



TechLine

Information for Noxious Weed Control Professionals

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The Complex Ecology of Weeds, Grazing, and Wildlife

by Don Bedunah

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A weed is a plant that, in a particular place at a particular time, arouses human dislike. This aversion depends not only on the "weed's" characteristics and habits, but also on its relationship to other plants.

Exotic species are those that occur in an area because of direct or indirect, deliberate or accidental human actions. Not all exotic or alien plants are considered weeds. Most crops and lawn grasses in North America are exotic plants. However, non-native weeds are of considerable concern to natural resources managers. Noxious weeds, as defined by federal law, are plants of foreign origin that can directly or indirectly injure agriculture, navigation, fish, wildlife, or public health.

This article discusses the ecology of invading plants, examines the role of grazing in the spread of exotic weeds and discusses the impacts of weeds on domestic livestock, wildlife, and natural flora.

Grazing

Domestic livestock grazing did not become widespread in the northwestern United States until the late 1800s. With the introduction of European-style agriculture, with its traditional use of the plow, domestic livestock, exotic plants, and fire control, the ecological balance of the area was drastically altered (*Harris 1967*).



Cattle graze, careful to avoid patches of leafy spurge.

The plant and animal communities of Western rangelands evolved together over thousands of years. The native climax communities were relatively stable, with different species maintaining a more or less permanent association in a balance between their environment and other species.

There were certainly natural disturbances that produced significant deviations in the climax communities. These disturbances, such as natural fire and insect

outbreaks, would change the community from a state of equilibrium to a state composed essentially of an unorganized assemblage of neighbors in a state of flux (*Whitaker 1965*). In time, however, these communities were succeeded by more stable groups of species, the climax plant community, which maintained a relatively stable association.

It is generally accepted that no two species in a stable community occupy the same niche (*Whitaker 1965*). Species tend to evolve toward habitat differentiation. Evolution of "niche differentiation" makes it possible for the coexistence of many species that are partial, rather than direct, competitors. Under natural conditions, evolution of both niche and habitat differentiation allow many species to exist together. The introduction of exotic plants can throw this balance off, possibly forever. Since the exotic did not evolve in the community, it has not had time to move toward niche and habitat differentiation there, and it may be a more direct competitor with the dominant and codominant plants.

For a time, the abundance of native forage in the West was seen as an unlimited resource, which encouraged its exploitation and

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created conditions that allowed exotic species to spread rapidly (Galbraith and Anderson 1970). By 1936, serious range depletion was "practically universal" (U.S. Forest Service 1936). Many valu-



Birds are frequent contributors to the spread of noxious weed seed.

able forage bunchgrasses had largely disappeared from many parts of the range, to be replaced by unpalatable and foreign plants. Grazing capacity was believed reduced by more than 50 percent (U.S. Forest Service 1936).

Numerous exotic weeds now plaguing the West were accidentally released in the Pacific Northwest around the turn of the century, as contaminants in crop seeds. Some of these, including cheatgrass, Russian thistle, and spotted and diffuse knapweed spread rapidly along human transportation routes. By the 1930s, exotic weed infestations already had made significant changes in native plant communities.

Spread

The actual process by which exotic weeds spread is not well-documented. The site and time of introduction are not known for most weeds, and primary invasions may have occurred at more than one site.

Spreading species like newly introduced exotics are less affected by within-in species competition and are more likely to escape disease and predation than non-spreading (usually native) species (Auld and Coote 1980).



Although elk may eat occasional spotted knapweed flower heads, they tend to avoid knapweed infestations because the weed displaces the animals' more desirable forage.

Disturbance is always a significant factor in the spread of exotic species. Severe soil disturbance from road building and cultivations immediately reduces competition and provides a seedbed for weeds. Livestock grazing is also a form of disturbance that can significantly increase bare soil and reduce the ability of grazed plants. Livestock can also transport weed seeds in hair or wool, and some seeds can remain viable in animals' digestive tracts and may sprout after excretion.

