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Potential Effects of Ecosystem Management on Cervids Wintering in Ponderosa Pine Habitats

Abstract

Elk (Cervus elaphus), *mule deer* (Odocoileus hemionus) *and white-tailed deer* (O. virginianus) *winter in ponderosa pine* (Pinus ponderosa) *habitat types on the Blackfoot-Clearwater Wildlife Management Area (BCWMA) in western Montana. Natural fire has been excluded from these habitats during the 20th century, promoting growth of dense Douglas-fir* (Pseudotsuga menziesii) *and ponderosa pine understories. "Ecosystem Management" (EM) prescriptions for restoring natural processes in ponderosa pine types result in widely spaced mature trees, less Douglas-fir in forest overstories, and a substantial decrease of conifers in understories. Douglas-fir was the dominant forage item for both deer species on the BCWMA throughout the winters of 1991-1993, and remained the primary forage for white-tailed deer during a very mild winter in 1994 when other forages were widely available. Tree lichen* (Alectoria sp.) *was also important winter forage for deer and elk. A decrease in conifers of all size classes could reduce abundance and above-snow availability of lichen, coniferous forage and thermal cover. Of the three cervids, elk appeared least dependent upon canopy closure and coniferous forage. EM prescriptions may benefit elk (excluding security concerns) because of enhanced grass production and availability. Mule deer used habitats with sparse or dense overstory canopies, which provided no evidence that mule deer would benefit from decreased coniferous cover. White-tailed deer used habitats with dense canopies and were most likely to be affected at the population level by typical EM prescriptions. This could be problematic in western Montana where high white-tailed deer numbers may be an asset for recovering populations of scavengers and predators such as the bald eagle* (Haliaeetus leucocephalus) *and gray wolf* (Canis lupus).

Key words: elk, mule deer, white-tailed deer, ecosystem management, habitats, ponderosa pine, Douglas-fir, lichen.

Introduction

The Keystone Forum (1993) defined Ecosystem Management (EM) as "an approach to environmental management that: (1) is at a scale compatible with natural processes, (2) is cognizant of nature's time frames, (3) recognizes social and economic viability within functioning ecosystems, and (4) is realized through effective partnerships among private, local, state, tribal and federal interests; with the goal of preserving, restoring or, where those are not possible, simulating ecosystem integrity as defined by composition, structure and function that also maintain the possibility of sustainable societies and economies."

The U. S. Government has promoted EM to guide the management of federal lands in the 1990s. Evolving EM principles reflect two contrasting

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philosophies: (1) human values should drive land management, and (2) humans are intruders in natural systems (H. Salwasser, U.S. For. Serv., pers. comm.). Ecosystem Management strives for high public participation in decision making, and incorporates a growing public appreciation for retaining ecological components of biological systems, such as habitat for nongame wildlife.

Perpetuating ponderosa pine forests has become an EM objective in western Montana. Prior to the arrival of European settlers, a high frequency of natural fires in these forests prevented high fuel accumulations, which resulted in low fire intensities (Arno 1980). This fire cycle favored growth of large ponderosa pine trees in single-storied stands (Fischer and Bradley 1987). Shade-tolerant Douglas-fir typically occurred in patches that were either missed by frequent fires or regenerated during intervals between fires.

During the past 100 years natural processes in ponderosa pine forests have been increasingly disrupted (Gruell 1983). Most of the largest pines have been harvested for lumber, and fires have been suppressed to protect timber and settlements. These actions have favored the dominance or codominance of Douglas-fir in forests that were historically dominated by ponderosa pine. Shade-tolerant Douglas-fir saplings and poles are now common where forest understories were once sparse across western Montana. An abundance of sapling and pole-sized Douglas-fir increases the probability that stand replacement fires will occur in ponderosa pine communities, which may negatively impact species such as pileated woodpeckers (*Dryocopus pileatus*) (McClelland 1977), western bluebirds (*Sialia mexicana*) (R. Hutto, Univ. of Mont., Missoula, pers. comm.) and flammulated owls (*Otus flammeolus*) (V. Wright, Univ. of Mont., Missoula, pers. comm.).

