

## **I. BERM MANAGEMENT PLAN**

Weeds along the dikes, canals, and roadways (collectively referred to as berms in this section) of the leased lands in Tule Lake NWR continue to be a source of biological concern for Refuge managers, as weeds rob otherwise productive habitat, and for farmers, as they threaten crop production and are costly to control. The primary weeds of concern for leased lands are those listed in **Table 2**, in the Weeds section of this workbook.

Within this list, the major pest species along dikes, canals and roadways are five-hook Bassia, kochia, Canada thistle and perennial pepperweed. Some agricultural managers consider the stinging nettle to be a weed pest as well. However, this species was not listed because it is a food source for various wildlife species and used for nesting cover by ducks and pheasants (U.S. Fish and Wildlife Service 1994).

Kochia and five-hook Bassia are quite similar in appearance and are often mistaken for one another or referred to synonymously (Jim Hainline, U.S. Fish and Wildlife Service, personal communication, August 26, 1996). While this confusion with identification and/or terminology may be quite common, it is of little concern as both plants are in the same family and control methods are identical.

### **A. CURRENT BERM MANAGEMENT**

Weed management along the dikes, levees, canals and roadsides, has been and is a controversial subject. Considerable time and money has been spent by Reclamation, the Service, Tule Lake Irrigation District (TID), U.C. Davis, and leased land managers on trying to manage these areas. However, management has been piecemeal, and a lack of coordination and cooperation has existed between these entities, partially due to strong differences in management objectives.

The Service considers berms as primary sites for ground-nesting birds. Service staff are interested in controlling weed pests while recognizing that certain pests, such as stinging nettle, are beneficial to ducks and pheasants. In addition, Agency staff are concerned about the potential impacts of agrichemicals on aquatic and terrestrial wildlife and have placed certain restrictions on chemical use. TID, on the other hand, is primarily interested in weed control, stabilization of banks, and erosion/silt control. Its primary objective is the efficient and effective transport of water for irrigation. While farmers recognize the benefits to wildlife from the berms, they also see them as source sites for weeds and animal pests that invade fields. They also believe the stringent chemical controls required by the Agencies have contributed to the abundance of weeds on berms.

Growers and Agency staff agree that a healthy grass stand which could adequately out-compete most weeds would be far superior to the existing conditions. Many plantings have been attempted using various varieties of grasses, under varying conditions. To date, most have been unsuccessful. Stand establishment has been most difficult to accomplish. When it has been successful, stand longevity is quite short, rarely lasting more than 5 years.

Certain Agency personnel, Agricultural Extension Service staff, researchers from U.C. Davis, and leased-land growers have gained valuable knowledge on the successes and failures of establishing and managing grasses on these sites. The berm management strategy presented below was based on interviews with these individuals, and on a draft berm management plan offered by Don Kirby, Intermountain Research and Extension Service.

## **B. POTENTIAL FOR BIOLOGICAL CONTROL OF WEEDS**

*The following information on all biocontrols is derived primarily from "Biological Control of Weeds in the West," Western Society of Weed Science, 1996.*

Of the four major weed pests, only Canada thistle has some known biocontrols. This is Canada thistle stem weevil. This weevil feeds on plants during spring and summer. Feeding has little effect on plants but secondary damage caused by other organisms can have a major impact. Other damage-causing organisms including small insects, other arthropods, nematodes and pathogens enter through the exit holes below soil surface made by the stem weevil, resulting in rotting of the underground shoot during the winter months and reduced shoot production the following spring.

The Canada thistle stem weevil is now established in parts of Oregon. It is recognized as a viable control of Canada thistle but one that must be augmented by another biocontrol agent to substantially reduce thistle populations.