Defoliation affects the intensity of both intra- and interspecific competition. It reduces a plant's competitive ability by diminishing its effectiveness in acquiring resources from the environment. Yet grazing and defoliation of exotic weeds are not entirely a matter of cause and effect. Several exotic weeds will invade undisturbed climax communities and can become significant components of a community. For example, Tyser and Key (1988) reported that spotted knapweed invaded and reproduced in rough fescue communities in Glacier National Park.

Likewise, Belcher and Wilson (1989) reported that most native species were absent where leafy spurge was most abundant. Selleck et al. (1962) reported that leafy spurge spread every year in competition with all other species in their study area; the spread was greater in ungrazed native grassland than in stands of introduced grasses.

Once perennial exotics such as leafy spurge, spotted, diffuse, and Russian knapweeds invade a site, they seem to be able to move into healthy stands of native vegetation (Harris 1991), posing a huge management problem.

The success of exotic weeds has been attributed to allelopathy (the production of chemicals that suppress other plants), their superior ability to get and use water and nutrients, and magnitude of reproduction. But a major factor in their favor is a lack of natural enemies, in the form of pathogens and herbivores.

Biodiversity Threatened

Until recently, concern about the spread of exotic weeds focused on their effects on crop and livestock production. Now the effects of exotic species on wildlife, native plant diversity and aesthetic quality are attracting attention. The U.S. Forest Service, for ex-

ample, is taking a hard look at weed infestation of wilderness areas, and "weed-free" hay is required in a growing number of areas managed by public agencies.

Wildlife Impacts

The possible effects of exotic weeds on wildlife might appear a relatively simple question. But the natural world is complex. It is certainly conceivable that some wildlife species may benefit from some exotic species. Yet North American wildlife did not evolve with the exotic species now spreading across the continent.

Exotic plants could, at least theoretically, influence wildlife habitat by displacing forage species, modifying habitat structure—that is, changing grassland to a

forb-dominated community—or changing the interaction of species within the ecosystem.

Most of the perceived threat of noxious weeds to wildlife is their ability to reduce native forage. Spotted knapweed, for example, is considered a serious threat to rangelands in Montana, Washington, Idaho, Oregon, Wyoming, and large parts of Canada. Graminoid production dropped by 90 percent in some knapweed-infested sites in Alberta and western Montana (Harris and Cranston 1979, Bedunah 1988).

Hakim (1979) found that elk used knapweed sites in northwestern Montana much less than they did bunchgrass communities. When evaluating the noxious weed infestation problem on the Lolo National Forest, Spoon et al. (1983) stated that forage production lost on big game winter ranges could *theoretically* result in a loss of 220 elk annually by the year 1998. Bedunah and Carpenter (1989) hypothesized that spotted knapweed invasion of three bunchgrass sites in western Montana could result in a loss of 27 elk days/acre of elk winter forage. They also postulated that spotted knapweed on elk winter range might result in elk moving from the range to preferred forage on private property. Increased elk depredation of hay might convince landowners to lobby for a reduction in the number of elk.

Quantifying the effects of exotic weeds on a highly mobile animal like elk is quite difficult. The productivity of an elk herd depends on

many variables – weather, summer forage conditions, availability of thermal cover, etc., – so the impacts of weeds on productivity could be minor. However, since



Angora goats help minimize seed production of leafy spurge through grazing.

many agencies spend a great deal on big game production, and because herbicides are being considered for weed control, it is important to begin identifying weed-related impacts on wildlife.

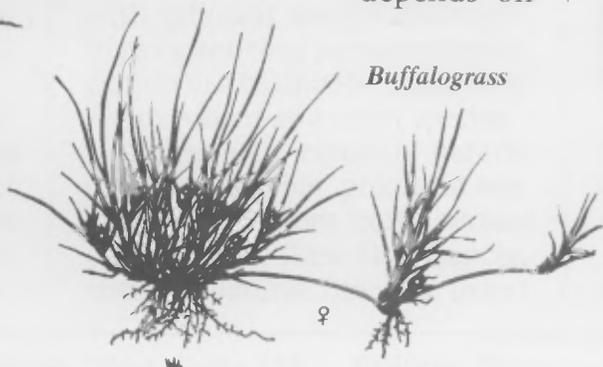
Costs

The real costs of exotic weed infestation are impossible to compute. Weeds have dramatically changed native plant communities, thereby altering visual quality, wildlife habitat and the value of these sites for livestock grazing.