Ecosystem Management prescriptions in ponderosa pine habitats typically are devised to remove most Douglas-fir, thin pole stands to recruit large pines, leave most large pines, and underburn to open the understory for establishment of pine seedlings. These prescriptions promote commercial harvest of mature Douglas-fir and some ponderosa pine, reduce the risk of stand-replacing wildfires, and result in aesthetically appealing, park-like stands.

Ecosystem Management treatments may attract consent from traditional logging opponents because such treatments are aimed at enhancing natural processes and nongame wildlife populations. Therefore, EM prescriptions in ponderosa pine forests of western Montana could be widely supported and applied across large acreages and mixed ownerships. Since 1992 we have observed increasing commonality of timber harvest prescriptions in ponderosa pine forests owned by the Bitterroot and Lolo National Forests, the Montana Department of Natural Resources and Conservation, Plum Creek Timber Company, and private landowners.

In this paper we explore the potential differential effects of opening forest overstories and understories on wintering elk, mule deer and white-tailed deer. Also, we discuss how EM implementation may affect the abilities of wildlife managers to achieve and balance human demands for the three cervids and associated charismatic species in a modern, fragmented environment.

Research Basis For Our Perspective

Our observations are based on the senior author's study of cervids on the BCWMA (Baty 1995). The BCWMA, located 72 km east of Missoula, Montana, provided winter range for migratory herds of about 1,000 elk, 1,000 mule deer and 500 white-tailed deer from 1991 through 1994. Coniferous forest covered 83 percent of the 9,000-ha study area, with the remainder divided between bunchgrass (15%) and aspen (2%) types. Douglas-fir, ponderosa pine, subalpine fir and spruce types comprised 81, 13, 4 and 2 percent of the coniferous forest, respectively. Average overstories of coniferous forest types ranged from 2-53 percent canopy cover and average conifer seedlings ranged from 0-4,870 stems/ha. Generally, forest stands reflected the influences of fire exclusion, livestock exclusion, and sporadic, selective timber harvest over the previous 47 years.

Baty (1995) measured habitat characteristics, and counted elk and deer tracks in snow within 191 vegetation stands along 40 km of evenly spaced transects. Habitat preferences were indicated from 22,268 elk, 23,662 mule deer and 15,741 white-tailed deer track sets counted during January-February 1992-1993. Radio telemetry, aerial surveys and ground observations supplemented track-set indications of cervid distributions. Diets were estimated by personnel at the Wildlife Habitat Laboratory, Washington State University, Pullman using microhistological analysis of fecal composites collected periodically during the winters of 1992-1994.

Potential Effects On Elk

Elk used forested winter habitats on the BCWMA, but only displayed preference for those with overstory canopy coverages ≤27 percent (Baty 1995). Graminoids comprised 60-82 percent of average elk diets during January and February 1992-1993, while conifers comprised 10-22 percent. General observations indicated that elk groups of <50 individuals used north-facing slopes where dense forest cover intercepted snow and moderated crusting and drifting. However, groups of 500-700 elk were most commonly observed in rough fescue (*Festuca scabrella*) grasslands. Clearcuts on upper-elevation north slopes were rarely used.

The high affinity of elk for graminoid forage and grasslands suggested that elk would likely benefit from increased grass abundance in forest understories following EM treatments. Although graminoids are often unavailable during periods with deep snow, a greater abundance of grass interspersed with sparse overstory cover might improve foraging opportunities overall. Also, the influences of wind and solar warming on exposed slopes following treatments would probably reduce snow depths and intermittently increase grass availability.

Potential Effects On Deer

Both deer species appeared well adapted to multi-storied Douglas-fir stands. White-tailed deer were most consistent in their preference for habitats with overstory canopy coverages ≥50 percent, and did not show preference for any overstory canopy <41 percent during the most severe winter conditions sampled in February 1993 (Baty 1995). Mule deer consistently preferred open Douglas-fir stands, as well as some of the most densely forested habitats on the study area. Douglas-fir was the highest ranking forage species in the January and February diets of both deer species during 1992 and 1993, comprising 31-59 percent of the estimated monthly diets. Deciduous shrubs, primarily serviceberry (*Amelanchier alnifolia*), comprised only 3-20 percent of the estimated diets for the same period.

