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Habitat Manipulations to Prevent Elk Damage to Private Rangelands

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Abstract.--Habitat manipulations were initiated on the Wick Brothers big Game Winter range in southern Wyoming to alter traditional movement patterns of Rocky Mountain Elk (Cervus elaphus nelsonii). Manipulations included spraying with 2-4-D and follow-up fertilization of the same plot in successive years with ammonium nitrate at the rate of 40 lbs. (18 kg.) free nitrogen per acre. Burning hay meadows and upland sagebrush sites and salting were used in combination with the other treatments. Elk distribution shifted to the treated plots in response to the increased quality and quantity of the grass production on these areas. Spring distribution of elk shifted to Department lands and away from private lands. This shift in spring elk distribution should augment efforts to enhance calving habitat and develop a migration corridor south of the unit through silvicultural treatments on adjacent National Forest land.

INTRODUCTION

The impact of elk (Cervus elaphus nelsonii) grazing on native rangelands has received increased interest in recent years from members of the Wyoming Agricultural Industry. Historic elk use was tolerated until the depressed economy of the agri-industry brought increased need of efficiency in the livestock operation. By the late 1970's and early 1980's, several landowners and ranch managers questioned the use of private rangelands by elk. in what they felt was direct competition with their domestic cattle operation. As a result, an increased number of damage claims was received by the Department pertaining to wildlife use of private lands. Those claims are legally covered under Title 23 Article 9 of Wyoming Game and Fish Law.

The State of Wyoming Game and Fish Department pays dAmage as mandated by state statute 23-1-901 which states; "The Department shall consider the claim upon a description of the livestock damaged, the damaged land, growing cultivated crops, stored crops, improvements and extraordinary damage to grass." In several cases ranchers claimed damage to native private rangelands as a result of early season grazing by elk, under "Extraordinary Damage to grass." By definition in the regulation, extraordinary use means, "the consumption or use of noncultivated grass plants in excess of the consumption or use which normally occurred during the two (2) years immediately preceding the time covered by the claim." (Wyoming Game and Fish Law, Revised, 1988)..

In response to these damage claims, department personnel work load was shifted to accommodate the need to document elk distribution and numbers on private land. Pre-claim data is a necessary prerequisite for determining baseline or normal use and "Extraordinary use" or use in excess of the baseline use. Documentation became labor intensive and other alternatives were researched to simplify the process. Historical use by elk of private lands was documented and use calculated in the form of Elk Unit Months (EUMS). Conversion to the universal Animal Unit Months (RUMS) was made and the clain;ant reimbursed for that use.

Efforts to alter this historic use pattern were initiated to reduce the number of elk using private land and reduce the cost of managing the elk that winter on the Wick Unit.

Our research focused on one elk herd that traditionally utilized private native *rangelands* in the spring where claims of alleged damage had occurred. The problem centered around the spring migration of elk off of winter range owned by the Department and private native

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rangelands adjacent to the unit. A list of options was formulated to reduce or eliminate conflicts.

A thorough review of the literature on :::iteration provided insight into the behavior of these elk. The literature suggested that elk migrations are traditional (Marie, 1951; Brazda, 1953; Craighead. et al., 1972; Knight, 1970) and are learned behavior (Anderson, 1958; Murie, 1951). Recent research addressed elk spring migration patterns in the terms of habitat; habitat requirements and habitat accessibility during movements from the winter range to spring range (Adams, 1982; Compton, 1975; Skovlin, 1982). Researchers also indicated ungulate use could be altered through salting, fertilizing and spraying. Dalke (1965) reported salting has a limited effect on spring elk distribution, yet research also suggested that movements of elk were related to use of natural salt licks (Knight, 1970). Chfistensen (1969) reported that elk distribution could be changed by spraying sagebrush (Artemesia sp.) and Skovlin et al. (1983) suggested that elk distribution could be altered with vegetative manipulations including fertilizing.

