing factors. These factors potentially include differences in access for hunting, habitat condition, hunting regulations, and other factors such as predation, climate change, stochastic events, inherent habitat differences between FS lands and other ownerships, or a combination of these.

MDFWP generally uses Hunting District and Elk Management Unit boundaries to gather information on population objectives, hunting success, bull-cow ratios, and other aspects of elk management. The proportion of a hunting district or elk management unit that is in part comprised of FS lands varies greatly. The FS does not monitor elk or other big game and relies on MDFWP for information on elk population trends. Since the surveys conducted by MDFWP do not occur exclusively on FS lands, it is difficult to draw inferences on elk population effects from habitat management on FS lands.

The lack of public access to hunt big game on private lands and the resulting differences in relative hunting pressure can play a major role in elk population dynamics and distribution. Human disturbance and potential for displacement of big game animals is not restricted to the 5- week rifle season currently in place in Montana. Because archery hunting has increased significantly in popularity, there has been a noted shift in some cases of elk moving to private land, as a result of displacement during the archery season. Human disturbance may also influence elk habitat use and distribution during time periods outside of the hunting season. In addition, predators (generally mountain lions, wolves, and bears) also influence elk population dynamics and distribution in some areas.

Cover dynamics also have the potential to affect elk habitat use (Peek et al. 1982, Unsworth et al. 1988). However, our management paradigm regarding the relationship between cover and elk reflected by the work Lyon et al. completed in 1985 (elk and timber management) was based on a focused road building and timber management program on Montana forests. That paradigm currently has shifted towards smaller, more focused fuel reduction thinning projects; although, the pendulum could swing back toward larger timber harvest projects in the future. Many forested areas that were regenerated by timber harvest (from the 50's, 60's, and 70's) have largely recovered and are healthy sapling and pole sized forested stands. However, insects and diseases have reduced the amount of mature live coniferous tree cover that is available on the landscape. These impacts are currently most notable on the Helena National Forest, but have also affected the amount of live coniferous cover on the other National Forests that are included in this assessment. Small and large fires have also affected cover availability.

Forage remains a key habitat attribute affecting elk population dynamics and distribution, as well as their use of a landscape. Forage quality and quantity can be affected by domestic grazing, noxious weeds, fire, and forest management.

## OVERVIEW AND RECOMMENDATIONS

### *1. Scale and Scope of an Elk Habitat Analysis*

The recommendation is to use an elk analysis unit (EAU), which in many cases may reflect elk herd unit home ranges as defined by Edge et al. (1986). Edge et al. showed that cow elk segregated into discrete herds and showed fidelity to a specific geographic area. They concluded that this is the normal social structure for the species, and that the herd unit represents the best evaluation area for assessing the impact of various management activities on elk habitat. Ideally, herd unit home ranges are *defined by animals*, typically on the basis of radio relocation data collected over enough time and for all seasons that the annual use patterns of elk form a pattern (Hillis et al. 1991; Lyon and Christensen 1992). Since this level of understanding of herd ranges is not consistently available across the geographic area represented by the four forests, the EAU (*defined by people*) represents the best approximation of a herd unit home range based on local knowledge of biologists from both agencies (as well as other knowledgeable sources). The use of elk analysis units is also consistent with Hillis et al. (1991) and Lyon and Christensen (1992) as they refer to the term "habitat analysis unit" in their work. If there is no observational or survey data on which to delineate the EAU(s) for a given project area, the EAU(s) should be based the best professional judgment of both FS and MDFWP local biologists.

The EAU serves as the unit for examining direct, indirect, and cumulative effects at the project level.

**Discussion:**

Both agencies agreed that the area for assessing direct, indirect, and cumulative effects to elk habitat is to be identified up front and be biologically defensible.

The state of Montana in its 2005 Elk Plan defines elk objectives by Elk Management Units (EMU). Each EMU encompasses one or more hunting districts that share similar ecological characteristics and, in most cases, encompasses the yearlong range of major elk populations inhabiting the EMU. Hunting districts are somewhat convenient to use in discussions regarding elk populations since those are the basis for setting harvest quotas and hunting regulations. However, FS and MDFWP wildlife biologists agreed that EMUs and hunting districts are too large to appropriately quantify FS project level effects.

Edge et al. (1986) recommended using elk herd unit home ranges as the basic land unit for elk management. Hillis et al. (1991) recommended using the local herd home range during hunting season as the ideal basis for analyzing elk security areas. For the elk herds discussed in Hillis et al., herd units had been determined using telemetry studies (relocations of elk with radio-collars over time). However, Hillis et al. also discussed the use of a standardized "habitat analysis unit" and that in the absence of telemetry defined area, to use the experience of reliable local biologists, hunters, and outfitters.

There was some concern from MDFWP wildlife biologists about drawing elk analysis units without the benefit of telemetry studies. Knowing that this data was not consistently available or likely to become available, the agency participants discussed the use of watersheds ($6^{th}$ code or possible $5^{th}$ code) as one basis on which to analyze the quality of elk habitat. Watersheds are logical units for many ecological processes and are consistent with Lyon and Christensen (1992) from the perspective of representing a "geographic" boundary. Watershed boundaries also have some biological meaning relative to elk. For example, Lyon et al. (1985) point out that some topographic features (such as ridgelines) provided line-of-sight barriers between elk and human disturbance, which reduced the displacement distance. The agency participants agreed that a collaborative mapping effort from both agencies' biologists would be needed and based on the best professional judgment of the individuals involved.

The agency participants recognized that there is year to year variability of the areas used by an elk herd, as well as potential overlap of elk herd unit home ranges, either on summer range or on winter range. However, there was an acknowledged need for an analysis tool which provides non-overlapping (to the extent possible), relatively static EAU's to which Forest Plan direction and analyses would be applied. We expect that elk analysis units will be large enough to encompass this natural variation in the way elk use landscapes. EAUs will need to be reviewed periodically (by local FS and MDFWP biologists) to reflect new or better information if and when it becomes available. We recommend that EAU's be re-evaluated at least every 10 years (based on Van Dyke et al. 1998).

Where EAU's include private land, there was some discussion of whether the FS should not only take the habitat conditions and circumstances on adjacent lands into account when designing and analyzing projects (cumulative effects analysis), but whether the FS should be required to compensate by managing at a higher standard when conditions on adjacent land(s) were low. There was also concern that high value elk habitat conditions and circumstances on private lands could justify a lower standard on adjacent NFS lands. The agency participants recognized that elk may use lands with limited or no hunting access differently than public lands that typically have higher levels of hunting pressure. For example, the importance of cover and security areas may be less on private land where hunting pressure and recreational use is lower, than on public land where hunting pressure and recreational use is generally higher. When the goal is to keep elk on public land, we would encourage consideration of conditions on all ownerships within the EAU, whether good or poor, when making decisions at the project level.

### *2. Ecological Context*

The agency participants focused on elk habitat considerations in this effort. That being stated clearly, the group advocates for ecologically appropriate elk habitat management under the umbrella of landscape scale ecosystem management, which provides a range of habitats to support all fauna native to the landscape, including elk. This landscape scale ecosystem approach includes a complementary ecosystem and species specific approach (coarse filter/fine filter) to guide ecological restoration based on maintaining biological diversity.

**Discussion:**

The ecosystem component (coarse filter) includes a consideration of the composition, structure, ecological functions, disturbances, and habitat connectivity characteristics of an ecosystem. Providing habitat conditions across a landscape that are representative of those which produced and have sustained native fauna will generally provide for ecological integrity and biological diversity at a landscape scale. However, there may be circumstances where maintaining the appropriate habitat requirements for a particular species at the appropriate geographic scale does not result in the species being present for reasons outside of the FS control (e.g. not habitat related).

The species specific component (fine filter) of this approach focuses on the critical habitat elements and limiting factors for a particular species, and may be focused more on human related disturbances rather than habitat. An example of a fine filter consideration is limiting human disturbances on big game winter range to prevent displacement or harassment.

