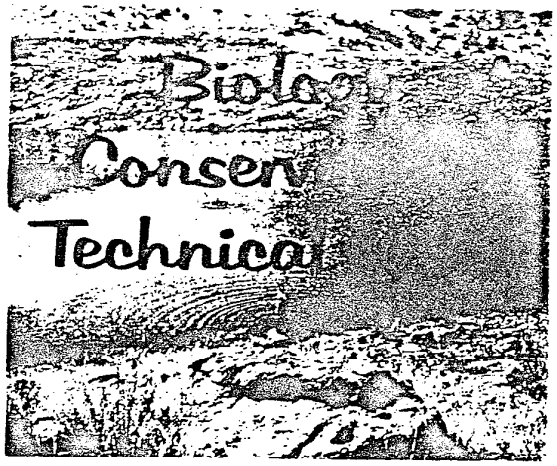


Photo by New Mexico Department of Game and Fish

Photo by New Mexico Department of Game and Fish

U. S. DEPARTMENT OF AGRICULTURE NEW MEXICO SOIL CONSERVATION SERVICE

BIOLOGY NOTE NO. 26

March 1982

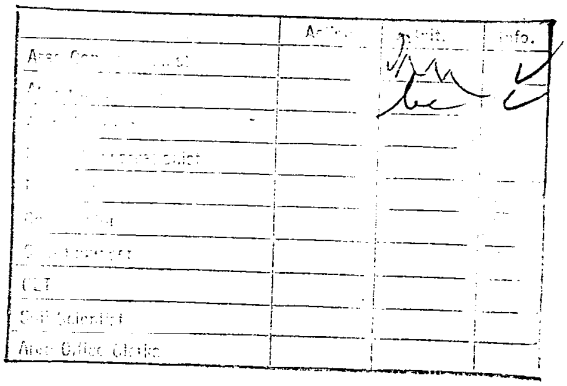
SUBJECT: Brush Control

Attached is a current reference which provides a good overview of wildlife response to various brush control activities.

The article was written by Jerry Holechek of NMSU and originally appeared in the September-October 1981 issue of the Journal of Soil and Water Conservation.

Dr. Holecheck points out that brush control can both enhance or destroy wildlife. Some species, such as elk, and lesser prairie chicken, can be benefitted, while mule deer and pronghorn antelope habitats are degraded by the loss of shrub and forb species.

It is obvious that the effects of brush control are extremely site specific as well as being very species specific.



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Brush control impacts on rangeland wildlife

Jerry L. Holechek

Properly planned brush control can increase the capacity of rangeland to support both wildlife and livestock

DEMANDS on rangeland for red meat, water, wildlife, and recreation are increasing. Meanwhile, about 32 percent of the rangeland in the United States is in poor condition, and 50 percent is in fair condition (5).

Invasion of grassland by woody plants caused by overgrazing, temporary cultivation, or a reduction in burning has been the primary cause of the declining rangeland condition over the past hundred years. Once desirable plants are eliminated and brush invasion occurs, range improvement is difficult. Associated with brush invasion is a gradual reduction in groundcover, which can result in serious soil erosion. Many brush species will permanently occupy an area once they have become established, regardless of whether livestock grazing occurs or not. Therefore, range improvements are necessary.

Although heavy stands of brush are generally undesirable, range managers now recognize that limited quantities of woody plants should be maintained even when the goal of management is primarily livestock production. This is because shrubs provide shade in the summer, high quality forage during drought, and a food source during the winter. The deep root systems of shrubs stabilize stream banks and prevent soil from sliding in steep areas. Shrubs also help stabilize rangeland ecosystems as well as enhance their appearance.

Range improvement through brush control, such as spraying, burning, chaining and reseeding, has been and will be applied to several million acres in the western United States. Many game and nongame wildlife species depend upon shrubs during all or part of their lives. Large-scale brush control projects can thus have severe impacts on wildlife. When properly planned, however, such projects can usually benefit both livestock and wildlife.

