

## What is a Weed?

“A plant whose virtues have not yet been discovered”

◦ Ralph Waldo Emerson

## The Bottom Line

- ▶ Any “plant” can be a weed – it all depends entirely on a human’s opinion
- ▶ Some of these “plants” that humans call weeds are useful or desirable, others seem to have no real use

## WEEDS can have useful purposes

- ▶ Reduce wind and water erosion
- ▶ Provide food and habitat for wildlife
- ▶ Provides a source of labor for some
- ▶ Many minor uses
- ▶ Human food source
- ▶ Some are truly valuable or desirable plants--  
–it all depends on HUMANS



Mixing the floss from milkweed pods with down produces an extremely lightweight thermal filling. The milkweed plant also provides a habitat for monarch butterflies.



### common pokeweed

A poisonous plant, yet when prepared properly can be eaten like a green leafy vegetable similar to collard greens



### Devil's-claw

Highly competitive weed whose seed capsules are used in decorations. The seeds can be roasted and eaten much like sunflower seeds.

## Devil'-claw

- ▶ An African herb, has long been popular in Europe for relieving back pain.
- ▶ Researchers in Germany treated patients with Vioxx and devil's-claw extract for 6 weeks.
- ▶ 42% of the patients using devil's-claw claimed reduced pain. 33% of the patients using Vioxx made the same claim.

## Other uses

- ▶ Medicines
- ▶ Phytoremediation
- ▶ Ornamentals
- ▶ Minor foods
- ▶ Minor fibers
- ▶ Soil stabilization/erosion control

## Weed-Crop Interactions

Two major ways weeds cause losses

Directly- actually reduces the cash return of the crop; amount in field, amount harvested, and/or quality.

- i. Interference--the struggle of two or more plants for the same growth factor can cause direct losses: 3 types.
  - Competition - mutually adverse affects between plants.
  - Allelopathy - the exuding of naturally synthesized compounds by one plant which affects the growth of another plant (same or different species)
  - Parasitism - one plant is living on or in another.

## Weed-Crop Interactions

Two major ways weeds cause losses

Indirectly - impact on land owner or society, not directly impacting the crop

- Herbicide cost
- Environmental cost
- Mechanical cost
- Medical cost
- Allergies
- Harboring insects or diseases

## Weed-Crop Interactions

Review

- ▶ Competition--the struggle of two or more plants for the same growth factor
- ▶ Allelopathy--the exuding of naturally synthesized compounds by one plant which affects the growth of another plant (can be the same or different species)
- ▶ Interference--a term used to describe the effects of a community of plants on one another.

## Weed Interference

- ▶ The magnitude of the weed/crop relationship--weeds interfering with crops is affected by
  - plant species--both crop and weed
  - plant density--both crop and weed
  - duration of interference--how long and when is the weed present with the crop
  - in "the real world" it is plant species X plant density X duration of interference.

## Competition by Plant Species

- ▶ All plants are NOT created equal!
- ▶ Some weeds are poor competitors with some crops and some are strong competitors
- ▶ Some crops are poor competitors with some weeds and some are strong competitors

## Weeds For Example

- ▶ Carpetweed does not compete well with corn
- ▶ Seedling johnsongrass does not compete well with corn; however, rhizome johnsongrass is very competitive with corn
- ▶ In general, most vegetable crops are poor competitors and extensive efforts must be made to control weeds

## Crops For Example

- ▶ Corn and soybeans can be grown where they are very competitive with weeds
- ▶ Cotton is NOT a strong early season competitor, but later in the season it is rather competitive
- ▶ Wheat is moderately competitive

## Below-ground competition

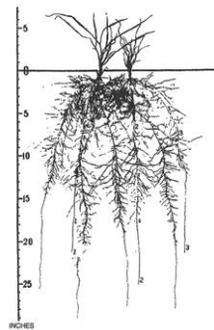


FIGURE 6.19 Root competition between *Rhizopus* wheat (left) and wild oats (marked 1,2,3). 22 days after emergence. (From *Ecology*, 1954.)

## General rule of competition

Competition is greatest when individuals are most similar

- ▶ Same demands on the habitat
- ▶ Same strategies for acquiring resources
- ▶ Same niche

Individuals with many differences are lesser competitors

## Niche Definition

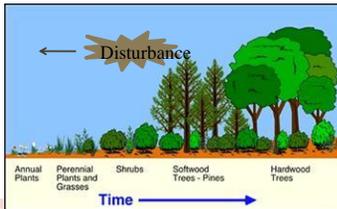
*Niche*: The functional position of an organism in its ecosystem.

Weeds exist because agriculture leaves niches open for them.