Another biocontrol of Canada thistle is Canada thistle bud weevil. This weevil feeds on the developing tissues of the flower stalk and seeds during the larval stage. Therefore, infested buds often become distorted and fail to open fully. Pupation occurs in the bud inside a loose cocoon of chewed bud tissue. Adults feed on the young foliage of the thistle. Most damage to the plant is done during the larval stage, however, large numbers of adults can damage upper leaves and developing buds. Consequently, this agent will only affect thistle spread by reducing wind-blown seed.

This weevil is currently known to exist in Washington and does well under a wide range of climatic conditions. It is an accidental introduction and therefore strong concerns exist about deliberate redistribution before host-specificity testing has been completed. To date, the weevil is not recorded as a pest to any economically important plant. It is also recognized as an ineffective control agent unless augmented by other biocontrols.

The last recognized biocontrol is thistle stem gall fly. This fly tunnels into the plant during the second-instar (molt stages in insects) larvae and forms galls. As the gall matures, the larvae molt to the third instar and quickly assume 98 percent of their body weight. Adult flies emerge from the deteriorating galls in late spring to early summer.

The effect of this gall is to reduce plant vigor, making plants less competitive and less able to resist pathogens and attacks by other insects. Also, stems above the galls may not produce flowers, thereby reducing seed production.

This fly currently exists in California and Oregon and was originally introduced in California. It is not recognized as being a solitary source of control and there is some history of difficulty establishing in areas with cold winters and hot dry summers.

Using a combination of these biocontrols is considered to be a suitable alternative to chemicals in reducing Canada thistle populations. The use of biocontrols must be PUP approved. It is recommended that a brief survey be conducted to determine locations of thistle concentrations and releases pursued at these sites. However, for sites where cultural control through grass competition is pursued, releases should be delayed until or unless Canada thistle invasion into the stand becomes a problem.

### **C. PROPOSED BERM MANAGEMENT STRATEGY**

The following plan *is meant to be flexible* and will require a trial and error period and modifications based upon successes and failures.

Control methods for weeds on the berms are limited due to many reasons: 1) biocontrols are only available for Canada thistle; 2) herbicide use is restricted; 3) keeping the area bare would be expensive and substantially increase dredging due to erosion; and 4) keeping the area bare would provide no habitat for wildlife. For these reasons alone, the most acceptable form (to all parties) of berm weed management appears to be cultural control through competition from grasses.

Berm management success will be dependent on the allocation of resources to the project. A working team would be formed composed of one permanent employee from TID, the Service, Reclamation, U.C. Davis, the Intermountain Research and Extension Service, and one grower representative. Their sole purpose is to provide expertise to the Service and Reclamation; they would not have decision-making authority. Formation and successful function of this team is critical to success. To date, the fragmented approach to berm management has not worked.

The team would review and agree upon:

- areas to be planted, methods and timing of plantings;
- species selection and planting rates;
- current and past successes and failures;
- management objectives;
- management techniques for existing stands;
- PUP-approved chemicals applied and application methods; and
- responsibilities of each of the participants.

The Service would be responsible for taking the lead in forming this working group. Some financial resources initially could be provided by Reclamation, TID, or the Service. The IPM Citizen Advisory Group was unanimous in advocating that leased land funds should be applied to berm management. However, since this money goes directly to the U.S. Treasury, it is unavailable for this purpose. Annually, a minimum of \$100,000 would be needed for this project. These monies would be used to buy, rent, or lease equipment; purchase grass seed and fertilizer; and pay for irrigation and labor, tillage, and other various costs. In addition, these monies could be used to fund graduate studies that would provide: 1) labor to monitor plantings and weed controls, 2) documentation for present and future managers, and 3) additional technical expertise to the project.

Many species of grasses have been planted on the berms. To date, the two most successful (assuming the stand was managed properly) seem to be 1) Alkar tall wheatgrass mixed with pubescent wheatgrass, and 2) smooth brome. A third seed mix of Alkar tall wheatgrass and basin wild rye has potential but needs a local field trial.

