

The Role of Weed Ecology in Integrated Weed Management



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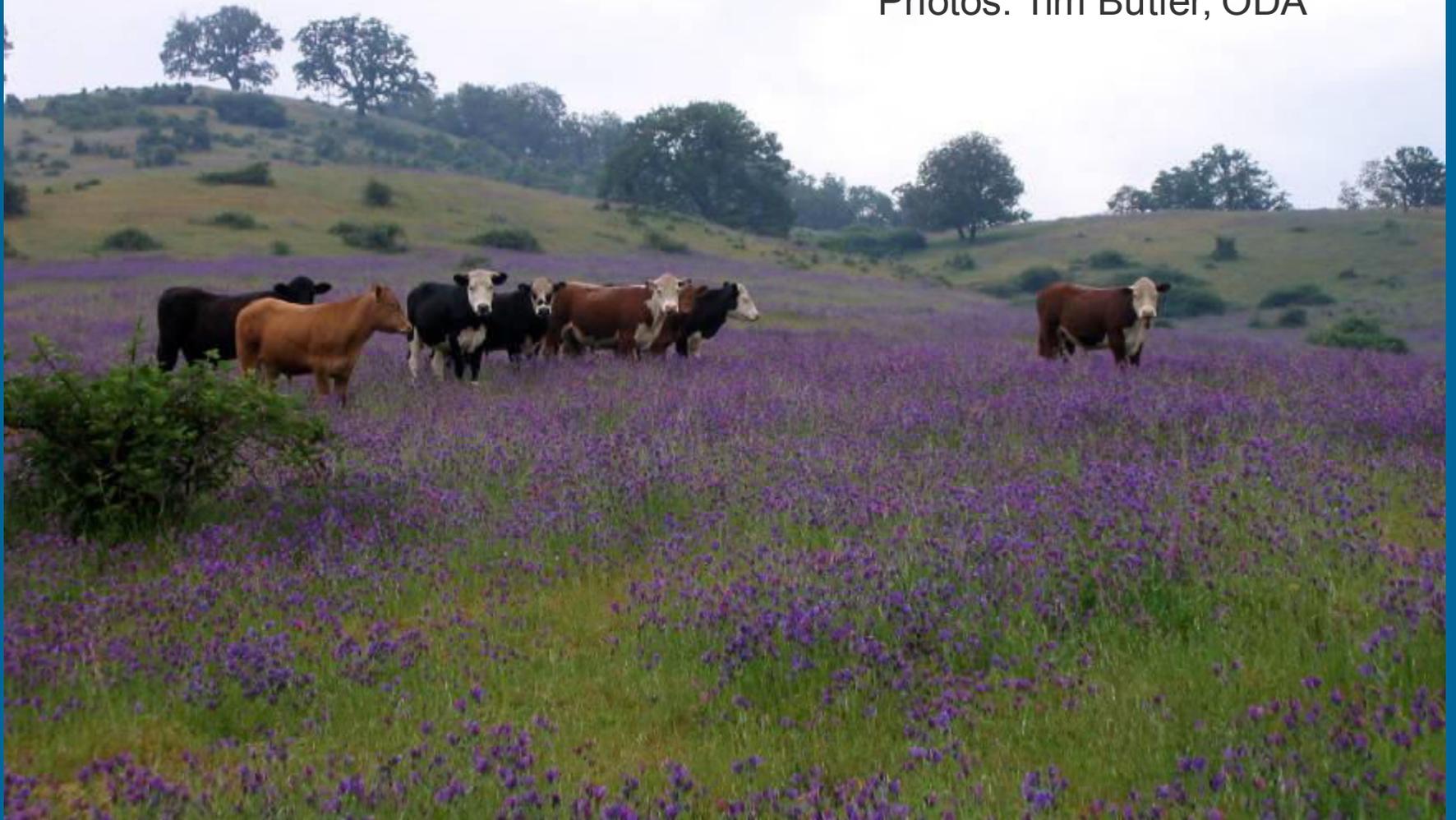
Afternoon Outline

- Weed Management Principles
 - Ecological characteristics of weedy plants
 - How they relate to management methods
 - Applicable to hort, ag, range, turf, roadside, pastures, forages, etc.
 - Current Weed Management Related Issues In Forages
 - Current Weed Ecology and other Management Resources
-

Numerous definitions of weeds...

- A plant out of place or not intentionally grown
- A plant that grows where it is not wanted
- A plant whose “virtues” have not yet been discovered
- A plant that is competitive, persistent and interferes with human activity
- Impacts are numerous...

Paterson's Curse
(*Echium plantagineum*)
Douglas County
Photos: Tim Butler, ODA





- 250,000 species of plants worldwide

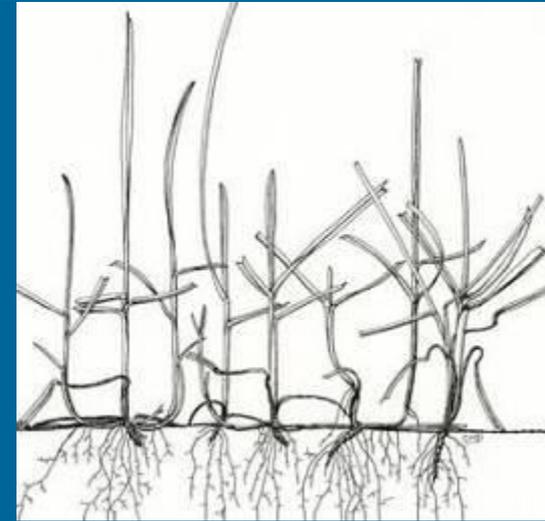
- 3 % or about 8000 species are weedy

- most invasive plants are ornamental in origin, however most ornamental plants are not invasive



Weedy Characteristics...

- Abundant seed production
- Rapid population establishment
- Seed dormancy and long-lived seed bank
- Adaptations for spread
- Vegetative reproductive structures
- Ability to occupy sites disturbed by humans



Abundant Seed Production and Rapid Establishment

TABLE 4-1. Seed production capacities of selected weeds.

