Integrated Vegetation Management Strategies for Nonnative Invasive Plants

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Integrated Vegetation Management

- Integrates plant ecology and technology with preventive, cultural, biological, mechanical, and chemical methods to manage nonnative invasive plants in natural land areas.
- No one method is preferred.

Objectives of Invasive Plant Management

- Control/suppress nonnative plants
- Protect native plants
- Promote or establish self-sustaining ecosystems
- Maintain/improve water quality
- Prevent erosion
- Enhance biodiversity

The questions to ask first are:

- Length of commitment
  - Short or long
- Availability of funding
- Technical expertise
- What do we plant?
- Control usually can be achieved, but rehabilitation may be very difficult.

Well, what do we plant?

Things to consider:
- adaptability to the site
- seed/plant sources
- maintenance requirements
- pests?, common weeds?

MONEY

Environmental Considerations

- Maintain or improve water quality
- Prevent soil erosion
- Preserve, conserve and enhance biodiversity and integrity of desirable native plant sites including threatened or endangered species.
Control vs. Eradication

Control - Process of limiting a weed infestation to a desirable level.

Eradication - Elimination of all plants and plant parts.

IVM Strategy

- Identify plant, life cycle, habitat
- IVM methods
  1. Preventive
  2. Physical
  3. Cultural
  4. Biological
  5. Chemical

Preventive Methods

- Weed-free seed and plant material
- Screened and sterilized topsoil, soil amendments
- Keep all equipment clean

Physical Removal and Barriers

- Hoeing, pulling, etc.
  - Effective on annuals
  - Most expensive method
- Mulches and/or landscape fabrics

Mulches and Landscape Fabrics

- Fabric type affects the degree of weed suppression.
- Straw, wood chips, pine straw, and other organic materials prevent weed emergence.
- Practicality, expense.

Mowing

- Useful in grass-dominated plant communities
- Reduces seed production if done before flowering
- Repeat, repeat, repeat………..
The cultivation method can be extremely dangerous to workers, bystanders, wildlife, endangered plants. It is costly and indiscriminate.

**Cultivation**

**Advantages**: Controls most annual weeds quickly and easily

**Disadvantages**: Can be expensive, may increase erosion, prunes roots, practicality.

**Cultural Methods**

- Adapted, competitive native plants
- Spacing patterns
- Fertility and pH
- Burning (forget it)
- Water management
- Insect and disease control

**Cultural**

- Competitive, native plants
  - highly desired
  - plant succession force
  - naturally perpetuating wildflower meadow in Georgia are very rare
  - need research to identify species

**Biological Methods**

- Insects (thistle weevil)
- Pathogens - *Myrothecium verrucaria*
- Grazing animals (geese, goats)
- Fish (Sterile grass carp)
  - Highly desirable method
  - In need of much research

**Chemical Methods**

**Herbicide** - chemical that is used to control, suppress or kill nonnative, invasive plants (weeds).
Before Herbicide Use

- Identify weed.
- Use products labeled on site.
- Read and UNDERSTAND label.
- Follow directions carefully.
- Use only recommended amount.
- Maintain and calibrate equipment.

Herbicides

- Selective or non-selective products
- Application method can determine selectivity
- Can promote release of native plants through selective (physiological, or application) approaches
- Less costly than other VM methods
- Usually provides longer control

Herbicide Mode-of Action

**Mode-of-Action** - The entire sequence of events that happen from the time the herbicide is absorbed to the eventual plant response (usually death).

Or, The way a herbicide kills or inhibits the growth of susceptible plants.

Why understand herbicide MOA?

- Better understanding of how to use herbicides.
- Better understanding of how herbicides perform.
- Diagnosing herbicide injury.
- Professionalism.
- Public relations.

Herbicide Classification - Selectivity

- **Selective**
  - controls or suppresses one species of plant without seriously affecting the growth of another plant species.
- **Example**
  - Vantage will control Japanese stiltgrass without affecting the growth of non-grass plants.

