

Noxious range weed management

Control options - Mechanical Control

- A number of mechanical techniques are used to control rangeland weeds including hand-pulling, hoeing, tilling, mowing, grubbing, chaining, and bulldozing.
- Hand-pulling and hoeing or shoveling are effective methods in loose and moist soil with shallow-rooted weeds that are killed with complete crown removal (Sheley *et al.* 1999a).
- These techniques are also effective for the control of small infestations or weeds at the fringe of a major infestation. They also are commonly used in a follow-up management program where only a few plants remain (Sheley *et al.* 1998).



Cultural control

Proper grazing management can minimize spread and effectively manage noxious weeds in rangeland. Olson (1999b) describes three grazing strategies for managing weeds: (1) moderate grazing levels to minimize the physiological impact on native plants and to reduce soil disturbance; (2) intensive grazing to counteract inherent dietary preferences of cattle, resulting in equal impacts on all forage species including weeds; and (3) multispecies grazing that distributes the impact of livestock grazing more uniformly among desirable and undesirable species. Multispecies grazing takes advantage of the inherent grazing preferences among different classes of livestock (Walker 1994). In all cases, it is important to select the most appropriate grazer for the specific situation.

- **Biological control**
- The goal of a biological control program is not to eradicate the target weed, but to exert sufficient environmental stress to reduce its dominance in the plant community (Wilson and McCaffrey 1999). Insect agents can achieve this by boring into roots, shoots, and stems, defoliation, seed predation, or extracting plant fluids. All these effects can reduce the competitive ability of the plant relative to the surrounding vegetation. Over the past 100 years, more than 200 control agents have been released against 114 weed species worldwide (Blossey *et al.* 1994).

Despite the many attempts to control rangeland weeds through biological control, most attempts have been unsuccessful. Of the 23 weed species where biological control has been attempted, only 29% have demonstrated complete or significant levels of control in large areas (DeLoach 1991). Where it is successful, however, biological control can be a cost-effective, long-term, and self-sustaining management option (Blossey *et al.* 1994).

Chemical control

Herbicides are the primary method of weed control in most rangeland systems. Of the 400 million ha of rangeland in the United States, about 25% were treated with herbicides in 1997 (Bussan and Dyer 1999). Herbicides can be applied to rangeland by a number of methods including fixed-wing aircraft, helicopter, ground applicators, backpack sprayers, and rope wick applicators.



Herbicides commonly used in rangelands of the western United States are listed in Table 3. Of these, the auxin or growth regulator herbicides have played the most important role in rangeland weed control. These compounds include picloram, 2,4-D, dicamba, triclopyr, and clopyralid.

Table 3. Commonly used rangeland herbicides (from Bussan and Dyer 1999).

Common name	Trade name	Mode of action	Weed spectrum	Soil residual
2,4-D	Many trade names	Growth regulator	Broadleaf species	No
Clopyralid	Transline [®]	Growth regulator	Broadleaf species	Yes
Dicamba	Banvel [®] , Vanguish	Growth regulator	Broadleaf species	No
Glyphosate	Roundup [®]	Amino acid synthesis inhibitor	Non-selective	No
Imazapyr	Arsenal [®] , Stalker [®]	Amino acid synthesis inhibitor	Non-selective	Yes
Metsulfuron	Escort [®]	Amino acid synthesis inhibitor	Broadleaf species	Yes
Picloram	Tordon [®]	Growth regulator	Broadleaf species	Yes
Tebuthiuron	Spike [®]	Photosynthetic inhibitor	Non-selective	Yes
Triclopyr	Garlon [®] , Remedy [®]	Growth regulator	Broadleaf species	No

- Timing of herbicide applications can determine the effectiveness of the treatment. Although most perennials and shrubs are easier to control with an autumn herbicide application, the most effective timing for *Euphorbia esula* control is in **spring** (Lym. and Messersmith, 1994).
- Timing may also vary depending on the herbicide. Control of *L. latifolium* and *Cardaria draba* with sulfonylurea herbicides was effective with applications made in spring, summer, or autumn (Drake and Whitson 1989; Whitson *et al.* 1989; Young *et al.* 1998), whereas control with a **postemergence herbicide such as glyphosate** was **best when applied in spring** when **plants were at the late-bud to early-flowering stage**.

