

Developing a Strategic Management Plan

Prevention

Yellow starthistle infests about 15 to 20 million acres in California, but has the potential to infest nearly 40 million acres (Pitcairn et al. 1998b). Consequently, preventing the introduction of rangeland weeds is the most cost-effective method for starthistle management and is an essential component of a noxious weed management strategy. The major elements of a management program are to prevent introduction or re-invasion of starthistle weed seed, reduce the susceptibility of the ecosystem to yellow starthistle establishment, develop effective education materials and activities, and establish a program for early detection and monitoring (DiTomaso 2000).

Avenues of introduction

Yellow starthistle can encroach by establishing small infestations in relatively close proximity to a larger infestation (Sheley et al. 1999a). This can be through natural means including wind, water, and animal dispersal mechanisms. To prevent this type of encroachment, neighboring weed infestations on adjacent lands should be contained. The most effective method of containment is to spray the borders of infested areas with a herbicide (Sheley et al. 1999c).

In many cases, however, introduction of yellow starthistle and other noxious weeds onto grasslands can be associated with human-related activities. Seeds or plant vegetative fragments can be introduced as contaminants of hay or animal feed. This can be prevented by using feed that is certified as weed-free (Sheley et al. 1999c). Transporting soil contaminated with starthistle can lead to new infestations. This is a common method of introducing yellow starthistle seed along roadsides or in construction sites.

Livestock can move starthistle seeds from one area to another by passing viable seed through their digestive system or by transporting seed attached to hair. Seed dispersal by animals can be minimized by avoiding livestock grazing in weed-infested areas during flowering and seeding stages or by holding animals for seven days before moving them to un-infested areas (Sheley et al. 1998).

Equipment and vehicles driven through infested landscapes can transport yellow starthistle seed to un-infested areas. Even human clothing can transport seed, particular in soil particles attached to shoes and boots. Equipment and clothing should be cleaned immediately after leaving an infested site.

It is particularly important to control or prevent weed invasions along transportation corridors, including roadsides, waterways, and railways. These areas are typically disturbed sites and, consequently, are more susceptible to noxious weed establishment (DiTomaso 2000).

Susceptible landscapes

Yellow starthistle often become established following disturbances, either natural or through human activity. Although starthistle can invade some undisturbed areas, disturbance usually allows for more rapid establishment and spread. Following soil disturbance, sites should be monitored to prevent establishment and subsequent seed production in these susceptible areas. In many cases, disturbed sites should be re-vegetated with desirable species to slow the invasion of yellow starthistle.

Proper grazing can maintain desired plants and provide a more competitive environment. To minimize starthistle invasions, overgrazing is discouraged and grazed plants should be

allowed to recover before re-grazing. This ensures that grasses remain healthy and vigorous, maximizing their competitiveness and reducing the potential for starthistle encroachment (Sheley et al. 1999c). Re-vegetation with aggressive perennial grasses can prevent establishment of starthistle (Enloe et al. 1999a, 1999b, 2000). However, communities most resistant to weed infestations are usually composed of a diversity of plant species. This diversity allows for maximum niche occupation and resource capture (Sheley et al. 1999a).

Educational programs

Educating employees and the public can be accomplished by a number of methods. Information can be made available through brochures, posters, internet websites, calendars, scientific papers, and other written media. Educational programs can be conducted for landowners, land managers, or the general public. These can include public seminars, professional symposia, school programs, and volunteer field workshops conducted by church groups, environmental organizations, scouts, and several other groups. The media also play an important role in educating the public through radio or television news stories, public service announcements, newspaper articles, public displays, or even roadside bulletin boards. All these educational events or activities facilitate greater cooperation among private, federal, state, and county agencies, industries, landowners, and the general public. In addition, they increase the potential for early detection and rapid response to new starthistle infestations.

Early detection and monitoring

The best management of starthistle is to recognize potential weed problems early, control them before they reproduce and spread, and monitor the site regularly to maintain adequate follow-up control. Understanding the potential threats that may exist on surrounding property can provide an early warning system for weed invasion. One successful method for preventing yellow starthistle invasion is to regularly inventory the area by field surveys or aerial photography and remove individual weed plants before they become well established (Sheley et al. 1999c).

Eradication

Eradication is not often practical for yellow starthistle, but in previously un-infested areas it may be possible to eradicate new small invasions. An effective eradication program is closely tied to prevention. The key element to a successful eradication plan is early recognition of yellow starthistle populations and rapid response to prevent reproduction and the development of a seedbank. Control options in an eradication program are typically limited to mechanical removal, including hand pulling, and herbicide treatment. The objective is to completely eliminate the species from that site, not to manage the population. Eradication is not complete until all viable starthistle seed are depleted from the soil.

Eradication efforts are usually confined to smaller infestations (< 2 acres). These can be satellite populations adjacent to large infestations or isolated invasions far from other infestations. In some cases, eradication efforts can focus on the borders of large infestations (Zamora and Thill 1999). An eradication plan can be developed for small (<5 ha) or large (>50 ha) starthistle infestations. Financial resources, available technology, potential benefits, and social and geographical constraints will limit the size of the infested area that can be targeted for starthistle eradication (Zamora and Thill 1999). In some cases, large eradication programs

require re-vegetation to completely eliminate yellow starthistle. Even when all these issues are considered, complete eradication of large infestations are rare.