With an effective ecosystem/coarse filter component in place, the more costly and information intensive species specific/fine filter approach can be focused on the few species whose requirements and circumstances may not be fully addressed by the ecosystem/coarse filter approach.

Habitat varies in space and time given the dynamic nature of ecosystems. This may be referred to as natural range of variation (NRV); FS 2012 Planning Rule (USDA-FS 2013). NRV is defined as the spatial and temporal variation in ecosystem characteristics under historic disturbance regimes during a reference period. The reference period considered should be sufficiently long to include the full range of variation produced by dominant natural disturbance regimes, often several centuries, for such disturbances as fire and flooding and should also include short-term variation and cycles in climate. Natural range of variation (NRV) is a term used synonymously with historic range of variation or range of natural variation. The NRV is a tool for assessing ecological integrity, and does not necessarily constitute a management target or desired condition. The NRV can help identify key structural, functional, compositional, and connectivity characteristics, for which plan components may be important for either maintenance or restoration of such ecological condition. Addressing departures from NRV (e.g. conducting treatments to increase aspen habitat if aspen habitat is underrepresented on the landscape), generally contributes to providing habitat conditions across a landscape that are representative of those which produced and sustained the fauna native to that landscape. Native species (including elk) evolved with, adapted to, and contributed to, natural disturbance patterns and the resulting mosaic of habitat conditions. The diverse needs of all species across a landscape require the consideration of habitat requirements over broad geographic areas and extended time periods.

Habitat restoration opportunities may exist where conditions have departed from those that provided for the species that are native and adapted to that landscape. Restoring the range of ecological conditions that sustained native species in the past will best conserve biological diversity and will maintain habitat for a broad range of species.

### *3. Winter Range Recommendation*

Human disturbance on winter ranges should be minimized to prevent displacement or harassment of elk on winter range. In addition, the amount and types of available cover and forage should accommodate the needs of elk (within the bounds described in the ecological context section above) and take into consideration the limiting factor for elk on winter range.

At the project level, the various canopy cover classes of conifer cover on winter range will need to be examined relative to their potential benefit to elk.

**Discussion:**

The desired condition for winter range is to maintain elk use of NFS lands during the winter and early spring (approximately December 1 to May 15, but should be flexible to account for site specific conditions), in keeping with MDFWP 2005 Elk Plan and FS Forest Plan direction for multiple resources.

The agency participants agreed that winter range would either be updated at the project level by MDFWP for an elk herd or default to the delineations currently mapped by MDFWP and available on their website. MDFWP currently does not delineate or map 'critical/crucial' winter range separate from other winter range. It was recognized that in many areas very little winter range is found on NFS lands due to their relatively higher elevations and accompanying higher snow accumulations. Given that consideration, where NFS lands do provide winter habitat for elk, the agency participants defined a desired condition of providing maximum protection, by maintaining adequate forage and cover and by restricting travel for the objective of maximizing effective use of winter ranges on NFS lands by elk. Consistent with this idea, (but not generally considered by the FS in travel management), it was recognized that in a given local situation, special area closures may be warranted for motorized and non-motorized uses (precluding those activities such as snowshoeing or skiing), or at least a consideration of prohibiting cross-country or dispersed travel on winter range by designating travel corridors for both motorized and non-motorized recreation.

Both motorized and non-motorized routes should be examined for the potential to disturb and/or displace elk. Elk may be able to habituate to predictable, limited human travel when it is limited to a designated route (with associated area closures) through winter range, although there may still be physiological effects (Canfield et al. 1999; Cassier and Ables 1990). The location of routes should be examined as well. Relocation of routes may reduce impacts on elk, for example, by relocating an over-the snow motorized route away from key areas used by elk in severe winter conditions.

The literature suggests that forested cover on winter range may have multiple functions including snow interception, thermal modulation, wind buffering, and to provide areas that "hide" animals and provide security in the face of disturbance. The first two functions are provided by relatively mature forest stands with relatively high canopy cover (40-100%) (Carter 1984, Eon 2004). Thomas et al. (1979) suggested that thermal cover is coniferous trees at least 40' in height and 70% crown closure, but these numbers have not been validated experimentally (Skovlin et al. 2002).

Lyon et al. (1985) reported that east of the Continental Divide elk forage in grasslands during the winter, but seek cover in adjacent timber stands. The research summarized that logging in these forested stands will normally be detrimental to elk. West of the Continental Divide, Thompson et al. (2005) documented the importance of forage availability in the coniferous stands when snow conditions in the grasslands become crusty. The research recommended maintaining connected patches of denser canopies for snow interception, and to maintain some more open canopy conditions that result in "forested forage". Skovlin et al. (2002) also report that different stand conditions provide varying degrees of thermal protection and cover from snow. Mysterud and Ostbye (1999), in their discussion of all the important functions of cover for ungulates, distinguish between canopy cover, which shelters an animal from above, and ground cover, which is what hides an animal viewed from ground positions, which are both potentially important functions of cover on winter range. All that being said, elk populations can prosper in areas lacking a coniferous forest structure (Skovlin et al. 2002). In those situations, elk may use topography and aspect to regulate temperature (Beall 1974).

Cook et al. (1998) concluded that elk benefited more from forage than from cover in terms of overall fat metabolism through the winter. They concluded that thermal cover may be important under certain conditions, but its value is relational to other habitat attributes that contribute to the productivity of elk herds. The agency participants had an opportunity to discuss this research with staff from the Starkey Research Station. We concluded that the conditions under which the study was conducted, including the climate of the study area and the use of penned and fed elk, may not be applicable to winter conditions for free ranging wild elk on the four forests addressed in this document.

The agency participants ultimately agreed that elk may use cover in the winter for a variety of reasons that may include thermoregulation, but that forest cover may also be important in keeping forage available to elk in some situations (crusty, icy conditions, or deep snow for example), or to buffer elk from potential disturbances on winter ranges. MDFWP representatives pointed out that from an energy expenditure reduction standpoint, big trees and multi-layer canopies may provide benefits not provided by small trees or single layer forest canopies. The participants concluded that coniferous cover should generally be maintained on elk winter ranges within the capability of the landscape (see ecological context section). The agency participants also discussed the time it takes for conifer cover to become multistoried or dense-canopied, which is the kind of structure that provides snow interception following regeneration of forest cover (e.g. burning or timber harvesting) on winter range. Although the screening function may be recovered in about 15-20 years, the structural conditions that provide for snow interception may not recover for 60 years or more.

Fire suppression for the last several decades has changed the way fires burn. Fire exclusion has resulted in a more homogeneous landscape with an increased potential for larger stand-replacing fires (Arno and Bunnell 2002, Hessberg et al. 1999, Quigley et al. 1996). This is especially applicable in warm, dry low-elevation forests (the types of forest that provide elk winter range) where frequent low-intensity fires were the norm. Many of these forests are now unnaturally dense. Furthermore, as more homes are built in the wildland urban interface, there is a greater social demand for fire suppression at the same time that the risk of fire has increased. While maintaining multi-layered canopies may be beneficial for elk on winter range, the group recognized that treatment of hazardous fuels in areas where winter range overlaps with a wildland urban interface may trump the needs of elk.

After the 2000 wildfire season, which burned a substantial amount of NFS lands (as well as other lands), the Forest Service re-examined wildland fire policies. As a result, several documents were developed that set goals for wildland fire policies. Congress subsequently passed the Healthy Forests Restoration Act in 2003 which further emphasized the need to manage hazardous fuels. In conclusion, forested cover is an important consideration on elk winter range; however, the national attention and emphasis on reducing hazardous fuels to protect communities, watersheds, and other at-risk values may result in management activities that affect winter cover. This effect could be mitigated if ungulate cover needs are considered in the design of hazardous fuels projects. The agency participants concluded that any potential conflict between managing for cover on elk winter range and the potential need for hazardous fuels reduction would be best resolved at the project level.