With annual species such as ***Centaurea solstitialis***, application of post-emergence herbicides in spring does not provide full season control, but spring treatment with picloram or clopyralid gives excellent season-long control and maximizes forage production.

Although herbicides effectively control noxious range weeds, they seldom provide long-term control of weeds when used alone (Bussan and Dyer, 1999). *Herbisitler zararlı yabancı otları etkili bir şekilde kontrol etmelerine rağmen, uzun süreli başarı sağlamaları nadirdir (Çünkü onlar hastalığıdaki ateş gibi semptomları yok ederler. Asıl hastalık nedenini yok etmezler).*

In the absence of a healthy plant community composed of desirable species, one noxious weed may be replaced by another equally undesirable species insensitive to the herbicide treatment. *istenilen türlerden oluşmuş (Klimaks türler) sağlıklı bir bitki topluluğunun yokluğunda, uygulanan herbisitten etkilenmeyen bir diğer yabancı ot herbisitin yok ettiği türün yerini doldurabilir.*

In addition, continuous use of a single herbicide can select for resistance in the target weed species. Sürekli tek bir herbisit kullanılması hedef yabancı ot türlerinde dayanıklıların bir nevi seçilmesini ve bunların vejetasyonda çoğalmasına vesile olabilir.

Population shifts through repeated use of a single herbicide may also reduce plant diversity and cause nutrient changes that decrease the total vigor of the range. Thus, herbicide use in rangelands should be part of an integrated weed management system. Tek bir herbisit tekrarlanan kullanımları populasyonu değiştirir. Bitki çeşitliliğini, ve totalde meranın gücünü (vigor) azaltabilir. Bu nedenle meralarda herbisit kullanımı entegre yabancı ot mücadelesinin bir parçası olmalıdır.

Integrated approaches

Most often a single method is not effective to achieve sustainable control of a range weed. A successful long-term management program should be designed to include combinations of mechanical, cultural, biological, and chemical control techniques. This is particularly true in re-vegetation programs where seedling establishment is the most critical stage and is dependent upon the suppression of competitive species, especially annual grasses and broadleaf species such as *C. solstitialis* (Jacobs *et al.* 1999).

Table 4. Successful examples of integrated strategies for control of rangeland weeds.

Weed species	Techniques employed
<i>Euphorbia esula</i>	Herbicide and biocontrol
	Herbicide and revegetation
	Tillage and herbicide
	Tillage and fertilization
	Grazing and biocontrol
	Grazing and herbicide
	Herbicide, burning, and revegetation

<i>Centaurea solstitialis</i>	Herbicide, revegetation, and biocontrol
<i>Centaurea spp.</i>	Tillage, herbicide and revegetation
	Burning and herbicide
<i>Bromus tectorum</i>	Herbicide and revegetation
	Tillage and revegetation
	Herbicide and grazing
Herbicide and grazing	Burning, herbicide and revegetation

Numerous integrated approaches have been developed for the management of *E esula* (Table 4).

These include the judicious use of herbicides in combination with biological control agents or grazing (Lym *et al.* 1997).

Other successful combinations for *E. esula* control include herbicide and perennial grass revegetation, sheep grazing and biological control insects (Hansen 1993), goat grazing and herbicides (Lym 1998), tillage followed by a herbicide or fertilization (Lym and Messersmith 1993), and an autumn herbicide application followed by a spring prescribed burn and revegetation with perennial grasses (Masters and Nissen 1998).

Herbicide treatment for *juncus effesus* L. (Hasır sazi, Kofa)

