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Elk Management in the Northern Region: Considerations in Forest Plan Updates or Revisions

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INTRODUCTION

In the West, a large percentage of elk habitat is managed by the Forest Service, U.S. Department of Agriculture. Elk are a giant economic factor in Montana and Idaho, easily accounting for over $100 million annually for hunting alone. This activity is especially important to many small, rural communities. At the same time, elk management can be controversial where it conflicts with other resource activities such as grazing, logging, and public access. As the habitat manager for this valuable resource, the Forest Service must develop management programs based on the best available information, work closely with State game managers, fully inform the public and disclose the effects of management actions, and embrace implementation of an ecological approach to elk management.

When the initial forest plans were developed in the early 1980's, there was no cohesive direction identifying a common set of elk management standards. As plans were written, generally recognized key pieces of elk management information were creatively modified by virtually every forest in an attempt to meet local needs. This often resulted in adjacent forests having startlingly different goals, objectives, standards, guidelines, and terminology.

In these forest plans, the approach to elk was usually narrow and focused. Because elk was a regional indicator species, managers established population targets, habitat standards, and monitoring goals. We recognize now that elk are part of a bigger picture and that elk habitat management must be placed within the context of ecosystem management, biodiversity, State management strategies and goals, and shifting public demand and interest that now embrace nonconsumptive and consumptive interests.

This problem has been recognized and a solution proposed for the Northern Region of the Forest Service. Common terminology, a new perspective on elk vulnerability, and a better understanding of the application of habitat effectiveness have created the opportunity for forests to be more consistent and in tune with State management objectives. In the interest of better elk management, it is imperative State plans and forest plans address the same issues. Elk vulnerability is the framework issue.

We present an initial overview under which individual forests can creatively address elk management and yet retain consistent and cohesive approaches within regional and State boundaries. Emphasis has been placed on process, content, and implementation of new information rather than on numerical standards, although these remain important for measuring success. Specific process guidance for biologists in the Northern Region of the Forest Service is provided in the appendix.

KEY COMPONENTS OF ELK MANAGEMENT

The relationship between National Forest lands and elk needs to be recognized for the following key components:

1. Habitat in which elk grow, reproduce, and exist as elements of biological diversity.
2. The basis upon which State management programs depend. While hunting mortality accounts for upward of 90 percent of elk mortality, the States depend on habitat availability and condition for their programs to exist.
3. Sites for the public to have the opportunity to hunt and view elk. Recreation is an important product of National Forest lands. In most areas, use of forests peaks during fall hunting seasons, but in other areas wildlife viewing is a year-around product. The setting needs to be considered along with other habitat issues.
4. Maintenance of elk as a part of the natural community and recognition of elk habitat in a landscape context and in response to natural processes.

These key components can be recognized and evaluated in the following three types of habitat considerations:

Habitat effectiveness: This is a measure to be applied to nonhunting, summer and fall habitat situations. It was developed from research related to the ability

of habitat to meet elk needs for growth and welfare requirements. It has been consistently misapplied as a measure of security during hunting season.

Elk vulnerability: This deals with security for elk during the hunting season. There is a rapidly expanding body of new information relating to this management concept that will be available for inclusion in forest plans as they are updated, revised, or amended.

Winter range: This has been a collective term referring to elk habitat during the nonsummer and fall, nonhunting season. However, during some years elk will move to winter habitat during the fall hunting season and, in most situations, become vulnerable. In updates, revisions, or amendments we must recognize and deal with this possibility as well as deal with traditional considerations.

HABITAT EFFECTIVENESS

Summer range includes the habitat used by elk from about late green-up (May) until they move to winter ranges, but prior to the hunting season. Summer range is the complete matrix upon which elk herds depend for growth, reproduction, and thrift. Management focus is on maintaining the ability of the habitat to meet elk needs for forage, water, seclusion, and special features (such as licks and moist areas). Forest Service lands that support summer range are the basis for State elk management; specifically, if habitat is degraded or poorly managed, the elk population will be degraded and, thus, directly influence State elk population management programs.