In addition to looking at the energy conservation aspects of winter range related to reducing disturbance impacts and having sufficient forest cover, we also discussed the importance of forage quality and availability for elk using winter range areas on NFS lands. In recognition of this desire, the agency participants outlined some situations where it might be desirable to allow some level of timber harvest and/or fire, recognizing that there may be situations where an increase in non-conifer vegetation (often to enhance quantity or quality of ungulate forage) are determined to be beneficial to elk or other wildlife species on winter ranges.

In conclusion, there will be situations where multiple use considerations (other than elk) and human safety will drive vegetation management on winter range, or where vegetation management affecting coniferous cover may be recommended on winter range to benefit elk or other species. Examples include:

- For research studies
- For conifer removal in aspen stands to promote aspen regeneration
- To remove conifers from areas that are desirable as grassland or shrubland areas; these are generally smaller trees on the edge between an opening and a coniferous forest and are generally considered as areas of conifer colonization
- For safety reasons such as fuel reduction around dwellings and/or administrative sites, and/or hazard tree removal along roads
- To conduct hazardous fuels reduction projects within the wildland urban interface aimed at protecting communities, and other values at risk (e.g. campgrounds, municipal watersheds) from catastrophic wildfires. To the extent practicable, integrate wildlife habitat considerations in project designs.
- For situations where the removal (salvage) of dead trees has a benefit to elk in the long-term (forage production/movement/recovery of the stand)
- To improve elk forage where forage has been determined to be limiting rather than cover

### *4. Security Area Recommendation*

The agency participants recommend that forest management activities involving access management (e.g. travel planning; vegetation projects requiring temporary or permanent road construction) provide adequate security areas to allow elk to remain on NFS lands during the archery and rifle hunting seasons. Lyon and Christensen (1992) defined security as “the protection inherent in any situation that allows elk to remain in a defined area despite an increase in stress or disturbance associated with the hunting season or other human activities”. They defined security areas as “any area because of its geography, topography, vegetation, or a combination, that will hold elk during periods of stress.” We suggest that the local MDFWP and FS wildlife biologists work together to define the numerical parameters (i.e. size of area, distance from roads, percentage of analysis unit, etc.) to be used for determining security areas at the local project level. Concepts from the “Hillis Paradigm” (Hillis et al.

1991) can be used to guide this process. For FS and MDFWP purposes, the analysis unit is the EAU, as described in section 1. We suggest a consideration of the following in the security discussion:

- In regards to elk security, the period September 1 – October 14, i.e. for the archery season, in addition to the standard October 15 – November 30/December 1 time period, i.e. the rifle season should be considered relative to public routes used by any motorized vehicle. Consistent, frequently-used non-public routes or temporary roads that are used during hunting season(s) would also need to be included in any security analysis. Thresholds for consistent, frequent use of these roads are to be determined based on site-specific considerations and discussions between local biologists from both agencies.

- Security areas should be well-distributed within the EAU (not all concentrated at high elevations or in wilderness) to account for movements due to weather and to help maintain good elk distribution on NFS lands throughout the hunting season. Generally high elevation areas that are above tree-line or steep (≥ 80% slope) areas that are not used by elk will generally not be considered elk habitat. However, at the project level, there may be examples where steep or cliff-like areas may serve to deter hunters and therefore contribute to security.

When the amount and arrangement of motorized routes has been determined to be a limiting factor in a given situation, and when security areas on NFS are not adequate to maintain elk use of NFS lands through the expected fall time period (until weather triggered migration events), as deemed through discussions between the two agencies (discussion to include whether other factors are affecting how elk use an area), MDFWP and FS biologists should jointly develop specific recommended strategies to address the situation (including the use of Hillis et. al. 1991 concepts). Recommended habitat management strategies may include the use of seasonal road closures (9/1 or 10/15 depending on the individual situation) to increase area specific elk security levels, managing for a higher percentage of the EAU that provides security (e.g. 50%, etc.), increasing the minimum size of security areas (e.g. 500 acres, etc.), and/or increasing the minimum distance of the security areas from open motorized routes (e.g. 1 mile, etc.). To be effective, project activities related to travel management would need to be designed to address these specific strategies.

**Discussion:**

Security areas are intended to reduce elk vulnerability during the elk hunting season, and to provide animals the opportunity to meet their biological needs without making large range movements (e.g. to private land where hunting is not allowed or to lower quality habitats) (Lyon and Canfield 1991). This also allows for a more ethical, fair chase hunting experience, and for the hunting public to have the ability and real opportunity to effectively hunt and harvest a public resource on public lands. Maintaining elk on public land also contributes to wildlife viewing, other values, and ecological roles (e.g. herbivory, predator prey dynamics, a source of carrion, etc.).

MDFWP biologists advocated that the 'hunting season' include the archery season as well as the general rifle season in regards to analyzing security levels. They cited a consistent increase in the number of archery hunters (doubling between 1990 and present) and subsequent increased levels of motorized use during the archery season. MDFWP's elk security concerns depending upon the individual situation relate to: 1) bull elk survival during both the archery and rifle season in some cases; 2) elk distribution during the hunting season (i.e. are elk being pushed into marginal habitats that may negatively influence survival and reproduction); and 3) availability of elk, particularly antlerless elk, on NFS land (i.e. potential displacement to private land or checker-boarded areas of NFS ownership where access to NFS land is limited or unavailable, or into only generally inaccessible areas on NFS land) during the fall hunting season. The last concern is particularly important prior to the opening of the general rifle season when the overwhelming majority of antlerless elk harvest for population control occurs.

As such, fall elk security levels should be assessed either just using the September 1 starting date or both the September 1 and October 15 hunting season related starting dates, rather than just running an analysis using October 15 as the starting date, as has often just been done in the past.

The concept of security areas is embodied by the "Hillis paradigm", a paper compiled by Hillis et al. in 1991 as part of an elk vulnerability symposium proceeding. Hillis et al. recommended identifying security areas within the hunting season home range. In practice on these four National Forests, elk have the potential, depending on weather and other conditions, to use the entire breadth of elevations within their home range during the big game archery and general rifle hunting seasons. Therefore, it is not necessary or possible to identify a consistently "separate" fall use area within an EAU.

Hillis et al. recommended identifying areas at least ½ mile from an open motorized route and at least 250 acres in size as the minimums for providing adequate security. The authors cautioned that in some cases, distance from open routes and the size of security area blocks must be increased (e.g. 350 acres >=1 mile from an open motorized route) to provide adequate security. Hillis et al. recommended that at least 30% of a valid analysis unit be comprised of security areas.

Although Hillis et al. (1991) define security as "non-linear blocks of hiding cover", they also suggest that effective security areas may consist of several different cover –types if the block is relatively un-fragmented. Relative to the composition of the security areas, there was discussion about whether Hillis et al. (western Montana) was applicable to these four National Forests.

The agency participants spent a fair amount of time discussing the definition, distribution and vegetative composition of security areas. MDFWP biologists felt that security areas are not meaningful to elk, if by virtue of the physical conditions of the landscape (rocks, cliffs, steep areas) elk would not be expected to use them to meet their biological needs. To be most effective, security areas should be well-distributed cross the breadth (geographic and elevations) of elk habitat within the EAU. This is especially relevant where a portion of the home range is relatively inaccessible such as represented by sanctioned wilderness areas.

The studies considered by Hillis et al. were done in areas where forests of various ages were continuous. In their discussion of security areas, Christensen et al. (1993) speak to the significance of cover in this equation and note that where cover is ubiquitous, security can be controlled by road management alone. They recommend that detailed analyses of hiding and thermal habitat components are not essential relative to security areas and that a consideration of coniferous cover is important for more than just elk vulnerability and therefore should be assessed at a landscape level to develop long-term perspectives to address the condition, quantity, location, and configuration of cover (see ecological context section and spring-summer-fall cover section).

