

Developing Invasive Weed Prevention Areas for Rangeland Ecosystems

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Introduction

Invasive weeds are introduced plants that cause environmental or economic harm. Compared to native plants, these plants have greater net reproductive capacity and competitive ability for resources. They also lack natural controls that are absent in their new habitat. These traits and other aggressive abilities, such as fast growth, good dispersal, and tolerance of a wide range of environmental conditions, are associated with displacement of native plants and the native animals that rely on them. In addition to displacing native species, invasive weeds can irreversibly damage whole ecosystems and impact ecological services with serious economic consequences. The direct costs of invasive weeds include reduced grazing capacity and increased management expenses that increase the costs of producing livestock. The indirect costs of weeds include degradation of natural resources and wildlife habitat, which may be the basis of recreational and tourism revenues.

Invasive weeds infest over eight million acres in Montana. Most weed programs focus on land already infested with noxious weeds at a cost of about \$20 per acre per year. This expenditure is justified because of the need to mitigate weeds and recover lands. But weeds continue to spread to new sites in spite of widespread control efforts. Most rangeland in Montana remains weed-free, but these ecosystems are threatened by likely invasion. Grasslands and riparian areas are susceptible to invasion because of frequent openings in plant cover where new weeds can establish. The protection of weed-free areas from invasion has been proven to be successful and cost-effective. Costly economic and ecological impacts can be prevented by prioritizing weed management in areas without weeds.

Cooperative prevention systems are needed to reduce the risks of invasion and environmental harm. Weed prevention areas meet this need by operating at the local level to reduce rangeland susceptibility to invasion, interrupt weed invasion pathways, and detect and eradicate new weeds

using systematic monitoring approaches. Inventories direct management activity and establish ecological baselines to maintain over time. Proactive weed management strategies are site-specifically developed and collectively implemented by local rancher groups. Weed prevention areas take the approach that it is only a matter of time before weeds invade new areas. Ranchers and public land managers are anticipating invasion and taking a proactive role to keep weeds out, potentially saving millions of dollars in damages and control costs and preserving native plant and animal resources. The purpose of this publication is to describe the development and implementation of cooperative weed prevention areas in Montana and the coordinated efforts that protect rangelands from weed invasion.

Methods

Local-level Weed Prevention Areas (WPAs) are cooperative weed management areas with a prevention and early control focus. Proactive cooperation is critical and leadership for coordination is provided by county weed boards, weed districts and agency coordinators, extension agents, and concerned landowners. Weed prevention areas consist of weed-free, or relatively weed-free, rangeland ecosystems. They currently range in size from 150,000 to 450,000 acres. Weed prevention areas are delineated on the basis of invasion threat, ecological status, geographic characteristics, and the number of landowners that would advocate the development of invasive weed prevention programs. Boundaries usually follow section lines or visual markers like waterways and roads. The three important steps in developing WPAs are identified below:

- Preliminary meetings and initial assessments are conducted with landowners and federal and state land managers to designate the WPA, identify leadership, and design a locally based prevention program. To ensure a rapid response, local prevention programs focus on private landowners since they are often the first to detect a new invader.
- A series of workshops and learning group discussions are conducted with landowners to share information and gather project recommendations. These discussions formulate site-specific decisions to encourage ownership and collective implementation of integrated plans that are designed by landowners. This, in turn, promotes adoption of prevention stewardship through a “learn-by-doing” approach to maintaining weed-free ecosystems over the long-term.
- Long-term WPAs are protected from weed spread with proactive weed management efforts implemented by private landowners and guided by WPA-specific, integrated plans. Each plan is clearly presented as a two-page strategy with full-color weed alert fact sheets that include diagnostic and biological information, habitat requirements, and early control techniques. Plans include education, exclusion, detection and eradication, mapping, and ecosystem management components, and are evaluated annually.