STUDY AREA AND METHODS

A study was initiated in 1981 to address four objectives; 1) document travel routes of radio collared elk off the Wick Unit onto sunaner range; 2) determine the response of elk to vegetative manipulations on the Unit and on adjacent National Forest lands; 3) identify important elk use areas on Unit and adjacent National Forest lands as spring transitional range which could be enhanced; 4) inventory the vegetative and physical characteristics of habitats used by elk in the spring.

The Wick Brothers Big Game Winter Range study area is about halfway between Laramie and Rawlins, in south central Wyoming. The unit is located 6 miles (9.65 km) southeast of the town of Elk Mountain, Wyoming, on the northern edge of the Snowy Range. Elevation of the study area ranges from 7,263,Ieet (2,214 m) to 8,907 feet (2,715 rn). The topography is dominated by high rolling hills and benches. Major watersheds include Mule Creek, Wagonhound Creek and Foote Creek, tributaries of the Medicine Bow River. Precipitation averages 15.6 inches (39.73 cm) and moisture occurs generally as snow and early spring rains. During the winter, wind keeps the upland sites snow free and available to elk. Snow deposition is generally in the draws and stream bottoms as a result of snow drifting. The area is mapped to range sites using the Soil Conservation Service Technical Guide (1978) and has been summarized by Pinchak (1983). Range sites include wetland, subirrigated, grazeable woodlands, loamy sites, very shallow, shallow loamy and coarse uplands. The sites on private lands classed as very shallow, shallow loamy, and coarse uplands appear to be the mast vulnerable to spring grazing in the areas where cattle and elk use overlap.

Field work was .initiated in 1982 in the pretreatment phase of the project. Adult elk fitted with radio collars have been monitored since 1982. Radio collars have been placed on 19 cows and 1 bull during the course of this project.. Elk were collared primarily to determine migration routes, the response of these elk to any shift in migration routes, and the use of the vegetation treatment areas on the Unit and on National Forest land.

In .3n attempt to hold elk on the Unit longer in the spring, series of manipulations were planned. The use of salting was first initiated in 1982, burning and spraying in 1983-1985, and fertilization with ammonium nitrate was applied in the fall of 1985. The use of fertilizer was repeated again in 1986 on plots treated previously by spraying 2-4-D on sagebrush. Spraying was generally directed at Big Sagebrush (Artemisia tridenta), 3-tipped Sagebrush (Artemesia tripartita) and Black Sagebrush (Arten;esia nova). Mat forming forbs, as well as the sagebrush, were removed, releasing the grass communities.

RESULTS AND FINDINGS

Transects were established following treatments in 1983. A standard utilization cage and end of the year production transect utilizing a circular hoop of 9.6 sq. ft. (.8913 sq. in.) was read in 1984 (Stroud and Pers. Comet.). The 1934 results of the 2-4-D spray program showed a dramatic increase in grass and forb production (Table 1) when followed up with fertilization of ammonium nitrate. The elk responded to the increased forage quality and quantity and regularly were observed on vegetative treatments.

It appears that both fertilizing and spraying are useful in attracting elk. However, the benefits from fertilization appears to be more short lived. Fertilization acted as an attractant for two successive years. Spraying and the resulting change in the plant community, appears to prolong elk use over time.

Table 1. Results from the plot)prayed with 2-4-D and fertilized with anwiionium nitrate. (Stroud, 1985).

	Treated	Control
Production	1983	1983
Grasses	676.7	235.0
'•Forbs	246.1	285.1
Shrubs	94.3	260.8

*Forb production appears to decline on treated area. However, reduction in mat formers increased production of other forbs.

In addition to the vegetative treatments a program of salting was initiated in 1982 to attract and hold elk. This program showed limited success. However, it appears that elk did use salt heavily through all phases of the project. Shifts in elk distribution were documented to areas near established salt stations.

The use of salt and the use of the treated areas by elk appeared to be greatest in late March and April which coincides with the period of damage on adjacent private lands. In the areas treated by fertilization and herbicide, elk use increased 3 fold over pre-treatment levels, 50.8 EUMS compared to 130.0 EUMS. Shifts in elk home ranges between years was also documented, favoring the treated areas.

