

Learning objectives

- How weeds evolve and move
- Ecology of weeds
- Weed competition
- Weed life cycles
- Some weed id
- What makes a plant invasive
- Weed management



Lambsquarter: Summer annual

What are weeds?

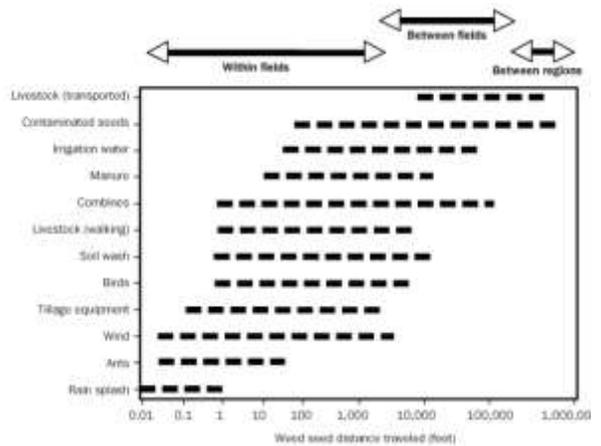
- Plants that are
 - Competitive
 - Tenacious
 - Definitely not wimpy
 - and fantastically interesting!!



Horsetail : Equisetum arvense
Herbaceous perennial

Most weeds depend on humans for dispersal

- Local movement
- Large scale movement



European immigrants brought many of them. Why?

- Food (many examples)
- Fiber (one nettle species and others)
- Pharmaceuticals (Foxglove and others)



Foxglove *Digitalis purpureum* biennial

Other reasons

- Attractiveness (many flowers and woody plants)
- Industrial uses (teasel and others)
- Accidentally



Teasel *Dipsacus fullorum* biennial

But what made them so successful?



Photo: Margo Bors

How about:

- Similar climate (temperate latitude).
- Bred for success (either consciously or through accidental selection in the course of agricultural, forestry, land management practices).
- But especially, they like disturbed ground.



Oxalis corniculatus
Herbaceous perennial

Weeds thrive in disturbed environments

- Humans and/or natural processes change native vegetation & disturb the soil
- But this creates opportunities for weeds
- Climate change as a disturbance



We love to disturb ground!

- lawns, tilled gardens, & landscape beds
- farm fields
- waste areas, railways & roadways
- natural areas (often disturbed by a mix of human and natural processes like floods, fire etc.)



Why do we (try) to manage weeds?

- Public safety
- Damage to the built environment
- Destructive to natural areas
- Poisonous
- Aesthetics
- Competition with desirable plants (crops or landscapes)



Japanese knotweed

Where do we manage weeds?

- Roadways and railways
- Pastures
- Farms & gardens
- Forests
- Parks
- "Natural" areas (sometimes)
- Commercial and industrial
- Others



What is plant succession?

Biological principle: Plant communities change over time.

Gardening is all about creating those communities and maintaining them for the aesthetic and functional benefits they provide.



How do weeds compete?

- Quick seed germination
- Aggressive leaf canopy
- Aggressive root growth
- Can adjust growth to less than perfect conditions
- Chemical warfare (allelopathy)



Weed competition

Whoever gets the sunlight wins!!



Weeds compete for...

Water
Nutrients
Light



Small seedlings are very vulnerable.

The most important time to weed is the 3-4 weeks after planting your vegetable seeds



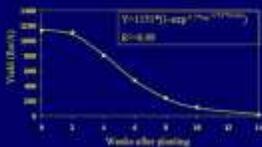
Weed/crop interaction

<u>Crop</u>	<u>Weedy</u>	<u>Weeded</u>
Carrots	27 #s	503 #s
Onions	4 #s	68 #s
Potatoes	53 #s	148 #s
Cabbage	129 #s	233 #s