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. Based on years of research from various sites in Montana and Idaho, relatively sophisticated technologies exist for calculating habitat effectiveness. In forest plan revisions, updates, and amendments, this term should be used as a measure of summer range ability to support elk. Sources of information for habitat effectiveness and the major factors that influence it are included in Irwin and Peek (1979), Leege (1984), Lyon (1983, 1987), Lyon and others (1985), Thomas and others (1979), and Wisdom and others (1986). (See the References section at the end of this publication.)

Considerations for Forest Plans Related to Habitat Effectiveness

The following list is not inclusive but does cover the main issues managers need to consider.

1. *Roads*—density (miles per square mile), construction standards, seasons of use, method of closure.
2. *Special features*—wet sites, riparian habitat, licks, movement corridors.
3. *Cover*—extent, shape, size, connectiveness.
4. *Scale of analysis*—site specific, herd unit, habitat analysis unit.
5. *Spatial relationships*—intermingled ownerships, adjacent administrative units, district or forest "averaging."
6. *Domestic livestock*—forage and spatial competition.

Recommendations

Roads—Roads are undoubtedly the most significant consideration on elk summer range.

1. Use figure 1 (Lyon 1983) road model for determining habitat effectiveness related to roads. Avoid classifying roads as primitive and downgrading their effect unless they really are.
2. Discuss methods of closure. For elk, physical closure with "trashing" is desirable for year-long closure. Area closures are needed where terrain features and cover characteristics do not favor closure with gates or barriers. Honor systems of closure have been only moderately successful, at best.
3. Discuss construction standards. Where roads will be system roads, strive for construction and design features that lay lightly on the land. Identify temporary roads where they are an option. Avoid "tie through" systems where possible. Strive for minimum miles of new construction in summer range. Identify logging technology that reduces road construction. Avoid key habitat features when locating roads.
4. Any motorized vehicle use on roads will reduce habitat effectiveness. Recognize and deal with all forms of motorized vehicles and all uses, including administrative use.
5. Levels of habitat effectiveness:

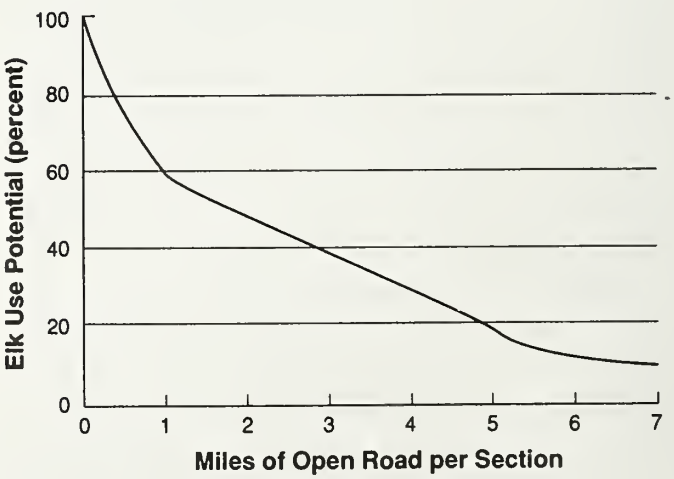

Figure 1—Habitat effectiveness for elk determined by road density (Lyon 1983).

a. For areas intended to benefit elk summer range and retain high use, habitat effectiveness should be 70 percent or greater.

b. For areas where elk are one of the primary resource considerations habitat effectiveness should be 50 percent or greater.

c. Areas where habitat effectiveness is retained at lower than 50 percent must be recognized as making only minor contributions to elk management goals. If habitat effectiveness is not important, don't fake it. Just admit up front that elk are not a consideration.

d. Reducing habitat effectiveness should never be considered as a means of controlling elk populations. A population over target is not a Forest Service habitat problem. Remember that in most situations, populations can be reduced through hunting.

