Pacific Northwest Invasive Plant Council

Mitigation Design to Discourage Invasives

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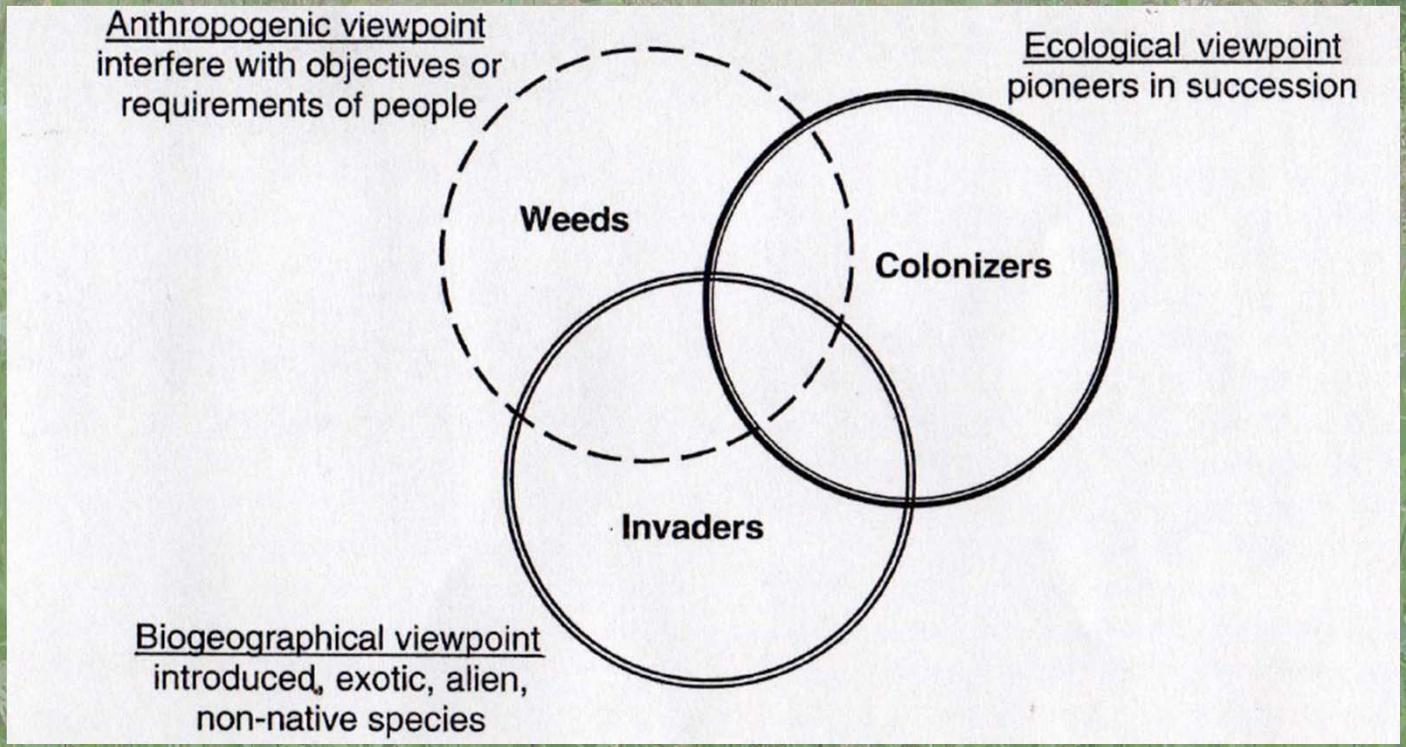
What Constitutes a Weed Definition



No matter your Definition, Weeds are a problem on Restoration Sites

Is the definition based on abundance?

Does weed cover have to reach a threshold before it is considered a weed?

A suggested definition is:

"a native or introduced species that has a perceived negative ecological or economic effect on agricultural or natural systems."

Presentation Outline

- Introduction-a restoration ecology perspective –what you need to know
- Components of a design oriented towards weed management: site prep, design, site maintenance
- What weeds are the key players here in the PNW?
- Controlling weeds after installation
- Contingencies that may come in handy

Why Are Weeds More Competitive?