Weed control timing is important

Critical Timing of Weed Removal



Weed dispersal by seeds and/or wandering roots/vegetative parts



Purple loosestrife:
2 million seeds/plant



Dandelion: 15,000 seeds
15 years



Purslane: 53,000 seeds
40 years



Red root pigweed:
118,000 seeds
10 years

Weed biology – seeds in soil

- Incredible number of seeds in some soils
- Some weed seeds live a very long time
- Seed decay/predation lowers seed counts
- Staggered germination
- Cultivation/rotation



Smartweed *Polygonum persicaria*
Summer annual

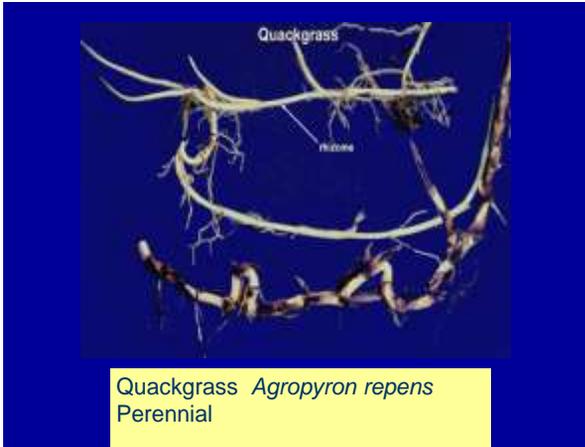
Weed biology – reproduction by cloning



Canada thistle
Cirsium arvense
Herbaceous
perennial



Quackgrass
Agropyron repens
Perennial



Weed biology – seed/plant dispersal

- Wind
- Animals/birds
- Water
- Vehicles
- Farm & other equipment
- People



Yellow flag iris



Herbaceous perennial



Weed biology – genetic plasticity



Reed canarygrass *Phalaris arundinacea*

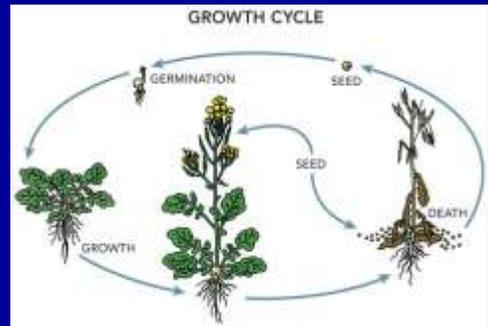
When you identify a weed, what is the most important thing you learn?



???

(*Oxalis corniculatus*)

Life cycle of the weed!!



Ok, what's so important about life cycles?



If you know a weed's name

- You know how it grows
- And how it reproduces
- And then maybe how to manage it

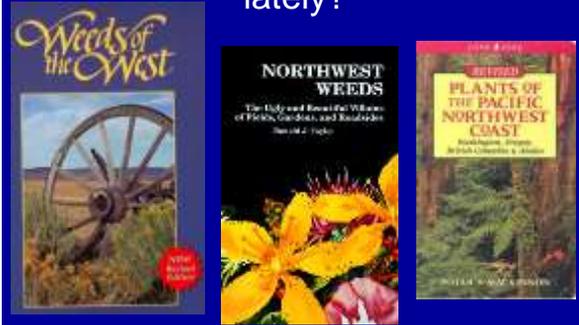


Oxalis corniculata
Herbaceous perennial

Weed Identification books I like

- *Northwest Weeds* – Ronald Taylor
- *Weeds of the West* – Extension consortium
- *Gilkey's Weeds of the Pacific Northwest* – Gilkey and Dennis
- *Plants of the Pacific Northwest Coast* – Pojar and Mackinnon

Read any good weed books lately?



How do you learn the names?

- Give your most irritating weeds nonsense or descriptive names that you will remember

(all learning starts with naming things and making distinctions between them)

- Hmm... I'll call it Aunt Betty



Closing the loop

Then when you take a class, talk to someone or look through a weed id book you will buy, you can say.....
Aha!! Aunt Betty = purslane. This technique really works!



