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Integrated rangeland weed management¹

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The magnitude and complexity of noxious rangeland weeds, combined with their cost of control, necessitates using integrated weed management. Integrated weed management on rangeland involves the use of several control techniques in a well-planned, coordinated, and organized program. Inventory and mapping are the first phases of any integrated weed management program. The second phase includes prioritizing weed problems, and choosing and strategically implementing control techniques for a particular weed management unit. The third phase is adopting proper range management practices. The weed management program must fit into an overall range management plan.

Inventory

Inventory is the first phase. The goal is to determine and record the weed species present, area infested, density of the infestation, rangeland under threat of invasion, soil and range types, and other site factors pertinent to successfully managing weed-infested rangeland. Inventories can be conducted by field surveys, aerial photography, and geographic information systems. Identification of weeds and conducting an inventory requires considerable technical skills and can be time consuming. Information from an inventory should be incorporated into a ranch or management unit map that shows the location, type, and size of weed-infestations. Accurate mapping is important in developing a land use plan and in evaluating the success of a weed management plan.

Planning and implementation

Planning and implementing is the second phase of a rangeland weed management program. Planning is the process by which problems and solutions are identified and prioritized, and an economic plan of action is developed to provide direction for implementing the program. Implementing an integrated weed management plan includes:

- 1) preventing encroachment into uninfested rangeland,
- 2) detecting and eradicating new introductions,

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- 3) containing large-scale infestations,
- 4) controlling large-scale infestations using an integrated approach, and often,
- 5) revegetation.

The key component of any successful weed management program is sustained effort, constant evaluation, and the adoption of improved strategies.

Preventing weed encroachment

Preventing the introduction of rangeland weeds is the most practical and cost-effective method for their management. Prevention programs include techniques such as limiting weed seed dispersal, minimizing soil disturbance, and properly managing desirable vegetation. New weed introductions can be minimized by:

- 1) using weed seed free hay, feed grain, straw, and mulch,
- 2) refraining from driving vehicles and machinery through weed infestations and washing the undercarriage of vehicles and machinery after driving from a weed infested area to an uninfested area,
- 3) allowing livestock to graze weed infested areas only when weeds are not flowering or producing seeds, or moving them to a holding area for about 14 days after grazing a weed infested area, but before moving them to weed-free areas,
- 4) requesting that campers, hikers, and sportsmen take care in brushing and cleaning themselves and equipment after recreating in weed-infested areas,
- 5) minimizing unnecessary soil disturbance by vehicles, machinery, water flow, and livestock, and
- 6) managing grasses to be vigorous and competitive with weeds.

Detecting and eradicating new introductions

Early detection and systematic eradication of weed introductions are central to integrated weed management. Weeds encroach by establishing small satellite infestations, which are generally the spreading front of the large infestation. Eradication involves employing appropriate management to totally remove the weed from the area. It is usually achievable on a small scale. An eradication program includes delimiting the proper control procedures and the number and timing of follow-up applications. This generally requires aggressive annual applications of herbicides. Revegetation of infested areas may be required to eradicate weeds in areas without an understory of desirable species which can reoccupy the site after weeds are controlled. Eradication of small patches requires continual monitoring and evaluation to ensure successful and permanent removal of the weed.

Containing large-scale infestations

Containment programs are generally used to restrict the encroachment of large-scale weed-infestations. Studies have shown that containing weed infestations, which are too large to eradicate, is cost effective because it preserves neighboring uninfested rangeland and enhances the success of future large-scale control programs. Containing a large-scale infestation requires using preventative techniques and spraying herbicides on the border of weed infestations to stop the advancing front of weed encroachment.