Concurrent with habitat improvements on the Wick Unit, the Forest Service and Wyoming Game and Fish personnel designed a timber sale on adjacent National Forest land to improve spring elk habitat. Clear cuts were designed to create a mosaic of openings, aspen patches, and conifer stands to provide better habitat for elk calving and spring forage. A number of the clearcuts were designed to blow free of snow to provide winter forage and access to the upper Wagonhound drainage in early spring. This silvicultural treatment was proposed to augment efforts on the winter range to hold elk on public land in spring and attract elk away from traditional calving areas and spring migration routes determined from monitoring telemetered elk. The timber sale was complete in 1987. The slash should be treated and the clearcuts should be seeded with grasses in 1989. The response of the elk will be determined by monitoring radio collared cow elk over the next two years.

DISCUSSION AND SUMMARY

Both telemetered elk and noncollared elk responded to increases in vegetative production on areas treated by fertilization and herbicide. Shifts in spring use patterns of marked elk towards the treated areas and reduced use of private rangelands! were noted. The treatment and post treatment data clearly supports other research which indicates the usefulness of vegetative manipulations to alter ungulate distribution (Christensen, 1969; Dalke, 1965; Skovlin et al., 1983). In the case of the Wick Unit, the manipulations established a use pattern that could enhance efforts to establish a migration corridor on public land.

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Characteristics of Deer Damage to Experimental Orchards in Ohio'

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SPRY

We measured several variables of newly established apple trees (1) to compare growth differences between trees damaged by browsing deer (Odooooileus t hemionus and trees protected from deer, (2) to determine if seasonal browsing patterns existed, and (3) to determine if deer browsed selectively among Ohio's 3 most commonly planted apple cultivars. All testing was die at the 0.05 alpha level. Experimental trees were measured repeatedly from June 1986 the May 1988.

Trees were planted in experimental orchards planted at research farms representative of areas where apples are groan commercially. Each experimental, orchard contained 20 tees each of 3 cultivars, red delicious, golden delicious, and red rune. Trees were planted randomly by cultivar pairs and arse tree of each pair was enclosed in a welded wire cylinder 1.5 m high to exclude deer. Eight orchards were planted the first year; 5 additional orchards were planted the second year. At the beginning of the second year half of the tree pairs in the 8 original orchards were randomly selected and the enclosures switched from the control to the treatment tree. Trees were measured mthly the first year, and bimonthly the' second year because the trees were much larger. Variables measured included branch length, number of leaves/branch number of leaves/can of branch length, and browsing frequency. Radial growth was determined by measuring trunk diameter at time of planting and each autumn thereafter.

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length of branches in all orchards but 3 were significantly reduced by browsing deer and browsed trees in all but 2 orchards had significantly reduced numbers of leaves. Browsed branches were observed in all but 1 orchard. The reduction in branch length ranged from 0% in the single undamaged orchard to 98% in one of the most serely browsed orchards; reduction in number of leaves/branch had a similar range from 0% to 85$.

Significant seasonal effects were found in branch length, number of leaves/branch, and browsing frequency between browsed and control trees. Two seasonal patterns existed among significantly browsed orchards. Browsing was concentrated either in early summer or autumn. Orchards with greatest branch and leaf reductions sustained significantly more browsing in early summer than any other season. Browsing in these orchards bean as soon as trees began to grow and teased only uher. trees failed to initiate new growth, became dormant, or died. Orchards with lower levels of browsing were damaged in late autumn and winter. Deer began to browse these orchards at the time leaves dropped from trees in adjacent wooded areas. leaves persisted oar apple trees longer than in surrounding forest trees. Sporadic browsing continued into winter in such orchards.

No evidence was found that deer selectively feed on any of the 3 cultivars tested. Browsing was severe enough to cause higher mortality among treated trees in 6 orchards ($p < 0.01$). Four orchards were moderately brow: mortality rates between browsed and unbrowsed trees were not different but radial growth was reduced significantly among browsed trees. Three orchards were browsed lightly, neither mortality rate nor radial growth was significantly different between browsed and unbrowsed trees.