Special Features—Wet drainage heads, saddles, riparian habitats, shadowed draws with cool air movement, and wet meadows are some examples of special features. In many areas these features support a disproportionate level of elk use and contribute significantly to overall elk use of a larger area. Generally, these sites are highly desirable for forage, water, temperature regulation, movement, or a combination. Such sites should be recognized and protected in prescriptions that deal with elk summer range. Logging activities, road locations, and siting of structures or activities should all be evaluated. Avoid damaging these features where elk are a benefiting resource (Lyon and others 1985).

Cover—Early guidelines greatly emphasized analysis of cover, specifically thermal and hiding cover (Thomas and others 1979). Today, detailed analyses of hiding and thermal habitat components are not considered as essential except in habitats with high natural levels of openings or where conifer cover is at a premium. Some approaches have created the classification "optimal cover" (Wisdom and others 1986) as an aid in analyzing cover from aerial photographs. Another approach, where stand analysis data are available, is provided by the HIDE2 hiding cover computer model (Lyon 1987).

While we still need to recognize the importance of maintaining cover blocks and movement corridors, a more meaningful approach to cover analysis includes maintenance of security, landscape management of coniferous cover, and monitoring elk use with radio telemetry or other means. Recognition that summer cover blocks are also fall hunting season security areas is an important coordinating consideration.

Cover unit size, patterns on a landscape basis, connectiveness with other cover, the amount of cover available to elk, and known use patterns by elk should be considered in prescriptions.

Scale of Analysis—Early guidelines tended to be project specific in scale; often 3,000 to 10,000 acres was recommended. However, while road locations, special features, and the location of cover or cutting units still need project-level analysis, such analysis also needs to recognize the project in a broader context of herd units (where known), habitat analysis units, or other meaningful, larger scale perspectives. Herd units need to be identified in cooperation with State biologists. Consideration of project-level effects may necessitate analysis in light of influences on adjacent herd units, adjacent forests, or even adjacent States over landscape units from 30,000 to 150,000 acres.

Another consideration in establishing factors for scales of analysis are known movement patterns. If your management of summer range may influence elk in terms of their movement to adjacent fall or winter ranges, the scale of analysis should be appropriate.

Spatial Relationships—This criterion has to do with habitat features, values, or project analyses that have a relationship to intermingled ownerships, concurrent and adjacent activities, or adjacent features that are significant to your concerns for elk habitat.

When elk habitat crosses intermingled ownerships, activities that reduce habitat effectiveness on intermingled lands require the Forest Service to decide how they will be dealt with in prescriptions. Adjacent and concurrent activities beyond Forest Service control, such as logging and grazing on private land, should be recognized in prescriptions, and courses of action for the Forest Service should be identified. Federal managers need to coordinate with State biologists on these activities.

Internally controlled activities that affect elk summer range should also be recognized. An example is the relationship of herd units or analysis areas to each other and, collectively, to forest elk habitat. Each individual unit should have an identified role for elk and a level of habitat effectiveness. In this way, the whole area or forest can achieve an expected level. It is undesirable to play off one unit against another. For example, recognizing high habitat effectiveness values in adjacent wilderness areas should not be a justification for excessive reductions in habitat effectiveness in managed areas, even if some average level for the forest is met.

Significant reductions in habitat effectiveness in areas identified as benefiting elk cannot be recovered at a pace equal to our ability to move activities around a forest. In addition, patterns of recreational activity related to elk can be significantly affected by this type of management.

Domestic Livestock—Current perspective is that cattle on elk summer range are not as significant a conflict as formerly thought and probably only warrant analysis where local understanding indicates a problem may exist. Elk appear to avoid areas where cattle

are present if other options exist. Where no other options exist, elk will tolerate some cattle use.

Major points of conflict are wet sites and gentle terrain with succulent vegetation. Season-long cattle occupation of these types of sites undoubtedly reduces their value to elk.

