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ELK

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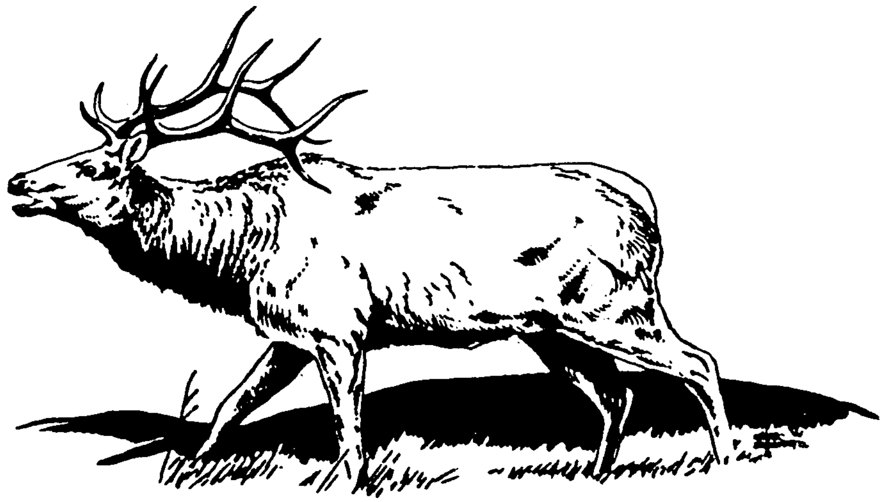

Fig. 1. Rocky Mountain elk, *Cervus elaphus nelsoni*

Damage Prevention and Control Methods

Exclusion

Large wooden panels around haystacks are effective but expensive. Wrapping haystacks with plastic sheeting or netting is less expensive but effective for only 1 to 2 years. Tensar snow fence material is inexpensive and effective for many years.

Woven-wire fencing is highly effective, but expensive. Electric fencing is less expensive and almost as effective as woven wire.

Welded-wire cages up to 6 feet (1.8 m) tall effectively prevent elk damage to fruit and ornamental trees.

Vexar® and Tubex® plastic cylinders and paper budcaps effectively prevent elk damage to conifer and hardwood seedings.

Cultural Methods

Alternative forage plants provide protection under limited conditions.

Planting larger trees, especially conifers, is highly successful.

Alternating grazing by cattle and elk provides increased amounts of nutritious forage for both on the same pasture.

Harvesting timber in large blocks (100 to 200 acres [40 to 80 ha]) promotes increased forage production and overwhelms elk with more forage than they can eat, increasing potential for adequate seedling density.

Frightening

Hazing with aircraft provides short-term and expensive control of damage to range and forage crops.

Propane exploders provide temporary (2 to 4 weeks) relief from elk damage.

Repellents

Moderately effective for short periods (2 to 4 weeks). They usually require multiple applications.

Toxicants

None are registered.

Trapping

Corral-type traps are cumbersome, expensive to erect, and of limited effectiveness.

Shooting

Special hunts designed to reduce local elk numbers are of limited effectiveness.

Selective harvest of individual offending elk may provide relief from localized damage.

Other Methods

Some western states compensate landowners for damage by elk to agricultural crops.

PREVENTION AND CONTROL OF WILDLIFE DAMAGE — 1994

Cooperative Extension Division
Institute of Agriculture and Natural Resources
University of Nebraska - Lincoln

United States Department of Agriculture
Animal and Plant Health Inspection Service
Animal Damage Control