After 2 growing seasons, most foliage was beyond the reach of deer. Browsing damage is most critical to small and immature trees. Growth rate and tree vigor are affected by edaphic conditicns, rootstock, and cultivar. Under editions of rapid growth, apple trees can outgrow the detrimental effects of deer browsing and protection might only be needed the first 2-3 years.

Deer Damage to an Austrian Pine Tree Nursery in Wheatland, Wyoming'

Dennie A. Hammer

Abstract.--During the winter of 1987-1988 southeastern Wyoming experienced severe weather *conditions. The* agricultural land south and west of Wheatland, Wyoming became critical to the survival of both mule and white-tailed deer. A 120 acre commercial tree nursery was located in these farmlands at the foothills of the Laramie Mountain range. Approximately 150 deer moved into the nursery seeking both hiding and thermal cover. Shifting snow created large snow drifts throughout the area which inhibited the foraging patterns of the deer. The deer yarded up within the confines of the nursery and were forced to consume pine needles in an attempt to meet their daily energy requirements. This foraging by deer caused various degrees of damage to 4,564 Austrian pine trees. Evaluation techniques used to determine the extent of the damage in monetary terms were those developed by a tree and landscape appraising firm. The completion of the evaluation resulted in the largest single damage claim ever paid by the Wyoming Game and Fish Department for wildlife depredation.

INTRODUCTION

During late December (1987) and throughout January (1988), southeastern Wyoming experienced severe winter weather. Mule deer were driven down from their winter ranges in the foothills of the Laramie Mountain range by heavy snows, cold temperatures and strong, winds, and were forced into the agricultural land south and west of Wheatland, Platte County, Wyoming. The extraordinarily high density of deer in this area created many depredation problems, most of which occurred to easily accessible and unprotected piles of field corn and stacked alfalfa hay. Centrally located within this agricultural area is a commercial tree nursery, operated by Wyoming Evergreens of Wheatland, WY. The nursery, at this time, was nine years old, 120 acres in size, and producing approximately 120,000 trees. Deciduous and coniferous trees were being grown, however, the majority of production was in coniferous trees such as Austrian pine (Pinus nigra), Ponderosa pine (Pinus ponderosa), Blue spruce (Picea pungens), Bristlecone pine (Pinus aristata), and Rocky Mountain juniper (Juniperus scopulorum). During the severe weather, the nursery provided excellent hiding and thermal cover for a large number of displaced deer. Although a livestock fence encompassed the nursery, it was not a barrier to deer movements.

DAMAGE INVESTIGATION

In early February, 1988, the Wyoming Game and Fish Department (WGFD) was informed by Wyoming Evergreens nursery manager that wintering deer had caused extreme damage to a large number of trees within the nursery. As winter progressed, shifting snow had created large drifts throughout the agricultural area. The deep snow inhibited foraging patterns and approximately 150 mule and white-tailed deer yarded up within the confines of the nursery. As the deer became stressed by the winter conditions, they browsed heavily on the nursery stock in an attempt to meet their daily energy requirements. Subsequent field investigation of the damage revealed that the majority of damage had occurred to the Austrian pine trees. Although several species of trees had sustained various degrees of damage, the Austrians were apparently the most palatable.

The Austrian pine is a native of central and southern Europe and Asia Minor. It is very

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adaptable to nearly any growing condition,

adaptable to nearly any growing condition, provided there is full sunlight. It's growth form is densely pyramidal, stiffly branched, and wide spreading. The fascicles of two needles are dark shiny green on yellow-brown twigs. Needles are recurved and range between 3 and 6 inches and are both unbendingly stiff and very sharply pointed. Winter buds have a pineapple-like silhouette and are very hairy. The rough bark is dark brown-gray and noticeably grooved (Hudak, 1980).