Large-scale weed control

Most successful large-scale weed control programs are completed in a series of steps. Weed control areas should be divided into smaller units to make them more manageable. Weed control should be carried out unit by unit at a rate compatible with economic objectives. Initially, large-scale weed control should focus on range sites with an understory of residual grasses and the highest potential productivity. Suppressed grasses have the greatest chance of re-establishing dominance on these sites. These areas must be spot treated each year to ensure control and minimize re-invasion. In most cases, some percentage of the management unit will require that control measures be repeatedly applied until the weed seed bank and root reserves are exhausted. Next, control efforts should focus on the sites adjacent to those initially treated to minimize re-introduction of the weeds. Usually, large-scale control is most effectively applied from the outside of the weed management unit inward toward its center. Selection and application of weed control techniques in large-scale control programs depends on the specific circumstances for each portion of the management unit. Control techniques used in one area of the management unit may be inappropriate for another area. For example, sheep grazing leafy spurge in one area may provide cost-effective control, but sheep do not readily eat spotted knapweed and herbicides may be more appropriate. Similarly, the most effective herbicide for a particular weed species may not be labeled for use in an environmentally sensitive area. Selection of a proper control program will depend on the 1) weed species, 2) effectiveness of the control technique, 3) availability of control agents or grazing animals, 4) use of the land, 5) length of time required for control, 6) environmental considerations, and 7) relative cost of the control techniques.

Researchers are in the process of determining if combining treatments will provide a synergistic response in controlling weeds. Some preliminary evidence suggests most control techniques are compatible. Experimenting with combinations of control techniques may provide better and longer term control than any singly applied treatment. For example, in areas with adequate precipitation, combining Tordon 22K with fertilizer can increase the longevity of spotted knapweed control and triple forage production over either treatment applied alone.

Revegetation

Revegetation with desirable plants may be the best long-term alternative for controlling weeds on sites without an understory of desirable species. Establishing competitive grasses can minimize the reinvasion of rangeland weeds and provide excellent forage

production. On appropriate sites, a fall herbicide application after weeds have emerged, followed by plowing or discing, and drill seeding is most effective for establishing desirable species.

Proper range management

Adopting proper range management practices in conjunction with the weed management program is the third phase to successful weed management. Follow-up management determines the longevity of weed control. Proper livestock grazing is essential to maintain competitive desirable plants, which will help prevent weed re-invasion after control measures are completed. A grazing plan should be developed for any management unit involved in a weed management program. The plan should include altering the season of use and stocking rates to achieve moderate grass utilization. Grazing systems should rotate livestock to allow plants to recover before being regrazed and to promote litter accumulation. Range monitoring and annual evaluations should be conducted to determine the adequacy of existing management plans.

Monitoring and evaluations

Monitoring and evaluation are the keys to determining when weed and/or grazing management plans need to be changed. Monitoring involves making observations, gathering data and keeping records on the range condition and trend. Monitoring must be designed to detect changes in weed and desirable plants, biological control agents, as well as soil surface conditions including litter accumulation, exposed soil, erosion, and soil compaction. Management practices (e.g. grazing utilization patterns) and climatic factors affecting condition and trend must be monitored as well. Monitoring data must be compared to earlier years, and weed management programs must be adjusted according to the predetermined management objectives.

Summary

Noxious rangeland weeds are highly competitive and persistent. Their control requires integrating a number of methods. Integrated weed management programs begin with an inventory and mapping of the ranch or management unit to identify weed problems and land use. Once identified, problems can be prioritized and an integrated weed management strategy that includes prevention, detection and eradication of new infestations, containment and control of large-scale infestations, and revegetation can be planned and coordinated with a grazing management plan. Weed encroachment can be prevented by limiting weed seed spread, minimizing soil disturbance, and maintaining vigorous and competitive forage plants. Small weed infestations can be eradicated, and small scale satellite infestations should be persistently treated with herbicides. Large-scale infestations must be contained using herbicides along infestation borders. Depending on site conditions, a combination of herbicide, biological control agents, and grazing management can reduce weed populations and weed seed production in large-scale infestations. Competitive forage plants can be maintained with proper grazing rotations that allow plants to recover vigor after disturbance. Monitoring will detect changes in weeds

and desirable plants as an integrated weed management plan is implemented. Management adjustments can be made to address the changing conditions. A key component of any integrated weed management program is sustained effort, constant evaluation, and the adoption of improved strategies.