# Succession

(Review)

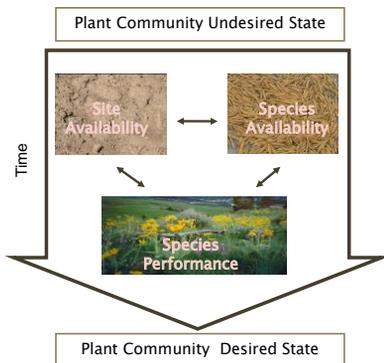
- ▶ Process whereby one plant community changes into another. It involves the immigration and extinction of species, coupled with changes in the relative abundance of different plants.



# Nature at Work

- ▶ Weeds or weedy plants are the first stage of natural succession where disturbances have occurred.
  - ▶ Humans are trying to push the processes of nature back.
  - ▶ The cultivation or tillage of land and the planting of spaced plants (crops) provides a "natural" habitat for weeds.
- ▶ There are 4 stages for OK farmland to return to prairie vegetation
  - ▶ Weeds (ragweed, pokeweed, etc. - 2 to 4 years)
  - ▶ Annual grasses (prairie three awn, etc. 9 to 13 years)
  - ▶ Perennial bunchgrasses (little bluestem - 15 to 30 years)
  - ▶ True prairie vegetation (maybe as long as 40 years)
- ▶ This same process has been documented to take 33 years in Kansas
- ▶ "Succession" – Natural Progression to Climax Community

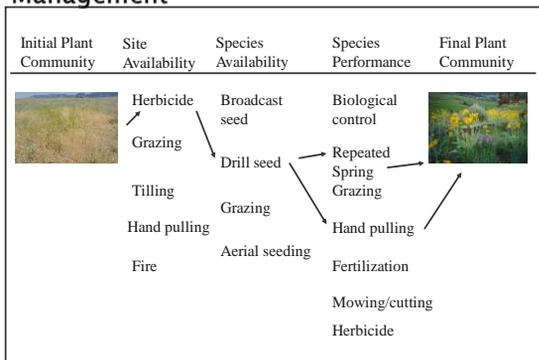
# Managing succession



# Age of Big Data: What about ecological data?

- ▶ Biological data collection is extremely important – it really does not become dated like some information.
- ▶ Data collected in the 1930's is still valid today.
- ▶ As climate change continues to be an issue we will watch to see if and how this statement changes.

# Ecological Framework Useful for Management



# Environment Definitions

*Environment:* The summation of all living (biotic) and non-living (abiotic) factors that can affect the development, growth, or distribution of plants.

*Macroenvironment:* The broad-scale regional environment that includes many aspects of soil and climate, such as overall light intensity, rainfall, humidity, wind, and temperature.

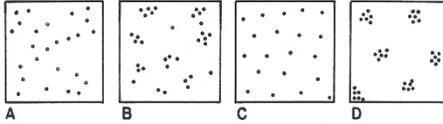
*Microenvironment:* That aspect of the macroenvironment that is influenced by the presence of objects (rocks, trees, etc.), chemicals (organic matter, nutrients), and topography.

Plants generally respond to the microenvironment to form a mosaic of vegetation over a local or regional landscape.

## Plant population dynamics:

### Distribution of plants through space:

- Across landscapes

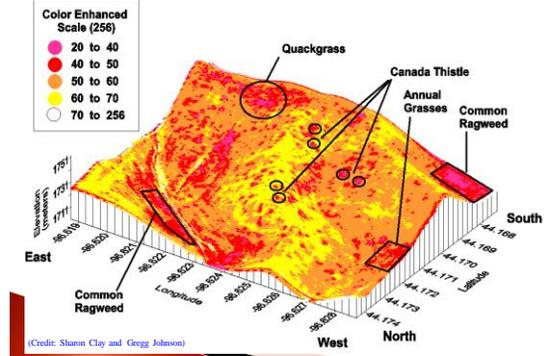


**FIGURE 2.3** Four ways in which individuals of a population can be distributed in horizontal space in a community. (a) Random dispersion (note its apparent irregularity). (b) Clumped or contagious distribution. (c) Regular or negatively contagious distribution. (d) Combinations of strong clumping of individuals into colonies, and regular distribution of the colonies. (Reprinted with permission of Macmillan Publishing Co., Inc. from *Communities and Ecosystems* by R.H. Whittaker. Copyright 1975 by Robert Whittaker.)

Uniform vs. patchy?