The most apparent damage to the trees was needle removal through browsing (fig. 1). Closer examination of the damaged trees revealed that many of the lateral branch buds had been selectively removed (fig. 2), and depending upon the height of the tree, terminal branch buds had also been browsed off. The actual amount of deneedling varied from slight to over 50% of an individual trees' needles. On many of the severely damaged trees needles had been eaten to within one-half inch of the branch. The majority of deer had moved out of the nursery due to improving weather when investigated by Department personnel, but 40-60 deer were still utilizing the nursery.

Figure 1. An Austrian Pine tree which sustained heavy **deneedling to it's lower branches due to deer browsing.**

To prevent further damage to the nursery, short-term scare tactics were employed. Zon guns were set up around the perimeter of the nursery and operated on a 24-hour basis. In addition, nursery personnel patrolled the area

Figure 2. An Austrian Pine tree showing lateral branch bud removal due to deer browsing

during the night periodically shooting explosive cracker shells and whistle bombs provided by the WGFD.

DAMAGE EVALUATION

Wyoming Evergreens estimated there were 20,000 Austrian pines in the nursery. Of these, 12,000 were considered to be six to twelve feet tall and of harvestable size. The remainder of the Austrians were five feet tall or less in height. Although as previously stated, several species of trees sustained damage, Wyoming Evergreens was interested in recovering damages only to an estimated 4,564 Austrian pines.

Under current Wyoming statue (W.S. 23-1-901) the WGFD is responsible and may be held liable for damage caused by big or trophy game animals or game birds. In 1981, John Demaree and Tim Fagan, Damage Control Wardens (WGFD), organized a handbook of methods used to evaluate various types of wildlife damages. The handbook is used as a reference source for the majority of the damage claims submitted to the WGFD. However, there were no techniques described in the handbook for evaluating damage to nursery trees. Generally, damage to ornamental trees was just a matter of determining replacement costs.

In an attempt to locate previously used evaluation techniques, literature searches were conducted through the U.S. Fish and Wildlife Center in Maryland, and the Science Library at the University of Wyoming in Laramie, WY. Neither search resulted in locating workable evaluation techniques for our situation. Several western and mid-western State agencies

and Universities were contacted with virtually no success in identifying previously tested procedures.

On several occasions, WGFD personnel attempted to formulate workable evaluation techniques. At the same time, the nursery also continued to refine their estimates of the actual damage and unfortunately, agreement over the actual cost figures between Wyoming Evergreens and the WGFD could not be reached. Subsequently, Wyoming Evergreens suggested contacting a tree buyer from Denver, Colorado who had done business with the nursery in the past **and who was, therefore,** familiar with their operation. After visiting the nursery, the tree buyer felt that he was not qualified to assess the actual damages in monetary terms. The buyer recommended contacting Eyerly and Associates, Denver, Colorado, a consultant firm which provides landscape and tree appraising services. **Shortly thereafter, the consultant firm was contacted by the WGFD, and the damage situation explained to them.** It was learned through this contact that the firm had extensive nursery business background and served as a principal witness for the U.S. Justice Department in a court case in Arizona. After having reviewed the available information, the firm felt that the damage claim could possibly be assessed utilizing National Standards currently in use for appraising damages due to hail storms. The firm also agreed to evaluate the damages in monetary terms and to support their findings in a court of law if the need arose.

ASSESSING THE ACTUAL DAMAGE

The evaluation procedure began by determining the average size of the damaged trees and placing them into four categories. Category 1 trees ranged from 7 to 9 feet (averaged 8 feet), Category 2 trees ranged from 6 to 7 feet (averaged 6.5 feet), Category 3 trees ranged from 3 to 6 feet (averaged 4.5 feet), and Category 4 trees ranged from 2 to 4 feet (averaged 3 feet).