Purslane - summer annual

Plant life cycles

- Annual
 - winter annuals, spring/summer annuals or the year-round annual types
- Biennial
- Perennial
 - woody
 - herbaceous (wandering or not)



Life cycle succession

- Plants (weeds) tend to group by life cycle unless an area has repeated disturbance
- Perennial landscapes and orchards tend to favor perennial weeds.
- Tilled landscapes tend to have annual weeds



Winter annuals

- Germinate in the fall/winter/spring and go to seed in the spring to early summer
- Some, in this climate, grow year round
- Slow germination, remove when young, and keep from seeding



Groundsel – *Senecio vulgaris*

More winter annuals



Red dead nettle – *Lamium purpureum*



Annual bluegrass- *Poa annua*

Another winter annual



Little bitter cress
Cardamine oligosperma

Still another winter annual



Common chickweed – *Stellaria media*

Not another...winter annual



Bedstraw- *Galium aparine* aka "velcro plant"



Shepard's purse *Capsella bursa-pastoris* Annual



Shepard's purse *Capsella bursa-pastoris* Annual



Brassica campestris
Field mustard
Winter/summer
annual



Dove foot geranium *Geranium molle*
Annual/biennial



Redstem filaree *Erodium cicutarium* Annual/Biennial

Summer annuals

- Germinate in the spring and summer
- Flower and seed by fall
- Compete with vegetable crops
- Slow germination, control to reduce competition and stop seeding.



Summer annuals



Red root pigweed – *Amaranthus retroflexus*

Summer annuals



Lambsquarters *Chenopodium album*

Summer annuals



Crab grass – *Digitaria sanguinalis*



Barnyard grass
Echinochloa crus-galli
Annual

More summer annuals



Dog fennel or Mayweed
Anthemis cotula
Smells wretched



Pineapple weed
Matricaria matricaroides
Smells nice



Black nightshade *Solanum nigrum* Annual



Black nightshade *Solanum nigrum* Annual

Summer annuals



Petty spurge
Euphorbia peplus
Dermal toxicity - wear gloves



Biennials

- Germinate in spring-fall
- Overwinter as a "rosette"
- Flower and seed next year in the late spring-summer and die



Bull thistle – *Cirsium vulgare*

Biennial rosette



Bull thistle
rosette in
winter

More biennials



Poison hemlock – *Conium maculatum*

More biennials



Wild carrot
Queen Anne's lace
Daucus carota

More biennials



Tansy ragwort – *Senecio jacobea*
with rosette above

Tansy ragwort

Senecio jacobea Biennial



Tansy ragwort

Senecio jacobea Biennial





St. John's Wort
Hypericum perforatum
Perennial

Often confused at bloom with Tansy ragwort. Note leaf shape and compare.



St. John's Wort
Hypericum perforatum
Perennial

An invasive biennial



Herb Robert -
Geranium robertianum
aka "Stinky Bob"



Herb Robert can be confused with our native bleeding heart

One more invasive biennial



Garlic mustard

Very competitive biennial that establishes in the understory of forests. It eliminates most of the native plants by crowding and chemical warfare

Annuals or biennials



Prickly lettuce
Lactuca serriola



Common mallow – *Malva neglecta*



Nipplewort
Lapsana communis
Annual/biennial



Lapsana communis
Nipplewort

Perennials

- Woody – more landscape level problems
- Herbaceous (aboveground leaves die back) – common in gardens and wild areas. Wandering or not.
- In between (not woody but leaves don't die) – example false dandelion
- These are often our worst weeds in terms of control in gardens and landscapes
- Have to control roots and seed production

Woody perennials

- Tend to spread by bird/animal moved seeds.
- Some vegetative spread e.g. ivy
- Control: physical removal (control sprouts), grazing, chemicals, bio-control.