Herbicide Classification - Selectivity

- **Nonselective**
  - Nonselective herbicides control plants regardless of species.
- **Examples**
  - Roundup Pro, Finale, Reward, Scythe
**Herbicide Movement**

**Phloem Mobile**
- Glyphosate
- 2,4-D
- Tordon
- Garlon
- Lontrel (Transline)

**Xylem Mobile**
- Velpar
- Atrazine
- Simazine
- Spike
- Hyvar

**P+Z Mobile**
- Oust
- Telar
- Escort
- Plateau
- Vanquish
- Arsenal

**Non-Mobile**
- Paraquat
- Finale
- Diquat

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**Modes of Action**

1. Amino acid and lipid synthesis inhibitors.
2. Growth regulators.
3. Photosynthesis inhibitors.
6. Pigment inhibitors.
7. Fatty acid synthesis inhibitors.

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**Amino Acid Synthesis Inhibitors**

- **Amino Acid Derivatives**
  - Glyphosate

- **Imidazolinones**
  - Arsenal
  - Plateau

- **Sulfonyleureas**
  - Escort
  - Oust
  - Telar

**Roundup on azalea**

**Yellowing of new growth**

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**Glyphosate**

- Sometimes causes stunted compact growth.

**Glyphosate**

- Strapped leaves on a maple due to glyphosate.
- Mimics 2,4-D and other hormone-like herbicides
**Sulfonylureas**
- Escort, Oust, Telar, Outrider
- rapid shoot and root absorption
- translocates to meristematic areas
- inhibits leucine, isoleucine and valine synthesis
- growth is impaired and plants die over 1 to 3 wk period

**Imidazolinones**
- Arsenal, Plateau
  - rapid shoot and root absorption
  - translocates to meristematic areas
  - inhibits leucine, isoleucine and valine synthesis
  - growth is impaired and plants die over 1 to 3 wk period

**Arsenal (imazapyr)**
- Causes bunched, compact growth.

**Growth Regulator Herbicides**
- Phenoxy
  - 2,4-D
  - dichlorprop
- Benzoics
  - Banvel
  - Vanquish
- Picolinic acids
  - Tordon
  - Garlon
  - Transline, Lontrel

**Phenoxy, Benzoic Acid, Picolinic Acid**
- readily absorbed by foliage, less so by roots
- extensively translocated
- interfere with DNA, RNA and protein synthesis
- results in uncontrolled cell division and elongation
- vascular tissues are plugged, 1 to 3 wks

**2,4-D - Japanese Maple**
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Herbicide Risks

- "Everything is Poison. There is nothing without poisonous properties. The dose differentiates a remedy from a poison."

Philippus Aureolus Theophrastus Bombastus von Hohenheim 1493-1541 Better known a Paracelsus

Risk Communication

- Risk / (Hazard, Exposure)

- Example:
  - Acetaminophen – Mouse LD50 = 338 mg/kg
  - 200 lb. mouse. Take 2 = no headache. Take 60 = death (50%)

- Reduce risk by reducing exposure!!

Facts

- 30 yrs added to lifespan in 20th century
- 8 yrs added since use of pesticides
- only 37% of land farmed in 1950 is cultivated today
  - Dennis Avery, Hudson Institute, Wall Street Journal, August 12, 1999
- deer, turkey, geese populations increasing in GA

Facts

- Cancer risks - smoking, sun bathing, fatty diets

- "After billions of dollars spent trying, not one pesticide-residue cancer victim has been found."
  - Dennis Avery, Hudson Institute, Wall Street Journal, August 12, 1999

Herbicide Concerns

- Last forever
- Contaminate water
- Affect human health
- Sterilize soil
- Use is not needed
- Kill all desirable organisms
- Degrade the environment

Herbicide Fate
Herbicide ½ Life

Amount of time it takes a herbicide to reach one-half (t1/2) of the originally applied concentration. Expressed in days, wks, months, yrs.

1.0 lb. Ai/acre  0.5 lb. Ai/acre

IVM program

1. Diagnose problem
2. Evaluate methods
3. Select methods
4. Initiate program
5. Evaluate effectiveness

Post Herbicides – Avg. t1/2

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Soil Persistence</th>
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<tbody>
<tr>
<td>2,4-D</td>
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<tr>
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