Common Name	Number of Seeds	
	Per Plant	Per Gram
Barnyardgrass	7,160 ^{1,2}	714
Buckwheat, wild	11,900	143
Charlock	2,700	526
Dock, curly	29,500	714
Dodder, field	16,000 ²	1,299
Kochia	14,600	1,176
Lambsquarters	72,450	1,428
Medic, black	2,350	833
Mullein	223,200	11,111
Mustard, black	13,400 ³	588
Nutsedge, yellow	2,420 ¹	5,263
Oat, wild	250 ¹	57
Pigweed, redroot	117,400 ¹	2,632
Plantain, broadleaf	36,150	5,000
Primrose, evening	118,500	3,030
Purslane	52,300	7,692
Ragweed, common	3,380 ¹	253
Sandbur	1,110 ¹	148
Shepherdspurse	38,500 ^{1,2}	10,000
Smartweed, Pennsylvania	3,140	278
Spurge, leafy	140 ³	286
Stinkgrass	82,100 ^{1,2}	14,286
Sunflower, common	7,200 ^{1,2}	152
Thistle, Canada	680 ^{1,2}	637

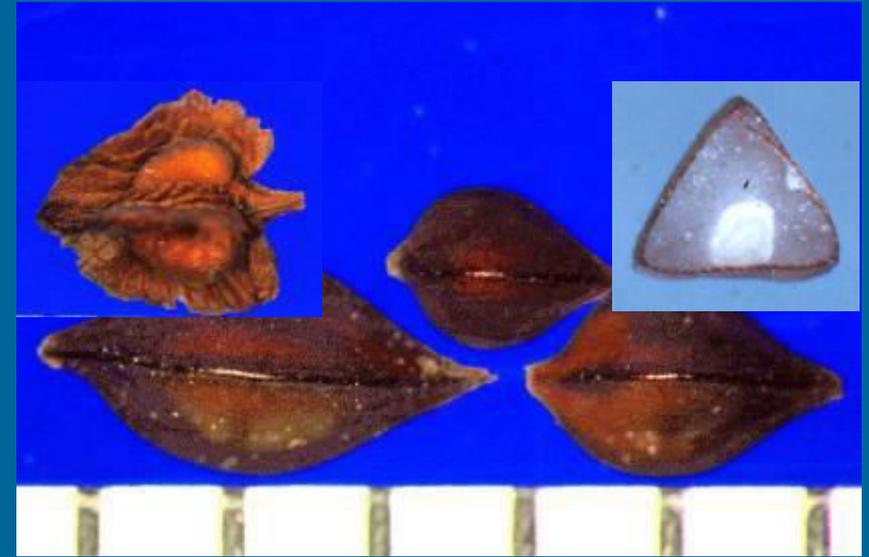
¹Calculated immature seeds also present.

²Many seeds shattered.

³Yield of one main stem.

Source: Data from Stevens, 1932.

Curly dock *Rumex crispus*



1 mm Scale

- Perennial
- Robust with deep taproot
- 2-5 ft. tall
- Mostly basal leaves with wavy margins
- Flowers and sometimes entire plant turns red at maturity
- Also called sour dock



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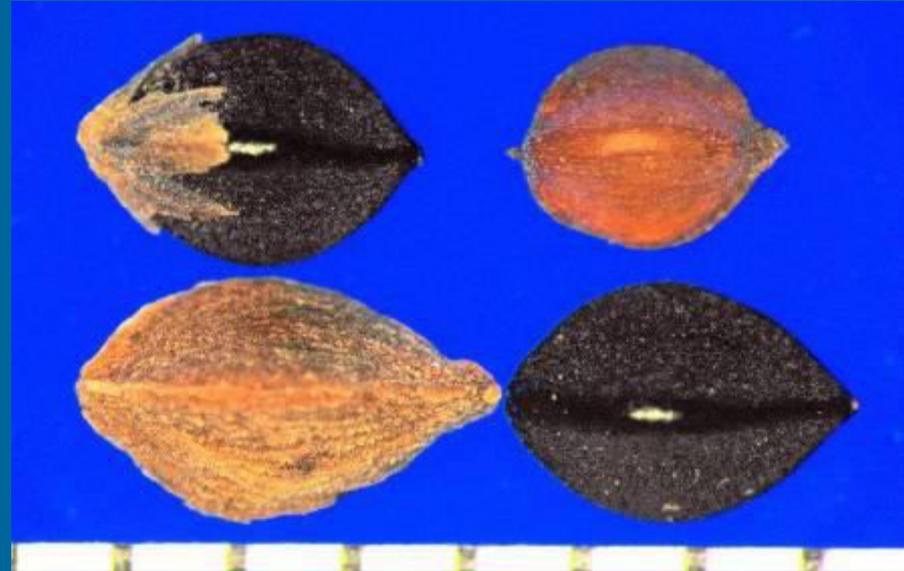
¹Calculated immature seeds also present.

²Many seeds shattered.

³Yield of one main stem.

Source: Data from Stevens, 1932.

Wild buckwheat *Fallopia convolvulus*



- Annual 1 mm Scale
- Trailing stems, often wrap around other plants
- Heart-shaped leaves
- Papery sheath at stem base of each leaf
- Tiny greenish flowers