Woody perennials – English ivy



Woody perennials



Old Man's Beard – *Clematis vitalba*



Woody perennials – gorse and Scotch broom



Scotch broom



Gorse (note thorns)

Woody perennials - blackberries



Armenian blackberry

Evergreen blackberry

More woody perennials



Bittersweet nightshade
(semi-woody)
Solanum dulcamara



Purple loosestrife
Lythrum salicaria

Herbaceous perennials

- Tops die back
- New shoots each spring from roots/crown
- Very difficult weeds
- Continuous shoot removal, smother, chemicals



Hedge bindweed *Calystegia sepium*
aka Morning glory



Field bindweed *Convolvulus arvensis*
Herbaceous perennial

More herbaceous perennials



Horsetail *Equisetum arvense* Buttercup *Ranunculus repens*

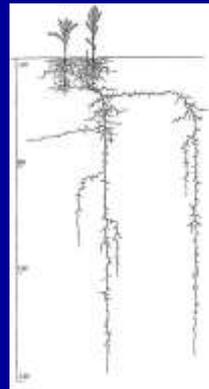


Canada thistle *Cirsium arvense* Perennial



Canada thistle
Cirsium arvense
Perennial

Canada thistle
Cirsium arvense
Perennial



More herbaceous perennials



False dandelion
(Spotted catsear)
Hyphchaeris radicata
Perennial



Common or True Dandelion
Taraxacum officinale Perennial



Nigella
Cichorium intybus Perennial



Broadleaf Dock
Rumex obtusifolius
Perennial



Red sorrel
Rumex acetosella
Perennial



Red sorrel
Red Sorrel
Rumex acetosella
Perennial



Narrow leaf plantain
Plantago lanceolata
Herbaceous Perennial



Broad leaf plantain
Plantago major
Herbaceous Perennial



Northern willow herb *Epilobium ciliatum*
Herbaceous perennial with rosette

What makes a plant invasive?

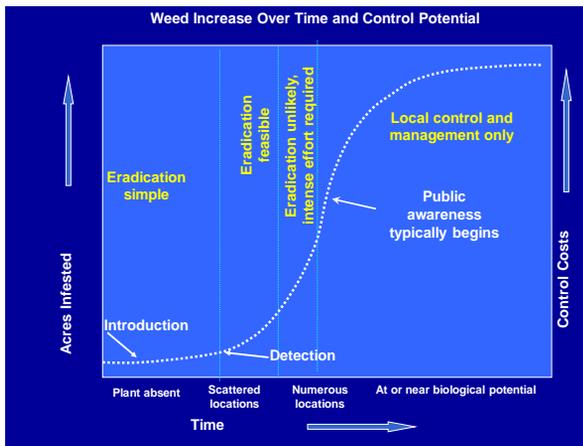


Key terms

Invasive: Can take over stable native landscapes, often not needing disturbance to get started.

Noxious: A more general term related to plants injurious to crops, livestock, wildlife habitat, etc. It is part of the threat classification system for weeds.

Vegetable garden weeds may be noxious but not generally invasive.



Herbaceous perennial invasive weeds

- Knotweed complex
- Giant hogweed
- Yellow archangel
- Lesser Celandine
- Italian arum
- Yellow flag iris
- Eurasian milfoil
- Parrot feather
- Bishop's weed
- Star of Bethlehem
- Chinese lantern
- Virginia jumpseed
- Knapweeds

Japanese knotweed complex: herbaceous perennials



Virginia jumpseed (*Persicaria virginiana* 'Painter's palette')

- In the knotweed family
- Not so aggressive
- Dig it up
- Spreads by root pieces
- Glyphosate?



Giant hogweed

- Plants top 12 feet
- High skin toxicity
- Spreads by seed and crown
- Usually found in clumps



Giant hogweed

- Reddish stem dots
- Dinner-plate sized umbels
- Manage by removing flowers and spraying the rest
- High on ODA's alert list



Yellow archangel

- Other names: aluminum or lead plant
- Invasive on forest floors
- Spreads with garden debris disposal
- Seeds and rooting runners



Yellow archangel

- Manual removal possible but difficult
- Some chemical options



Bishop's weed (*Aegopodium podagraria*)



- Both variegated and non-variegated forms
- Running stems and roots
- Easily spread
- Can invade forests, usually starting from landscape cleanup discards.
- Hard to control chemically

Knapweeds (*Centurea* sp.)