Great Plains Agricultural Council
Wildlife Committee

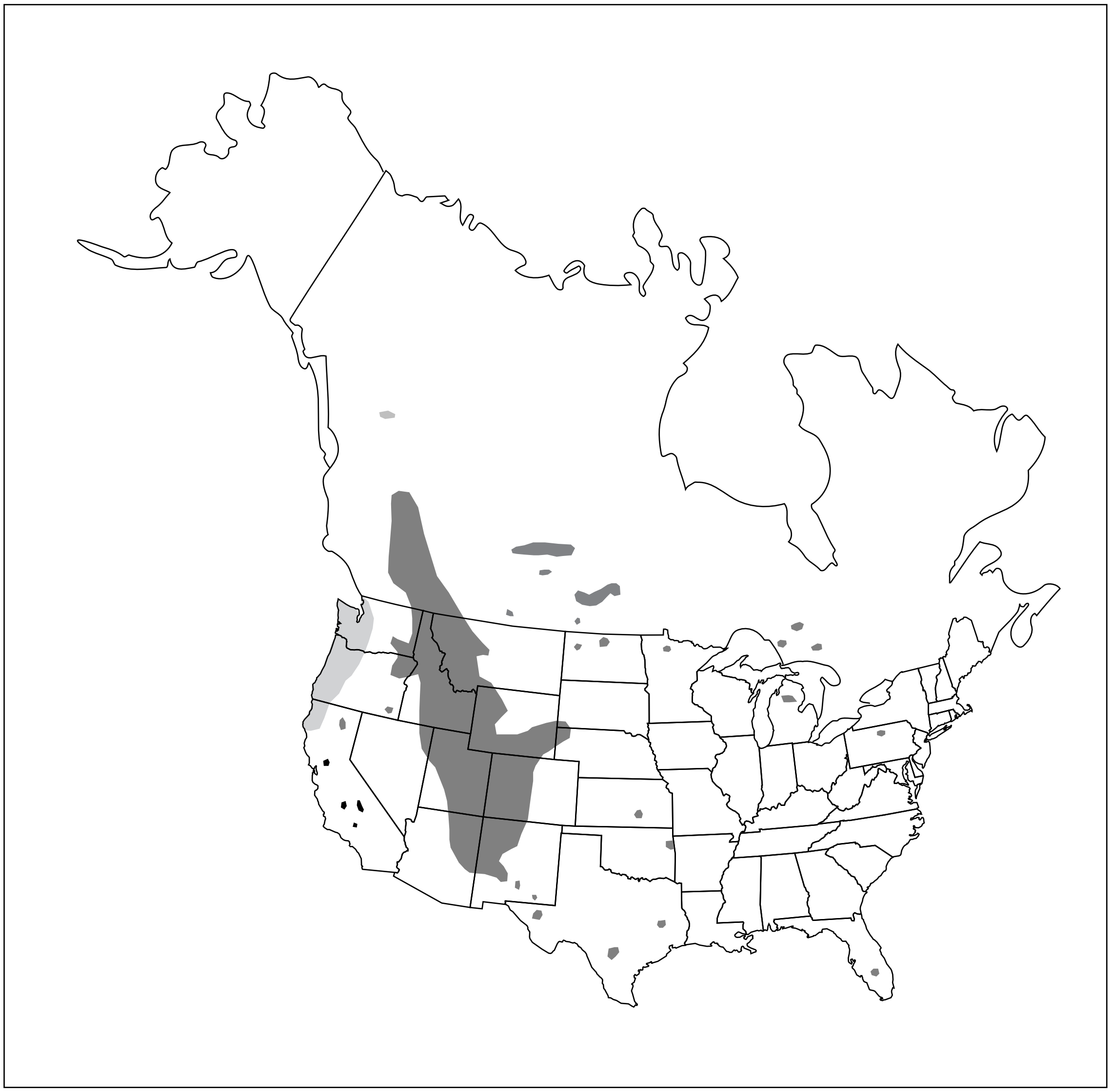

Fig. 2. Range of the Rocky Mountain elk (horizontal stripes), Rocky Mountain transplants (vertical stripes), Tule elk (dark) Manitoban elk (medium), and Roosevelt elk (light).

Identification

The elk is a large, powerful animal with an adult weight averaging over 400 pounds (180 kg) (Fig. 1). Pelage (hair coat) is light to dark reddish brown on the body, a darker brown on the neck and legs, and creamy on the large rump patch. Males bear large, impressive antlers with six or more tines branching from two heavy central beams.

Range

The Rocky Mountain elk (*Cervus elaphus nelsoni*) is found in the Rocky Mountain states and in scattered locations in the Midwest and East (Fig. 2). The current distribution of the Roosevelt elk (*C. e. roosevelti*) is the inland coastal areas of northern California, Oregon, Washington, Vancouver Island, British Columbia, and Afognak Island, Alaska. The Tule elk (*C. e. nannodes*) is found only in California and the Manitoban elk (*C. e. manitobensis*) is found in Manitoba and Saskatchewan.

Habitat

Although elk once roamed freely into lower elevation grasslands, they are now found primarily close to heavily forested areas that are dotted with natural or human-made (clear-cut) openings. Typically, elk use the openings to forage for food. Elk seek the shelter of dense stands of conifer and deciduous trees for protection from temperature extremes, predation, and harassment by humans. Elk usually spend their summers at higher, cooler elevations. In fall, they migrate along traditional corridors (2 to 80 miles [3 to 133 km]) long to lower elevations to escape weather extremes and snow depths that prohibit foraging in winter. Some herds are not migratory, spending the entire year within fairly well-defined and restricted areas.

Food Habits

Elk graze on grasses and forbs, and browse on shrubs, tree seedlings, and saplings. Diet is variable, depending on the availability and nutritive content of forages. Elk dietary preferences often overlap those of domestic and other wild ungulates. Where both grasses and shrubs are available, elk may favor grasses. When snow reaches sufficient depth to cover grasses and shrubs, elk are forced to rely on conifer seedlings and saplings, and bark and twigs of deciduous trees, such as aspen. Wind-fallen branches and attached arboreal lichens are an important energy source in winter.

General Biology, Reproduction, and Behavior

Weather and human activities influence elk activity. Where no hunting is allowed, elk readily habituate to humans and may be observed foraging during daylight hours. Otherwise, elk tend to forage primarily in the early morning hours, in late afternoon, and during the night. They also forage more on warmer south-facing slopes during daylight hours in colder months, retiring to the thick protective cover of conifer/deciduous forests in early afternoon. In summer, elk forage early in the day when temperatures are lower and seek refuge from midday heat and insects in cooler riparian areas or forested, windswept ridge tops.

Elk use a variety of habitats and habitat components (slope, aspect) to optimize feeding opportunities, thermal regulation, and protection from predation. This flexibility is closely associated with the impact elk have on domestic hay, grain crops, and on pastures shared with domestic livestock. For example, spring migration coincides with the development of new growth of succulents, which concentrates feeding in pastures and grain crops and leads to heightened levels of damage.

The breeding season (rut) begins in late summer, when dominant males (bulls) herd "harems" of cows together for breeding. Cow elk may breed as yearlings, but many breed first as 2-year-olds. A single calf is born about 250 days following conception.