Seed Dormancy and Long-Lived Seed Bank



Johnson Grass
Sorghum halepense



Stramonium Weed 3.6X
Atropa stramonium

Seed Coats



Seeds

Dormancy

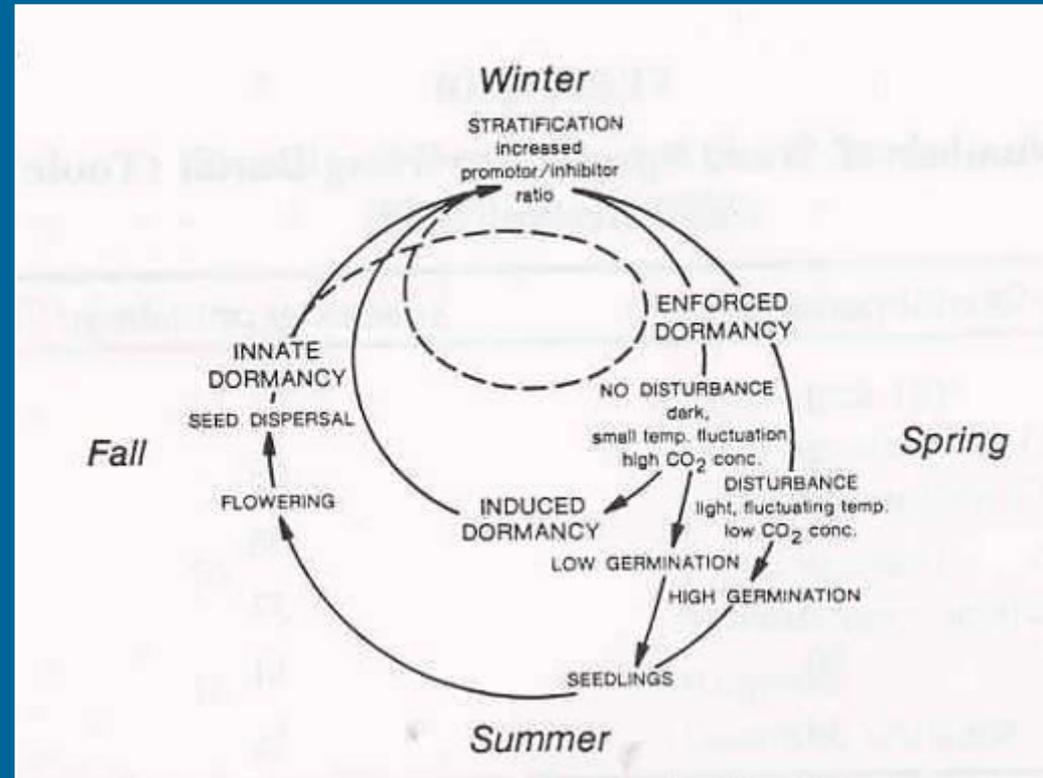
- Innate

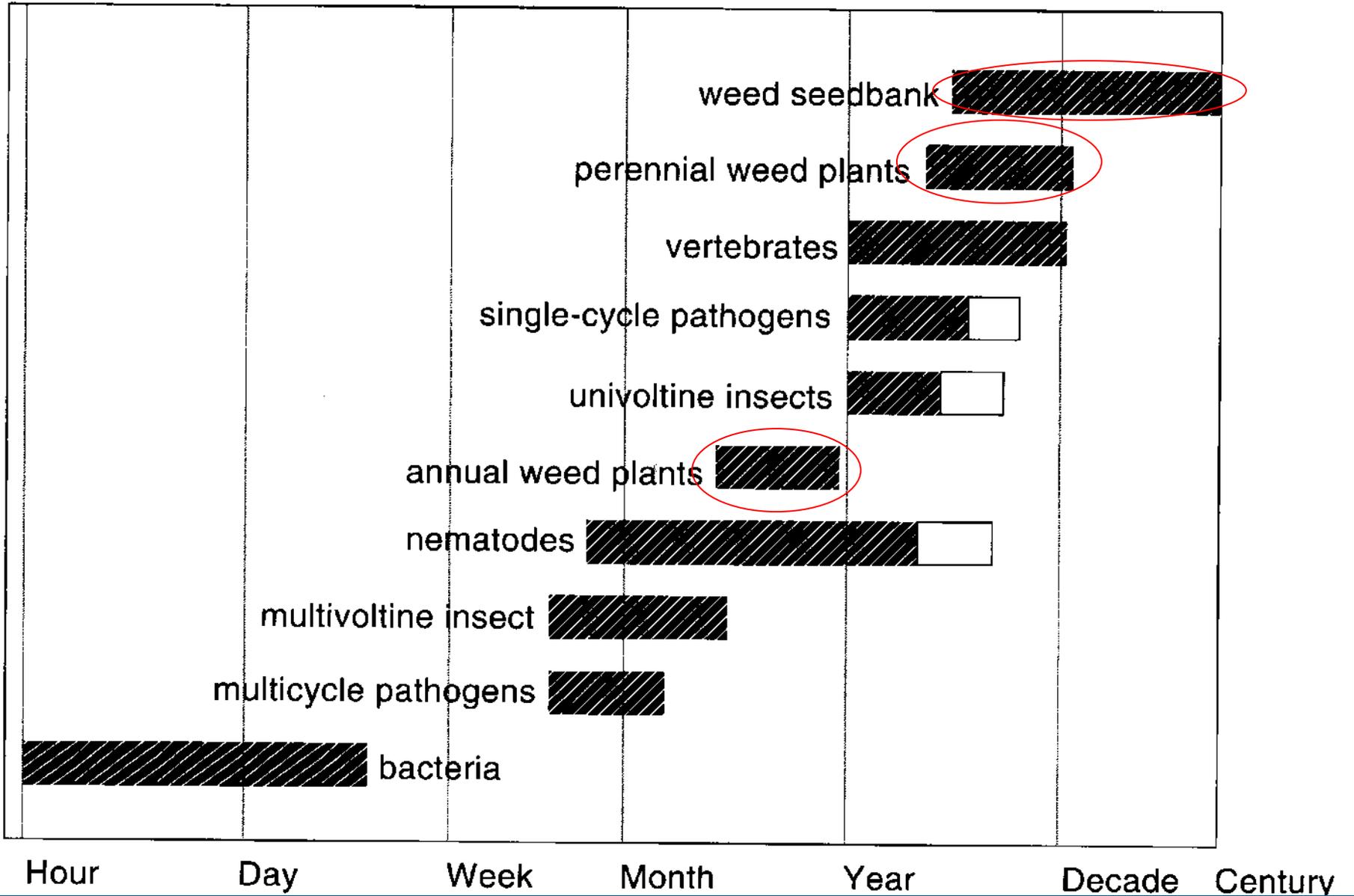
- Seed not fully developed, after-ripening

