Appendix 11

Integrated Weed Management

Contents

Introduction

The magnitude and complexity of noxious weeds in the project area, combined with their cost of control, necessitates using Integrated Weed Management (IWM). This involves the use of several control techniques in a well-planned, coordinated, and organized program to reduce the impacts of weeds on public lands. Where noxious weeds do not currently exist, the cheapest, most effective, and highest-priority IWM technique is prevention. Prevention, public education, detection, and quick control of new / small infestations are very effective and economical as the first steps for implementing IWM. "These strategies are urgently needed to protect the vast majority of western federal lands that are not yet seriously infested with exotic plants." (Partners Against Weeds, January 1996) Along with effective noxious weed control, proper management must be adopted as part of the IWM program. The IWM program must fit into an overall land or activity management plan.

Integrated Weed Management

Goal 1. Education and Awareness

Knowledge of what noxious weeds are and what they can do to the land will help the public and land managers understand why long-term noxious weed control is so important. The public and land managers must recognize the impacts of noxious weeds to the diversity of native plant and animal species and the economic impacts to those who use the land for ranching, farming, hunting, camping, bird watching, and other activities. Recognizing how and where noxious weeds are spread is critical. Weeds can be spread by livestock, pack animals, wildlife, motor vehicles, seed mixtures, hay, wind, water, people walking through infested areas, and countless other ways. Emphasis must be placed on developing outreach programs, training opportunities, cooperative education and awareness programs, university courses, and other opportunities to inform and educate the public and land managers. Once standard weed prevention measures are a part of the public's and land manager's normal activities, then the spread of noxious weeds by human actions will cease to be one of the major issues in noxious weed management.

Goal 2. Prevention of Weed Spread

Preventing the introduction of rangeland weeds is the most practical and cost-effective method for their management. Prevention 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 weed seed free hay, feed grain, straw, or mulch, (2) refraining from driving vehicles and machinery through weed infestations and, before driving from a weed infested area to an uninfested area, washing the undercarriage of vehicles and machinery, (3) permitting livestock to graze weed infested areas only when weeds are not flowering or producing seeds, or, if livestock are grazing weed infested areas, moving them to a holding area for about 14 days before moving them to weed-free areas, (4) requesting that campers, hikers, and sportsmen who are recreating in weed infested areas, brush and clean themselves and their equipment before moving to uninfested areas, (5) minimizing unnecessary soil disturbance by vehicles, machinery, waterflow, and livestock, and (6) managing grasses for vigor and competition with weeds.

Goal 3. Detection, Inventory, and Mapping

Early detection is crucial to IWM. Weeds encroach typically by establishing small "satellite" infestations, which are generally the spreading front of the large infestation. It's imperative that these small infestations are discovered prior to their development of larger infestations so that eradication is successful. The goal of inventory and mapping is to determine and record the weed species present, the area infested, the density of the infestation, the land under threat of invasion, the soil and vegetation types, and other site factors pertinent to successfully managing infested lands and lands susceptible to invasion. Inventories and mapping can be conducted by field surveys, aerial photography, and geographic information systems.

Goal 4. Planning

Planning is the process by which weed problems and solutions are identified and prioritized. In addition, an economic plan of action is developed to provide direction for implementing the IWM program. Implementing control techniques includes: (1) preventing encroachment into uninfested rangeland; (2) detecting and eradicating new introductions; (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.

Goal 5. Integrated Methods of Weed Control

Integrated Weed Management is based on the fact that combining several methods of weed control has greater likelihood of being effective than using a single method only. It involves four general categories of management options which are, cultural, biological, physical, and chemical control. Cultural control methods are management related programs such as prevention, livestock grazing, wildlife management, soil disturbing activities, and public use. Physical control methods include "grubbing", hand pulling, mowing, plowing, and burning. Biological control methods include introducing insects that feed on reproductive portions of the noxious weed, or grazing livestock, such as sheep, on leafy spurge. Chemical control methods includes herbicides and fertilization to increase competitiveness of beneficial plants and pesticides. Therefore, IWM requires that you determine which control measures or combinations thereof will best reduce or eradicate the noxious weed(s) you are targeting.