- They are able to obtain more of the resources (light, water, space, nutrients) than nonweedy plants.
- They respond favorably to disturbance in edaphic and climatic conditions, whereas nonweedy plants are often negatively affected.
- They are often allelopathic (able to interfere with the growth of nonweedy plants).

"Ideal" Weeds (Baker 1974)

- Germinate in a wide range of environmental conditions
- Long-lived seeds that are internally controlled
- Weed seeds remain dormant in the soil for long periods
- Seed is often the same size and shape as crop seed so it is difficult to separate
- Seeds produced continually throughout growth period or set seed twice per year
- Seeds are produced through a wide variety of environmental conditions

"Ideal" Weeds (Baker 1974) (cont.)

- Plants are often deeply rooted and the roots are thick and hold reserves to get the plant through stress
- Rapid growth from vegetative stage through flowering stage; quick maturation
- Cross-pollination by wind or generalist insects
- Self-pollination is common

"Ideal" Weeds (Baker 1974) (cont.)

- Have high seed output when conditions are favorable
- Have seeds that are adapted to both short- and long-distance dispersal
- If perennial, has a high rate of vegetative reproduction or can regenerate from fragments
- Has strong potential to compete with other species using special adaptations, rosette formation, climbing growth

Weed Ecology

Understanding weed ecology will (hopefully) lead to more effective weed prevention because:

- **Weeds more susceptible to herbicides are replaced by resistant species.**
- **Monoculture species are problematic if using only one strategy (e.g., reed canarygrass).**
- **Herbicides are often detrimental to the overall environment.**

Weed Ecology

Edaphic (soil) Factors

help to determine which weeds survive and compete

- **Water**
- **Aeration** (O2 availability)
- **pH**
- **Fertility**
- **Temperature**

Know your soils!

Types of Weeds

Categorize weeds based on the habitats they typically* invade:

- Agricultural systems, croplands
- Waste sites
- Grasslands, rangeland
- Aquatic systems
- Forestry systems
- Native systems

* But can get into your restoration

Weed Invasions -Dispersal Modes
Seed Production

- Seed dormancy allows for dispersal over time.
- Mechanical dispersal involves bristles, spines, hooks that attach the seed to the dispersing agent for transport.
- Wind dispersal is key. It involves very small, light seeds, and structures that allow being held aloft or rolling along.
- Water dispersal—float or survive submerged.
- Human dispersed—usually as contaminant in seed or by tagging along in planting pots.

Seed Dormancy

- Breaking of weed seed dormancy is usually brought on by soil disturbance.
- Many species require light for germination—light becomes available with soil disturbance.
- Some seeds are "hardened" and require passage through the acid digestive system, physical damage (scarification), or microbial decomposition.
- Some buried seed needs more oxygen to germinate. Being closer to the surface and reducing soil compaction both increase germination.

Weed Invasions—Dispersal Modes
Vegetative Dispersal

- Vegetative dispersal can be vastly more efficient than sexual reproduction (e.g., water hyacinth 300 seeds per pod = 1 year to flowering, vs. double size of clone in 10 to 15 days)
- Vegetative means shoots can sprout if broken, bulblets can be released, roots can send both above- and belowground runners
- Tilling the soil can increase the spread!

Why are Weeds a Problem on Restoration Sites?

- Their presence makes it hard to meet Performance Standards.
- They increase the costs of site preparation
- They increase the costs of maintenance
- They decrease growth rates in plantings
- They result in higher planting mortality

Why are Weeds a Problem on Restoration Sites?

- Weeds have a competitive advantage in disturbed sites and mitigation sites are most often "disturbed".
- Most often restoration sites are in more urban or agricultural environments where weeds are present and often well established.
- We are interrupting the usual route of succession when we clear and plant a site in late succession species. Nature is trying to re-establish normal succession by putting back early succession species (which are often weeds, or plants that have weedy strategies.