Many studies have evaluated brush control impacts on wildlife habitat. Range and wildlife managers now generally recognize that variety and quality of cover are as important to wildlife as forage variety, quantity, and quality. For this reason diversity and edge effect are generally beneficial. Those that reduce the plant species and community diversity over large, continuous blocks are detrimental. Just as there is an upper limit on how much brush can be removed from an area without detrimental effects on wildlife, there is an upper limit on the amount of brush that can occupy an area without also severely reducing wildlife populations (*4*). The distribution or pattern of brush in an area is far more important than the quantity of brush.

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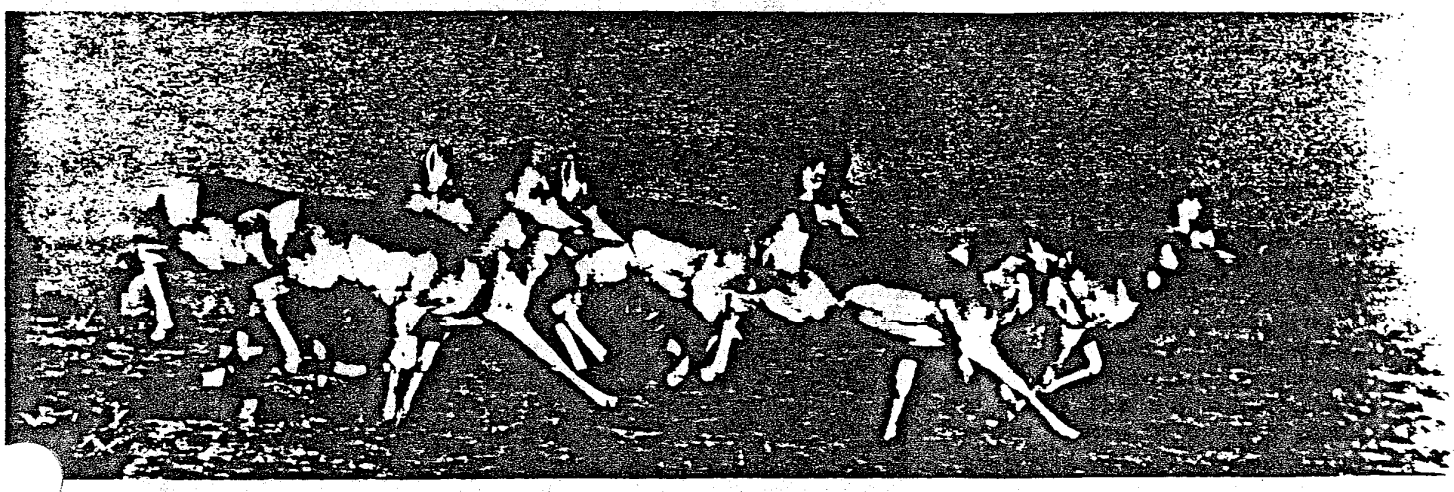
Impacts on wild unglulates

Considerable research has been done on the response of white-tailed (*Odocoileus virginianus*) and mule and black-tailed (*Odocoileus hemionus*) deer to brush control. All three species depend upon brush for food and cover (*14, 43*). When brush is completely removed from large areas, deer use declines (*38*). However, if sufficient brush is available to meet deer cover requirements, quantity and quality of available forbs becomes the second most limiting factor to deer (*36, 38, 46*).

Opening up dense stands of brush with fire, mechanical treatment, or herbicides generally increases the availability of forbs and palatable browse to deer (*38, 46*). But if brush control is to benefit deer, it should be done so that strips or blocks of brush remain. Diversity of food and cover types over relatively short distances is the key to enhancing mule deer populations in sagebrush areas.[1] Generally, deer habitat can be improved most effectively by control-

[1]Urness, P. J. 1967. "Influence of Range Improvements on *Artemesia* Deer Winter Range in Central Oregon." Paper presented at the 20th annual meeting. Society for Range Management.