Priorities for control measures are as follows:

1. **Eradicating New Introductions** - Eradication involves total removal of the weed and is achievable on a small scale. An eradication program involves delineating the boundaries of the infestation, both 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 might be required to eradicate weeds in areas that do not have an understory of desirable species that can reoccupy the area after weeds are controlled. Eradication of small patches requires continual monitoring and evaluation to ensure successful removal of the weed.
2. **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 preventive techniques and spraying herbicides on the border of weed infestations to stop the advancing front of weed encroachment. Containment programs typically require a long-term commitment to herbicide application because they are designed to limit spread and are not designed to modify or reduce the infestation level. Roadways and railways, where weed infestations often begin, should be subjected to a constant prevention and containment program.
3. **Controlling Large-scale Infestations** - 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 implemented unit by unit at a rate compatible with economic objectives.

   Initially, large-scale weed control should focus on rangeland sites with an understory of residual grasses and the highest potential productivity. Suppressed grasses have the greatest chance of reestablishing dominance on these sites. These areas areas must be spot treated each year to ensure control and minimize reinvasion. 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 reintroduction 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 might be inappropriate for another area. For example, sheep grazing leafy spurge in one area might provide cost-effective control, but sheep do not readily consume spotted knapweed

and herbicides might be more appropriate. Similarly, the most effective herbicide for a particular weed species might not be labeled for use in an environmentally sensitive area. Selection will depend on the (1) weed species, (2) effectiveness of the control technique, (3) availability of control agents or grazing animals, (4) land use, (5) length of time required for control, (6) environmental considerations, and (7) relative cost of the control techniques.

Researchers are currently determining if combining treatments will provide a synergistic (the effects of the treatment combination are greater than the sum effects of each treatment applied individually) response in controlling weeds. Some preliminary evidence suggests most control techniques are compatible. The later discussions of each weed species in this report include recommendations for treatment combinations that might be effective.

4. **Revegetation** - Revegetation with desirable plants might be the best long-term alternative for controlling weeds on sites without an understory of desirable species. Establishing competitive grasses can minimize the invasion of rangeland weeds and provide excellent forage production. In most areas, a fall herbicide application after weeds have emerged with subsequent plowing or disking and drill seeding is most effective for establishing desirable species.
5. **Proper Range Management** - Proper range management is especially critical during the management phase after weed control. Proper livestock grazing is essential to maintain competitive desirable plants, which will help prevent weed reinvasion 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 utilization of the herbaceous component. Grazing systems should rotate livestock to permit plants to recover before being regrazed and should promote litter accumulation. Range monitoring and annual evaluations should be conducted to determine the adequacy of existing management.

Goal 6. Collaboration and Coordination with Federal, State, and Local Agencies; Tribal Governments; and Others, as Appropriate

Benefits realized from noxious weed control will be more noticeable if management of noxious weeds is conducted consistently and efficiently across jurisdictional and political boundaries. If noxious weed control only occurs on federal lands while weeds continue to invade and take over other lands, such as private or state, then the federal land effort is wasted because the source of spread stems from the adjacent infested lands causing infestations to continue cropping up on federal lands. It is imperative that cooperation with federal, tribal, state, and county organizations and private landowners be undertaken so that all entities are efficiently and consistently managing noxious weeds, simultaneously.

Goal 7. Monitoring, Evaluation, Research, and Technology Transfer

No noxious weed plan is complete without effective monitoring and evaluation. It is imperative that data is collected and evaluated on the success stories and failures of noxious weed programs. If a program is not meeting noxious weed control objectives, then management changes are needed to get the program back on track. Monitoring and evaluation tracks the progress of a noxious weed program and informs managers when their program is not effective. Knowledge must be gained through experimentation with various control methods so managers can constantly improve their control methods and advance to effectively control noxious weeds. Once new methods or a combination of methods are discovered they must be transferred to field personnel who administer the noxious weed programs.