Components of a design oriented towards weed management

- Do a site reconnaissance

and

- Aerial photo study

To look at the surrounding landscapes that you should also visit- at least as a drive by

Components of a design oriented towards weed management

1. Know what weeds are on your site pre construction
   - Which species, their extent, & distribution
   - Seed bank and rhizome base
2. Know what is in the landscape that can affect your site. Surrounding infestations: e.g. pastures w/ reed canarygrass

and modes of transport:

- flood, wind, wildlife (birds, rodents, deer..)

Components of a design –Site Preparation

If weed load is high, prepare a detailed and extensive site preparation plan

- Know your species and their management!
- Develop prescriptions for each species – schedule and treatment included
- Set up contractors well in advance so you don't miss critical time frames for species-specific management. Make sure you set up the necessary schedule e.g. Reed canarygrass may take 2-3 years!

Components of a Design

1. **Strategies that limit weed invasion**
   - High densities
   - Uniform distribution
   - Fast growing plants
2. **Strategies that optimize natives over non-natives**
   - Don't fertilize except in planting pits
   - Emphasize forested or inundated habitat (not optimal for most common weeds)
3. **Strategies for controlling weeds**
   - Have budget to Maintain. keep on top of it.

Components of a Design

If weed load is heavy then:

- ✓ **Increase woody stem density in the design by 10 to 25.**
- ✓ **Distribute plants in a more regular pattern so that no open spaces will be present. This is counter to a more natural clumped pattern.**
- ✓ **<u>Do</u> use mulch in the planting rings.**
- ✓ **<u>Do</u> seed in the understory (but not in mulch rings).**

Installation Oversight

1. A site inspection must occur after the preparation work is done to give the the installation a final go-ahead. Don't assume the site is ready. Make sure it is! A final grubbing, herbicide may be necessary!

2. Be sure the installation contractor is spacing the plants and adding the mulch ring correctly.

Contractors may not understand the gravity of a heavy weed load and not take the care they need to. Be there to make sure they get it!

Strategies that Limit Weed Invasion After Planting

- Prepare a maintenance manual that is given to the contractor to bid on.
- Have the maintenance contractor on contract before the spring season starts for the entire year.
- Have a regular maintenance schedule established. I typically use: (can be decreased in later years)
  - ✓ **April**
  - ✓ **June**
  - ✓ **Late July or early August**
  - ✓ **September (if needed)**

Families of PNW Worst Weeds

- Poaceae
- Cyperaceae
- Asteraceae
- Polygonaceae
- Lythraceae
- Brassicaceae
- Leguminosae
- Convolvulaceae
- Rosaceae
- Caryophyllaceae

The biggest Problem Weeds

- Reed Canarygrass
- Knotweed- Includes japanese, giant and hydrbid
- Blackberry
- Purple loosestrife
- English ivy
- Butterfly bush
- thistles
- Bird's foot trefoil
- bindweed
- All daisy-like herbs
- Scotch broom
- English holly

Some other Problem Weeds

- Gorse
- Smartweeds
  - especially lady's thumb
- Teastle
- Beggars-tick
- Bitersweet nightshade
- Cyperus
- What did I miss?

Don't worry about these:

- Creeping buttercup
- Soft rush
- Velvet grass
- Meadow foxtail

An Example—The Ecology of *Phalaris*

Experiments show why *Phalaris* is invasive

- • **light** allows seedling establishment and vegetative spread
- • **clonal subsidy** allows rhizomes to penetrate dense shade
- • **nutrients** enhance vegetative spread
- • **nitrate** enhances its ability to suppress diversity
- • **sedimentation** eliminates topographic heterogeneity and facilitates invasion

and what limits *Phalaris* establishment:

- • **species-rich canopies** reduce invasibility

and what eradicaiton methods work? (many in tandem)

Shading multicanopy
Dense planting
disking
Herbicides
burn or excavate roots

Contingencies- some ideas

1. Weed, weed, weed- add more maintenace till you get on top of the problem and NEVER take time off before the weed problem is in check.
2. Infill plating the second year to fill in all bare spots
3. Keep mulch ring clear of weeds and re-apply mulch
4. Top dress planting pits with fertilizer in buffer so plants grow faster

This talk can be found at

www.cookescientific.org

Along with some very helpful weed info links