Pronghorn antelope.



ling brush over small areas of 5 to 40 acres. Removal of more than half the brush over a large area appears to be detrimental to deer (*36, 38, 46*).

Pronghorn antelope (*Antilocopra americana*), in contrast to deer, prefer relatively flat, open country, which permits great visibility. An estimated 68 percent of the pronghorn population in North America occurs on grasslands, 31 percent on brushland-grasslands, and 1 percent on deserts (*47*). In spring and summer, pronghorns prefer succulent forbs, but in the winter they depend more on shrubs (*27, 48*). Open rangeland with a variety of vegetation are preferable to monotypic plant communities (*48*).

Brush control treatments applied to areas of 500 acres or more may be particularly detrimental to pronghorn. Herbicides that eliminate many forbs and shrubs should be used cautiously if pronghorn habitat is to be maintained or enhanced.

Monotypic shrublands and grasslands are poor pronghorn habitat (*48*). Even small seedings of crested wheatgrass on deteriorated sagebrush range in southeastern Oregon enhanced pronghorn habitat by providing more feed (*15*).

Yoakum (*49*) recommended that brush control projects for pronghorns be less than 405 hectares (1,000 acres) in size and maintain shrub cover of 5 to 10 percent on the control area. He suggested spraying, chaining, or prescribed burning, rather than plowing, to minimize the loss of native plants. When reseeding, mixtures including alfalfa (*Medicago sativa*) or other palatable forbs should be used instead of a single grass species. More antelope were seen on areas seeded to grasses and forbs than on adjacent shrub-dominated areas in Oregon when these practices were applied (*49*).

The American elk (*Cervus elaphus*) depends less upon forbs and browse for forage than either pronghorn or deer. Elk also depend less upon brush for cover. However, cover becomes more important as disturbance by man increases.

Research shows that herbicides can be a valuable tool for improving elk habitat, particularly in areas with dense stands of brush and little understory. Spraying Gambels oak (*Quercus gambelii*) with 2, 4, 5-TP in western Colorado, for example, resulted in a 73 percent increase in use of the area by elk (23). Similar results were reported in Wyoming when sagebrush range was sprayed with 2, 4-D (*44*). In both studies, areas of 70 acres or less were sprayed, resulting in greater habitat diversity as well as increased forage availablity. Results from these studies may have been different if large areas had been treated, however.

Moose (*Alces alces*) in North America are associated primarily with shrubland habitat. They require habitat in early successional stages, where browse has not grown beyond their reach. Prescribed burning has been a valuable tool in maintaining this type of habitat in British Columbia, northern Idaho, and western Montana (*10, 12, 24*). Herbicides seemingly could be used also in moose habitat management to retard succession and maintain shrub availability, but their use in moose habitat manipulation has not been studied.

Forest and brush encroachment on grassland range has been a significant factor in reducing bighorn sheep (*Ovis canadensis*) habitat in the past century (*40*). Bighorns prefer grasses, sedges, and forbs as foods, although they will eat shrubs and trees when these foods are unavailable (*41*).

Bighorn sheep depend primarily upon open, rugged terrain rather than trees and brush for protection from predation (*45*). They tend to avoid areas with heavy brush or trees. Wildfire maintained the open habitat preferred by bighorn sheep prior to settlement of the West. Fire can thus be an important tool for improving bighorn sheep habitat (*38*). Chaining, slashing, or logging are other potential treatments for improving habitat on grassland invaded by brush or trees (*45*).

At one time, wildlife scientists thought fire was highly detrimental to caribou (*Rangifer tarandus*) in North America. Fire, they felt, destroyed the lichens needed for food by caribou. This belief has changed in the past 20 years, however. Research on fire's effect on caribou range showed that fire probably enhanced caribou range by recycling nutrients and improving the growth of lichens, sedge forbs, and shrubs (*18*). A later study showed that fire increased diversity in caribou habitat in northern Manitoba (*26*). It was also found that many heavily used lichen-woodland winter ranges in Labrador and Ontario owed their existence to fire (*2*). This was attributed to the capacity of fire to open up forest and shrub canopies, allowing greater production of lichen forage.