Damage

Elk commonly impact agricultural resources by competing with domestic livestock for pasture and damaging cereal and hay crops, ornamental plants, orchards, and livestock fences. Elk also damage forest resources by feeding on seedlings and saplings of coniferous and deciduous trees. During winter, elk concentrate in areas where food is available, including pastures, winter wheat fields, and young conifer plantations. A survey conducted in 1989 indicated that elk caused damage to crops in seven states, mostly to haystacks and pastures. Elk damage appears to be a local problem that usually is dealt with locally.

Elk damage problems are increasing in property developed in traditional elk wintering ranges. This problem can be avoided by zoning regulations that prohibit development in such areas.

Because the elk is a highly desired game animal, management efforts in the last few decades have concentrated on increasing the size of local elk herds. As elk numbers have gradually increased in many parts of their range, the incidence and intensity of damage to agriculture and forestry have also increased.

Damage Identification

Plants browsed by elk have a characteristic appearance. Vegetation is grasped between the lower incisors and the upper palate and ripped or torn, resulting in splintered and fragmented plant parts (Fig. 3). In contrast, rabbits and large rodents clip vegetation off at a sharp 45º angle (Fig. 4). Elk damage to conifer seedlings may appear as a thorough stripping of bark from the upper half of the growing tip or "lateral" (Fig. 5). This damage generally occurs weeks after planting, usually in early to midspring. Meadow mice gnaw or "girdle" rather than clip as larger rodents and rabbits do, or browse as elk and deer do. The appearance of damage to browsed plants is similar for elk, deer, and cattle, but their tracks and scats (droppings) are easily distinguished (Fig. 6).

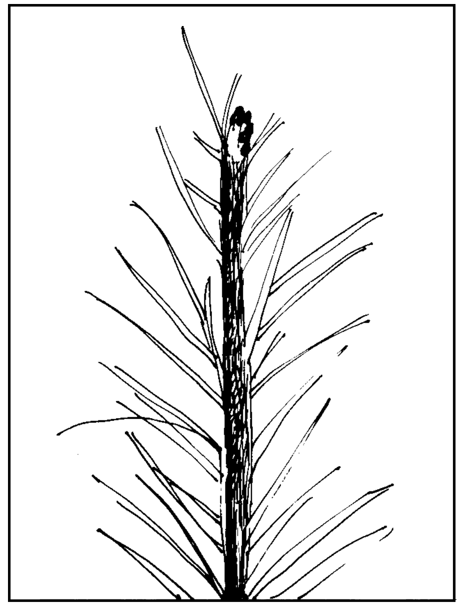

Fig. 3. Elk browsing results in a ragged twig edge.

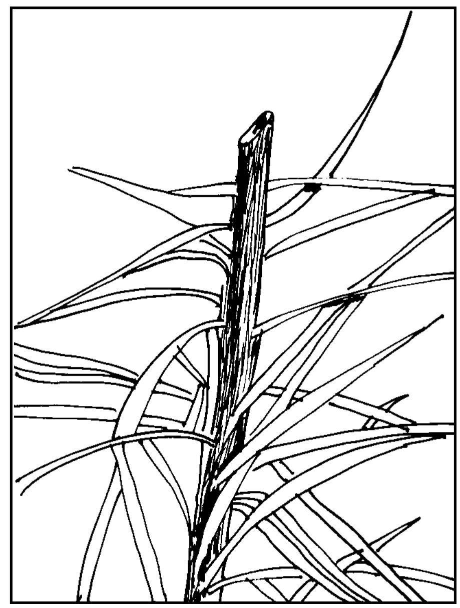

Fig. 4. Rabbit browsing results in twigs and small branches cut cleanly at a 45º angle.

Elk tend to roam over greater expanses of habitat than deer, so the occurrence of damage by elk is more widespread and sporadic than damage by deer. Also, because elk move in groups instead of singly, the nature of their destruction to crops and pastures includes trampling, much like that of domestic livestock.

Damage by elk is often seasonal. Damage to hay and grain crops generally occurs in spring when these crops are the first succulent vegetation to emerge, and native forages are in short

Fig. 5. Conifer seedling damaged by elk shortly after planting.

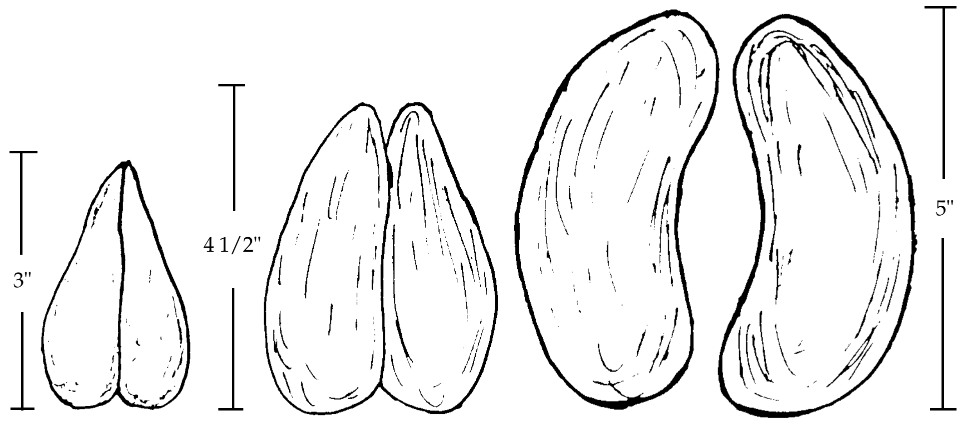

Fig. 6. Tracks of deer, elk, and cattle

supply. If native forages are chronically limited, damage to crops may persist through harvest. Much of the damage to orchards occurs in winter and late spring when the growing tips of young (1- to 5-year-old) trees are high in protein and highly digestible. Damage may continue through late summer at a reduced level. Conifers are often damaged after they are planted on clear-cut sites. Elk are drawn to conifers when other food supplies are limited and/or of low nutritive quality. Elk also are attracted during spring when conifers produce new growth that is especially palatable and highly digestible. Damage to haystacks occurs during winter when there is little food available for elk on winter ranges. Elk damage to pastures usually occurs during winter and during migration periods when elk move between summer and winter ranges.