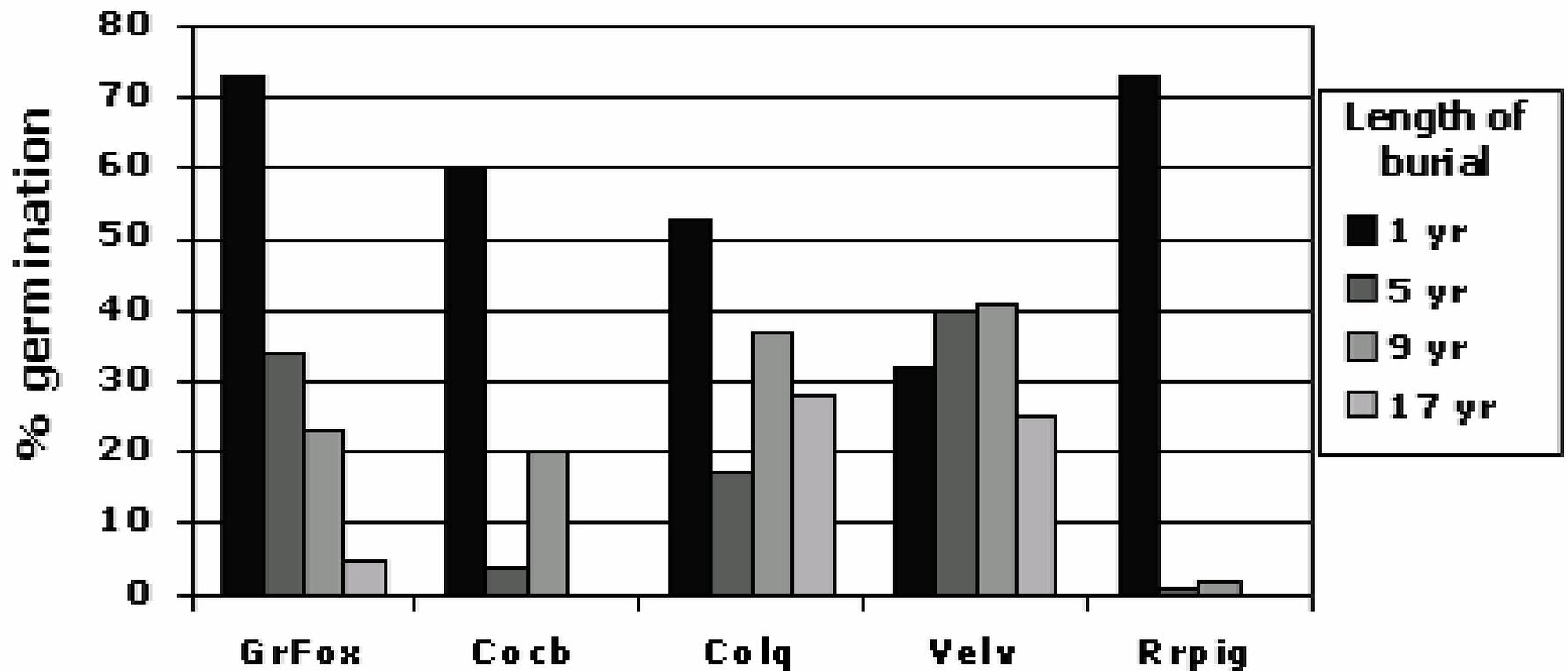
- Seed coats

- Induced

- Environmentally controlled



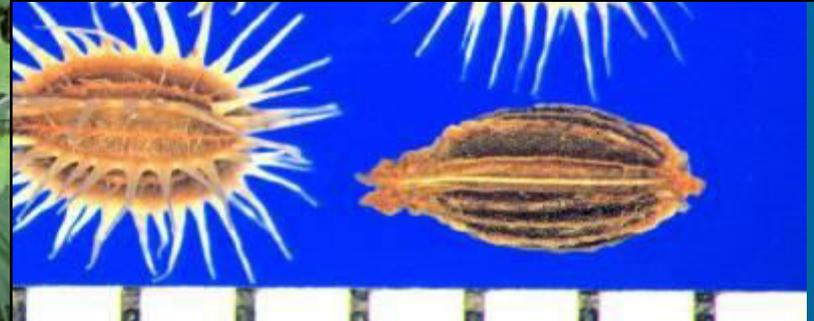




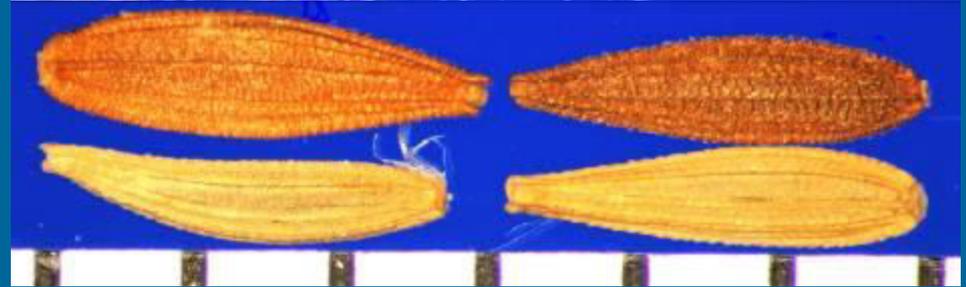
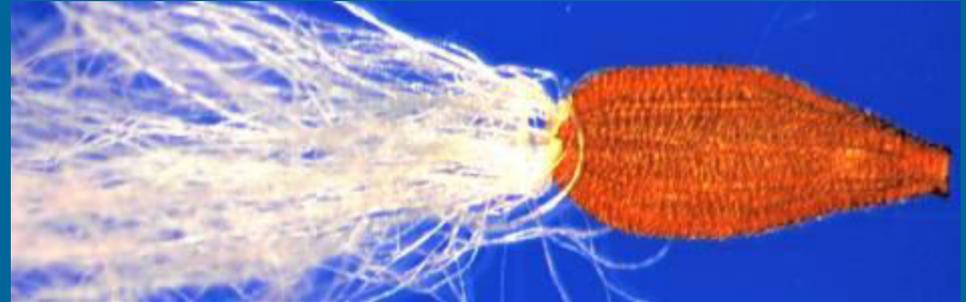
Burnside et al. 1996. Weed Sci.