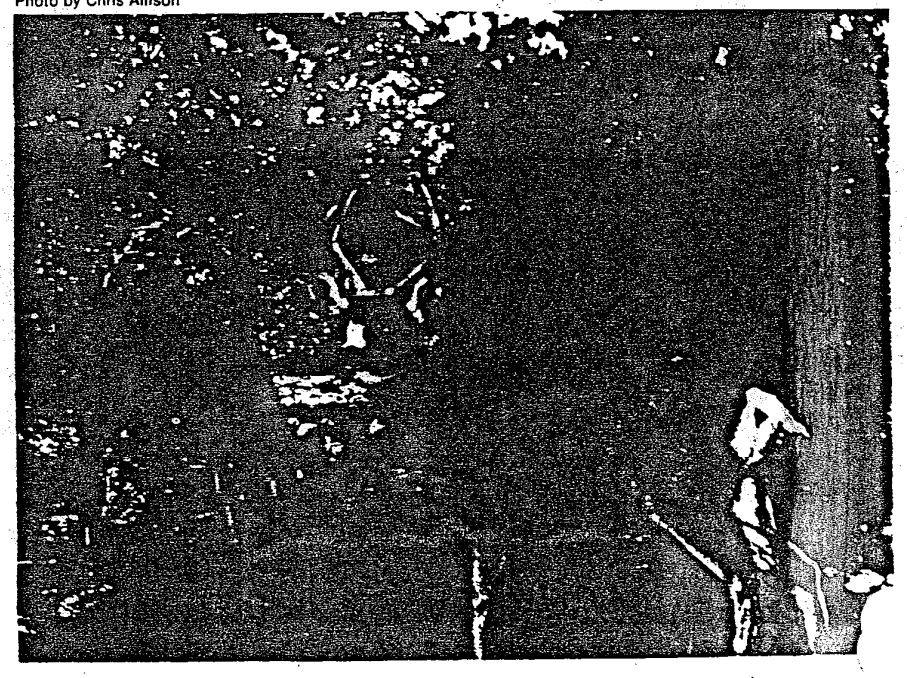
Brush control impacts on birds

As with wild ungulates, brush control can either benefit or harm bird populations, depending upon how it is accomplished. Generally, the same considerations that apply to wild ungulates also apply to birds.

The impact of big sagebrush (*Artemisia tridentata*) control on sage grouse (*Centrocercus urophasianus*) has been a subject of considerable controversy. Big sagebrush

Mule deer depend upon brush for food and cover, but forbs are an important food source also in spring and summer. Openings in stands of brush improve habitat for both mule deer and livestock.

Photo by Chris Allison



provides essential food and cover for sage grouse. One study showed that spraying big sagebrush with 2, 4-D greatly reduced the number of nesting grouse (*20*). Sage grouse did not return to the location for sting until five years after spraying. oding use was less affected, although oods declined during the five years after spraying. Ten years after spraying, the area was back to full nesting use. The same study showed that sage grouse avoided dense stands of big sagebrush.

The loss of forbs, important sage grouse foods during the summer, as well as the loss of nesting habitat should be a primary concern when herbicides are used to control big sagebrush. However, forbs will generally return to pre-spray abundance within five years. Other studies have shown that large-block removal of sagebrush generally reduces sage grouse numbers (*25, 34, 35, 42*). On the other hand, spraying areas with a sagebrush cover in excess of 30 percent in small blocks or strips can benefit sage grouse (*35*).

Fire may be an even better tool than herbicides to control sagebrush from the standpoint of sage grouse (*21*). Patches of sagebrush can be left unburned. Also, fire is less destructive to forbs than herbicides, such as 2, 4-D.