Forests where cattle are a concern need to work with State biologists on standards and guidelines for cattle and elk relationships.

Of equal concern is the perception that elk herd expansion is causing cattle use reductions on National Forests. In developing management guidance, forests should address this issue and strive to gather habitat use data that will help clarify this situation.

Summary for Summer Range

1. Habitat effectiveness is the method of measurement.
2. The presence and motorized use of roads is the major impact on elk habitat effectiveness.
3. Detailed cover: forage analysis is important only when cover is at a premium.
4. Landscape levels of analysis are necessary.
5. Recognition of adjacent activities, intermingled ownerships, and cumulative effects is needed in plan revisions and updates.
6. Analysis of elk and domestic livestock conflicts is probably warranted where it is considered a problem locally.
7. Forests should set standards for habitat effectiveness that are congruous with goals for a prescriptive unit. Specific prescriptive guidelines should reflect the level of habitat effectiveness desired.
8. Close coordination with State biologists and recognition of identified State management goals for elk are necessary in all aspects of summer range management.
9. Forests should recognize traditional uses of elk as well as burgeoning nonconsumptive interest in elk.

ELK VULNERABILITY ANALYSIS

The primary source of elk mortality is hunting. While the State manages hunters, the Forest Service management of access and cover are extremely influential in affecting the ability of hunters to kill elk. Therefore, it is important that in forest plan revisions or updates, prescriptive guidance is identified for elk vulnerability analysis. This procedure applies during the hunting season and is not to be confused with habitat effectiveness. Vulnerability is a separate issue that forests need to recognize in elk management and write into prescriptions. Vulnerability results from an extremely complex relationship involving access, cover, topography, hunter density, and weather. A great deal of intercorrelation among these factors exists, and a great deal of cooperation between agencies will be necessary to achieve the goals of elk vulnerability management.

The measure of success for elk vulnerability is the level of compatibility between Forest Service and State management plans. Often, this will be the number of bulls per hundred cows surviving the hunting season or some expression of the quality of the recreation experience provided.

Considerations for Forest Plans Related to Elk Vulnerability

The following list is not inclusive but does include the main issues managers need to consider:

1. *Roads*—season of use, density.
2. *Security areas*—distance from roads, size, cover characteristics, closures (area), topographic characteristics.
3. *Cover management*—description, connectiveness, scale, terrain relationships.
4. *Mortality models*—demonstrated predictors of elk mortality based on habitat quality, hunter density, or other factors.

Recommendations

Roads—As with habitat effectiveness, access to and use of roads appear to be the most significant factors in vulnerability analysis.

Two studies in Idaho have demonstrated direct relationships between levels of road access and bull mortality (Leptich and Zager 1991; Unsworth and Kuck 1991). In Montana, Youmans (1991) implicated "road densities as the key factor in increased elk vulnerability."

Concerning open roads during hunting season, forests should develop criteria that meet State management goals for elk. Information on the relationship between roads and elk vulnerability is so new that specific criteria are scarce. However, the studies in northern Idaho provide initial guidance. Unsworth and Kuck (1991) found bull survival more than doubled in situations comparing road densities in excess of 4 miles per section with densities under 0.5 mile per section. In a different study area, Leptich and Zager (1991) reported bull mortalities of 62, 45, and 31 percent in study areas with 4.5, 2.6, and 1.0 miles of open road per section. In both these studies, cover during the hunting season was not considered limiting.

1. In areas with heavy cover, road management can be extremely influential in meeting desirable postseason bull:cow ratios.
2. Where heavy cover is not available, reduced open road densities contribute to maintaining some level of quality hunting opportunity through the season and to meeting postseason bull:cow ratios. In areas of

more open cover and, perhaps, gentler terrain, roads speed up the harvest of available bulls and make bulls more vulnerable throughout the season. Increased emphasis should be placed on security where poor cover conditions exist.