The next step was to identify the quantity of trees that sustained deer damage. Information on size and quantity was obtained from information submitted to the WGFD by Wyoming Evergreens. The consultants reviewed the information and after an on-site inspection of the nursery, concurred that the numbers provided were reasonable. Then utilizing Wyoming Evergreens' catalog of available nursery stock and 1988 price lists, and examining the current fair market value of Austrian pine sizes not listed by Wyoming Evergreens, a basic value/tree was assigned to each category. By multiplying the basic value/tree by the number of trees in that category, a total cost was determined for each category. Since the prices quoted in the catalog included the costs of digging, market preparation, and freight charges (within 200 miles), it was necessary to deduct this cost from the total cost. Digging costs were considered to be less for trees under six feet in height, therefore, two separate digging cost figures were used. The number of trees/category multiplied by the digging cost/tree gives the digging cost/category. Then by subtracting the total digging cost/category from the total cost/category, you obtain the initial value/category of the damaged trees.

There were two basic assumptions made that should be identified here. The first is that each of the damaged trees is considered a total loss to the nursery, therefore, damages will be assessed only one time. Wyoming Evergreens had proposed that because the damage was variable, some of the trees would take longer (years) to recover than others. Based on this, a restoration plan over a four year period was suggested. The plan would have required annual inspections with a payment applied each year based upon growth and recovery rates. However, the consultants felt that this type of plan would project too many variables, such as environmental conditions, degree of care, current market value, disease and other unknowns. The second assumption is that the initial value of the trees is the value of a tree that was in perfect growing condition prior to the deer damage. This condition is based upon a tree's annual growth rate, percent decadence, structural weakness, the presence of insects and/or disease, mechanical injury, survival conditions, and life expectancy. The condition of a tree is evaluated as a percentage along a scale from 0 to 1001. It was determined by the firm that the condition of the trees prior to the deer damage ranged from 30 to 60% and that a fudge factor of 5;o should be added to provide a reasonable average of 65%.

Multiplying the initial value/category by the condition factor gives the total value of the trees in each category. Since the trees are considered a total loss to the nursery, there are removal and cleanup costs that need to be considered. As with the digging costs, the cost to remove and cleanup a damaged tree varies with the size of the tree. Once this cost/size of tree was determined, the removal and cleanup cost/tree was multiplied by the number of trees/category to determine the additional cost of the trees/category. The sum of the total value/category and the removal and cleanup cost/category equals the assessed damages due to deer depredation/category. Finally, the sum of the four category assessments equals the recommended damage claim payment (figure 3).

Figure 3. The calculations used in determining the recommended damage claim payment were:

C, = a category of trees by average height
N, = number of trees/category
BV = basic cash value of a tree given it's height
TC1 = total cost/category
do = digging cost/tree given it's size
DC, = digging cost/category
IV, = initial value/category
CF = condition factor
TV1 = total value/category
rc = removal and cleanup cost/tree
RC, = removal and cleanup cost/category
AD, = assessed damages/category
RDCP = recommended damage claim payment

so, the calculations for each category are:

TC, - BV, X N,
DC, = do X N,
IV,, = TC, - DC1
TV, = IV1 X CF
RC, = rc X Ni
ADi = TV1 + RC,

then, the recommended damage claim payment is:

RDCP = AD, + AD, + ...

SUMMARY

The damages awarded to Wyoming Evergreens is to this date the largest amount of money ever paid by the WGFD for an individual deer depredation claim. We feel that the procedures followed by Eyerly and Associates to assess the damages were fair and reasonable. As part of the damage claim agreement, Wyoming Evergreens was informed that all of the 4,654 damaged trees had to be removed. and documentation of that action had to be provided before future damage claims would be considered. It was also suggested that a deer-proof fence be installed by Wyoming Evergreens to prevent deer movement into the nursery. The nursery has since erected an eight-foot deer-proof fence.

Prevention of damage situations is always the preferred course of action; however, this may not always be possible. It is important that States such as Wyoming which are financially liable for wildlife damage make available through publications and workshops those techniques and procedures for damage evaluation that are workable, tested, and acceptable. In addition, state wildlife agencies should promote and fund scientific research to develop improved evaluation techniques which are specific to unique wildlife damage situations.

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