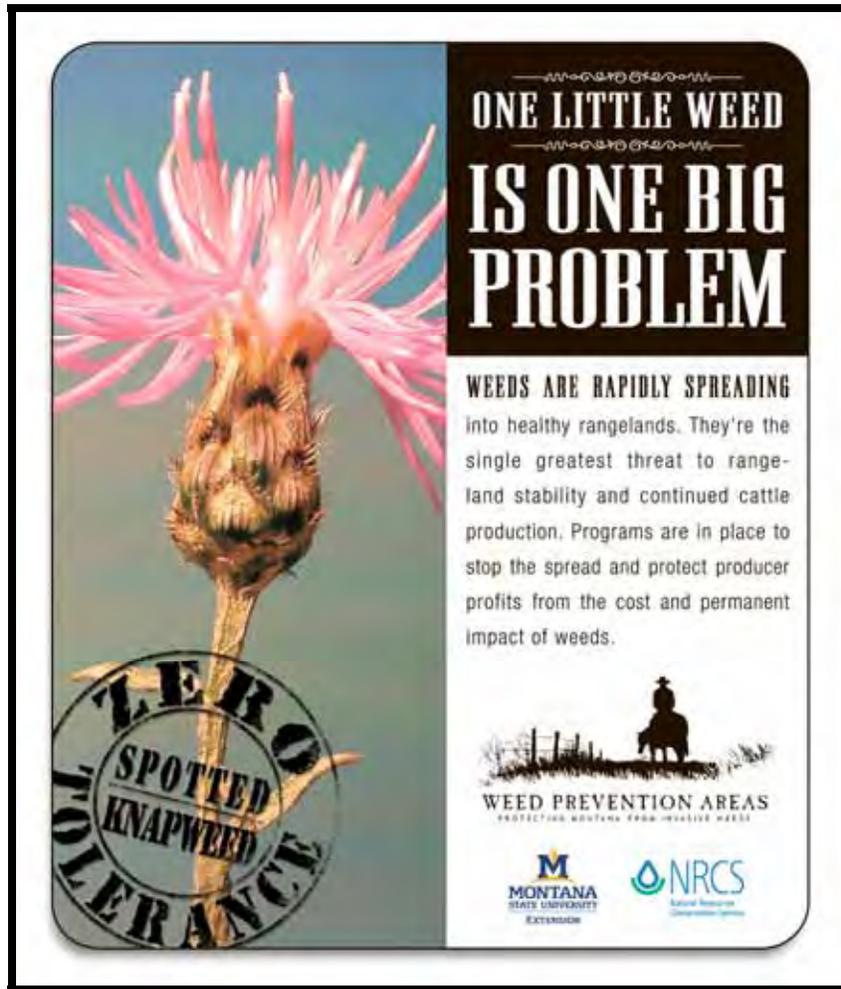


Figure 1. Messages are placed in local and regional newspapers and magazines to increase landowner awareness of weed spread.

Integrated WPA Plans

Education

Local-level awareness campaigns and programs recruit participants and promote the importance of proactive management to protect areas that still remain weed-free. Prevention messages promote the urgency of early intervention (see Figure 1) and entrance signs delineate WPAs (see Figure 2). Proactive weed management is also promoted with field tours, workshops, and on-site ranch visits conducted by county weed leaders and seasonal WPA “weed scouts.” Weed scouts provide monitoring assistance for new weeds and promote consistent communication between private landowners and county weed districts. Personal contact by weed scouts promotes a strong prevention message and may build cooperative, long-term relationships with weed-free landowners to improve the chances of long-term prevention success. Field tours include weed identification, hands-on Global Positioning System (GPS) training to teach landowners how to map new weeds, herbicide selection and application, and sprayer calibration. Through field tours, landowners learn to identify weeds in a natural setting, a better method than identification by photographs. While landowners often hear warnings about weeds, this may not be enough to encourage actions that could limit weed spread. Weed tours to infested sites, however, may

influence behavior change. For instance, a WPA rancher in Custer County, Montana, said he heard the warnings about weeds, but he did not change his management until he observed a large-scale leafy spurge (*Euphorbia esula*) problem on a field tour. Meetings with other landowners that have managed areas with significant weed problems may also help promote the benefits of prevention. Annual prevention symposiums promote prevention and enhance communications among WPAs. A recognition program would formally acknowledge the ecological value of weed-free ranches and enhance landowner pride of ownership.



Figure 2. Weed prevention areas in Garfield County, Montana protect over 642,000 acres of weed-free mixed-grass prairie from weed invasion. Photo courtesy of Garfield County.