In contrast to the Hillis et al. study areas, the landscapes on these four National Forests include many areas of more open habitat or where forests and grasslands are interspersed in a mosaic. A break out group of agency participants discussed the cover and security area relationship and concluded that consideration of the quantity and quality of forested cover at the scale of the non-winter portion of the elk analysis unit would be better than defining security areas as “blocks of hiding cover”. This also allows for the situation where areas naturally include a mosaic of forest and/or open habitats, but which operationally are secure. In addition, recent analyses of elk habitat selection during the hunting season in Montana (Proffitt et al. 2012 and personal communication with Kelly Proffitt, MDFWP) did not show a significant selection for security areas comprised of total conifer cover relative to security areas just defined by size and distance from a road. In addition, Proffitt’s analysis showed that security areas as a variable in habitat selection during the hunting season are strongly related to the motorized route variable.

Hillis et al. only speak to “open roads” and “closed roads”. They suggest that hunting pressure is concentrated along open roads, but that (hypothetically) closed roads located within security areas may increase elk vulnerability by providing walking and shooting lanes. Unsworth and Kuck (1991) note that road closures may have varied effects on animal distribution and hunter use and success. They cite to several studies where road closures allowed elk to remain in more preferred sites for longer periods of time (Irwin and Peek 1979, Marcum 1975). Basile and Lonner (1979) reported that when vehicular travel was restricted, hunters spent more time walking, saw more elk, and had greater success and reported having a higher quality hunting experience. Based on these studies and the recent review from McCorquodale (2013) on elk and roads, the agency participants agreed that Hillis et al. recommendation to “minimize” closed roads within security areas was not necessary.

The agency participants noted that there has been a dramatic increase in all-terrain type vehicles, and therefore agreed that all FS system routes that receive any kind of motorized use by the public should be considered for their impact to elk not just open ‘roads’. A review of the scientific literature regarding elk, roads and traffic (McCorquodale 2013) provides strong evidence that elk use declines as traffic volume increases (Johnson et al. 2000, Edge and Marcum 1991, Rumble et al. 2005, Stubblefield et al. 2006, Montgomery et al. 2013). Johnson et al. found that elk avoided roads that had 2-4 vehicles per 12 hours or higher.

Given this threshold for avoidance, agency participants agreed that closed routes or low intensity, occasional private or administrative travel and management activity on routes closed to the public could be reasonably excluded in identifying security areas. However, consistent, frequently-used non-public routes or temporary roads would detract from security areas, if such roads are used during hunting season(s).

The agency participants recognized that there were a lot of different variables that must be considered when applying the parameters from the Hillis et al. paper, and as the paper suggests, the numerical recommended guidelines may not be sufficient in all cases and that "**strict adherence to the guidelines should be avoided**".

One of the driving factors in the security area discussion was to try to reduce or eliminate elk displacement from public land prior to normal migration events. The objective of maintaining or enhancing elk presence on NFS lands so that elk are available to the hunting public on public land should be considered in the determination of the specific parameters (block size, distance from motorized routes) used to identify security areas, in the percentage of the EAU dedicated to security areas, and in discussions involving hunting season related seasonal road closures. Additionally, it was recognized that elk may use habitat differently on private lands than on public lands. For example, the importance of security areas may be less on private land where hunting pressure and recreational use is lower, than on public land where hunting pressure and recreational use is generally higher. The agency participants recognized that increasing elk security alone on NFS land may not be enough to maintain elk use of NFS land.

The agency participants felt strongly that posted private land was not the desired way to provide security for elk that also use FS lands, as that situation results in lost opportunity for the general public and decreased or lost management effectiveness relative to population control. In addition, when elk are displaced to private land, it negates any intentional elk –related management decisions by the FS. The agency participants recognized that although it isn't desirable for posted private land to act as security for elk using public lands, elk may choose that form of security. There was discussion regarding whether or not elk would re-occupy public land after displacement to private lands where hunting is not allowed regardless of potential management actions by the FS and/or MDFWP. We concluded that increasing security and habitat quality are important and necessary considerations, but that some elk herds may, through learned behavior, continue to use private lands regardless of conditions on public lands. This would need to be addressed outside of habitat management and hunting seasons on NFS lands. For example, there may be access incentives available for private landowners to consider.

The agency participants recognized that given high enough levels of hunter numbers and hunting pressure, security areas may not be effective, resulting in elk being displaced to other areas including private land (Vales et al. 1991; Lyon and Christensen 2002). It may be determined through the course of discussions between the two agencies that non-habitat related management actions outside of USFS control (such as a hunting season related change) may be necessary to address elk distribution and displacement issues, if habitat management actions alone are insufficient, with the recognition that any hunting season related change would have to go through MDFWP's public Commission process. Given that both land use (i.e. travel plans) and hunting seasons can represent significant public values and expectations, it is recognized that changes to either can be procedurally difficult and contentious. It is also recognized that each has its own process and that elk distribution issues need to be responsibly addressed by both. Working together, both agencies would need to assess the relative management gains represented by different FS and MDFWP management options and not unilaterally rely upon the other's actions or dismiss the potential for making changes that would increase the potential to maintain elk on NFS lands.

The group acknowledged that the FS multiple use mandates may result in lower than desired elk security levels in some areas, particularly during the archery season. Where travel management decisions have already been made, and consideration was given to elk security in the overall decision, elk security analyses at the project level should (1) focus on any additional temporary motorized routes and their potential to reduce elk security and (2) include potential mitigation opportunities to enhance elk security including but not limited to date changes to existing open motorized routes. The potential to revisit existing travel plans in order to improve elk security where needed should remain an option.

### *5. Habitat Effectiveness Recommendation*

Habitat effectiveness is defined as the percentage of available habitat that is usable by elk outside the hunting season (Lyon and Christensen 1992). For areas intended to benefit elk summer range and retain high elk use, habitat effectiveness related to motorized routes should be 70% or greater. For areas where elk are one of the primary resource considerations habitat effectiveness should be 50% or greater. In situations involving elk summer range where habitat effectiveness is less than 50% elk use potential (which equates to an open motorized route density of about 2 miles/square mile (Christensen et al.1993), these areas must be recognized as making only minor contributions to elk management goals (Christensen et al. 1993). We recognize that due to the USFS's multiple use mandate that there will be areas that are managed for habitat effectiveness of less than 50% elk use potential. At the project level an elk habitat effectiveness analysis should be conducted. In those areas where there is a desire to improve and/or maintain elk habitat use, we recommend maintaining or decreasing road densities that correspond with the desired habitat effectiveness level per Christensen et al. (1993).

Travel planning should also take into consideration the location of motorized routes and minimize motorized use in highly productive elk summer range habitats (see discussion).

For simplicity, route density is used as the proxy for habitat effectiveness. In reality, elk habitat effectiveness may be influenced by other factors than motorized routes. Other factors should be considered at the site-specific project level.

**Discussion:**

A desired condition expressed by the agency participants was to maintain elk use of National Forest land during the highly productive summer months (per Canfield et al. 1999). This recommendation focuses on elk distribution and is related to effective use of habitat for optimal fat accumulation on summer range (the time of year when forage conditions allow for weight gain needed to survive the winter and other stresses (such as the rut, and/or calf production and recruitment). Habitat effectiveness is defined as the percentage of available habitat that is usable by elk outside the hunting season (Lyon and Christensen 1992). This is the measure of success in meeting elk needs on summer range. Habitat effectiveness is directly related to motorized route densities (Christensen et al. 1993), but route locations may also be important. Recent studies (e.g. Wisdom et al. 2004; Proffitt et al. 2012) validate Lyon's (1983) finding that elk avoid open motorized routes and therefore, areas with high motorized route densities have the effect of reducing the available habitat. At 2 miles/section, elk use potential is about 50% (see **Appendix B**).