- Spotted, meadow, and diffuse knapweed most common here
- Spread easily by seed from trucks and cars
- Herbaceous perennials develop into big clumps



Lesser Celandine (*Ranunculus ficaria*)

- Buttercup family
- Bulblets
- Can tolerate shade
- Short growth and bloom cycle
- No controls work well except digging and sifting soil



Lesser Celandine (*Ranunculus ficaria*)





Italian arum

- Bulblets again
- No chemical treatment
- Slow spreader
- Very tenacious



The large view

- Prevention: Keep the plants out!
- Eradication: The plants are here but only a few of them. Complete elimination possible.
- Management: We lost. Now in damage reduction mode.

Prevention



Eradication: too late in the SE



Integrated weed management

- Mechanical weed control
- Cultural control techniques
- Biological weed management
- Chemical weed control options

Mechanical weed control options

- Hand pull
- Hoe
- Chain saw
- Tractor
- Rototiller
- Flaming (may not be mechanical)





Cultural control techniques

- A primary option for homeowners
- Collection of techniques that favor the plants you want versus their competitors
- Some techniques take planning ahead
- They include mulching, directed irrigation, competitive planting (inc. "right plant, right place"), transplants, solarization, etc. taken alone or in combination

Cultural control - mulching

- Suppresses seed germination
- Not useful on established herbaceous perennial weeds
- Adds organic matter over time
- Should be used a lot more often in the fall



Cultural control - solarization

- Cover a worked bed tightly with clear plastic in July
- Hope for 100 degree days
- Excellent on some weeds and weed seeds, poor on others
- Developed in Israel



Cultural control – competitive plantings

- Leave few bare spots
- Use plants like daylilies, hostas, and woody materials
- As the landscape matures, the weed problems decrease



Cultural control - transplants

Helps control space in the vegetable garden or the flower bed

Transplanting done into weed-free surface.



Cultural control – zoned irrigation

- Water where your desirable plants are and not the rest of the area
- Weed growth won't be completely eliminated (rain, residual soil moisture, etc.) but will be greatly reduced.
- Annuals most affected, perennials, least.
- Drip irrigation is the most common technique

Biological weed management

Animals have been used for years for weed management, mainly goats, sheep, and geese.



Biological weed management

- Natural predators (diseases and insects) are sometimes released to help manage specific weeds over large areas.
- These projects require lots of bio-secure testing before they are approved.
- They will not eliminate a weed population but will weaken it and lower its adverse potential



Cinnabar moth & larva introduced for tansy ragwort suppression



Chemical management

- Organic and conventional herbicides
- Herbicides represent (by quantity) by far the largest amount of pesticides sold to homeowners.
- Since they are so widely used, it is crucial to know how herbicides work, their strengths, and their complications

Important herbicide terms

- Selective versus non-selective
- Contact versus systemic
- Foliar or soil applied
- Pre-emergent versus post-emergent

Always, Always, Always...

- **Read and follow the label instructions!**

Phenoxy herbicides

- Used for broadleaf control ("Weed & Feed" and others)
- Systemic, foliar, and mostly post-emergent
- Won't damage established grass
- Some formulations volatile on hot days (>80 degrees). May move from application site and damage desirable plants.
- Common active ingredients: 2,4-D, mecoprop, mcpa, and dichloroprop

Dicamba

- Part of some lawn broadleaf control mixes
- Selective (won't generally damage grass)
- Mostly post-emergent but some residual soil activity.
- Much greater potential for root uptake from soils. If overused, tree roots in lawns may pick it up and show aboveground tree damage.

Triclopyr

- Sold alone or mixed with 2,4-D (Crossbow)
- Used for herbaceous and woody broadleaf weed management
- Must go through foliage
- Very good on many brush species
- Little impact on grasses
- The ester formulations can be volatile on hot days. Avoid use on these days.