3. Even primitive roads that see little summer use are often used extensively during the hunting season. Area closures with open routes designated will most likely provide better security than individual closures. Area closures should address all motorized vehicles including all-terrain vehicles.

Security Areas—Security is the result of a combination of factors that allow elk to remain in a specific area while under stress from hunting. In Forest Service management, such areas are defined by cover blocks and road management. Specifically, these are areas of coniferous cover large enough and far enough away from open roads to provide security. There have been efforts on the Lolo and Deerlodge National Forests to develop criteria for managing security. The "Hillis paradigm" (Hillis and others 1991) provides these criteria and, with careful consideration, may be appropriate for other forests to use as a general guide. Briefly, this model identifies the size (250 or more acres), shape (nonlinear), and distance from open roads (over 0.5 mile) for security areas as well as how much of the area (over 30 percent) should be dedicated to security.

In discussions with biologists in Idaho and Montana, there appears to be a gradient from west to east regarding the significance of cover in this equation. In northern Idaho, it appears that open road density, hunter numbers, and topographic roughness are the major considerations (Unsworth and others 1993). Cover is so ubiquitous that security can be controlled with road management alone. As you move east into Montana and over the Continental Divide, cover considerations become more important because cover is less abundant and less contiguous. It is extremely important for forest biologists to work with their State counterparts in developing criteria for security areas, including their size, extent, distance from roads, and vegetative characteristics. Data from radio telemetry studies are the best source for developing such criteria.

Cover Management—This criterion is directed mostly at the more naturally open elk habitat in central and southwestern Montana and southern Idaho where care must be taken to recognize and retain adequate coniferous cover. In developing this criterion, a landscape-level perspective is absolutely necessary. Size, location on the landscape, connectiveness with other cover, and vegetative composition are important considerations (Hillis and others 1991). Data from Montana hunting seasons suggest that elk are less selective about the specific vegetative characteristics of coniferous cover and more responsive to size of units, connectiveness with adjacent units, and the scale of cover on the landscape (Lyon and Canfield 1991). A strong relationship exists between maintaining cover for summer range habitat effectiveness and maintaining the same cover for security during fall hunting. Where coniferous cover may be a limiting factor, it will be important to develop long-term perspectives (rotation length) on cover management that address condition, quantity, location, and configuration.

Mortality Models—Models that link habitat, hunter density, and elk mortality can provide guidelines to coordinating habitat condition and State management objectives. Unsworth and others (1993) have developed a model for northern Idaho that predicts bull elk hunting season mortality using open road density, circular standard deviation of aspect, and hunter intensity (density for the length of the season). This model virtually requires a computerized Geographic Information System for calculating the aspect variable. But the effect can be estimated based on the fact that greater topographic relief reduces elk vulnerability. The more moderate the topography (fig. 2), the more impact road density and hunter density have. If we assume average topography and around 10 hunter days per section spread over a 26-day season, the probability of mortality for a bull elk is 60 percent greater in an area with 1 mile of road per section than in an unroaded area. Likewise, 2 miles of road per section will more than double the mortality probability, and at higher road densities bulls usually do not survive the hunting season.

Using a different measure of hunting intensity, Vales and others (1991) and Vales (1993) presented data from northeastern Oregon indicating that the ratio of hunters to available elk can also provide an estimate of probable mortality; basically, there is a consistent increase in harvest rate as the number of hunters per elk increases (fig. 3). These data are important because they indicate that excessive hunting pressure can, in the end, overwhelm all other provisions of elk vulnerability management.

Summary for Elk Vulnerability

1. Roads appear to be the single most important variable that the Forest Service manages. Roads not only directly affect elk mortality but also affect hunter opportunity by accelerating bull mortality. Forests must work closely with State biologists to identify acceptable levels and locations of motorized access to meet postseason bull:cow ratios and maintain optimum hunter opportunity.

2. Security area definition is variable across the region. Some forests have developed criteria. It is essential that cooperation and coordination with State biologists be used to formulate criteria.