Exclusion

Exclusion strategies decrease the likelihood of invasion by reducing the frequency of repeated weed introductions. The number and frequency of weeds arriving at a site seems to be the main component of successful invasion. Repeated introductions are frequently associated with terrestrial and water pathways or dispersal corridors, such as roads, railways, trails, rivers, irrigation ditches, and streams. Repeated human patterns of movement, such as cars and contaminated equipment traveling on roads, is the main dispersal factor for terrestrial pathways, and water is the agent that supports downstream weed movement. Periodic disturbance along roads and waterways creates openings in vegetative cover that encourage weed establishment.

Because human activity increases the number of weed introductions and disturbance, it is likely responsible for the quickest and most distant weed spread. Exclusion strategies, therefore, should focus on interrupting weed movement where humans are the dispersal agent. Preventable means by which weeds can be introduced from human action include roads and railways, cattle shipments, livestock movement from “weedy” areas to weed-free rangeland, and contaminated equipment and materials, such as forage and feed grains, seeds, soil, and gravel. Non-local angler and hunter activity may also be increasing accidental introductions. For example, recent studies have documented that an increase in the number of human visitors to an area leads to an increase in the number of invasive weeds.

Prevention strategies may include requesting weed-free material or closely monitoring sites for new weeds where at-risk material was applied. Another strategy is to hold livestock in easily accessible pastures for five to seven days prior to release into weed-free ecosystems. When these pastures are not available, livestock could be fed weed-free forage before being moved to weed-free areas. Clean-out sites could be designated for livestock shipping trailers so plants that establish can be destroyed before they set seed. Prevention strategies may also include posting signs that request anglers and hunters to clean their boots, dogs, horses, boats, and equipment prior to entering weed-free areas. Parking in designated areas and remaining on trails with all-terrain vehicles could make monitoring easier for landowners. The booklet entitled *Invasive Plant Prevention Guidelines* is a helpful reference for identifying site-specific prevention strategies. It is published by the Center for Invasive Plant Management and is available for purchase from the Extension Publications office at Montana State University.

Detection and Eradication

Prevention is the first line of defense, but it is not perfect. When weeds defeat prevention measures, successful management relies on detecting new weeds early when eradication is most successful. Early detection in the form of surveys typically focuses on locating invaders in high-risk sites, such as areas near seed sources. In weed-free areas remote from seed sources, high-risk sites include weed pathways, areas where at-risk material was used, and human-modified sites, such as developed areas, campgrounds, fishing-access sites, and disturbed areas. Cost-effective monitoring requires that sampling be directed to these high-risk sites, since the prospect of detecting additional weeds away from these areas may become too low. High-risk sites are initially inventoried and rechecked periodically, and significant portions of low-risk land are annually surveyed to confirm weed-free status.

Detection is the highest level of management intensity performed in WPAs. Seasonal weed scouts help inventory WPAs and assist landowners with monitoring and eradication. Weed scouts usually survey for new weeds on horseback or all-terrain vehicles (see Figure 3). Transect intervals vary with site characteristics that depend on physical terrain features and vegetation cover. On average, weed scouts survey grasslands by following transects at 100-foot intervals. They can usually survey rangelands at a rate of about 200 acres per hour at a cost of about \$0.04 per acre, on average.

New weeds are mapped and eradication strategies are formulated. These strategies require 100 percent control where every plant is eliminated from an infestation to prevent re-invasion. Eradication treatments must be highly effective and cover sufficient area to locate any satellite plants away from the patch, since even recent invasions may have widely dispersed plants. The need to implement highly effective strategies over adequate areas may be augmented using

trained invasive weed detector dogs to locate plants that are potentially missed by surveyors. Canines are an effective and broadly usable detection technology. Detector dogs are more effective than humans for locating rare weeds because they have a strong sensitivity to a target and can quickly and thoroughly cover large areas. A recent Montana State University study found that on average, trained canines were significantly more accurate in detecting new invasions of spotted knapweed (*Centaurea maculosa*) than human surveyors (92 percent versus 76 percent). These findings suggest detector dogs may help with invasive weed eradication efforts. The popularity of weed detector dogs may also make early intervention more visible.