The agency participants acknowledged that not all FS lands would be managed with elk as the sole or primary consideration. The agency participants also acknowledged that travel management decisions often have to strike a balance between resource protection, public recreation opportunities, and other multiple use considerations. However, the potential to revisit existing travel plans in order to improve elk habitat effectiveness where there are concerns should be considered.

Where travel management decisions have been made, and consideration was given to habitat effectiveness in the overall decision, habitat effectiveness analysis at the project level should focus on the additional temporary project routes and their potential to reduce elk use of important summer habitat.

Although Christensen et al. (1993) suggest that any motorized vehicle use on roads will reduce habitat effectiveness, a review of the published literature provides strong evidence that elk use declines as traffic volume increases (Johnson et al. 2000, Edge and Marcum 1991, Rumble et al. 2005, Stubblefield et al. 2006, Montgomery et al. 2013). Johnson et al. found that elk avoided roads that had 2-4 vehicles per 12 hours or higher. Rowland and Wisdom (2012) also found that the strongest predictor of elk use in late summer was distance to open public roads. Therefore, low intensity, occasional administrative travel and management activity on routes closed to the public could be reasonably excluded in habitat effectiveness analyses. However, consistent, frequently-used non-public routes or temporary roads would detract from habitat effectiveness if such roads are used during the summer. The specific situation should be addressed at the project level and needs to be interpreted relative to potential for displacement of elk (see Lyon et al. 1985).

The group acknowledged that HE is an average condition, and that a range of habitat effectiveness can occur over a landscape. Some areas will have fairly homogenous route systems; other areas will have concentrations of open routes. In those situations, it is important to manage some areas with seasonal or yearlong restrictions such that route density is close to zero (100% habitat effectiveness).

The location of motorized routes may potentially negatively impact elk habitat as much as actual motorized route densities. Travel planning should consider minimizing or restricting motorized use on routes that impact high quality habitat, such as heads of drainages, saddles, moist areas, wet meadows, etc. (Lyon et al. 1985, page 7), and other important foraging habitats (e.g. aspen, riparian, grassland meadows, shrublands).

### *6. Recommendation for Spring/Summer/Fall Forest Cover*

The recommendation is that within the non-winter portion of the EAU, coniferous cover will be managed within the ecological context or NRV for the geographic area (e.g. mountain range) where the EAU is located (see ecological context section). Cover assessments conducted for a project level analysis within the EAU should include a consideration of the condition (health), quantity, location, and configuration of desirable cover conifer species (see discussion). Specific to elk, the amount and types of available cover should accommodate the needs of elk relative to an assessment of limiting habitat factors (forage, cover) within the EAU.

**Discussion:**
The agency participants discussed the need to have any restrictions regarding cover management for elk, given the lack of research regarding the quantity of cover that is optimal. Additionally there is the general trend on the four forests (since the Forest Plans were written) of less timber harvest overall, smaller timber sales, and greater cover retention in treated areas (thinning rather than clear cutting). In addition, fire suppression has probably resulted in more cover than would be supported under a more natural fire regime. However, the agency participants recognized that the timber harvest levels could increase in the future and that large forest fires could significantly change the amount of available timber cover on any landscape in the future.

Current cover requirements in Forest Plans distinguish between cover for hiding and cover needed for thermal regulation. While we recognize the importance to elk of having cover available that provides hiding and/or thermal regulation benefits among other attributes, the agency participants did not see the need for managing for two different types of cover with different definitions. We did, however, recognize value in differentiating between the functions of cover on winter vs. spring/summer/fall ranges. We agreed that generally both hiding and thermal functions on spring-summer-fall ranges could be provided by conifer stands with at least 40% canopy cover (as determined from available map products). Other functions of cover on spring-summer-fall range (e.g. forested foraging areas) could be satisfied with lower canopy cover stand conditions.

A previous interagency group that discussed management direction for elk in 2004 concluded that travel management and forage production were more important as management emphases to elk, and that cover is naturally dynamic relative to fire and the levels could be managed within natural fire regimes on most elk range. They felt that cover, where it occurred on elk winter range, was critical and should be maintained (Firebaugh et al. 2004). For this current effort, agency participants acknowledged that forested cover could function to reduce elk vulnerability during the hunting seasons; otherwise, forested cover may influence the way animals use habitat, and the ability of habitat to meet elk needs for growth and welfare requirements (Christensen et al. 1993). For example, Rowland and Wisdom (2012) found that late summer forage quality for elk in the Blue Mountains was highest where it was within a forest cover type.

The agency participants discussed instances where forest cover was important for holding elk on public land even when security (due to route density) was lacking. The agency participants agreed that there may be legitimate reasons to maintain more cover in certain situations while reducing cover in other situations depending on the management issues in question. We ultimately agreed that it would be best to manage cover levels with respect to the ecological context of the geographic area (e.g. mountain range) in which the EAU occurs (see ecological context section).

The function of cover during spring, summer and fall may include thermal regulation, lengthening the season of succulence and palatability where adequate understory forage exists and the overstory provides shades, seclusion, and buffering of special features such as licks and moist areas (Christensen et al. 1993). Forested cover influences the way animals use habitat, and the ability of habitat to meet elk needs for growth and welfare requirements (Christensen et al. 1993).

In some areas, juniper, limber pine, whitebark pine, or ponderosa pine may function as cover for elk, but agency participants agreed that thinning or removal of these species may have more value, in the larger ecosystem picture, than to manage them as sustainable cover for elk. The exception would be for the Ashland and Sioux Ranger Districts on the Custer NF where ponderosa pine is the primary tree species.

Forest cover is renewable. In other words, if cover is removed by fire or by timber harvest, it can regenerate with seedling trees naturally, or it can be planted with seedlings. To assess cover in an elk analysis unit, burned and harvested areas must be assessed and sorted into either baseline-non-functional cover or included as existing cover. Regenerated cover stands which are about elk height (4.5') high and >=40% canopy cover can function as hiding cover.

Ponderosa pine occurs on all 4 forests, but is the primary conifer species on the Ashland and Sioux Districts of the Custer National Forest. Ponderosa is more naturally open grown than other conifer species. On these 2 Ranger Districts, where ponderosa pine is the primary forest type represented, field validation showed that stands with at least 40% canopy cover consistently functioned to meet the hiding cover definition (90% of an elk at 200 feet distance). Stands with canopy cover of at least 25% were often sufficient to function to screen elk in conjunction with undulating topography (Canfield 2012).

Based on other field studies (Canfield 2011; unpublished data on Helena NF) and Lonner and Cada (1982), spring-summer-fall cover is provided by tree species or species mixes (occurring on these four national forests) that are naturally capable of having relatively dense (>=40%) canopy cover, and could include Douglas fir, subalpine fir, spruce, and lodgepole pine. In eastern Montana (and South Dakota) ponderosa pine is the dominant cover type and is capable of having at least 40% canopy cover. These cover types or mixes of them will generally provide screening for animals and be capable of hiding 90% of an elk <=200'.

At the project level, additional considerations can be analyzed and field validated. For example, forested stands impacted by disturbance such as fire or insects and disease that had >=40% green canopy cover, but which currently have a high proportion of standing dead, may still function as hiding cover. Viewing angle may affect the functionality of cover in steep cutover areas (Canfield et al. 1986). Local topography can interact with vegetation to screen animals. Similarly, tall shrubs and/or downed woody material could also function to screen animals in some situations.

We concluded that a specific quantifiable cover recommendation was not supported by the scientific literature. While Lyon et al. 1985 (Coordinating Elk and Timber Management; 1985) speaks to "good cover" as being two-thirds of the total area, and Thomas et al. (1979) recommended managing for 40% cover and 60% forage for elk, to our collective knowledge, these recommendations have never been empirically tested. Blocks of forested cover were not a strong predictor of elk distribution in a recent study in Montana (Proffitt et al. 2012).