Elk usually damage areas that border standing timber because they have learned from their association with humans not to venture far out into large openings. They also prefer riparian zones and benches as opposed to steep slopes, and damage is usually distributed accordingly. Much of the damage caused by elk is in response to low availability of forage on winter range; thus crops on winter range or along migration routes are often damaged.

Legal Status

Elk are protected and classified as a game animal in states and provinces where they are sufficiently abundant. Elk are completely protected in most areas with small populations.

Damage Prevention and Control Methods

In some situations, only one technique for controlling elk damage is necessary. In many situations, however, the greatest reduction and prevention of future damage will be accomplished by application of more than one damage control technique.

Exclusion

Fencing has provided relief from elk damage where plants cannot be protected individually, such as in hay and grain fields, large orchards, and pastures. Six-foot-high (1.8-m) woven-wire fences, topped with two strands of smooth or barbed wire (Fig. 7) will prevent access, but the cost is high (Table 1). Some states have cost-share programs wherein some or all of the cost of fencing materials may be borne by one or more agencies responsible for managing elk damage.

Recently, high-voltage (3,500- to 7,500-volt) electric fences have proven to be a relatively inexpensive and effective alternative to woven-wire fences. They feature 8 to 11 smooth strands of triple-galvanized, high-tensile steel wire supported by conventional fence post systems (Fig. 8). Considerable expertise is required to construct these fences, but when built properly, they

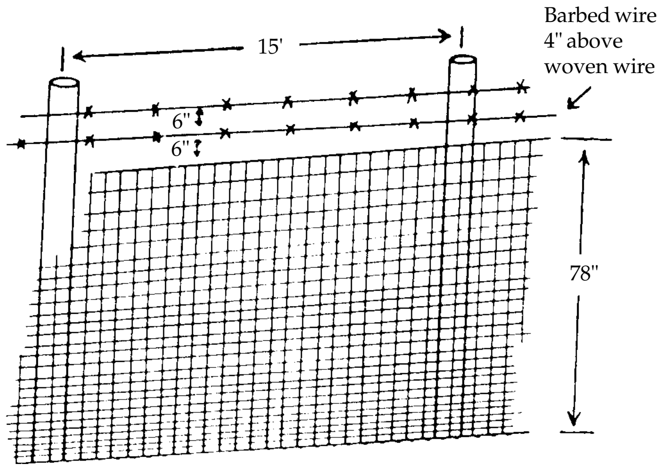

Fig. 7. Woven-wire fences can exclude elk.

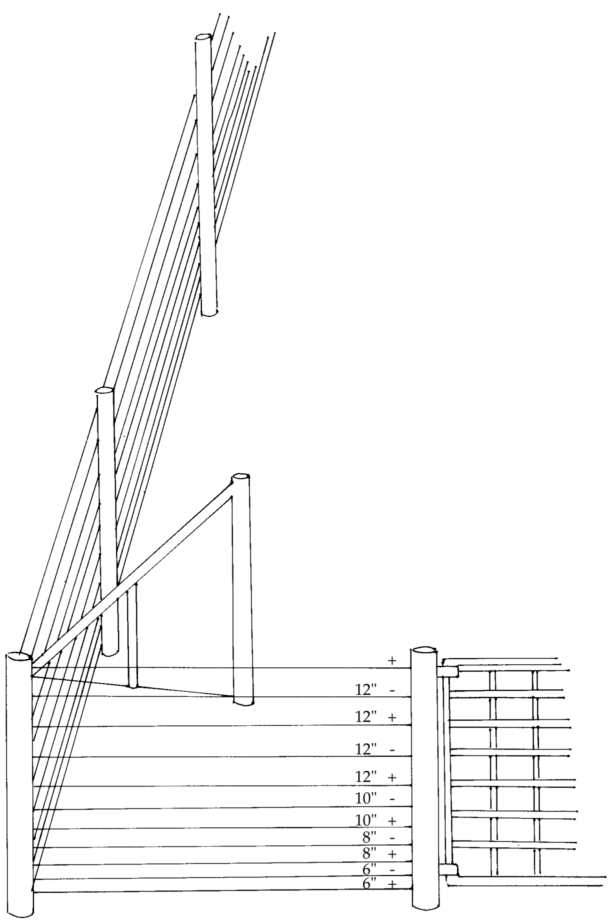

Fig. 8. A high-tensile electric fence can exclude elk.

can provide nearly as much protection from damage as mesh fences.