3. Elk vulnerability analysis, a new concept, will be further defined. Hunter density and opportunity

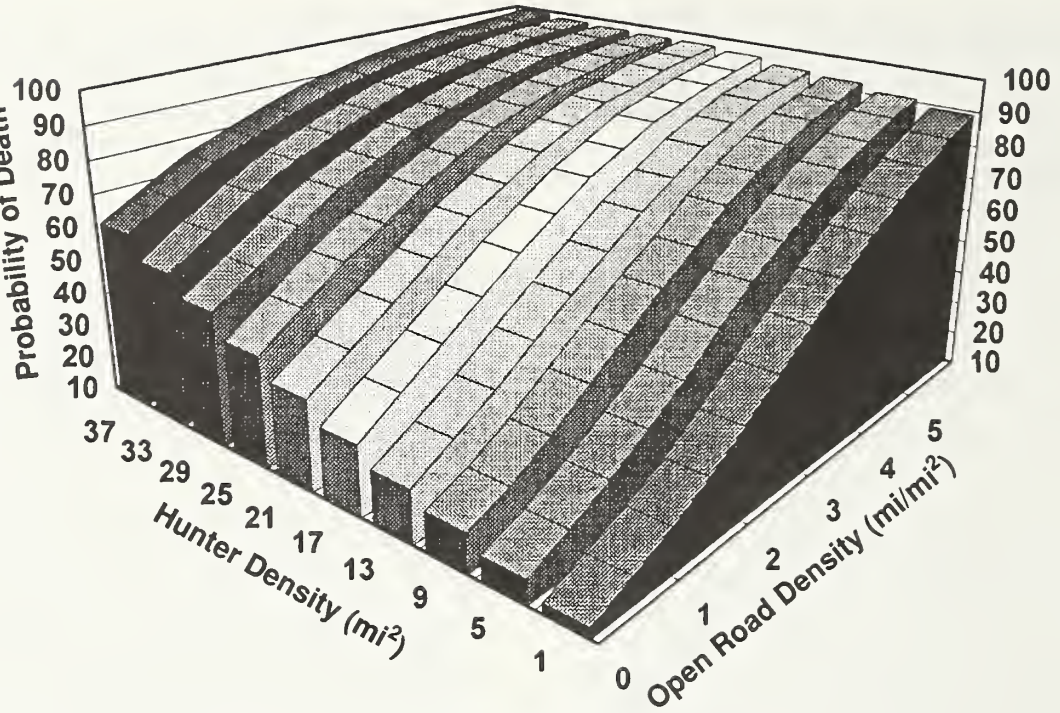

Figure 2—Elk vulnerability influenced by hunter density and road density (Unsworth and others 1993).

afforded by State regulations are also major components. It is essential that forest biologists and planners and their State counterparts communicate and coordinate extensively on this topic as forest standards and guidelines are developed.

4. Recently available mortality models can establish numerical standards for elk mortality. Local data bases may exist to help tailor mortality models to specific geographic areas. Numerical standards for elk mortality can be established through coordination with State biologists.

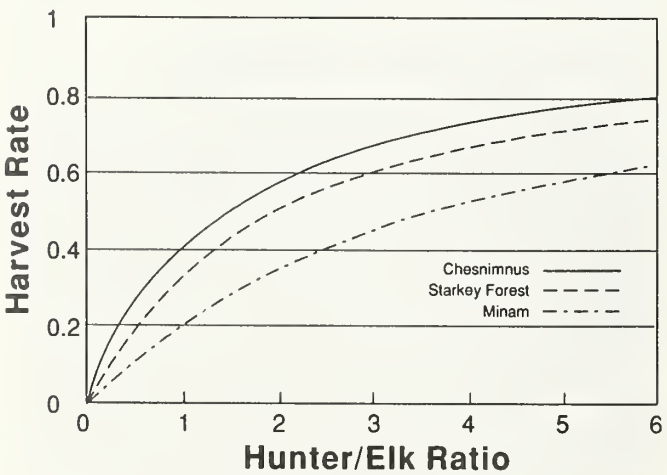

Figure 3—Elk vulnerability influenced by hunter to elk ratio (Vales 1993).