The tall wheatgrass mixes provide good cover for many species of wildlife and are excellent nesting areas for pheasants, gadwalls, and mallards. Conversely, cinnamon teal potentially will use the stand but prefer less tall dense cover. Smooth brome is very attractive to teal and provides excellent nesting habitat for both teal and other wildlife species preferring cover with less density and height.

These two plantings can be used in different locations along the berms. For example, smooth brome is an excellent choice for use on the banks and slopes along the irrigation ditches and drains, and on roadways. It establishes easily, is relatively inexpensive, and is extremely competitive with weeds as it spreads by way of rhizomes. These characteristics are all positive because the berms are difficult to access and spray, and because stand re-establishment will need to occur on berms following dredging.

Between the irrigation canals is a relatively flat area approximately 15 to 40 feet wide. This area lends itself ideally to the establishment of tall wheatgrass mixes. It is an area that is somewhat easier to access with equipment, where chemical application is easier due to proximity to crops and water, and is free from disturbance by placement of spoils. Therefore, once a stand was established, it would have the potential for tremendous longevity if managed properly.

Drawing down the ditches and drains to facilitate weed control and subsequent planting of berms is one management option. This would have to be timed carefully so irrigation water was available when needed. It also would have to be done during the growing season so weeds could be treated when green, and grasses could sprout after planting. This option offers the advantage of allowing weed controls (including chemical) on ditches and banks without endangering water resources. However, the disadvantage would be the interruption of waterflow for other purposes. This option would have to be carefully coordinated with all affected parties (e.g., TID, affected growers, and Refuge managers). Threatened and endangered species impacts also would have to be carefully considered.

Management of grass plantings would depend primarily upon the season. Assumptions used in developing management guidelines are listed below. **Table Berms-1** contains management guidelines for planting, based on available data.

- all grass plantings will be fertilized at 80 pounds per acre of 16-20-0-15, banded by drill or broadcast as applicable.
- tall wheatgrass mixes will be planted at 12 to 24 pounds pure live seed (PLS) per acre if drilled and 15 pounds (PLS) per acre if broadcast. Smooth brome will be planted at a minimum of 10 pounds (PLS) per acre when drilled and 15 pounds (PLS) per acre when broadcast.
- oats shall be planted at a minimum of 40 pounds per acre when used as cover and a minimum of 30 pounds per acre when used as a nurse crop.
- winter wheat shall be planted at a minimum of 30 pounds per acre when used as a nurse crop.
- all plantings will receive irrigation (if needed) for the first year.

**TABLE Berms-1.  
Berm Planting and Management Guidelines**

<b>Tillable Sites</b>	
<p>Spring Planting</p> <ol style="list-style-type: none"> <li>1. If possible, keep the area tilled for the growing season prior to planting. In early August, smooth till area and plant a ground cover (e.g., oats) to prevent winter erosion.</li> <li>2. Burn oats residue (if necessary) prior to sprouting of cool-season grasses.</li> <li>3. If the ground is not firm, cultipack the site.</li> <li>4. Broadcast or drill seed (drilling preferred). If broadcast, harrow following broadcast.</li> <li>5. Consider using a nurse crop such as oats or wheat. Mow at milk stage to prevent it from going to seed.</li> <li>6. If weeds are abundant right after planting, consider spraying with Roundup. A word of caution: note label instructions as Roundup can substantially reduce grass seed germination if used just prior to sprouting.</li> <li>7. If necessary, spray with a combination of 2,4-D and Banvel after grass has reached the three leaf stage. Application before this stage can damage newly planted grasses. Use a carrier that is non-toxic to fish. This will allow less stringent guidelines on use near water. Consider substituting Clarity for Banvel. It is a different formulation of Banvel and less susceptible to drift, however, drift concerns still exist. Clarity would require PUP approval.</li> <li>8. If required, mow grass stands for weed control. Try to mow slightly above grass height when grasses are less than 6 inches.</li> </ol>	<p>Fall Planting</p> <ol style="list-style-type: none"> <li>1. If possible, keep the area tilled for the summer months prior to planting. Just prior to planting smooth till the area and cultipack.</li> <li>2. Plant using broadcast or drill, drill when possible. If broadcast, harrow following broadcast. Plant no later than August 1 for wheatgrass mixes and August 10 for smooth brome.</li> <li>3. Consider using a nurse crop, preferably oats.</li> <li>4. If weeds are abundant right after planting, consider spraying with Rodeo or Roundup, following label precautions about proximity to water. A word of caution: read the labels as application of either chemical can substantially reduce grass seed germination if used just prior to sprouting.</li> <li>5. If necessary, spray with a combination of 2,4-D and Banvel after grass has reached the three leaf stage. Application before this stage can damage newly planted grasses. Use a carrier that is non-toxic to fish. This will allow less stringent guidelines on use near water. Consider substituting Clarity for Banvel. It is a different formulation of Banvel and less susceptible to drift, however, drift concerns still exist. Try to control weeds with mowing as opposed to chemicals.</li> <li>6. It may be necessary to apply herbicides the following spring to allow the grass stand to out-compete annual weeds.</li> </ol>