Most economic impacts attributed to noxious weeds are based on reduction in livestock carrying capacity. Bucher (1984) postulated that if spotted knapweed infested all susceptible sites in Montana, the potential annual loss would be more than \$155 million. Spotted knapweed, Russian knapweed, diffuse knapweed, and leafy spurge can reduce native plant production by as much as 80 percent. Bangsun and Leistritz (1991) reported that, because of reduced carrying capacity from leafy spurge infestation, ranchers and landowners lost \$2.2 million in Montana, \$8.7 million in North Dakota, \$1.4 million in South



Blue Grama



Buffalograss

Dakota, and \$0.2 million in Wyoming. The lost forage would have generated \$6.9 million in Mon-



Angora goats graze leafy spurge infestations within an Australian fence system, which keeps the goats concentrated on the spurge. The fence is solar operated.

tana, \$28.2 million in North Dakota, \$4.6 million in South Dakota, and \$1.1 million in Wyoming.

It is feasible to establish grazing systems that stress exotic weeds used by animals. For example, sheep have been reported to select succulent knapweed instead of grass in the spring (Cox 1989). They have adopted diets as high as 50 percent leafy spurge,

and sheep and goat grazing have reduced the amount of leafy spurge seed production (*The Missoulian* 1992). Kott (1989) reported that sheep will selectively and extensively use leafy spurge. Kott (1989) did not believe that sheep would eradicate leafy spurge, but they do keep it from spreading. Sheep and cattle grazing together can also utilize existing forage more efficiently.

Conclusion

Introduction of exotic plants, combined with severe human-caused disturbance, have radically changed many rangeland ecosystems. The replacement of native species by exotic species was rapid and severe in the Intermountain West. The primary invading species were annuals that established quickly on disturbed sites and are now a permanent part of the plant communities.

Although these annual invaders have not been able to dominate native grasslands, perennials such as knapweed, dalmatian toadflax, and leafy spurge can establish themselves in productive grasslands of the Intermountain region and northern plants. Vitousek (1986) noted that "invading plants can clearly alter ecosystem characteristics when they differ in life form from natives." The current spread of exotic perennials into western grasslands is changing some of these from grassland communities to communities dominated by forbs. The effects of such changes on ecosystem function are largely unknown.

What is certain is that the changes continue to occur. It is painfully apparent that the foothill grasslands in areas such as western Montana's Missoula and Bitterroot Valleys are an endangered vegetation type. Until the weed invasions can be controlled or at least slowed, these grasslands are in more peril than any other vegetation type in the West.

Answers to Questions About Tordon

If Tordon 22K kills weeds, won't it harm people?

Tordon 22K is active against vegetation but has no acute effect on mammals (i.e. humans). The picloram molecule is active within the plant metabolism but does not interact within mammals. There is a large margin of safety between the amounts required for effective vegetation control and exposures that might be toxic to humans and animals. Tordon 22K kills plants by acting like a hormone found only in

plants. However, when people observe the often impressive results of a herbicide application, they conclude that the material must be similarly powerful against humans. They fail to recognize that Tordon 22K is a highly selective compound in terms of its biological activity.

Consumers Voice Their Food Opinions

by Mary Lou Chapman

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Colorado Country Life

Economic concerns were foremost in consumers' minds in 1992, and these concerns carry over into their food shopping behavior. At least that is the conclusion drawn by the annual consumer attitude study recently released by the Food Marketing Institute (FMI).

Since 1974, FMI has been conducting studies designed to identify the changing priorities of American supermarket consumers. Their survey report, "Trends — Consumer Attitudes and the Supermarket 1992," contains the results of telephone interviews conducted nationally in January 1992. One thousand consumers were asked questions related to shopping habits, and another 1,000 were asked questions related to food safety and nutrition. In

"The most often named threat to food safety continues to be spoilage... Fewer than one in five named pesticides, insecticides, herbicides, residues, spoilage due to germs, or chemicals as threats to food safety."

most cases, respondents were given a list of answers from which to choose, rather than using their own words. Thus, the results are somewhat controlled.