Evidence indicated that feeding deer selected Douglas-fir. The highest proportions of Douglas-fir were detected in deer diets during January 1992 and 1993, when deciduous browse and other palatable forages were also available. Likewise, Douglas-fir comprised 18 percent and 32 percent of mule deer and white-tailed deer diets respectively during a mild weather period with very high forage availability (January 1994) (Baty 1995).

Moderate to densely forested habitats probably provided forage and thermal benefits for both deer species. Proportions of tree lichens in deer diets could not be estimated by fecal analysis because lichen was largely destroyed by laboratory procedures (B. Davitt, Wash. State Univ., pers. comm.). However, lichen appeared to be important winter forage for both deer species (Baty 1995). Lichen was abundant in forests with dense overstories. Deer quickly consumed lichen that fell from the forest canopy to the snow surface during windy conditions. Increasing densities of understory conifers might further enhance winter forage availability by intercepting windblown lichen that would otherwise become buried under snow. Many mule deer occupied winter habitats at the highest elevations on the study area (1,500 m) where snow depth may have limited availability of forage to conifers and lichens. Both deer species also occasionally sought shelter under low, overhanging branches of sapling and pole-sized conifers.

The preference of white-tailed deer for dense overstory canopies on northern winter ranges is well documented (Moen 1976, Mundinger 1980, Peek et al. 1982, Brockmann 1988, Hicks 1990). We assume that repeated observations of preference for thermal cover are indicative of a habitat requirement for maintaining productive white-tailed deer populations in western Montana (Peek et al. 1982).

Extensive mule deer use of forested habitats in winter has also been documented previously (Peek et al. 1982), but may not be fully appreciated. We perceive a concern among managers that forest succession on western Montana winter ranges may be detrimental to mule deer due to forage loss and/or an expanded habitat advantage for sympatric white-tailed deer. Observations on the BCWMA did not support these concerns.

We found mule deer wintering in a diversity of winter habitats, ranging from steep-open shrubfields to closed-canopy forests within a predominately forested landscape. Average wintering densities were conservatively estimated at 11 mule deer/km^2 (29 deer/mi^2), comparable to mule deer densities in the Missouri River Breaks (Hamlin and Mackie 1989) and Bridger Mountains (Pac et al. 1991). Thus, the forested winter range we studied was reasonably productive for mule deer relative to badlands and mountain-foothill habitats of central and eastern Montana. White-tailed deer appeared poorly adapted to handle snow conditions beyond a narrow geographic range located near the Clearwater River, and offered no possible competition to mule deer in any forest type across about 90 percent of the BCWMA. We found no evidence that thinning of overstory canopies or understory conifers is desirable to enhance the BCWMA winter range for mule deer, and it is plausible that population productivity could decrease due to decreased cover and increased energy expenditures (Parker et al. 1984). We hypothesize that mule deer can benefit substantially from structural and forage diversity provided by dense overstory and understory conifer cover in western Montana. Forest cover may be particularly important in intermountain regions where snow is deep and rarely accompanied by slope-baring winds.

An EM View Of White-Tailed Deer

We believe that local populations of elk and white-tailed deer are at twentieth century highs, while mule deer populations appear to be at moderate levels. Together, these ungulates form a prey base for a variety of predators, including man. Predation upon elk and deer is influenced by the desires of human society. The Endangered Species Act provides for the recovery of local bald eagle and gray wolf populations that prey upon or scavenge carcasses of elk and deer. Montanans also hunt these cervids and hunter participation rates approach 50 percent for men and 20 percent for women (Mont. Dep. Fish, Wildl. and Parks, unpubl. data). Accordingly, the Montana Department of Fish, Wildlife and Parks and Lolo National Forest cooperate to maintain a five-week hunting season for unlimited numbers of licensed Montana residents (Hillis et al. 1991:38).