Researchers in Pennsylvania developed 4- to 5-strand electric fences (Fig. 9) that provided 80% or more protection from deer damage. In Oregon, an 8-foot (2.5-m) electric fence consisting of 11 wires successfully kept elk from entering a rhododendron nursery that previously had sustained persistent trampling damage. A key component of electric fences is the high-voltage charger or "energizer." These are available as 110 volt or battery-operated units.

For a fence to be effective, it must be seen by elk. In the case of an electric fence, which a herd can easily run through, it must be seen and associated with an electric shock. Place branches along the top of livestock fences and drape light-colored surveyor tape from electric fences to make them more visible to elk. To help "initiate" elk to the shocking power of fences, place peanut butter on tinfoil strips and attach the strips to electric fence wires 3 feet (1 m) above ground . For more details on fencing, see the **Deer** chapter in this book.

Haystacks have traditionally been protected by wooden panels (Fig. 10). Because panels are expensive to build and unwieldy to place in position, they are no longer recommended except in cases where nothing else is available. With the advent of the effective and less expensive electric fencing, it is now feasible to place perimeter fences around hay yards. They allow ranchers easier access to hay and greater mobility in moving the hay within yards. Electric fences such as those illustrated are permanent installations, lacking the mobility of panel fencing, so placement is a factor in choosing panels or electric fences.

Haystacks can be protected from elk for one or two seasons by wrapping plastic barriers around them. Ten-foot-wide (3-m) sheets of 6-mil black plastic (Visqueen®) or netting made of expanded polyethylene are commonly used. Attach the sheets to standing stacks of hay bales by tying baling twine around pebbles enclosed in a

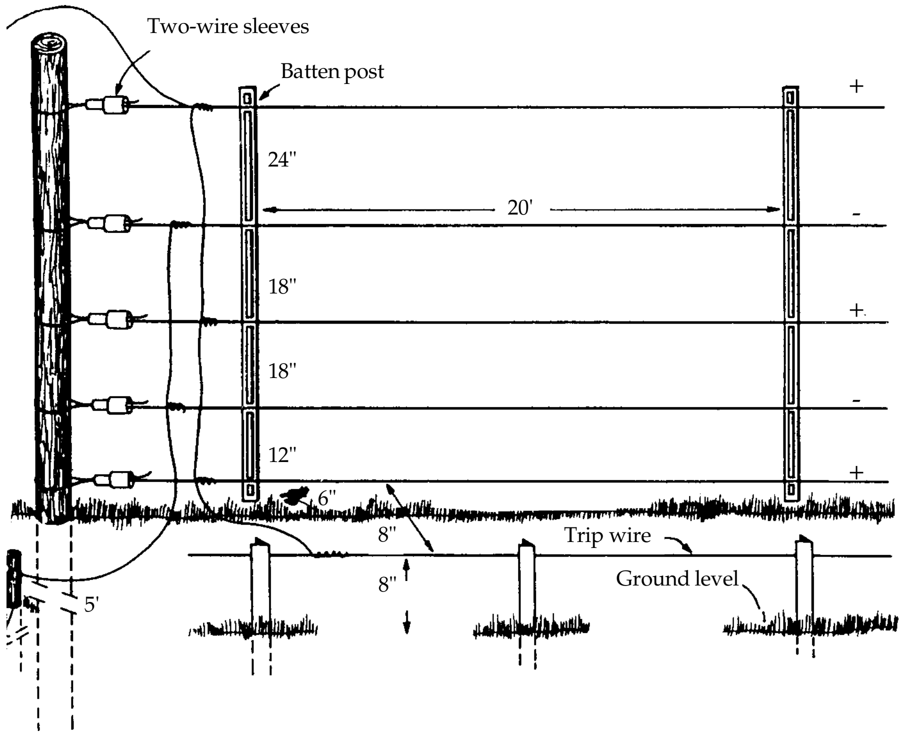

Fig. 9. The Penn State electric fence may be of use in excluding elk as well as deer.

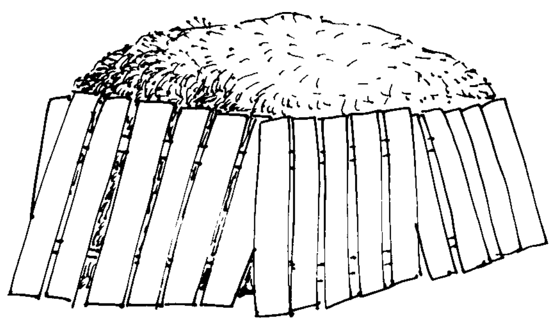

Fig. 10. Wooden panels have been used to protect haystacks.

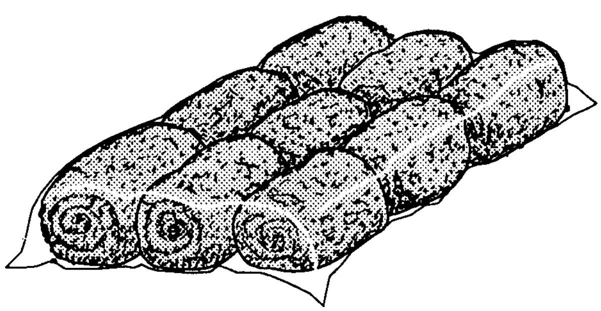

Fig. 11. Black plastic sheeting or netting wrapped around hay stacks provides inexpensive and effective protection for 1 to 2 seasons.

fold of plastic at the top of the sheet, and tying the loose end of the twine to baling twine on hay bales (Fig. 11). The netting is simply stretched around hay stacks.