When asked what they thought was the single most important issue facing our country today, unemployment was selected by 28 percent, more than 4 times the percentage who cited any of 20 other issues. The three next highest ranked issues drew only 6% of respondents.

Consumers also indicate that their economic concerns carry over into their shopping behav-

ior. Three out of four shoppers rated price as very important when shopping for food; the figure is up 4% from 1991. Ninety-one percent of the shoppers said they wanted their grocery stores to provide "items on sale or money-saving specials." They indicate that they search for ways to economize more than in the past. Two in five look in the newspaper for specials, or use cents-off coupons. Other measures used are stocking up on specials, comparing prices at different stores, doing more meal planning, using leftovers and buying fewer meals away from home. Several shoppers use store brands regularly to economize.

Average weekly family grocery expenditures are reported at \$78, about the same as reported a year earlier.

Shoppers also report that

they continue to be pleased with the jobs their grocery store is doing. This answer has remained constant since 1988.

In the area of nutrition and diet, consumers say they continue to be dissatisfied with the healthfulness of their own diet. Two out of three (66%) believe that their diets could be at least somewhat healthier, and only one in 10 think their diet is as healthy as it could possibly be. Eating more fruits and vegetables is the primary answer (60%) to ensuring a healthy diet. About a third of the shoppers said they are consuming less meat,

red meat, or fats and oils.

The overall level of those who say they are concerned about the nutritional content of their food increased considerably over the past year. Fat content was selected most often as the major concern relative to nutrition content of the food they eat.

Although concern about fats is reported at a historical high, nearly double that of 1988, the concern is supported by only marginal changes in the number of shoppers who said they were consuming less fats and oils. In a separate question, fats were listed as a "serious health hazard" by the largest percentage of respondents, but the percentage fell four percent below that of 1991 (from 62% to 58%).



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Concern over salt, sugar, and cholesterol seems to be dropping over the last several years. The number of consumers who say they are consuming more fiber, fish, or fresh foods has also decreased over the past year. However, the number of consumers who say they are cutting back on snack foods and dairy products has increased over last year.

Taste remains the most important factor when a person shops for food. Nine out of ten shoppers list it as very important. Nutrition came in second, with

77% listing it as very important; price was listed by 75% and product safety by 71%. Price replaced product safety this year as the third most important consideration. This coincides with those who responded on behaviors and attitudes about economizing.

For the first time since 1989, confidence in the safety of our food supply has declined — after reaching an all-time high in 1991 (82%). In the 1992 study, 72% said they were completely or mostly confident that the food in their market was safe. The most often named threat to food safety continues to be spoilage, and the figure is up significantly from 1991

and double that for any other food safety concern.

Fewer than one in five named pesticides, insecticides, herbicides, residues, spoilage due to germs, or chemicals as threats to food safety. Responsibility for food safety in the eyes of the respondents has shown little change over the years. They continue to rely on themselves more than any other source to ensure that the food they buy is safe. ♦

Answers to Questions About Tordon

Are the inert ingredients of Tordon 22K herbicides harmful?

The inert ingredients of Tordon pose no significant risk to health or the environment. The inerts in Tordon herbicides are not on the EPA's list of "Inerts of Toxicological Concern." Inerts include surfactants and emulsifiers, which aid in mixing and are present only in small quantities, and an anti-freeze (in some formulations) to allow year-long application of the product without risk of the solution freezing in equipment used in its application.

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Tordon 22K is a Restricted Use Pesticide

Serious Health Hazard or Not?

In a separate question these consumers were asked to rate whether they believed the following items were a serious health hazard, something of a health hazard, or not a hazard at all:

1. Residues, such as pesticides and herbicides
2. Antibiotics and hormones in poultry and livestock
3. Irradiated foods
4. Nitrites in foods
5. Additives and preservatives
6. Artificial coloring

Stated in this way, three out of four shoppers called residues a serious health hazard. Antibiotics came in next with 53% mentioned. This part of the survey indicates that the way in which a question is phrased can play a large part in the response. However, in all cases, consumer concern in these areas is declining. Levels of concern to these questions are at their lowest since 1988.



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