Adaptations For Spread

- Mechanisms for



Annual sowthistle *Sonchus oleraceus*



1 mm Scale

- Annual
- Lobed leaves with wavy edges and prickles
- Yellow flowers



Himalayan blackberry *Rubus discolor*



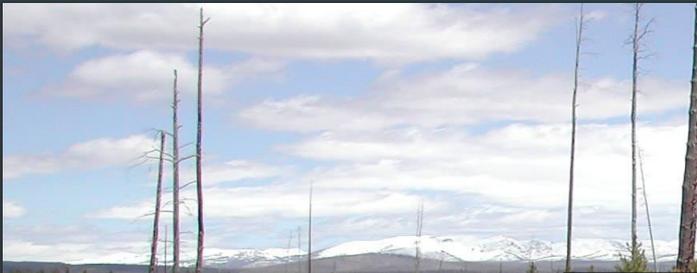
Vegetative Perennial Structures

- These structures allow perennials to spread (not all are present on each species)
- Stolons are above ground horizontal stems that root at the nodes to spread the weed
- Rhizomes are below-ground thickened stems that grow horizontally in the upper soil layers
- Tubers are enlarged rhizomes with compressed internodes located at the ends of rhizomes

Photo by:
Richard Old
www.xidservices.com



Ability to Capitalize on Disturbance



Integrated Pest Management-Use of Multiple Tactics

“...IPM seeks a combination of different methods for three reasons. First, a method may be ineffective by itself, providing only minimal levels of control, but may contribute significantly when used alongside other methods....Second, by spreading the burden of crop protection across several methods, the risk of crop failure or serious crop loss may be less if one method fails....Third, evolutionary models predict, and the history of pest control has shown, that the less a given control method challenges a pest, the longer it will take the pest to adapt to the method.” -- Bottrell and Weil (1995)

Weed Management Techniques

- Prevention
- Cultural
- Mechanical
- Biological
- Chemical



Prevention-Most Important Tool!

- Usually easier to prevent introduction of weeds than to manage established populations
- Clean tillage, mowing equipment
- Manure management
- Clean feed and seed
- Monitor roadways, ditchbanks, etc.



Cultural

- Create environment for maximum “crop/pasture” competition against weeds
 - ❑ Soil Fertility
 - ❑ Crop Rotation
 - ❑ Competitive Varieties
 - ❑ Cover Crops
 - ❑ Consider Planting Date and Rate
 - ❑ Composting



Cultural

- “Crop” growth rate is the single best measure of plant response to weed competition
- Forage and Turf Situations
 - Overseed with desirable forage mixtures to keep open areas to a minimum
 - Perennial ryegrass, annual ryegrass, orchard grass, white clover, native species
 - Rotationally graze if possible, do not overgraze
 - Optimum fertility for forage growth

Mechanical and Physical

- Hand Pulling
- Mowing
- Plowing
- Digging
- Mulching





Mechanical + Chemical
Control



Biological Control



- Use of other living organisms for the management of certain weed species
 - Insects
 - Diseases
 - Livestock
- Long-term approach
- Some success stories
- Many failures



Classical Biological Control in OR

- Tansy Ragwort
- Dalmatian Toadflax
- Canada Thistle
- Spotted Knapweed
- Diffuse Knapweed
- Yellow Starthistle
- Purple Loosestrife
- Saltcedar
- Others...see ODA Biocontrol site!



Chemical

- Herbicide use
- Very effective, but \$\$\$
- Must use properly
- Be aware of unintended consequences of herbicide use
 - resistance management
 - offsite movement
 - persistence in the environment
 - lack of restoration plan



Perennial Weed Management

- Live for more than two years and reproduce vegetatively and by seed
- Adopt a realistic and long-term approach
- Understand biology and recognize susceptible growth stages
 - Fall systemic growth regulator herbicides or
 - Broadleaves-bud to bloom stage
 - Grasses-mid boot stage
- Specific herbicide recommendations- Use PNW Weed Management Handbook, also OSU Extension Pubs

<http://weeds.ippc.orst.edu/pnw/weeds>

<http://extension.oregonstate.edu/catalog/>

Resource

Recommendations

<http://extension.oregonstate.edu>

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Public invited to observe lambing at OSU Sheep Center

Former Tanzania Peace Corps leader heads OSU Extension in Portland area

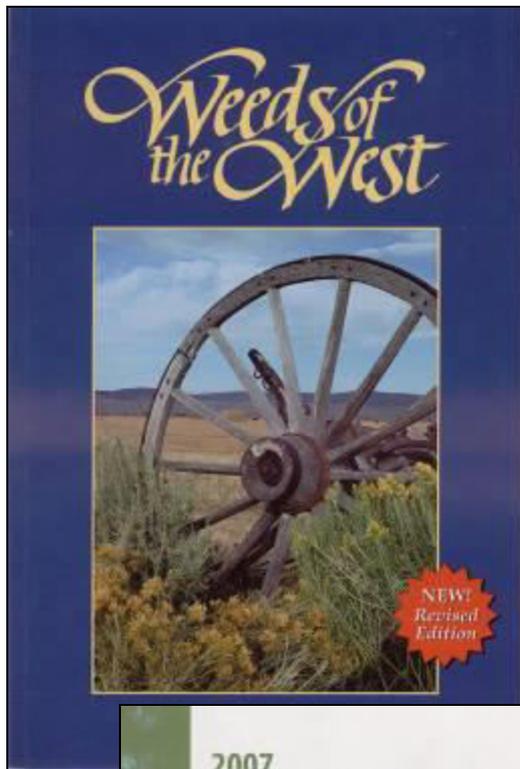
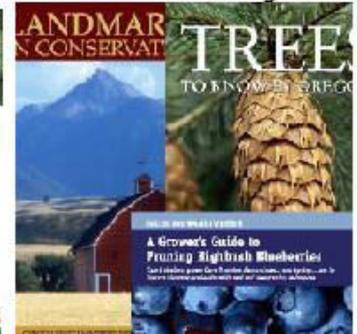
Preventing foodborne illness

Northwest Gardeners eNews



The OSU statewide: bridge

Publications & Multimedia Catalog

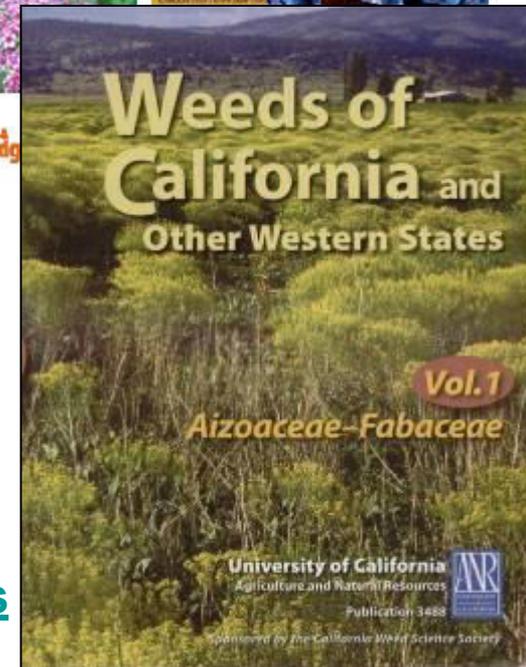


Online Weed ID:

<http://www.wssa.net/>

PNW Handbook

<http://pnwpest.org/pnw/weeds>



PNW 103 Revised July 2008



Scotch Broom

Biology and Management in the Pacific Northwest

Cytisus scoparius (L.) Link

A. Hulting, K. Neff, E. Coombs, R. Parker, G. Miller, L.C. Burnil

A bright sign of spring, Scotch broom (*Cytisus scoparius*) reminds us of its invasive presence each year as many acres of forests, pastures, and rights-of-way burst into golden bloom. Scotch broom is a native of Europe and North Africa, from Great Britain to the Ural Mountains, and from Sweden to the Mediterranean. It was introduced as an ornamental plant in California in the 1850s and later used to prevent erosion and stabilize banks and sand dunes.