Glyphosate

- Active ingredient in Roundup and many other similar products
- Non-selective and must go through green tissue (immature stems or leaves)
- No residual activity once it hits soil
- Timing for control depends on species, growth stage, and weather factors

Imazapyr

- Non-selective but with some limits
- Both foliar and root /shoot absorbed
- Somewhat persistent
- Generally found in homeowner products for "total vegetation control"

Dichlobenil (Casoron)

- Applied as a granule to weed-free areas.
- Only safe around woody plants – will damage grass, herbaceous broadleaves, bulbs, etc.
- Best used November through February just before a mild rain. Later applications should be covered with a mulch.
- Will control some tough herbaceous perennial weeds.
- Lasts a long time (no non-woody transplants for one year)

Trifluralin (Preen and others)

- Pre-emergent. Apply to weed-free soil.
- Won't generally damage established woody or herbaceous plants
- Best on germinating annual weeds, poor on perennial weeds.
- Read label carefully for specific plant comments. Transplant restrictions after application

Oryzalin

- Similar to trifluralin e.g. pre-emergent activity on annual grass and broadleaf weeds. Generally safe around established woody or herbaceous perennial plants.
- Not good on established perennial weeds.
- Restrictions on transplanting after application.

Sethoxydim and fluazifop

- Herbicides that affect established or seedling grasses but not broadleaf plants.
- Post-emergent use.
- Have slightly different profiles of which grasses they affect .
- "Grass-B-Gone" and other trade names

Plant oils

- Basis for a number of organic herbicides
- Contact herbicides that disrupt the waxy cuticle of plant leaves > dessication
- Non-selective
- Post-emergence
- Best on seedlings and annual weeds that are not yet flowering. Best applied on warm days.
- Coverage important.

Corn gluten meal

- Applied at the rate of 2 pounds/100 square feet and lightly worked in.
- Controls germinating seedlings of some plants annual broadleaf and grass species
- Soil surface should be allowed to dry somewhat after application
- Modestly effective

Vinegar

- What is sold for weed control is 20% acetic acid (store vinegar is 5%)
- Can damage eyes and skin
- Active on some plants, esp. seedlings
- Originally way oversold.
- How it sometimes works (or doesn't) is unclear.

Boiling water

- Effective on some seedlings and small established plants.
- Not too good on herbaceous perennials (they re-sprout like they do with other contact materials)
- Post-emergence
- Don't wear flip-flops when applying

Herbicide injury

- Generally unintended; sometimes malacious
- Symptoms vary with plants exposed and which products involved

Phenoxy type damage (2,4-D,
dicamba, and others



More phenoxy damage



Upward cupping of leaves on azalea.
Common symptom with dicamba
exposure.





Imazapyr



Bunched, compact growth on dogwood and sassafras

Glyphosate (Roundup et al)



Yellowing of new growth is common symptom of glyphosate exposure.



Split bark on apple from Roundup exposure.



Strapped leaves on maple due to Roundup.



Roundup drift from the previous fall may cause strapped leaves on peaches, apples and pears the next spring.



Stunted, compact growth due to glyphosate.



Other implications of herbicide use

- Weed shifts (actually a consequence of any weed control technique, chemical or not)
- Herbicide resistance – is it likely in the home garden world? Why or why not?
- Soil biology issues – in some cases, maybe
- Others?



Marestalk (horseweed) *Conyza canadensis* Summer annual

Be careful of some mixtures!

- Especially those that combine foliage absorbed materials with root absorbed materials. Read the label very carefully
- Example: glyphosate and imazapyr mix



In our soils, tree roots generally spread far beyond the drip line of the tree. This has implications for root absorbable herbicides. Problems after treating gravel driveways or lawns with tree roots under them.

How to manage specific situations without herbicides



Broad leaf weeds in lawns



Grass weeds in lawns



Weeds in vegetable gardens



Weeds in flower beds



Moss anywhere



Sprouting tree roots (including zombie trees)



Bamboo