### *7. Big Game Cover Patch Size Recommendation*

There is no minimum patch size (for forested cover) recommended. Recognition should be given at the project level to the site specific big game use patterns relative to patch size.

**Discussion:**
Agency participants discussed the distribution of forested cover, and whether or not there was a desirable minimum cover patch size. A research paper from Colorado (Wait and McNally 2004) identified 10 acres as a minimum cover patch size for that area, while a paper from the Blue Mountains area of Oregon (Thomas et al. 1979) recommended minimum patch sizes based on 4-8 sight distances (200') resulting in patches of 6.5 – 26 acres. We concluded there was no defensible specific minimum patch size for cover, but that there are circumstances when very small patch sizes or timber stringers might be important (but may also function as "linear traps" as hunters may recognize these as travel lanes; Lyon, email communication; March 2012), and that they should be identified at the project level. For example, habitat for a particular elk population may be inherently open and linear forested patches in draws may be very important to maintain.

### *8. Forage Recommendation*

While, there are no specific quantifiable recommendations relative to forage quality or quantity resulting from the current effort, agency participants recommend the following desired conditions relative to forage:

- On NFS lands, high quality and abundant forage will be available for big game throughout the seasons.

- Maintain a diversity of native forbs, grasses, and shrubs that are well distributed. Maintain a variety of successional stages, as well as key ungulate forage habitats such as riparian, aspen, grassland, sagebrush and other shrublands. Forage needs should be considered for all seasonal ranges.

- Grazing allotment plans should take into consideration the need for available high quality and abundant forage for big game, as well as the forage needs for domestic livestock where the species co-occur.

- During annual coordination meetings between MDFWP and FS, areas of concern relative to the availability, amount or quality of forage for big game will be considered, with the intent of developing specific strategies that may include modification of livestock grazing, modifications to motorized travel plans to address disturbance impacts, habitat improvements using prescribed burning, wild fire, timber removal; restoration of native plants, and/or invasive weed control.

**Discussion:**
Recent studies continue to support the importance of forage for elk and its effect on their use of a landscape (e.g., Rowland and Wisdom 2012). High quality forage is typically high in both carbohydrates and protein.

Local circumstances result in varying effects on elk (e.g. elk in Arizona may experience a very different habitat reality than elk in Montana). On NFS lands in the Northern Region, elk are coming out of the most forage restricted time of year in the spring, are in the last trimester of pregnancy, and are beginning to nurse. Summer forage is key to abundant milk production as nursing of the growing calf continues. Summer is also the time of year when fat reserves are accumulated, which affect breeding success, pregnancy rates, parturition synchronization, the energy to avoid predators in the winter, and general winter survival (physiological demands of cold temperatures, travelling in snow during a time of greatly reduced forage availability and quality). Fall forage provides some maintenance energy between the summer and the winter when fat reserves supply much of their energy. Fall forage also helps bulls recover from stress and energy expenditures associated with the breeding season. Winter forage provides some maintenance energy and roughage for rumination which produces body heat. In addition, protein levels in some shrubs may be sufficient even in winter to meet elk protein requirements.

High quality forage is often found in areas with limited coniferous cover (e.g., meadows, brushfields, and aspen stands). Riparian and wetland areas can provide disproportionate amounts of succulent vegetation (particularly in more arid conditions). Forests can also provide important forage, particularly where they are open enough to allow adequate sunlight, water, and nutrients to get to the forest floor. Forage within forested areas can have a longer green and succulent season, when more open areas cure out in the late summer sun.

Any management action affecting vegetation can affect forage quality and abundance (e.g., wildfire management, fire suppression, prescribed fire, thinning, timber harvest, noxious weed management, livestock grazing, and revegetation). Management actions related to motorized vehicles or even non-motorized uses which disturb or displace elk can affect the ability of elk to utilize available forage.

Factors such as fire suppression, noxious weeds, or some livestock grazing practices can alter vegetative composition, structure, and successional stage. Forage can often be produced or improved by addressing the departure from range of natural variation of vegetative composition and structure (e.g., fire management, mechanical treatments, improved livestock management, aspen or riparian treatments, and noxious weed treatment). Habitat management projects designed to address departure from NRV generally benefit a broad suite of fauna adapted to that landscape.

The main focus in this collaborative effort is on travel management and cover requirements for big game. However, agency participants agreed that at some future time, management of forage would need to be addressed in some detail. However, that discussion would need to include other FS and MDFWP specialists.

The agency participants recognized that forage availability and quality plays a critical role in big game habitat use and big game distribution. It was also recognized that more importance should be placed on forage availability and quality during the summer and early fall, as that is often the determining factor in whether or not animals make it through the winter (Canfield et al. 1999) and the effects on body condition during the rut likely influences other factors such as pregnancy rates and synchronized calving. High quality forage may be seasonally unavailable in some areas due to forest succession, conifer encroachment into foraging areas, domestic livestock grazing, or noxious weeds, fire suppression/altered fire regimes, altered vegetative successional pathways, aspen loss due to a variety of factors, etc.

Declines in foraging habitat quality may be particularly negatively impacting species such as mule deer and moose. Motorized and non-motorized recreation, nonhuman predators, and other factors can disturb and displace elk and other big game from high quality foraging habitat. It was also determined that future discussions, whether it be at the planning level or the project level, will need to address the issues related to prescribed burning and management of species such as big sagebrush and juniper species.

### *9. Elk Parturition/Nursery Areas*

The recommendation is to avoid activities that disturb known calving areas during the birthing period (generally from May 15 to June 30). In areas where brucellosis is a concern, delineating calving areas will be an emphasis from the standpoint of maintaining spatial/temporal separation with domestic livestock.

**Discussion:**
Although not all the eastside forests have calving areas mapped, the agency participants felt it was important to provide security and structural habitat features to maintain elk use of birthing areas. There were discussions about whether protection of calving areas was needed and about the areas and types of habitat used by elk for calving/nursery areas.

There were examples provided by agency participants where elk used the same general areas every year for calving, and other examples where calving was variable depending on weather and snow conditions. Instead of developing a very specific recommendation, the agency participants decided that it might be best to address this issue on a case by case basis at the project level depending upon whether or not the Forests or MDFWP had mapped calving/nursery habitat, or if the project area is within an area that may be used as an elk birthing area due to its elevation and habitat type.

### *10. Migration Corridor Recommendation*

There are no specific, quantifiable recommendations for elk migration corridors. Project level discussions between the two agencies should take into consideration provision and/or maintenance of security and structural habitat features for landscape connections where they can be identified.

**Discussion:**
The agency participants discussed whether or not specific migration corridors could be identified. Telemetry data has shown some traditional use of seasonal migration routes. There was interest in maintaining not only seasonal migration routes but also dispersal routes that maintain landscape connectivity.

## OTHER BIG GAME SPECIES RECOMMENDATIONS

At the project level, consultation between the FS and MDFWP should include specific consideration to the habitat and security needs for other big game species such as mule deer, white-tailed deer, moose, bighorn sheep, and mountain goats, as needed.

In regards to bighorn sheep, the FS should work collaboratively with MDFWP to explore opportunities for re-establishment of bighorn sheep and/or maintenance of existing bighorn populations. The forage recommendation above in this document provides some general guidance for bighorn foraging habitat, recognizing that bighorn foraging areas are much more limited in extent then for elk and generally have some proximity to escape terrain, and that setting back vegetative succession can improve visibility and improve their ability to detect and escape predation. In addition, the following guidelines, specific to bighorn sheep, are recommended (WAFWA 2007)**:**

- Manage domestic sheep or goat grazing to achieve effective separation, reduce risk of association, and avoid range overlap with wild sheep.
- Ensure annual operating instructions (AOIs) issued to grazing permittees include measures to minimize association and identify strategies to deal with stray domestic sheep or goats.
- Develop and use of Best Management Practices (BMPs) to reduce straying by domestic sheep or goats.
- Manage wild sheep habitat to promote healthy populations in areas away from where domestic sheep or goats are permitted.