Maintenance of sage grouse requires cooperation between state wildlife agen- and whatever land management agen- plans sagebrush control (*6*). Maps should be made of areas used by sage grouse for booming grounds, nesting, and wintering. Control should not be applied where sagebrush cover is less than 20 percent and where slopes are greater than 20 percent. Nor should control measures applied within a two-mile radius of booming grounds, on known wintering and nesting areas, or within 100 yards of streams and meadows. When those constraints were applied, sage grouse populations increased substantially over a 10-year period in southeastern Oregon, even though sagebrush was controlled over several thousand acres. During the same period sage grouse declined in other parts of the state. It seems, therefore, that carefully planned sagebrush control in areas with little understory can benefit sage grouse.

The wild turkey (*Meleagris gallopavo*) inhabits oak-woodland areas in the western United States. Turkeys require considerable variety in habitat for nesting, roosting, and feeding. If large areas of woodland are converted to grassland, turkey populations decline rapidly. For example, on-juniper removal by chaining and ing over a 300-hectare (740-acre) area Arizona severely reduced turkey use

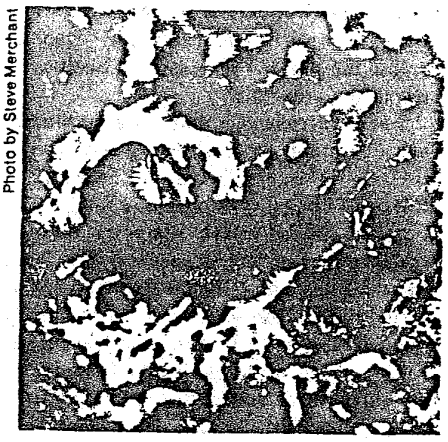


Photo by Steve Merchant

Partial control of shinnery oak with herbicides can provide ideal prairie chicken habitat, a mixture of the scrub oak and tall grasses.

(*37*). The same project found that turkeys seldom ventured more than 45 meters (148 feet) into openings. Recommendations from this study indicated that cleared areas in turkey habitat should be no wider than 90 meters (295 feet), and strips of cover should be retained as travel lanes to roosting areas.

Research in Texas has shown that control of brush in strips or small blocks does not adversely affect turkey populations (*1, 31*). Brush control in areas where little understory is available for food appears to be an effective tool for enhancing wild turkey populations if strips or patches of cover are left.

The bobwhite quail (*Colinus virginianus*), one of the most popular gamebirds in North America, depends heavily upon brush for cover, but needs grasses, forbs, and insects associated with more open areas for food. They require a minimum of about 15 percent of an area in brush, but prefer open areas for many of their daily activities.

Burning can improve bobwhite quail habitat as well as livestock production in the Rolling Plains of Texas if scattered patches of brush are ringed with firebreaks prior to burning to ensure adequate quail cover (*33*). If a portion of the brush is left for cover, root plowing of brush, followed by reseeding with large-seeded forage grasses, such as kleingrass (*Panicum coloratum*), has considerable potential for both improvement in bobwhite quail habitat and livestock production in the southern Great Plains (*36*).

A major gamebird in the Southwest, the mourning dove (*Zenaida macroura*) relies heavily on mesquite (*Prospis spp.*) for nesting in much of the region (*39*). Because mesquite causes serious livestock grazing management problems, however, its control is necessary. A recent Texas study (*39*) showed that when prescribed burning or spraying was used to control mesquite, mourning doves compensated for the loss of mesquite by nesting on the ground. The same study showed that ground-nesting attempts were more successful than those in trees and that doves preferred to nest in treated areas. Therefore, brush control, at least as applied in the Texas study, seemingly could benefit mourning doves in the Southwest.

The lesser prairie chicken (*Tympanuchus pallidicintus*) inhabits grasslands in the Southwest that include scattered clumps or motts of shinnery oak (*Quercus harvardii*) and/or sand sagebrush (*Artemisia filifolia*). With overgrazing or severe drought, these two shrubs become dense and produce little forage. Shinnery oak presents a hazard to range use also because the young buds, leaves, and acorns are highly poisonous to livestock in the spring.