Noxious Weed Control Guidelines for an IWM Strategy

Use the following cultural, physical, biological, and chemical control guidelines to implement and determine the best method(s) for an integrated approach to noxious weed management. (U.S. Department of the Interior, Bureau of Land Management. 1994. Noxious weed strategy for Oregon / Washington. Oregon State Office, Portland, Oregon. BLM / OR / WA / PT-94 / 36+4220.9.)

Cultural

Prevention

1. Develop available preventive measures, such as quarantine and closure, to reduce the spread of the infestation.
2. Determine whether policy and laws allow for the use of all preventive measures, including local quarantine and closure.
3. If past management activities have allowed the introduction and spread of noxious weeds, determine how to change management after selecting a treatment method.

Livestock Manipulation

1. Determine whether changes in livestock grazing will affect the target weeds. Reduced grazing may allow for increased competition from beneficial vegetation or just allow for more weed seeds to be disseminated. Increased grazing may reduce beneficial vegetation or may be used to reduce weed seed source.
2. Determine whether changes in movement or type of livestock is necessary to reduce or contain the infestation due to movement of seeds on or in the animals.
3. Determine whether containing livestock in a weed free area prior to introduction to the area would prevent new infestations.

Wildlife Manipulation

1. Determine whether wildlife or wildlife feeding programs can be managed to reduce weed infestations.
2. Determine feasibility of changes in wildlife movement that would reduce or contain the infestation due to movement of seeds on or in the animals.

Soil Disturbance Activities

1. Revegetate all bare soil following disturbance.
2. Select plant species that will reduce the spread of noxious weeds.
3. Defer soil disturbance if possible until weeds are controlled or under management.

Rock Sources

1. Develop rock source management plans.
2. Keep use of rock source confined to existing contaminated roads.
3. Keep new or “clean” rock stockpiles separate from contaminated stockpiles.
4. Obtain rock from uncontaminated sources.

Public Use

1. Determine most feasible land use to reduce and prevent infestations.
2. Determine whether specific public awareness programs could reduce the infestation or control the spread of weeds.
3. Determine whether exclusion is a possibility and how it would affect the weed infestation.

Physical

Manual Control

1. Determine whether hoeing or “grubbing” will reduce (or increase) the infestation.
2. Determine whether hand pulling the weeds reduces the seed source.

Mechanical Control

1. Evaluate terrain to allow for mowing and determine whether it is an acceptable option for control of the spread of seeds.
2. Evaluate cultivation and other conventional farming practices options that could be used cost effectively.

Control by Burning

1. Determine whether policy and laws allow controlled burning and address regulations regarding smoke management.
2. Determine whether the terrain and vegetative cover allow for a controlled burn program.
3. Evaluate a controlled burn program to reduce the infestation.
4. Determine long-term effect of burning on nontarget species.

Biological

Natural Competition

1. Determine whether there are naturally occurring agents within the ecosystem which can reduce the infestation.
2. Determine which elements affect naturally occurring control agents. Determine whether these elements can be modified to reduce the negative effect on these agents. Determine whether these elements can be enhanced to increase the effectiveness of these agents on the weed infestation.

Introduced Competition

1. Determine whether biological control agents can be introduced into the ecosystem to reduce the amount of infestation.
2. Determine which introduced biological agents provide an acceptable control method for this infestation.
3. Evaluate if the biological control agent has been tested for adverse effects against all nontarget species within the treatment area.
4. Determine whether the introduced biological agent can survive in the environment of the treatment area.
5. Determine whether policy and laws allow for the introduction of biological control agents.
6. Determine whether policy and laws allow for introduction and grazing of livestock as a biological control measure.

Chemical

Fertilization

1. Determine whether chemical fertilization would reduce the amount of weeds by increasing competition of beneficial plant species.
2. Determine whether increased nitrogen (or other nutrients) would reduce weeds due to direct effect (for example, Curlycup gumweed).

Pesticides

1. Evaluate the acceptability of herbicides (or other pesticides) to control the infestation.
2. Determine whether pesticides are labeled for use on the target weed and use on the infested site (consider nontarget plants, soil type, groundwater location, topography, climate, state labeling). Determine the most effective application techniques.
3. Determine the most effective and cost-efficient types of conventional application equipment.
4. Determine whether properly trained personnel are available to apply the pesticides.