

# INTEGRATED WEED MANAGEMENT

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## INTRODUCTION

The magnitude and complexity of pasture and rangeland weeds, combined with their cost of control, necessitates using Integrated Weed Management (IWM). IWM involves the use of several control techniques in a well-planned, coordinated, and organized program to reduce the impact of weeds on pastures and rangelands. Inventory and mapping is the first phase of any IWM program. The second phase includes prioritizing the management of weed problems, and choosing and implementing control techniques strategically for a particular weed management unit. The third phase is adopting proper range management practices as a portion of the IWM program. The IWM program must fit into an overall range management plan.

### Inventory

Inventory is the first phase of all IWM programs. The goal is to determine and record the weed species present, area infested, and density of the infestation. Soil and range types, and other site factors pertinent to successfully managing the infested rangeland should also be documented. Inventories can be conducted by field surveys, aerial photography, and geographic information systems.

### Planning and Implementation

Planning and implementing an IWM strategy 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 IWM program. Implementing an IWM includes, preventing encroachment into uninfested rangeland, detecting and eradicating new introductions, containing large-scale infestations, controlling large-scale infestations using an integrated approach, and often, 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. Preventative programs include such techniques as limiting weed seed dispersal, minimizing soil disturbance, and properly managing desirable vegetation. New weed introductions can be minimized by:

- 1) using hay, feed grain, straw, and mulch that are free of weed seeds;
- 2) refraining from driving vehicles and machinery through weed infestations, and cleaning 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 livestock 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 when recreating in weed infested areas;
  - 5) minimizing unnecessary soil disturbance by vehicles, machinery, waterflow, and livestock;
  - 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 IWM. Weeds encroach by establishing small satellite infestations, which are generally the spreading front of the large infestation. Eradication is employing appropriate management to totally remove the weed from the area and is achievable on a small scale. An eradication program includes delimiting the boundaries of the infestation (on-the-ground and on maps), determining 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 that don't have an understory of desirable species that can re-occupy the site after weeds are controlled. Eradication of small patches requires continual monitoring and evaluation to ensure successful 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, which often includes 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 management 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 will depend on 1) the weed species, 2) the 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 showing that combining treatments will provide a synergistic response in controlling weeds. 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 picloram with fertilizer can increase the longevity of spotted knapweed control and triple the forage production that would result under 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 re-invasion of rangeland weeds and provide excellent forage production. In most areas, a fall herbicide application after weeds have emerged, followed by plowing or discing, and seeding, is most effective for establishing desirable species.

### **Proper range management**

Adopting proper range management practices in conjunction with the IWM 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. 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 promote litter accumulation. Range monitoring and annual evaluations should be conducted to determine the adequacy of existing management. Limited early season use is critical to any grazing system designed for weed management.

**Monitoring and evaluations.** Monitoring is done to determine what is happening on the range over time. Monitoring and evaluation are the keys to determining when weed and/or grazing management needs 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. Management practices (e.g. grazing utilization patterns) and 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. The use of herbicides outlined in this section is only one tool that should be combined with biological or plant competition to be most effective.