Since then, Scotch broom has invaded much of the Pacific Northwest; its range stretches from British Columbia

into central California, and from the coast inland to the Cascade and Sierra Nevada mountains. While not as abundant, it also is present in most counties east of the Cascades in Oregon and Washington. Scotch broom is invading northern Idaho and is sparsely distributed throughout southern Idaho.

A woody, leguminous shrub, Scotch broom establishes quickly in disturbed areas, often outcompeting native plants to form dense, monospecific stands (Figure 1). Scotch broom's economic impact can be significant; the state of Oregon loses more than \$40 million annually in timber revenue and control expenses.



Figure 1: Scotch broom forming a dense thicket in a clearing disturbed by new home construction.

Description

Identification and Biology

Scotch broom is a woody shrub that can grow to 10 feet tall, although the average plant is usually 3 to 5 feet. Plants have sharply angled branches and bright yellow flowers. Plants bloom between March and June, before leaves emerge. Young branches have five ridges, are green and hairy, and are responsible for about half of the plant's photosynthetic activity.

Branches become smooth and brown as they age. Leaves are small and oblong, often with three leaflets, and develop later in the growing season. Single or paired flowers, clustered in leaf axils, are bright yellow and typical of plants in the Fabaceae family (Figures 2, 3 and 4, page 2). Occasionally plants bearing maroon flowers or bicolor maroon and yellow flower petals are in Scotch broom populations (Figure 5, page 3).

Andrew Hulting, Extension weed specialist; Kara Neff, faculty research assistant; Lory Burnil, former Extension weed specialist, all of Oregon State University; Eric Coombs, entomologist; and Glenn Miller, integrated weed management specialist, both of Oregon Department of Agriculture; Robert Parker, Extension weed scientist, Washington State University.

Pasture/Forage Weed Management Considerations

- Invasive winter annual grass weeds
- Problem broadleaf weeds
- Clover
- Cost of management/equipment limitations
- Aminopyralid residue management issues/restrictions
 - Grazing and feeding restrictions in general
- Grass forage tolerance to herbicides, particularly premixes containing SU herbicides
- Herbicide resistance management
 - Herbicide resistant weeds are common

Summary

- Learn to recognize common weed species
 - Familiarize yourself with biology of that plant and how that relates to its potential management
- Utilize an integrated management strategy
 - Prevention is key
 - One that suits your production goals and lifestyle
- Adopt a long-term strategy/outlook

Poisonous Plants

- Often a component of rangeland, pastures and hay fields
 - can native or exotic, common or rare
 - toxicity may vary between plant growth stages, sites and years
- Potentially dangerous to livestock
- Toxins related to complex secondary plant compounds
- Livestock will often avoid, but
 - inadvertent consumption (hay or silage or lush pasture)
 - extreme overgrazing
- Damage can be minimized
 - basic understanding of the plant species and occurrence
 - integrated management of livestock and toxic species

General Management Recommendations

- Improvement of rangeland and pastures
 - minimize overgrazing, forage selection, fertility, etc.
- Know the locations of toxic plant populations
- Targeted management of the plant population
 - preventative, cultural, physical, chemical and biocontrol
- Management of the affected livestock
 - Limit exposure-timing of grazing
 - most poisonings occur in early spring or late fall
 - moving or fencing off animals
 - Differential tolerances (sheep vs. cattle vs. goats)



Beef Cattle Sciences

Beef Cattle Library

Management Strategies for Dealing with Select Poisonous Plants in Oregon ¹

Professionally
Reviewed

“BEEF022”

Andrew G. Hulting ² and Karin Neff ³

Introduction

Rangelands, pastures and hay fields throughout Oregon often contain poisonous plants that are potentially dangerous to cattle and other livestock. Toxic secondary compounds found in these plant species perform multiple, complex functions. One role that these compounds play in plants is that they can serve as a defense mechanism against herbivory. Plants containing these compounds can have distinct, unpleasant odors and a bitter taste and are therefore usually not eaten and avoided by livestock. However, consumption of generally unpalatable plants can occur under a variety of environmental and management circumstances. For example, cattle in lush pastures may inadvertently consume poisonous plants such as poison hemlock. It is under these circumstances that livestock producers need to be aware that accidental livestock poisoning can occur. Unfortunately, with the increased reliance on maximizing forage in all types of rangeland and pasture-based production systems the potential to overgraze and degrade these areas also exists. Taken to the extreme, this may force livestock, including cattle, sheep and horses, to graze plants that they normally would not eat. It is under these situations that poisonous plants and livestock poisoning become a management issue for

landowners who are either unaware of poisonous plant populations on their property or who simply can not afford to purchase additional forage. However, with a basic understanding of the occurrence of these plants in Oregon and of how these plants may affect livestock, poisonous plants can be successfully avoided or managed in a variety of ways that limit losses for livestock producers. Livestock producers should work with local Extension agents to learn to correctly identify toxic plants and have established working relationships with local veterinarians who may be able to treat affected animals to mitigate losses to toxic plants.

General Management Recommendations

General improvement of rangeland or pasture is always important when high densities of poisonous plants occur throughout grazed areas. Minimizing overgrazing and knowing the locations of established poisonous plant populations are good first steps towards limiting livestock losses. More specific management strategies for dealing with poisonous plants may be grouped into two broad categories. These categories include targeted management of the problem poisonous plant

1. This document is part of the Oregon State University – Beef Cattle Library. Published in March 2010. Prior to acceptance, this document was anonymously reviewed by two experts in the area. For further information, please visit the Beef Cattle Sciences website at <http://beefcattle.sns.oregonstate.edu>.