## Untilled Sites

### For ditchbanks and other areas that cannot be tilled prior to planting

#### Spring Planting

1. Shortly after annual weeds have sprouted (i.e., 1 - 2 inches of growth) burn the site using prescribed fire or preferably a flame weeder. The latter has the ability to kill more of the weed seedbank lying near the surface.
2. Broadcast fertilizer, nurse crop and grass seed when cool-season grasses are sprouting. Planting earlier than this will allow considerable feeding on the seed by migrating birds. Use winter wheat as a nurse crop. This is used instead of oats as it will be incapable of producing seed.
3. If weed pressure is great immediately after planting, consider spraying with Roundup. A word of caution: note label instructions as Roundup can substantially reduce grass seed germination if used just prior to sprouting.
4. If necessary, spray with a combination of 2,4-D and Banvel after grass has reached the three leaf stage. Application before this stage can damage newly planted grasses. Use a carrier that is non-toxic to fish. This will allow less stringent guidelines on use near water. Consider substituting Clarity for Banvel. It is a different formulation of Banvel and less susceptible to drift, however, drift concerns still exist.

#### Fall Planting

1. Prior to planting (no later than August 1), burn the site using prescribed fire or preferably a flame weeder. The latter has the ability to kill more of the weed seedbank lying near the surface.
2. Broadcast grass seed, fertilizer and nurse crop. Use oats as a nurse crop as it will not be able to go to seed.
3. If weeds are abundant right after planting, consider spraying with Rodeo or Roundup, following label precautions about proximity to water. A word of caution: read the labels as application of either chemical can substantially reduce grass seed germination if used just prior to sprouting.
4. If necessary, spray with a combination of 2,4-D and Banvel after grass has reached the three leaf stage. Application before this stage can damage newly planted grasses. Use a carrier that is non-toxic to fish. This will allow less stringent guidelines on use near water. Consider substituting Clarity for Banvel. It is a different formulation of Banvel and less susceptible to drift, however, drift concerns still exist.

## Spoil Piles

### For spoil piles following cleaning of waterways.

#### Spring Planting

1. Smooth spoil piles as soon as possible after dredging period occurs. Let them dry and then they can be worked.
2. Plant immediately to smooth brome and a nurse crop. Oats are the preferred nurse crop if planted late enough so it doesn't go to seed. For a spring or early summer planting, use winter wheat.

#### Fall Planting

1. Leave spoil piles undisturbed (i.e., leveling is unnecessary).
2. Seed immediately with oats to reduce wind and water erosion during the winter and early spring.