Control of heavy oak infestations with herbicides greatly improves the productivity of forage species (*16*). However, complete eradication of shinnery oak or sand sage is undesirable even when livestock production is the sole management objective. Greater forage production and better erosion control are maintained when these species comprise a small part of the vegetation composition.

The lesser prairie chicken in New Mexico relies heavily on tall grasses, such as sand bluestem (*Andropogon hallii*), for nesting cover, but also makes shinnery oak and sand sagebrush an important part of its diet, particularly in winter (*8*). Areas with little tall grass and much shinnery oak were lightly used by the prairie chickens throughout the year.

Partial control of shinnery oak, sand sage, or both, with a herbicide, such as picloram, appears to have much potential for improving lesser prairie chicken habitat as well as for reducing soil erosion and increasing grazing capacity (*9*). Forbs are important lesser prairie chicken foods in the summer. Treatment of dense shinnery oak stands with picloram reportedly increased grass production without changing forb production or completely eradicating shinnery oak (*30*). Application of Grasslan, a new herbicide, greatly increased grass production also, but reduced forb yields. A review of more recent research, however, indicated that Grasslan can be used at low rates so as not to affect forbs adversely yet still increase forage yields (*9*). The same review showed that partial control of shinnery oak, sand sage-

brush, or both has actually improved use by lesser prairie chickens.

Use of fire to reduce shinnery oak apparently has limited usefulness in prairie chicken or livestock management because of its short-term effects on vegetation and because shinnery oak is found on sandy soils that are subject to wind erosion when vegetation is removed completely.

Following are guidelines for shinnery oak control in areas where lesser prairie chicken habitat is to be maintained:

1. Perennial grasses must be present in the understory before shinnery oak is controlled.

2. Partial control of shinnery oak should be practiced.

3. Shinnery oak control should occur in rotation on large blocks [150 to 300 hectares (370-740 acres)] of land because lesser prairie chickens are mobile and better able to adjust their range than many other gallinaceous birds.

Brewer's sparrow (*Spizella breweri*) and Vesper's sparrow (*Poecetes gramineus*) are closely associated with big sagebrush in the intermountain region of the United States. A study (*3*) of the effect of big sagebrush control on these two birds showed that spraying with 2,4-D increased the feed available for both birds. Partial control of big sagebrush by strip spraying had no effect on either sparrow. However, a total kill of big sagebrush reduced populations of Brewer's sparrow but had no effect on Vesper sparrow populations. Strip spraying of big sagebrush did not appear harmful to either species.

Populations of the ferruginous hawk (Buteo regalis), once a common raptor in partially wooded areas in much of the western United States (*17*), have declined in recent years. Utah juniper (*Juniperus osteosperma*) provides nesting sites for ferruginous hawks, and blacktailed jackrabbits (*Lepus californicus*) are their primary food. Juniper control in conjunction with reseeding crested wheatgrass (*Agropyron cristatum*) can improve habitat for the ferruginous hawk if small blocks of juniper are treated and islands of trees are left scattered throughout the seeding (*17*). The edges of seeded areas are heavily used by jackrabbits, so increasing these edges should increase the bird's food supply.

A study of bird populations in a shrub-grassland area of southeastern New Mexico found that 32 of 46 species of terrestrial birds observed over a four year period were adapted primarily or exclusively for life in habitats containing woody plants (*7*). The researchers recommended that any removal of woody vegetation from grazing lands in the region be done in swaths to ensure retention of bird species that depend upon the woody vegetation. Brush control in this form may even increase the number of grassland birds present in the area.

Lark sparrows (*Chondestes grammacus*) are a common ground-nesting songbird in the mesquite grasslands of Texas (*28*). Prescribed burning of mesquite for grazing purposes benefits lark sparrows because the birds prefer to nest in areas free from litter buildup and to use open areas for feeding (*32*). Complete removal of woody plant species by fire or mechanical means could be harmful because lark sparrows are shrub birds and require woody plants for perches (*32*).