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- Home
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- Soils
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Welcome

Oregon Small Farms provides information for the commercial small farmer as well as the small acreage landowner. It is hosted by the Oregon State University Extension Small Farms Program.

What's New

OSU Extension Small Farms Conference
February 21st, 2009
Online Registration Available

Events

- Saturday, Feb 21st 2009**
[OSU Extension Small Farms Conference](#)
- Wednesday, Feb 25th 2009**
[Healthy, Soak Systems](#)
- Friday, Mar 13th 2009**
[Diversifying Income Opportunities on Small Woodlands](#)
- Saturday, Mar 14th 2009**
[Living on a Few Acres](#)



Small Farms News
an online newsletter providing up-to-date information to small acreage farmers.
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Pasture & Grazing Management

Forage production is of primary importance to Oregon's livestock enterprises and agriculture economy. Pastures are kept in good condition by controlling weeds, fertilizing and most importantly, managing livestock. Implementing pasture management and grazing principles will increase forage yield and quality, provide a healthier place for livestock and improve farm aesthetics.

[Pasture Management Guide: Coastal Pastures in Washington and Oregon](#)

An overview of basic management principles, including grazing systems, forage establishment and selection and weed and insect management. This publication has valuable information for all of western Oregon.

[Pasture Principles for Smaller Acreage](#) (University of Idaho)

Written for landowners in Idaho, the same principles hold true for pasture managers throughout Oregon.

[Managing Small-acreage Horse Farms for Green Pastures, Clean Water, and Healthy Horses](#)

This publication, tailored for small acreages discusses basic management strategies for managing horses and pastures. Management practices include rain gutters, sacrifice areas, buffer strips, pasture rotation, well water protection, and manure management. These practices apply to all species of livestock.

[Managing Small-acreage Horse Farms in Central and Eastern Oregon](#)

This publication, tailored for small acreages discusses basic management strategies for managing horses and pastures in Central and Eastern Oregon. Management practices include rain gutters, sacrifice areas, buffer strips, pasture rotation, well water protection, and manure management. These practices apply to all species of livestock.

[Summer and Fall Pasture Management](#)

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Poisonous Plant Management Links

Fact sheet supporting horse farm publication for central and eastern Oregon:

<http://forages.oregonstate.edu/resources/publications/fs/PoisonFactSheet.pdf>

Here are some other references:

Cornell University Poisonous Plants Informational Database.

<http://www.ansci.cornell.edu/plants/index.html>

Guide to Poisonous Plants (Colorado State University).

http://southcampus.colostate.edu/poisonous_plants/index.cfm

Horse Owner's Field Guide to Toxic Plants, Sandra Burger (Breakthrough Publications, 1996).

The USDAARS Poisonous Plant Research Laboratory.

http://ars.usda.gov/main/site_main.htm?modecode

USDA Natural Resources Conservation Service Plant Links. Poisonous and Medicinal Plants.

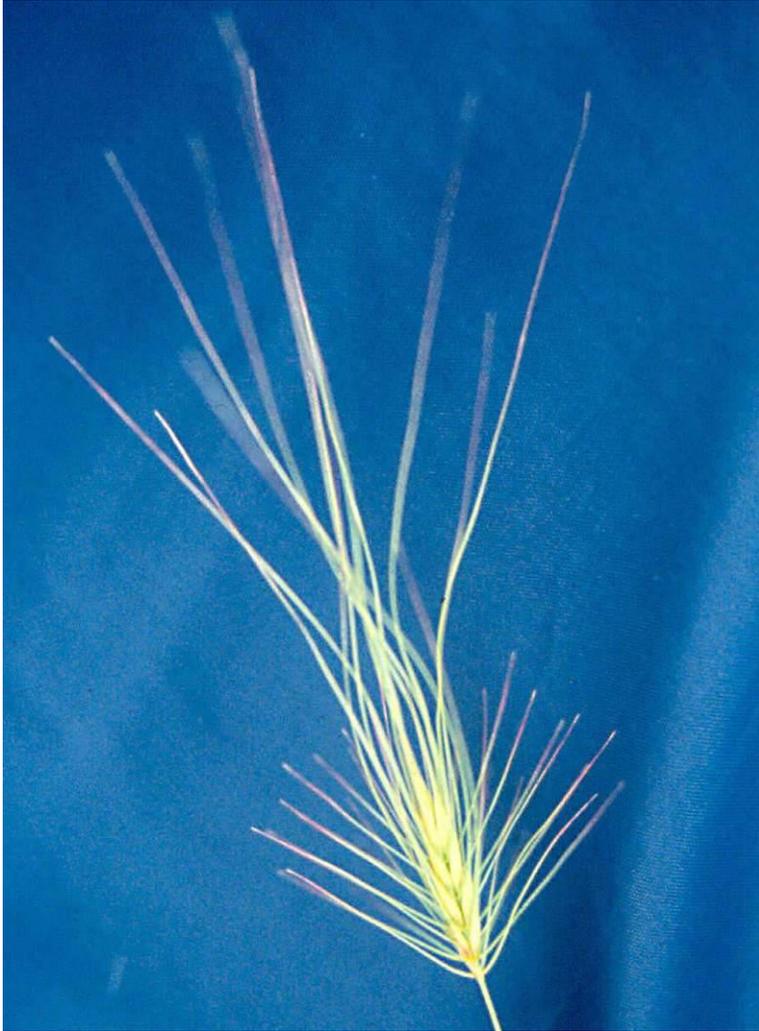
http://plants.nrcs.usda.gov/cgi_bin/link_categories.cgi?category=linkpoison

Weeds of the West (Western Society of Weed Science, revised 2001)

Weeds of California and Other Western States (University of California Press, 2007)

The Pacific Northwest Weed Management Handbook. <http://pnwpest.org/pnw/weeds>

Medusahead



- Winter annual
- Open sheath
- Long-hairy collar
- Glabrous auricles
- Sessile spikelets
- Lemmas and glumes with minute barbs and long awns
- Heads bend to nearly horizontal at maturity
- High silica content deters grazing as it reaches maturity

