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Montana Fish, Wildlife & Parks

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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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).

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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).

2 mi/sec = 50%

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.