**Discussion:**

Given time constraints, the agency participants focused almost entirely on elk. Generally, it was agreed that recommendations developed for elk would often benefit species such as mule deer, moose, etc. However, we recognized the need for caution in being “elk centric” as at times that may not benefit other species, and that recommendations specific to other species might be necessary. For example, recommendations for bighorn sheep which have experienced recent die offs, and which were recently listed by the Regional Forester in the Northern Region as “Sensitive “are included.

The agency participants recommend that the project level is the best option for dealing with habitat issues specific to other species.

**CONCLUSIONS**

These collective recommendations reflect many hours of deliberation and discussion, literature reviews, and conversations with elk researchers. New research will continue to contribute to the way we view elk and elk habitat management. These recommendations should be periodically reviewed and updated to reflect "best science" and the most current information.

For example, in western OR and western WA (Rowland and Wisdom 2012), a variety of analyses of radio-telemetry data from different study areas showed that in resource selection modeling four variables accounted for the large majority of elk use. These four covariates consistently ranked highest for elk use across 5 study areas/years and when applied to independent landscapes, showed an almost perfect correlation of elk predicted versus observed use. The four covariates were:

- elk dietary digestible energy (higher nutrition, higher use)
- distance to roads open to public access (farther from roads, higher the use, out to 4 km; this covariate also could include trails open to public motor uses)
- percent slope (flatter the slopes, higher the use)
- distance to cover-forage edges (closer to edges, higher the use)

This modeling process has more recently been used as a template for the Blue Mountains work, and a Blue Mountains summer range model (Rowland and Wisdom 2012) is now available. The Blue Mountains are more similar to the four eastside forests that participated in this collaborative effort. There were four variables that predicted elk habitat use for late summer:

- elk dietary digestible energy (higher nutrition, higher use)
- distance to roads open to public access
- % slope (highest use at moderate slope classes)
- % forested vegetation

MDFWP is working with FS Research to explore the potential application of any Blue Mountains model to Montana and to evaluate the potential of testing the performance of the model with data from Montana; see **Appendix C** for the highlights of this discussion.

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***Cite this paper as:***
*MDFWP and USDA Forest Service. September 2013. U.S Forest Service and Montana Department of Fish Wildlife and Parks Collaborative Overview and Recommendations for Elk Habitat Management on the Custer, Gallatin, Helena, and Lewis and Clark National Forests. Unpublished paper on file at: U.S. Department of Agriculture, Forest Service, Gallatin National Forest Supervisor's Office, Bozeman, MT, 36 pp.*

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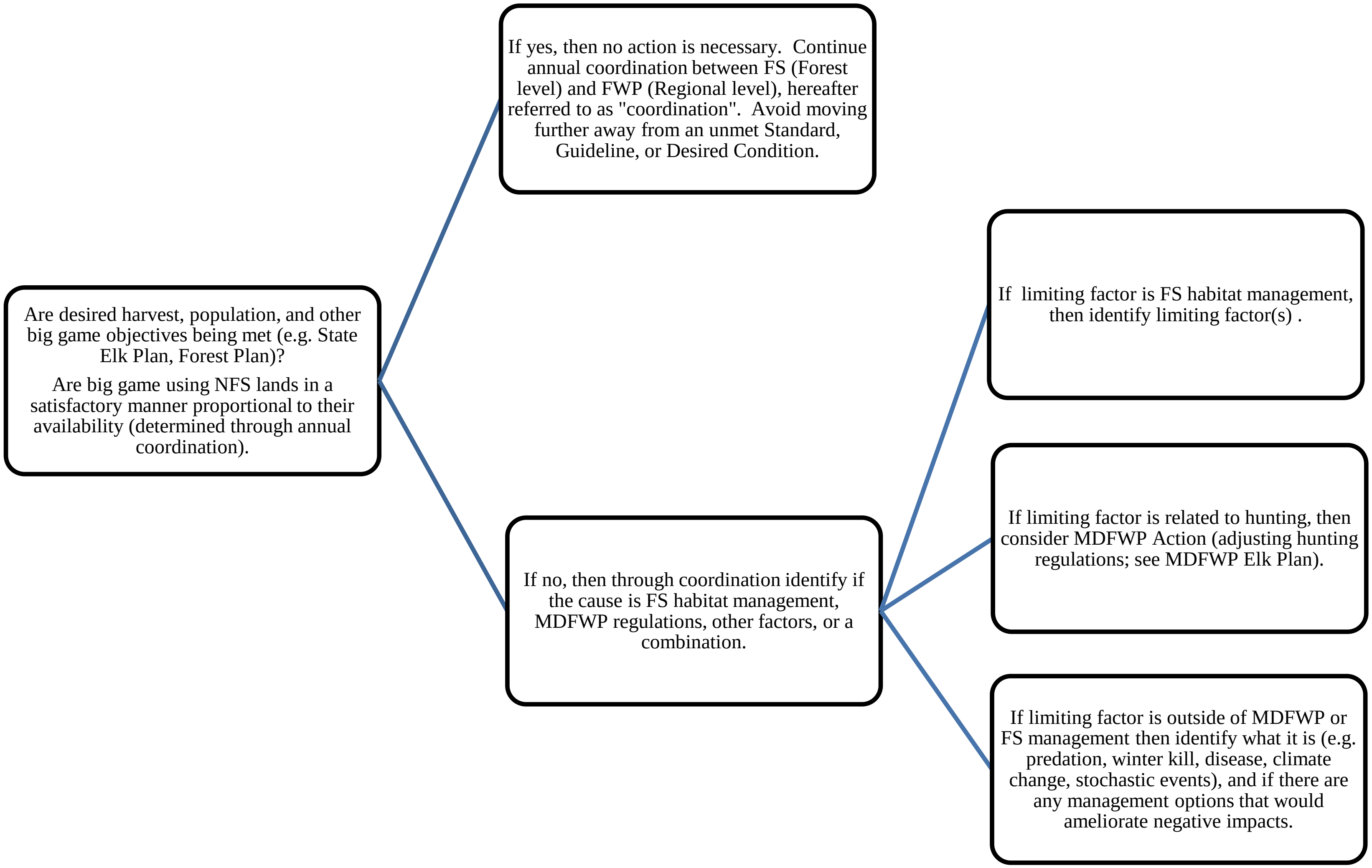
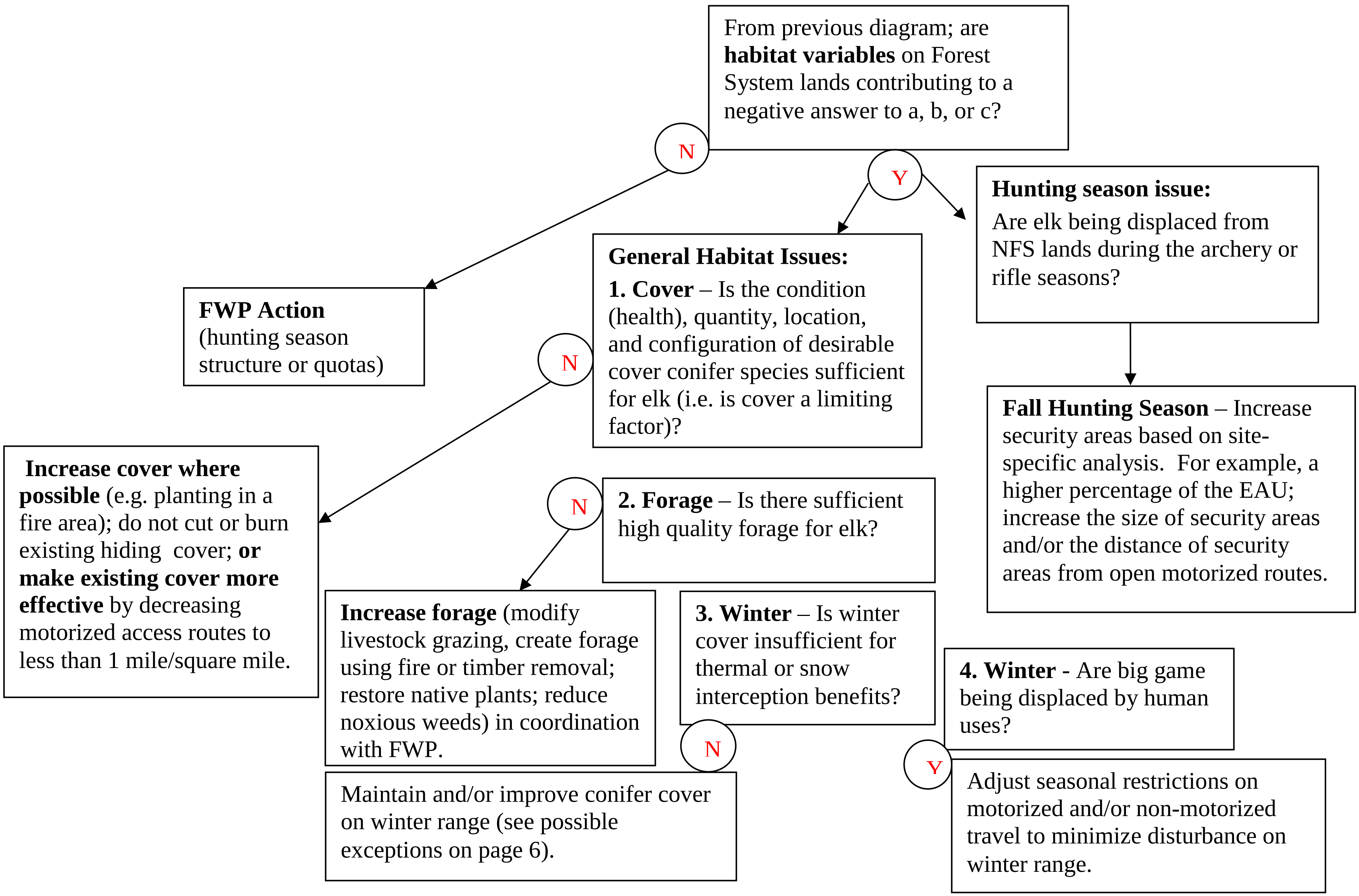
## Appendix A: Agency Coordination Strategies for Elk