Figure 3. Weed scouts provide on-site ranch visits to promote prevention and assist landowners with weed monitoring and eradication.

Mapping

Weed prevention areas are a long-term commitment because the number of weed introductions is expected to increase over time. Comprehensive distribution maps of native and invasive plants are important for successful, long-term approaches to prevention. Mapping strategies and surveys of native and invasive plants using GPS technology direct future activity and establish weed-free ecological baselines for comparisons as prevention systems progress over time. Weed scouts and Montana Conservation Corps crews assist ranchers and county weed districts with WPA surveys. Ranchers learn to map the location of new weeds on private and leased public land using GPS units (see Figure 4), which they then report to their county weed district. Bounty and recognition programs acknowledge rancher contributions to early detection. Prevention systems must be designed over the long-term to document changes that may take decades.



Figure 4. Hands-on GPS training of ranchers may improve the reporting of new weeds.

Ecosystem Management

Competition from desired plants is the foundation of weed prevention when combined with strategies that limit weed movement. Such competition reduces weed establishment and increases the effectiveness of weed control. An ecosystem management approach addresses maintaining healthy and competitive plant communities, since the condition of the invaded community may either aid or hinder invasion. Human modifications of ecosystems cause changes in community structure that may lower the competitiveness of native plants and assist weed establishment. Grazing is the most common disturbance on rangeland, but when properly managed, it can maintain the vigor of grasses and other forages. However, when grazing is applied incorrectly, it can open sites for weed establishment. Rangelands require management to maintain the desired vegetation. Prescribed grazing management that controls the timing, intensity, and frequency of grazing maintains plant community vigor and helps prevent weed invasion. By definition, application of a prescribed grazing plan requires evaluation of performance through frequent field checks of utilization, which can help to locate new infestations. Other practices, including watering facility development, can be encouraged to help in the application of prescribed grazing. On sites managed for hay production, irrigation management and crop rotation can be used to maintain productive land and prevent weed establishment. Prescribed grazing management can be adapted when natural disturbances such as wildfire and drought reduce plant vigor and increase susceptibility to weed invasion.

Evaluation

Prevention is the optimal management strategy over the long-term when the probability of invasion is fairly certain. Most weed-free ecosystems are susceptible to invasion as a result of either direct or indirect human activity. Prevention is difficult to evaluate because the long-term

maintenance of weed-free ecosystems requires a number of years to document. Prevention system efficacy over the short-term may be measured by evaluating system design. For instance, we can say a WPA is operating effectively when multiple proven strategies are being implemented. A prevention system may be operating ineffectively when critical strategies are missing. Prevention system efficacy may also be measured by documenting the number of participating landowners and the number of new invasions located with inventory efforts.

The cost of a prevention system can also be measured, and it may show how cost effective prevention is when compared to the resources needed to manage weeds. The small costs associated with prevention may yield ecological benefits that accrue indefinitely. Short-term estimates indicate the cost to protect weed-free rangelands from weed spread averages less than \$0.10 per acre per year. This estimate is favorable when compared to the average \$20 per acre per year to manage weeds after they become established. This mitigation cost is on-going and does not include costs associated with forage losses or reduced ecological value. The costs associated with prevention include educational brochures and signs, field tours, GPS equipment, all-terrain vehicles, seasonal weed scouts, and herbicides for small-scale eradication.

Conclusion

Invasive weeds displace native species and permanently damage biological communities and ecosystems, creating significant economic impacts related to reduced forage yield and quality, increased management, and potential loss of recreational and tourism revenues. Invasive weeds continue to spread into natural communities in spite of management efforts. Fortunately, most of our ecosystems remain weed-free, making prevention a viable option. Recognizing this opportunity, local-level weed prevention groups focus management efforts in weed-free areas, through proactive management implemented by unified rancher groups whose common goal is to safeguard native plant communities and rural livelihoods from the costly and permanent effects of invasive weeds. Coordinated and cooperative protection from weed spread may help preserve native species and natural habitats, allowing their ecological, economic, and societal benefits to accrue indefinitely. Maintaining weed-free rangelands may help sustain rural communities that depend on agriculture and wildlife-based expenditures.

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