“Wild Barley” Control in Pastures

- Hare barley (*Hordeum murinum* ssp. *leporinum*)
 - Non-native, cool-season annual grass that invaded from CA
 - Other common names: foxtail, wild barley, foxtail barley, etc...
 - Problematic throughout state, ~ 5000 pasture acres?
 - OSU group worked extensively on the problem in late 70's
 - Limited success with non-chemical management

Hare Barley



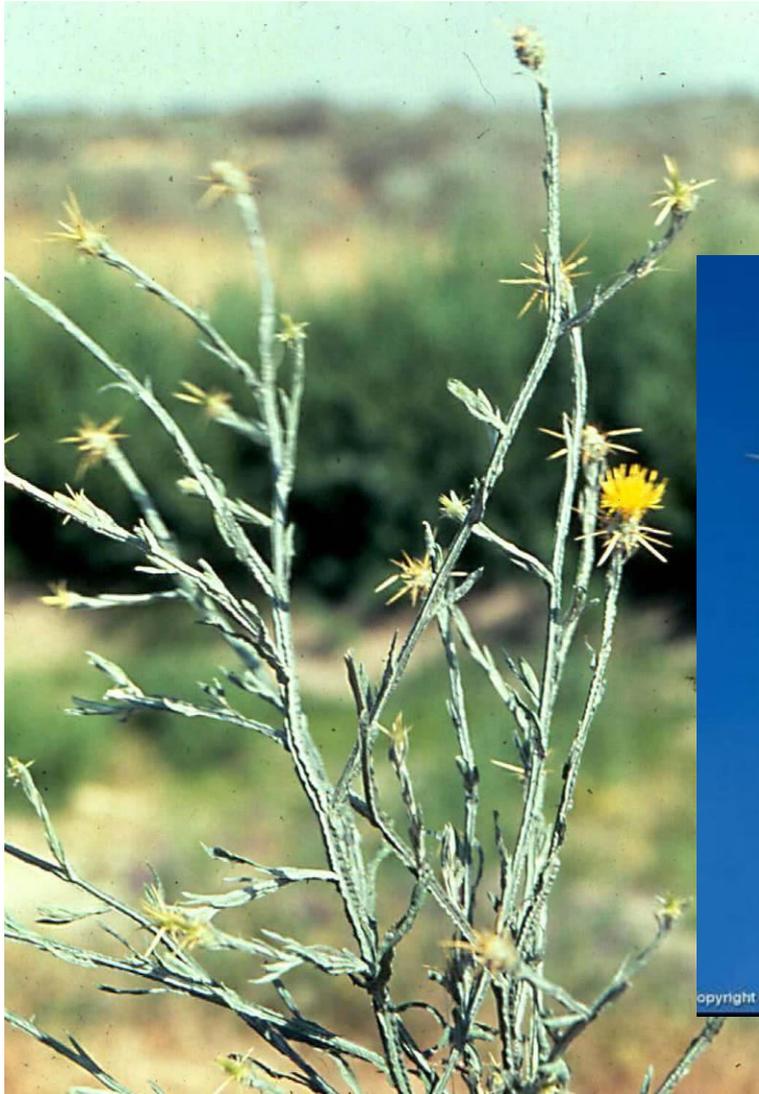
- Annual
- Well developed auricles
- Dense spike
- Prominent, stiff awns



Hordeum marinum ssp *leporinum* Hare barley “Foxtail”
or “Wild Barley”



Yellow Star Thistle



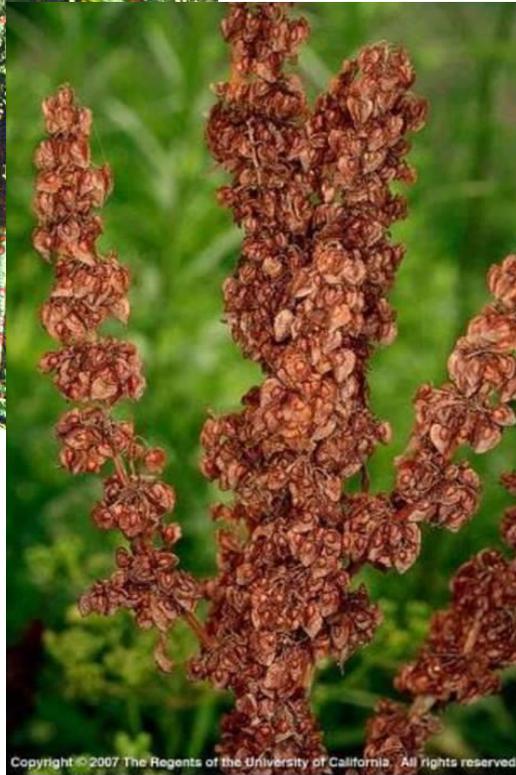
- Annual
- Rigid, branching stems with cottony hairs
- Lobed basal leaves
- Stem leaves entire and hairy
- Single yellow flowers at branch ends
- Long spiny bracts subtending flowers

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- Primarily horses affected
- Principle toxin: Sesquiterpene lactones (neurotoxin)
- Same symptoms as Russian knapweed: causes “Chewing Disease”
- Toxic when dry
- Slightly less toxic than Russian knapweed
- Not toxic to sheep or cattle, which can be used for control

Docks

- Perennial
- Swollen stem nodes
- Membranous, sheathing stipules
- Flowers in whorls at upper stem nodes
- Fruit in 3-winged perianth



- Sheep and horses affected most; cattle less susceptible
- Principle toxin: Oxalate accumulator – Not a common source of oxalate poisoning, but will be toxic if eaten in large quantities
- May cause irritation to skin and digestive tract; dangerous levels are rare
- Can cause hypocalcaemia
- Dock in silage is not a critical problem as long as it is diluted with plenty of other feed
- Calcium supplements will bind with oxalates and make them insoluble

Buttercups

- Various
- Deeply lobed leaves
- 5-petaled yellow flowers



- Sheep and cattle affected
- Principle toxin: Protoanemonin from ranunculin glycoside
- Toxin is released when plant is chewed
- Causes blistered mouth, excessive salivation and intestinal irritation which can result in diarrhea.
- Can be fatal if eaten in excessive quantities
- Can reduce milk production
- Creeping buttercup is toxic to cattle; bur buttercup is toxic to sheep
- Toxin lost in dried forage
- Not palatable; generally avoided