The Tensar® snow fence, which comes in 8 x 100-foot (2.6 x 30-m) rolls and has a 30-year life span, can also be wrapped around haystacks. State and federal wildlife agencies have been purchasing it and loaning it to ranchers to use before winter elk damage begins.

For smaller orchards (fewer than 50 trees), protect individual trees with 6-foot (1.8-m) cylinders of welded wire (Fig. 12).

Protectors for individual coniferous and deciduous tree seedlings are effective until the leader (growing tip) or lateral branches grow out of the protectors and are once again exposed to elk browsing. Use rigid diamond-pattern plastic or nylon tubes (Vexar®), netting, and waterproof paper cylinders (bud caps) (Fig. 13) to protect conifer seedlings. Vexar® tubes extend from ground level to above the top of the seedling. Netting and bud caps fit over the growing tips of the leader stem and lateral branches. Vexar® tubes are more expensive than netting and bud caps but have a longer life span (about 5 years).

Tubex® tree shelters (Fig. 14) are translucent, solid-walled cylinders 5 to 6 feet (1.5 to 1.8 m) tall, and 5 to 6 inches (12 to 15 cm) in diameter. The cylinders create a mini-greenhouse that accelerates the growth of seedlings. At $3.25 each, Tubex® protectors are expensive. Vexar® protectors, netting, and bud caps are recommended for conifer seedlings, while Tubex® is recommended for deciduous tree seedlings. Vexar® and Tubex® protectors must be held upright by lashing them to stakes driven into the ground. Both protectors are designed to biodegrade in about 5 years. If support stakes are wooden, they must be treated to prevent rot or they will break off at ground level in 1 to 2 years.

Elk can be excluded from tree regeneration sites by dense slash left after

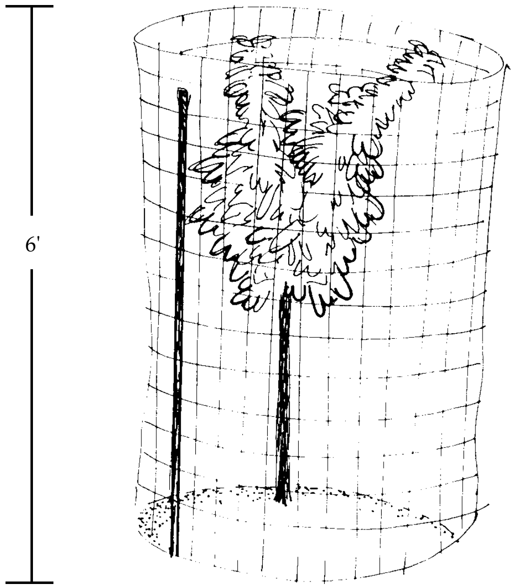

Fig. 12. A cylinder of welded wire can protect an individual tree from elk damage.

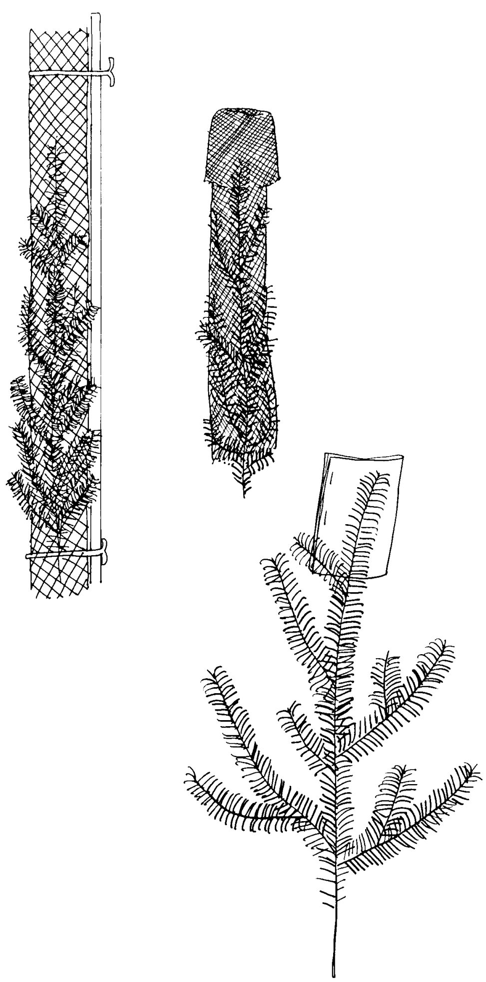

Fig. 13. Vexar® tubes (left), or netting (middle) can protect seedlings. Bud caps (right) have also been used successfully.

harvest. Unfortunately, when slash is sufficiently thick to deny elk access to seedlings, it provides protective cover for rodents. Subsequent increases in rodent populations could result in severe rodent damage to seedlings. Usually there is insufficient slash to provide total coverage on sites. Protection is provided to a limited number of seedlings in places where the slash is sufficiently dense.

Cultural Methods

Under limited circumstances, elk may be "deferred" from damaging crops by planting other forages that elk prefer. Broadcast legumes and domestic annual and perennial grasses over regeneration sites before planting conifer seedlings. Grasses and legumes that are not sufficiently cropped by elk, however, will provide excellent vole habitat, and damage by these rodents to seedlings may become a problem. Graze sheep in summer on such sites to remove excess forage until elk begin to graze in fall and winter.