WINTER RANGE

Management of winter range remains the single most site-specific consideration for elk habitat. Each winter range is unique in some way. In this section, we briefly address the traditional considerations that already appear in the majority of forest plans. We again mention, however, that winter range should be evaluated as a part of the vulnerability assessment where appropriate to do so.

Traditionally, winter ranges for elk have been viewed as geographic sites on which animals concentrate seasonally because of snow depths. Heavy utilization of available plants, and animal die-off in severe winters, have been commonly recorded. For many years, the primary objective of management was to improve, or at least prevent deterioration of, existing vegetation.

In recent years, our understanding of animal physiology on winter ranges has modified this view. Forage is important, but in severe weather many animals substitute an energy-conservation strategy for forage intake. Thus, management of winter range to improve thermal cover and prevent harassment may be as important as anything done to change forage quantity or quality.

Considerations for Forest Plans Related to Winter Range

The following list is not inclusive but does include the main issues managers need to consider:

1. *Forage quantity and quality*—methods for improvement.

2. *Thermal cover*—energy conservation considerations.

3. *Roads and other disturbances*—energy conservation considerations.

4. *Livestock management*—forage allocation management.

Recommendations

Forage Quantity and Quality—In the majority of situations, actually modifying forage quantity or quality on the winter range is a difficult management challenge. Encroaching vegetation can sometimes be removed mechanically or with fire, and large or decadent shrubs can be burned to produce resprouting.

Thermal Cover—Some winter ranges lack thermal cover, which does not mean thermal cover serves no purpose where it is available. Where behavior patterns have been recorded, elk select resting and feeding sites based on control of energy transfer rather than forage availability. We recommend selective retention of larger trees where possible.

Roads and Other Disturbances—Disturbance and harassment result in tremendous energy costs to wintering animals. Selective road closures and restrictions on recreational use have proved effective in reducing these costs.

Livestock Management—Appropriate management of domestic livestock can, in some cases, be an important consideration in management of elk winter ranges. Local range specialists should be consulted about grazing techniques designed to leave adequate winter forage for elk.

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APPENDIX: COORDINATING FOREST PLANS WITH STATE STRATEGIC PLANS

By Alan G. Christensen

The significance of managing the elk resources of the forests in the Northern Region has been well documented. Guidance for amendments, updates, or revisions of forest plans has been promulgated in the elk chapter in the Northern Region's handbook titled "Our Approach," and in a working paper sent to all the Region's forests in July 1992 (File 2600, dated July 2, 1992).

This appendix will largely focus on procedures recommended for coordinating the States' strategic elk plans with forest plans. This is not a recommendation for decision. Rather, it represents a method to identify where decisions are needed and what the specifics of the decision may be. It necessitates a close working relationship between the forest and district wildlife biologists and their State counterparts. It requires some time to work with maps, landscape perspective, and an exchange of resource information between Forest Service and State biologists. It is a dynamic process that will change as more information becomes available, as agency priorities shift, or as public demands change. We are fortunate to have a wealth of management information available, an identified plan with which to begin framing the decision space, and expanding populations of elk.

Step 1

Assemble all available information on elk and elk habitat for the forest. This will include maps, habitat-related information (for example roads, cover status), hunter-related statistics that the State has, elk population information, harvest and management information, the State strategic plan, and any related elk studies or data pertaining to your forest.

Step 2

In cooperation with State biologists, map the boundaries of proposed State elk management units on the forest maps. This is the initial point for coordination. Recognition of what the elk management unit boundaries mean in terms of biological, administrative, or management options is an important early perspective that is needed at the landscape level. The State elk management units are largely based on hunting district boundaries and may be drawn for biological reasons or administrative convenience.