# Considerations for
# Forest Service Management Options



**Appendix B:  Habitat Effectiveness from Lyon (1983)**

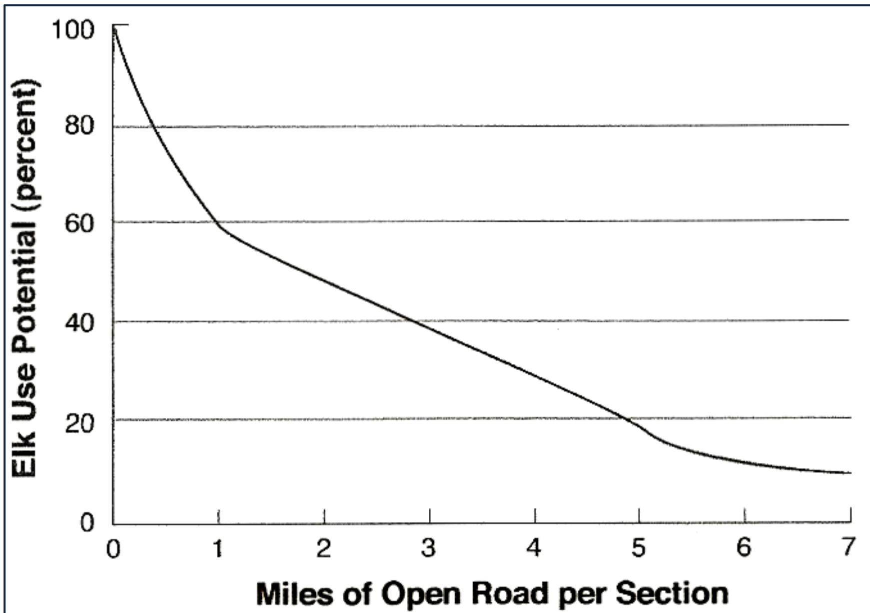



**Figure 1**—Habitat effectiveness for elk determined by road density (Lyon 1983).

**Appendix C: MDFWP discussion with BLM and FS Management and FS Research Biologists, July 2011.**

## Fundamental elk management objectives:

*a. Optimize elk use of public lands*
*b. Reduce conflicts on private land including agricultural lands*
*c. Maximize recreational opportunity (hunting/viewing)*
*d. Maintain a spectrum and diversity of recreational opportunities*
*e. Maintain engaged publics in resource decisions*
*f. Maintain a sustainable model of conservation*
*g. Balance the principle of public trust with private property rights*
*h. Maintain or improve ecological condition of important vegetation communities (e.g., aspen, riparian) while considering livestock use*
*i. Fulfill ecological roles of elk*
*j. Maintain populations and harvest within objectives*
*k. Meet specifically identified distribution objectives on public and private land*
*l. Maximize landowner tolerance*

## Specific habitat and harvest management tools

The impact of implementing these actions singly or in concert on elk distribution has not been evaluated relative to the intended outcome, in an experimental or adaptive management context. All work to date has been correlative using historical data.

***Habitat Management (forage, cover, human disturbance)***

***Forage***

- *Burning (planned and unplanned ignitions)*
- *Mechanical treatment (forestry; thinning etc.)*
- *Treatment of Noxious weeds or other undesirable vegetation*
- *Livestock grazing management (timing and use; location; closures; systems)*
- *Restoration of native vegetation (grassland, aspen)*
- *Seeding, fertilization, other kinds of vegetation management*

***Cover (quantity, size, canopy cover, spatial arrangement, quality/ species)***

- *Replanting in some situations (large fires)*
- *Fire management in consideration of natural fire regimes*
- *Thinning*
- *Juxtaposition of forage and cover; edge density*
- *Compensatory with access (human disturbance)*

**Appendix C: MDFWP discussion with BLM and FS Management and FS Research Biologists, July 2011.**

- *Timber harvest planning*
- *Unresolved questions about cover: How much is enough? What spatial arrangement?*

***Human Disturbance***

- *Management of Motorized route density and locations*
- *Management of nonmotorized routes and recreation in some areas*
- *Management of Project activities (timing, duration)*
- *Mitigations relative to Energy developments*
- *Area closures to provide "space" and security*
- *Restrictions to address "carrying capacity"*
- *Management of permitted activities on public lands*
- *Lands (acquisitions or exchanges or easements) and route rights of way to provide public access to public lands*
- *Unresolved questions about human disturbance: Do elk respond to area closures where non-motorized uses are restricted? Is there a level of use that is key?*

***Harvest Management of elk and other species** **(Hunter timing, distribution, numbers; elk harvest level, mortality, and composition; means of take; access)***

- *Length of hunting seasons*
- *Timing of hunting seasons*
- *Limited entry (permits, quotas, no limits) vs. general*
- *Weapon restrictions*
- *Targeted reduction (management hunts)*
- *Hunting area designations or closures*
- *Access agreements (routes, block management, etc.)*
- *Land acquisitions and easements*
- *Check in points (for distribution management)*
- *Vehicle restrictions*
- *Type of season and/or license type (either sex, brow-tined bull; permit only)*
- *Number of licenses per hunter*
- *Carnivore harvests*
- *Unresolved question about harvest management: How do you manage habitat to address predation risks?*