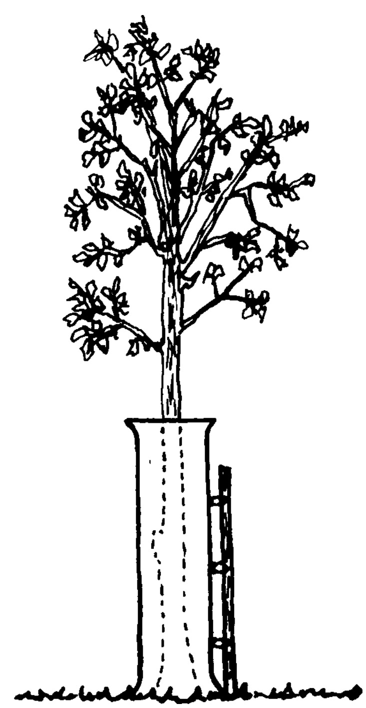

Fig. 14. Tubex® tree shelters are a new individual seedling protector designed for deciduous tree seedlings.

Food plots and salt blocks have been used on public lands adjacent to agricultural fields and pastures to reduce damage by resident and migratory elk. Food plots are maintained in an early successional state (grasses and forbs) by one or more techniques: seeding, mowing, fertilizing, burning, and/or spraying with herbicides. Effectiveness of this approach is still undergoing evaluation. The expense of establishing and maintaining substantial acreages of high-quality food plots limits their use.

Planting taller seedlings can reduce elk damage. Most seedlings are about 18 inches (46 cm) tall. Seedlings 36 inches (90 cm) or taller will provide more browse than elk can crop, and with their greater potential for rapid growth these seedlings can grow out of the reach of elk faster.

The early release of seedlings may also be achieved by eliminating other vegetation. Studies in western Oregon demonstrated that using herbicides to eliminate competing vegetation allowed conifer seedlings to grow sufficiently fast that they outgrew the browsing of deer and elk.

Elk, like deer, are attracted to the edge habitat between openings and forested areas. Their use of openings begins to decline 200 feet (60 m) into openings; by 400 to 600 feet (120 to 180 m), use drops below 50%. Creating larger openings by clear-cutting larger acreages (100 to 200 acres [40 to 80 ha]) as opposed to the 40 to 50 acres (16 to 20 ha) currently practiced on public lands will decrease elk damage in the interior portions of such clear-cuts. Protecting seedlings on the perimeters of larger clear-cuts with repellents or seedling protectors will provide an integrated protection system.

Recent studies with deer in the East suggest that concentrating projected timber harvest into a shortened period of time will overwhelm deer with a surplus of food, reducing the level of damage to seedlings. Instead of spreading out projected harvests over a 10-year period, all timber harvests are conducted within 1 to 2 years and the area is not cut again for 10 years. This system may work in other areas where elk are causing significant damage to seedlings. Placing the cuts in adjoining blocks ("progressive" clear-cutting) rather than scattering them will also reduce the amount of forest fragmentation, which is an emerging concern in forest management.

Where elk and livestock compete for the same forage, a long-term solution is a system of successional cropping. If cattle placed on the pasture from late spring through late summer do not remove all the forage, it will recover, mature in early fall, and provide quantities of high quality forage for elk in winter. The elk, in turn, will crop and stimulate the forage, providing good forage for cattle returning to the pasture in spring. Such a system has increased the availability of forage and numbers of both livestock and elk. Careful planning is required to ensure that proper numbers of livestock and elk use the pasture. Special hunts may be required to ensure that excessive numbers of elk do not occur.

Frightening (Hazing)

Propane exploders (Fig. 15) can prevent elk from using sites for several weeks, after which the elk lose interest and go elsewhere. Generally, one exploder will protect 5 to 10 acres (2 to 4 ha). Several may be required for larger areas. Exploders are most effective when their locations are changed every few days so that elk do not habituate to the sound pattern. Exploders may be an unacceptable nuisance to nearby neighbors.

Elk may be temporarily hazed or frightened out of crop fields, orchards, and pastures by the use of fixed-wing aircraft or helicopters, but both are expensive. Elk will return, however, especially if pastures are on their traditional winter range.

Repellents

Repellents may reduce elk damage in orchards, vineyards, and conifer plantations. Where frequent washing rains occur, some repellents must be applied more than once. Damage can be prevented without treating the entire area by applying odor repellents to plants

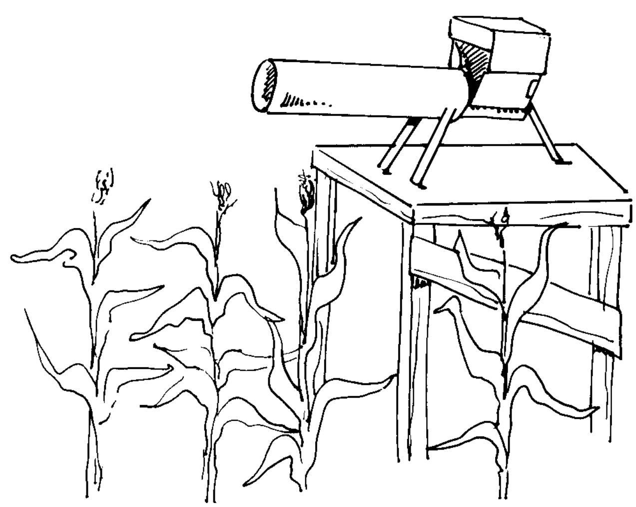

Fig. 15. Propane exploders may be useful in scaring elk away from particular areas.

within a 25-foot-wide (10-m) strip around field edges where most of the damage occurs.