The golden-cheeked warbler (*Dendroica chrysoparia*), a rare bird, inhabits the Edwards Plateau in west-central Texas (*22*). Clearing of Ashe juniper (*Juniperus ashei*) was once thought to reduce habitat for this species. However it was found that large, homogenous blocks of juniper provided neither optimum nesting habitat for the warblers nor adequate forage for deer, wild turkey, or livestock (*22*). Recommendations based on this latest research suggest that large blocks of juniper be broken up by trails, firebreaks, and clearings, and that dense stands of junipers be thinned to promote hardwood growth. It is also recommended that Ashe juniper be retained along stream and river courses, hill crests, limestone outcrops, and ravines to prevent soil erosion and provide edge effect for wildlife.

While they seldom venture far from cover, wild turkeys require a variety of habitat for feeding, roosting, and nesting.

Impacts on small mammals

In recent years, there has been an increasing recognition of the importance of small mammals in rangeland ecosystems. These animals provide food for other wildlife. They also consume considerable quantities of forage, contribute to nutrient cycling, and may provide recreation for man in the form of hunting or trapping. But they may cause problems for man because of forage consumption or predation.

Because they perform essential functions in maintaining nutrient cycling and energy flow, it appears critical to maintain this class of wildlife in range ecosystems. Like other wildlife, the best balance of small mammals results from habitat diversity.

Jackrabbits provide important food for many predators, such as the coyote (*Canis latrans*) and ferruginous hawk. On the other hand, they consume forage that could otherwise be used by domestic livestock. Data from Idaho (*11*) show that relatively low blacktailed jackrabbit densities are associated with native sagebrush rangeland. Areas with scattered cropland and crested wheatgrass pastures support high jackrabbit densities. Jackrabbits use these crops heavily for food. Areas where cropland or crested wheatgrass and sagebrush come together provide a highly suitable habitat for jackrabbits because of close proximity of both food and cover.

A study of the habitat requirements of the pygmy rabbit (*Sylvilagus idahoensis*) associated with sagebrush communities in the Great Basin found that sagebrush was critical to the pygmy rabbit for both food and cover (*13*). However, the rabbits preferred wheatgrass (*Agropyron* spp.) and bluegrass (*Poa* spp.) in summer and had little preference for forbs. This study concluded that cover was critical to the pygmy rabbit and that sagebrush eradication would probably be quite detrimental. This research suggests that, if carefully conducted, strip spraying of dense sagebrush areas containing few grasses could probably benefit the pygmy rabbit.

Research examining the effects of brush control on rodents and predators is lacking. One study from southeastern Idaho quantified rodent and predator populations in big sagebrush and crested wheatgrass communities (*34*). It was found that crested wheatgrass pastures supported both fewer species and lower densities of birds, predatory mammals, small mammals (primarily rodents), and reptiles than are dominated by sagebrush. This study

grass had been planted in large blocks. Results may have been different if strip or small block planting of crested wheatgrass had been practiced. However, the researchers did mention that crested wheatgrass had been planted on 650,000 hectares (6,150 acres) of public land and 000 hectares (494,200 acres) of private land in Idaho alone. Most of the seedings, according to the researchers, are in large blocks where little if any consideration was apparently given to wildlife. Observations over several years revealed that these large crested wheatgrass pastures are nearly devoid of wildlife.

Management recommendations

Brush control can enhance or destroy wildlife, depending upon how the control is applied. Most control efforts require a compromise between wildlife and livestock. Water availability and use must also be taken into account. The Vale Project in southeastern Oregon (*15*) and several Texas studies (*36*) have shown that wildlife, livestock, and water supplies can be enhanced if brush control is properly planned and carried out in an interdisciplinary manner.

Use of the following guidelines can ensure wildlife maintenance and enhancement in developing brush control projects:

1. Identify resident wildlife and the they presently inhabit.
2. Determine the ecological requirements of resident wildlife.
3. Determine those factors most limiting to resident wildlife.
4. Determine what critical habitats, if any, may be destroyed by the proposed brush control project.
5. Determine the longevity of the proposed project.
6. Evaluate the impacts of similar brush control projects in areas where they have been applied.
7. Coordinate the project with the needs of resident wildlife as much as possible.
8. Monitor the response of resident wildlife to the brush control treatment after its application.