Developing a Management Strategy

Once yellow starthistle is well established eradication is not practical without extremely high financial and labor inputs. The ultimate objective under these circumstances is to manage the infested area and contain the large-scale infestation. However, the goal of any management plan should not simply be control of the noxious weed(s), but improvement of the degraded rangeland community, enhanced utility of the ecosystem, and prevention of reinvasion or invasion by other noxious weed species. In severely deteriorated starthistle-infested grasslands, it may be necessary to reintroduce desirable plant mixtures. Ideally, a healthy weed-resistant plant community would consist of a diverse group of species that occupy most of the **niches**.

An effective yellow starthistle management strategy should include three major goals; 1) effective control of the weed, 2) achieve the desired land-use objectives such as forage production, wildlife habitat development, or recreational land maintenance, 3) prevention of re-invasion of starthistle or invasion of equally invasive species. To accomplish these goals, land managers will require an understanding of the land use objectives, management limitations, and biology of the system.

Understanding the land use objectives of a weed management system is critical to determining the proper management approach. Management strategies will differ if the primary goal is to enhance forage quantity and quality for livestock and wildlife, restore native vegetation or endangered species, or increase recreational value. In addition, selection of the proper management tool(s) and program may depend on a number of factors including weed species, effectiveness of the control techniques, availability of control agents or grazing animals, length of time required for control, environmental considerations, chemical use restrictions, topography, climatic conditions, and relative cost of the control techniques (Sheley et al. 1999a).

One of the most important aspects in developing a yellow starthistle or any noxious weed management strategy is to accurately identify and map lands infested with the weed(s) (Sheley et al. 1998). Knowing where the infestations occur can determine the control method used, assist in prioritizing the management strategy, and identify areas where eradication, containment, or management can be achieved. In addition, this information can prevent unnecessary herbicide treatments and slow the spread of the weed.

Weed infestations should be identified on a map and records should contain weed species present, areas infested, weed density, rangeland under threat of invasion, soil and range types, and other site factors pertinent to successful management of noxious weed-infested rangeland (Sheley et al. 1998). Continual monitoring will be necessary to prevent reinvading populations from becoming established. A number of monitoring techniques can be used, including hand drawing infested sites on a map, using GPS (global positions system) units and plotting the data using GIS (geographical information system) programs (Cooksey and Sheley 1998), or more sophisticated techniques such as using aerial remote sensing equipment (Lass et al. 1995, 1996, 2000, Price et al. 1998).

A thorough understanding of the biology and ecology of yellow starthistle, as well as the grassland system it infests, is necessary for long-term management. Much of this information is available in the Biology and Ecology section of this site. In addition to understanding the biology and ecology of the weed, it is important to be familiar with characteristics of the ecosystem. This can include an awareness of other desirable and weedy species present, the potential for

invasion into other yet un-infested sites within the area, impact of the management strategy on sensitive species and habitats, soil conditions and range types present, as well as other ecosystem parameters.

A coordinated effort among interested parties, including the general public, private and public landowners, federal, state and county agencies, and environmental organizations can lead to a more effective management plan. A cooperative program can eliminate duplication of effort, reduce avenues for reintroduction, consolidate equipment and labor costs, and decrease the risk of repeating previous failures. In addition, coordinated management teams can obtain cost-sharing grants to manage large infestations more effectively. This is typically achieved through the development of a Weed Management Area (see specific section on WMA).

Implementing Strategic Plan

Implementing a strategic plan is the most critical aspect of yellow starthistle management and typically requires input from weed management experts. Before any option can be employed, financial considerations must be addressed and a budget must be prepared to keep project costs within reasonable limits. Limited funding may require prioritizing areas of greatest concern. For example, the decision to re-vegetate must consider direct costs (seedbed preparation, seeds and seeding, follow-up management), indirect costs (risk of failure, non-use during establishment period), and benefits (increased forage, improved ecosystem function, soil conservation) (Jacobs et al. 1999, Smathers et al. 1985).

Control options should include, whenever possible, an integration of mechanical, cultural, biological, and chemical techniques. A long-term commitment of three to many years will be necessary in nearly all cases to deplete the weed seedbank. It is not unusual for yellow starthistle plants to be larger after a single year of control (Callihan and Lass 1996). It will require a significant reduction in the seedbank and an increase in seedbank of the desirable competing species before dramatic results can be observed. Regardless of the approach employed, annual monitoring and evaluations should be conducted to determine the adequacy of the management plan (Sheley et al. 1999c). Changes in the management approaches may be necessary to adjust to any unforeseen problems and improve the strategy.

Once the desired objectives have been attained, a yearly follow up program will be necessary to prevent starthistle re-infestation. This may involve annual hand pulling, spot herbicide treatments, or even periodic burning (DiTomaso 2000). In addition, changes in grazing practices may be required to ensure that rangeland conditions do not become susceptible to rapid re-infestation. If follow-up is not made for 2 to 3 years following a control program, the grassland will usually become [heavily re-infested in a short time](#).