Wolf numbers can be directly related to ungulate biomass (Fuller 1989), and white-tailed deer provided 79-98 percent of the biomass consumed by wolves each month in north-central Minnesota. White-tailed deer were also the primary prey species for wolves in northwest Montana from about 1993-1995 (K. Kunkel and M. Jimenez, Univ. of Mont., Missoula, pers. comm.). If wild prey such as deer are abundant, wolves may live near humans with lowered probability of conflict (M. Jimenez, pers. comm.). Moreover, white-tailed deer are easier to manage near people than elk, they are medium-sized and may appeal to a broader range of carnivores, and they have broader distribution that would benefit territorial predators.

The Blackfoot-Clearwater area is also a principal wintering area for bald eagles along the Mackenzie-Intermountain Flyway, where the birds feed heavily upon livestock and ungulate carrion (McClelland et al. 1994). Road crews and Montana Department of Fish, Wildlife and Parks wardens pile road-killed white-tailed deer in safe feeding locations on and around the study area. Seventeen eagles have been seen together at one local feeding station. Starvation of young eagles in their first winter can be a limiting factor to bald eagle populations, and abundant carrion may increase winter survival of young eagles (McCollough et al. 1994).

We expect that landscape-scale restoration of open, single-storied, ponderosa pine forests in the lower Clearwater drainage would ultimately reduce the white-tailed deer population. Macnab (1985:406) cautioned that a wide margin for error should be provided in the harvest management of prey population levels in the presence of natural predators, noting that heroic measures may be required to recover prey populations once they fall below threshold levels. Accordingly, we view high populations of white-tailed deer as a valuable asset in providing a necessary margin for error in western Montana. Abundant white-tailed deer potentially sustain an increasingly numerous and diverse complement of predators and scavengers, as well as an untold proportion of hunter harvest that might otherwise be transferred to sympatric mule deer and elk populations. A viable EM approach to balancing conflicting human desires within the limits of ecological sustainability should include white-tailed deer population and habitat management strategies that consider the broad social and ecological roles of high deer populations.

Recommendations

We suggest that the winter habitat needs of white-tailed deer in ponderosa pine forests could be accommodated if: (1) ponderosa pine stands with dense Douglas-fir understories remain interspersed with single-storied stands of mature ponderosa pine on a landscape; (2) size classes of understory Douglas-fir are a mix of seedlings, saplings and poles; (3) multi-storied ponderosa pine/Douglas-fir stands are large enough to function as thermal cover and are well connected across a landscape; and (4) low intensity fire occurs in ponderosa pine stands at relatively short intervals. These characteristics differ from existing conditions where stands with abundant Douglas-fir saplings and poles are large and continuous, and where fire as a natural process is lacking. Our approach would reduce the risk of stand replacing wildfire across the landscape while retaining large patches of coniferous cover and forage for deer.

This paper does not consider the management of forest cover to buffer cervids from human disturbance during the critical winter period or during hunting season. Baty's (1995) study area was closed to public use from 16 November-14 May annually. Although hunted populations of elk and deer were studied, data were not collected during the September-November hunting season. Our recommendations may require modification to consider security objectives in areas with frequent human disturbance and where security is low.

Conclusion

An EM approach to the management of elk, mule deer and white-tailed deer habitats in the low-elevation ponderosa pine forests of western Montana requires land and wildlife managers to consider and foresee the broader social and ecological roles of these common species in a modern environment. Under EM, elk and deer have intrinsic value, value as food for a complement of recovering predator and scavenger populations of national and biogeographic importance, and value for numerous consumptive and nonconsumptive human uses and economies. Formulation of a desired future condition for elk and deer abundance must consider the increasing cumulative demands placed upon these species, and must weigh habitat requirements and ecological trade-offs at local and regional scales.

This exercise leads us to conclude that high elk, mule deer and white-tailed deer populations are ecological assets that should be perpetuated to the extent possible in western Montana. Moreover, our evaluation suggests that moderate adjustments in EM prescriptions for restoring or simulating natural processes in low-elevation ponderosa pine forests would perpetuate effective winter habitat for these three cervids. It seems that awareness and acknowledgment of the interrelated social and ecological values of abundant elk and deer are necessary for managers to integrate the winter habitat requirements of these species into EM prescriptions in western Montana.

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