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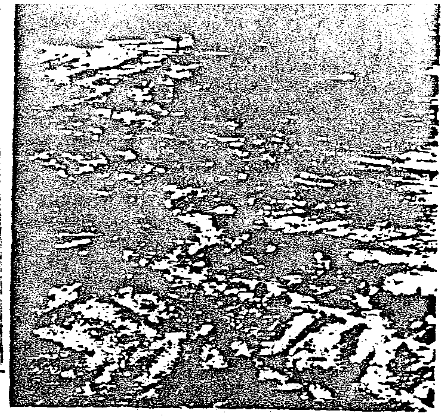

Urban erosion control: The conservation district role in Wisconsin

By Donald G. Last

CONSERVATION districts, long at the forefront of efforts in Wisconsin to control soil erosion on agricultural lands, are now focusing more of their technical resources on erosion problems in areas undergoing residential, commercial, and industrial development. If trends in other states hold true for Wisconsin as well, the state's conservation districts should assume a key role in urban erosion control programs.

A formidable challenge

Certain facts quickly illustrate the magnitude of urban erosion problems:

- Construction of homes, highways, shopping centers, schools, and businesses consumes 8,000 acres of the nation's undeveloped land daily (*1*).
- Urban development within Wisconsin's seven southeastern counties is projected to increase 22 percent between 1970 and 2000; 34 of the area's 100 lakes (and a significant number of streams) will not be "fishable and swimmable" by the end of the century if erosion from construction sites is not controlled (5).
- Areas undergoing urban development generate 20 times more sediment per unit area than is generated on cropland in the same watershed (3).
- Soil loss rates can approach 200 tons per acre per year on construction sites (2).
- Water that transports eroded soil across the land surface into lakes and streams often contains a variety of contaminants, including leaves, seeds, grass clippings, animal feces, weed and insect control chemicals, fuels and lubricants from vehicles, as well as material abraded from tires, streets, and clutch and brake linings (*6*).

Urban erosion produces a variety of impacts. The major impact—both environmentally and economically—is the result of off-site soil deposition. Sediment clogs roadside ditches, storm sewers, and culverts. It settles out in streams, ponds, lakes, and reservoirs, impairing navigation and recreation. Water clarity is reduced. Fish and wildlife habitat is damaged.

A financial burden results when sediment-damaged areas need to be cleaned up. Tax dollars often support such projects. These sedimentation cleanup efforts, however, should be unnecessary. Effective techniques are currently available to control both erosion and sedimentation. Standards and specifications for erosion control measures are available from conservation district offices, and local offices of the Soil Conservation Service (SCS) offer technical assistance in planning erosion control on land scheduled for development.

Technology, therefore, is not a barrier to solving urban erosion problems, although their application on a large-scale is lacking. Some attribute this to a lack of knowledge about the problem by contractors, builders, and developers. Others point to the need for more comprehensive regulatory programs. Still others believe financial inducements are needed, such as those available to agricultural producers.

Whatever the reasons for the shortcor ings of urban erosion control progra conservation districts are in a good posit to coordinate educational, financial, regulatory approaches to help resolve these problems. Through their efforts, as well as those of cooperating agencies, conservation districts can and should be providing leadership in this area.

Some Wisconsin examples

Wisconsin's conservation districts have maintained a harmonious relationship with rural landowners for years. Working entirely within the framework of a voluntary system, the districts have provided information, technical assistance, and financial support for the control of agricultural-related soil erosion. In recent years, districts in urban and urbanizing areas have begun to play a more active role in the control of soil erosion resulting from residential land development.

Erosion and sediment control requirements are now part of subdivision ordinances in about a dozen Wisconsin counties. In many cases districts encouraged these regulations and became active partners in their administration with cou planning and zoning departments.

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