## Aerial image (spectral data) of a 160 A soybean field in South Dakota (early October; 1-m pixel resolution)



## Agroecosystem Types

Types of ecosystems:

**Row crops (tilled)**

high disturbance

annual crops

annual weeds dominate  
dominate

**Turf/pasture/forest**

low disturbance

perennial crops

perennial weeds



## Silverleaf Nightshade: Seedling to Perennial

| Time of clipping from emergence | Plants regrowing or resprouting |
|---------------------------------|---------------------------------|
| 10 days                         | 0%                              |
| 15 days                         | 14%                             |
| 20 days                         | 60%                             |
| 25 days                         | 51%                             |
| 30 days                         | 94%                             |
| 35 days                         | 96%                             |
| 40 days                         | 90%                             |
| 45 days                         | 99%                             |

## Control – Practical Considerations

When to control weeds?... Weed thresholds

Aesthetic thresholds

Economic thresholds

Economic threshold = the number of weeds per unit area which, if not controlled, would cause an economic loss greater than the cost of control.

## Action Threshold

- ▶ “Action Threshold”
  - Money lost > Weed control cost = spray (treat with something)
  - Money lost < Weed control cost = no spray (do not treat)
- ▶ Money lost = loss of yield due to weeds present × \$ per unit of yield.
  - to determine yield loss, must know how competitive a weed species is to a crop
- ▶ Weed control cost = cost of herbicide + application cost + scouting cost.

## PIGWEEED POPULATIONS

(a hypothetical situation)

- ▶ Year 1
  - 1 pigweed every 100 feet of row.
  - 145 pigweeds/acre
  - 100,000 seeds per plant = 14,500,000 seed
  - 333 pigweed seed per square foot

## PIGWEEED POPULATIONS

(a hypothetical situation)

- ▶ Year 2
  - 1% of seeds germinate and emerge (145,000 plants)
  - a herbicide controlled 99% of the pigweed.
  - 1,450 plants survived the herbicide treatment
  - these 1,450 plants produced 145,000,000 seed
  - 3,329 seeds per square foot.

## PIGWEEED POPULATIONS

(a hypothetical situation)

- ▶ Year 3
  - 1% of seed germinate and emerge--1,450,000 plants
  - treated with a herbicide and controlled 99%
  - left 14,500 plants (1 every 3 square feet)
  - treated with a second herbicide and again controlled 99% of remaining population
  - left 145 plants--the original number we started with.
  - 333 pigweed seed per square foot

## PIGWEEED SEED BANK

(a hypothetical situation)

- ▶ Year 1
  - 14,500,000 seed less the 1% which germinated
  - 14,355,000 seeds left in the soil
- ▶ Year 2
  - 14,355,000 from year one plus 14,355,000,000 seeds from the 145,000 uncontrolled plants during year 2.
- ▶ Year 3
  - we start off the year with 14,355,000 seeds from year 1 plus 14,355,000,000 from year 2 for a grand total of 14,369,355,000 pigweed seeds in the soil bank.

## Weed Seed Production

Seed production varies among species

- Barnyardgrass--->7,000/plant
- Wild Buckwheat---11,900/plant
- Curly Dock---29,500/plant
- Kochia---14,600/plant
- Yellow Nutsedge---2,420/plant
- Redroot Pigweed---117,400/plant (1,000,000?)
- Common Sunflower---7,000/plant

“one year’s  
seeding = 10  
years’ weeding”

## Want to “go back to nature”?

- ▶ Without modern agriculture and or technology (if we reverted back to a society of gatherers) the Earth would support a population of about 10,000,000 people.
- ▶ All of these advances in agriculture have not been solely a result of weed control. Crop cultivars, soil fertility practices, genetic engineering, and control technologies of other plant pests have improved.
- ▶ In 1731, one farmer could produce for 4 people
- ▶ In 1920, one farmer could produce for 8 people – a result of animal power.
- ▶ In 1947, one farmer could produce for 16 people – modern herbicide usage (just starting), fueled machinery, chemical fertilizers, etc.
- ▶ Now a farmer can produce enough for over 200 people

## Presence of Weeds

Directly associated with human explorations and colonization, but they are not the only non-native organism!

- How many of our crops are native to the U.S.A.?
- How many of our livestock are native to the U.S.A.?
- How many of our weeds are native to the U.S.A.?
- How many of you are native to the U.S.A.?

## Weed Dissemination (Spread of Weeds to US)

- Native – 39%
- Europe – 35%
- Eurasia – 13%
- Tropical America – 3%
- Asia – 2%
- Other – 8%
- Pretty much the order of “early” immigration

## 14 of the World’s most serious weeds

- smooth pigweed – North America (a)
- spiny amaranth – Tropical America (a)
- wild oat – Central Asia (a)
- common lambsquarters – Europe (a)
- field bindweed – Europe (p)
- bermudagrass – Tropical Africa (p)
- yellow & purple nutsedge – India (p)
- crabgrass – Europe (a)
- jungerice & barnyardgrass – India (a)
- goosegrass – China, India, Japan (a)
- common purslane – Europe (a)
- johnsongrass – Mediterranean (p)
- \*\*Should learn at least the names of 5 of these!!!!