<p>3. If weeds are abundant after planting, consider spraying with Roundup. Note: Roundup can substantially reduce grass seed germination if used just prior to sprouting.</p> <p>4. If necessary, spray with a combination of 2,4-D and Banvel after grass has reached the three-leaf stage. Application before this stage can damage newly planted grasses. Use a carrier that is non-toxic to fish. This will allow less stringent guidelines on use near water. Consider substituting Clarity for Banvel. It is a different formulation of Banvel and less susceptible to drift, however, drift concerns still exist.</p>	<p>3. Overwintering will allow sites to dry, permitting spring tillage and /or leveling as necessary.</p> <p>4. Immediately following ground preparation, broadcast or drill (as contours allow) with smooth brome or a wheatgrass mixture and a nurse crop of oats or wheat. Mow the nurse crop at the milk stage to prevent seed development. Grass species selected will be selected based on frequency of dredging and/or cost of grass seed.</p> <p>5. If weeds are abundant after planting, consider spraying with Rodeo or Roundup, following label precautions about proximity to water. A word of caution: read the labels as application of either chemical can substantially reduce grass seed germination if used just prior to planting.</p> <p>6. If necessary, spray with a combination of 2,4-D and Banvel after grass has reached the three-leaf stage. Application before this stage can damage newly planted grasses. Use a carrier that is non- toxic to fish. This will allow less stringent guidelines on use near water. Consider substituting Clarity for Banvel. It is a different formulation of Banvel and less susceptible to drift, however, drift concerns still exist.</p>
<p><b>Dormancy Seeding</b></p>	
	<p>Follow the same guideline for fall seeding of tillable or untilled sites. Exception: seeding would occur in late October or early November to prevent grass seed sprouting. Oats should be seeded earlier in the fall so a minimal ground cover exists (e.g., 2 inches tall) to prevent wind erosion.</p>

**D. GRASS STAND MAINTENANCE**

Once established, grass stands would need to be actively managed to promote stand vigor and longevity. If areas of bare ground occur, spot reseeding management would include an active prescribed burn program so that stands were burned every 3 to 5 years (one field out of three each year) depending upon lodging, weed competition, and other factors. The optimal time to burn is in the spring just prior to sprouting. The Service is concerned about losing nesting cover with spring burning. However, this burning would occur prior to the initiation of nesting and would leave two-thirds of the fields (two fields out of three) available for nesting. Early fall burning is worthy of field trial, however it is sometimes difficult at this time of year (e.g., August 1). Burns are advantageous as some regrowth occurs before winter, making burned areas attractive for

spring nesters. Burning would require coordination with and approval by the IPM coordinator.

Escaped fires from stubble burning often spread to adjoining grasslands that have begun spring growth (Jim Hainline, U.S. Fish and Wildlife Service, personal communication, September 23, 1996). This does extensive damage to cool-season grasses, killing the above-ground grassy vegetation and requiring plants to resprout using already depleted root reserves. Tighter controls on stubble burns are needed if grass stands are to be managed properly.

Consideration must also be given to chemical control. Some use of broadleaf herbicides occasionally may be needed to control weed invasion (e.g., following burning). Flexibility and options within the Service's guidelines for chemicals should be explored to produce effective chemical control that is compatible with habitat protection.

### **E. FIELD TRIAL RECOMMENDATIONS**

Hydroseeding may be an alternative to broadcast seeding of the berms and should be considered as a possible field trial. Hydroseeding is the process of seeding cover/turf plantings through a liquid slurry. The slurry uses water as a carrier, with a mix of seed, fertilizer, and organic mulch. The mix is sprayed onto the soil at a predetermined application rate. The advantage of hydroseeding is a higher percent seed germination and shorter germination time than other seeding methods. Thus, desirable species are able to out-compete weeds, reducing the need for weed control. In addition, the need for initial irrigation is precluded.

## LITERATURE CITED

U.S. Department of Interior. 1994. *Habitat management plan for Lower Klamath National Wildlife Refuge*. December 1994.