- Look for boundary locations that don't "fit the landscape" and may create biological problems in the future analysis.
- Look for ownership patterns that will dictate management options (for example, checkerboard ownership).
- Look for administrative boundaries that may dictate management options (for example, wilderness, roadless, State or county boundaries).

Step 3

Within elk management units, you will need to further subdivide elk habitat so that eventually a ground-level project perspective can be developed. Some units have established habitat analysis units or other, smaller units that define an area of importance to elk but are still quite large, perhaps as big as a hunting district or several major watersheds. This habitat analysis unit or equivalent may represent all seasonal ranges for several herds, cross some administrative lines, include private lands, and still be at a scale difficult to implement at the project level. Defining habitat analysis units can be facilitated by known elk use from radio telemetry, or patterns of historical management by the State, or some negotiated reasoning between the State and forest biologists. In many instances, habitat analysis units have not been mapped yet. In the further subdividing of elk management units, areas of particular importance will begin to emerge that will highlight ownership pattern problems, area-specific management emphasis by the State or forests (for example, a roadless hunting area contained within an area scheduled for future harvest), and priorities for information gathering.

At this level of mapping, you can begin to compare some of the goals stated in the State strategic plan with those in the forest plan regarding management area allocations, standards and guidelines, and areas where plans may be in harmony or conflict.

Step 4

You will need a final mapping level that will facilitate project-level analysis and that represents herd units (where data are available). This level will recognize known core areas, seasonal ranges, movements, and patterns of use. If data are unavailable to base these units on, then State and forest biologists should agree on mapping units that can be used for project-level analysis. These units will probably encompass third-order drainages and be specific enough to be used in meaningful Habitat Effectiveness and Vulnerability analysis at the project level. These units will "nest" within the larger habitat analysis units, which in turn will "nest" within elk management units.

At this level, specific coordination will occur regarding road access, security cover management, and hunter opportunity. Aggregation of the herd units and the data related to them should be the basis for evaluating

where and to what extent forest plans and State strategic plans are in harmony or conflict.

Uses of the Stepdown Process

Without this stepdown process, it will be extremely difficult to identify and prioritize management decisions that will need to be addressed by amendment, update, or revision. It will allow forests to focus in on key areas, to identify strengths or weaknesses of existing plans, and to specify the alternatives that may be needed in future plan changes. It will provide a forestwide perspective that will facilitate an incremental approach to planning or an ecosystem approach. It will identify the key elements that must be addressed (for example, ownership patterns, management allocations, population factors) and the agency or entity that has the management authority and responsibility.

This process will also identify important needs and the agency responsible. For example, if road access or the status of security is the issue, then the Forest Service will need to develop the pertinent data. If bull mortality rates or adjacent private land depredation is a concern, then the State will lead. If ownership patterns emerge, land exchanges may be identified as a solution to long-term management needs.

In this stepdown process, a geographical framework for elk management will be established that identifies site-specific considerations. A landscape perspective can emerge where site-specific decisions can be framed to achieve a larger, overall goal that can be fully developed and implemented through the planning and decision process.

Christensen, Alan G.; Lyon, L. Jack; Unsworth, James W. 1993. Elk management in the Northern Region: considerations in forest plan updates or revisions. Gen. Tech. Rep. INT-303. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 10 p.

National Forests provide a major proportion of the habitats in which elk grow, reproduce, and exist as elements of biological diversity. Forests also provide the basis upon which State management programs depend and provide sites for the public to hunt, view, and otherwise enjoy the elk resource. Individual National Forests can creatively address elk management through habitat effectiveness and elk vulnerability, and yet retain more consistent and cohesive approaches within regional and State boundaries. Emphasis in this report has been placed on process, content, and implementation of new information rather than on numerical standards

KEYWORDS: habitat effectiveness, elk vulnerability, forest planning

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