The US Forest Service has a "20 to 80 percent" rule for determining whether repellents will be successful: If elk damage to conifers is less than 20%, application of the repellent will not pay for itself. If the damage is over 80%, the elk have become too habituated to feeding in the area and will not be deterred by the application of repellents.

Little success is reported with repellents such as human hair, tankage, blood meal, or thiram. Successful repellents include formulations of fermented eggs (Big Game Repellent® or Deer-Away®) and hot sauce containing capsaicin. For additional information on repellents, see the **Pesticides** and **Supplies and Materials** sections in this book.

Population Reduction

Permits are issued (usually for antlerless elk) to reduce local elk populations to levels of damage that are acceptable. These reductions generally are of two kinds: local herd reduction, and problem-animal elimination. In the former, the herd is usually too large for local resources and a general reduction in population density is required. Special elk damage hunts are established to reduce the size of herds on public lands, and, in some cases, on private property. Such hunts are conducted as extra seasons for which hunters enter drawings. Hunters must have good access to areas for these hunts to be effective for herd reduction and/or problem-animal elimination.

The second kind of reduction is for individual landowners who experience unacceptable losses of crops to one or a few elk. Permits are issued to the individual landowner to eliminate these problem animals; hunters usually are not used to harvest the elk.

Elk-reduction hunts are sensitive management issues. The general hunting public has had difficulty understanding why there is a need to remove individual elk, or to reduce populations when only a limited number of licenses is available to hunt for bulls. Effective public relations programs are essential for acceptance of and support for population reduction.

Special hunts may provide temporary relief from damage, but the conditions conducive to damage remain. Once the population rebuilds, damage is likely to resume, especially in orchards, crop fields, and pastures. Protection of conifer seedlings by hunting to reduce local elk densities is an exception. Seedlings can attain a height sufficient to avoid elk damage within 3 to 5 years, which is well within the period of protection afforded by a series of successful special hunts.

Another form of population reduction is the translocation of problem animals. Capturing and translocating elk was a common procedure in several states as long as there were areas understocked with elk. Small numbers of elk (1 to 10) were captured in large, baited corral traps. Free-ranging individual elk were immobilized by drugs injected by projectiles fired from rifles. These programs are being phased out because states with sufficient elk to cause damage problems no longer have areas of too few elk. Costs of trapping and transporting elk are prohibitive and are not recommended unless outside financial assistance can be obtained.

A final potential population reduction technique is the use of reproductive inhibitors. Effective reproductive inhibitors exist for elk. Unfortunately, there is no effective, selective delivery system available to implant or inject the inhibitors into the bodies of free-ranging elk.

Compensation

Four states pay ranchers directly for crop damage caused by elk. Funding for claims (which have a low upper limit, usually under $5,000) is taken from license fees and tags that hunters pay to hunt elk and other game. Compensation may be temporarily satisfactory to ranchers and farmers, but it does nothing to alter the circumstances favoring damage, so the damage will continue and may even increase. Compensation should be considered as a temporary, stop-gap response requiring a better, permanent solution.

Compensation is not a particularly efficient use of funds for reimbursing individuals with damage. In Colorado's $1.5 million program, only $300,000 was spent in actual reimbursement to persons with losses. Approximately $350,000 went to administration expenses, and $800,000 to provide damage prevention materials.

Economics of Damage and Control

Before any control program is begun, determine whether the cost of control will exceed the costs of damage. The costs of control methods vary greatly (Table 1).

Cost-effectiveness of damage control efforts may be approximated by dividing the value of elk damage by the cost of control. The result is usually referred to as the benefit-cost ratio. If the ratio is less than 1.0, control is costing more than damage and is not justifiable. More sophisticated benefit-cost models that will allow projection of benefits and costs into the future have yet to be developed for elk.

Table 1. Costs of methods for controlling elk damage.

Method	Cost[a]	Duration of protection
Woven wire fence	$2/foot	30 years
Electric fence	$1/foot	40 years
Panel fence	$3.50/foot	40 years
Repellent	highly variable	weeks
Wire cylinders for fruit trees	$4 to $6/tree	5 to 10 years
Alternate forage	$130/acre	5 years
Herbicide use	$30 to $40/acre	life of tree
Plant larger trees	$100 to $200/acre	life of tree
Plastic/paper cylinders for conifers	$200 to $350/acre (rigid mesh)	5 years
	$150 to $300/acre (flexible mesh)	3 years
	$75/acre (paper bud cups)	1 to 2 years
Tree shelters for deciduous trees	$3.25/tree	5 years
Hazing by aircraft	$200+/hour	weeks
Exploders	$10/acre	3 to 5 weeks
Trap & relocate	highly variable	
Special hunts	highly variable	
Visqueen®	$0.50/foot	1 year
Netting	$0.65/foot	1 to 2 years
Tensar® snow fence	$1/foot	30 years

[a]Costs are for materials only and vary from site to site. Labor costs are not included.

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Figure 1 from Schwartz and Schwartz (1981).

Figure 2 adapted from Thomas and Toweill (1982) by L. Bryant and C. Maser.

Figures 3, 4, and 7 through 15 by Jill Sack Johnson.

Figures 5 and 6 by the authors.

For Additional Information

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