

# HERBICIDE BOOT CAMP DAY 3

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# Outline

- Herbicides
  - Mode of Action
  - Selective vs non-selective
  - Residual vs non-residual
  - Pre-emergent vs Post-emergent
- Most common herbicide choices for invasive plant control
- Application techniques
- Licensing, wetlands, permits, variances, etc.
- Weather impacts on herbicide selection



# IPM Control Strategies

- Cultural
- Manual or Mechanical
- Biological
- Genetic
- Chemical/herbicides

# CHEMICAL OR HERBICIDE CONTROL

**For an herbicide to be an effective, it must:**

- 1. Contact the plant surface**
- 2. Remain on the plant surface long enough to be absorbed**
- 3. Reach a cellular site and disrupt a life supporting process or structure**
- 4. Degrade into non-toxic metabolites**

# Herbicide Modes of Action

- **Selective or non-selective**
- **Residual or non-residual**
- **Foliar absorbed**
- **Root absorbed**
- **Or both**
- **Contact or systemic**



# Application Methods

- **Ground – Skidder, Tractor, ATV**
- **Backpack Foliar - Mist blower, Manual pump**
- **Backpack - Basal Bark**
- **Stump Treatments**
- **Tree or Plant Injection**

# Individual Plant Treatment for Woody Plant Control

Month of Application

**Application Method**

JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

Foliar

after full leaf-out in the spring through summer until 10% leaf coloration

Cut Surface

avoid application during spring sap flow and when it is cold enough for spray mixture to freeze

Low Volume Basal

year 'round except on wet stems



# Herbicide Effectiveness

- Herbicides are most effective on a healthy growing plant.
- Damage, drought, pruning, browsing can all lead to poor efficacy.
- When possible, use foliar or basal bark applications to control plants (they take advantage of the entire functioning plant).

# Invasive Plant Control

- **Early Detection Rapid Response**
- From an IPM standpoint less herbicide is used in early detection treatments .
- Heavy infestations require more active ingredient and multiple “broadcast” herbicide treatments.
- Then we may still only **be** suppressing or reducing their spread.
- Treatments become non-selective and we lose or damage the native plants in the herbicide application.
- Promote native plant communities (Cultural Control strategy of IPM) to fight the spread of invasives.
- Selective herbicides or spot treatments to protect native plants.
- Herbicides are not the “silver bullet” remedy

## COMMON HERBICIDES

Herbicide		Mode of entry	Primary mode of action	
Chemical name	Product name		Type	Mechanism
Glyphosate	Rodeo Roundup	Foliage	Systemic	Amino acid synthesis
Imazapyr	Arsenal, Stalker	Foliage & soil	Systemic	Amino acid synthesis
Sulfometuron	Oust	Foliage & soil	Systemic	Amino acid synthesis
Triclopyr	Garlon 4, Garlon 3a	Foliage	Systemic	Growth regulator
Fosamine	Krenite	Foliar-Contact	Contact	Bud Inhibitor
2, 4-D	Weedone, Esteron	Foliage & soil	Systemic	Growth regulator
Metsulfuron	Escort	Foliage & soil	Systemic	Amino acid synthesis
Aminopyralid	Milestone	Foliage & soil	Systemic	Growth regulator
Imazapic	Plateau	Foliage & Soil	Systemic	Amino acid synthesis



# Growth Regulators Versus Amino Acid Inhibitors

- Growth regulators work very well early in the growing season when plants are actively growing, and cell division is occurring.
  - Garlon or triclopyr, 2,4-D.
- Growth regulators are also selective.
  - They control broadleaf plants but not monocots (grasses and sedges).
- Amino acid inhibitors work well later in the year as plants begin to store sugars in the roots.
  - Glyphosate and imazapyr

# Residual or Pre-emergent

- An herbicide needs to have soil residual characteristics to work as a pre-emergent or long term to control germination and future sprouting of invasive plants.
- An applicator needs to understand what types of “other” plants that herbicide can control before using a residual or pre-emergent product.
- Residual can be good, but also bad, if we want to be selective in our approach and maintain native plants to occupy the site (IPM cultural).

# Common Herbicides Used for Invasive Plant Management

- **RODEO, ROUNDUP** (Glyphosate)
- **GARLON 4 , GARLON 3A, VASTLAN** (Triclopyr)
- **PATHFINDER II** (Triclopyr and basal oil)
- **ARSENAL, POLARIS**(Imazapyr)



# RODEO-ROUNDUP

- *Glyphosate*, 40 or 54% active per gallon
- Glyphosate is a Non-selective herbicide
- Rodeo is aquatically labeled
- Amino acid inhibitor, results in the depletion of 3 essential amino acids in the plant
- Glyphosate works better later in the season as plants begin to produce sugars to store in the roots.
- Foliar active only
- Locks up tightly with soil molecules
- No soil residual activity

# GARLON 4 Ultra

- *Triclopyr*
- Selective herbicide, no grass control
- Typical auxin type plant response
- Ester formulation can result in volatility, or offsite movement.
- Absorbed mostly through the leaves, but can be absorbed through bark, stem and roots.
- Creates an EC with oil (20% Garlon 4, 80% Bark oil) for basal bark and cut stump.
- Oil carries the triclopyr through the bark into the cambium.
- Foliar applications work better early in the season before woody plants begin to shut down.

# GARLON 3A, VASTLAN

- *Triclopyr*
- 3-4 lbs active per gallon
- Aquatically labeled
- Amine formulation, no volatility!
- Need to add the surfactant to the mix for foliar applications



# PATHFINDER II

- *Triclopyr 14% and basal oil 86% mix*
- Ready to use product for basal bark and cut stump applications
- Best basal control on stems less than 6" in diameter.
- Year –round application unless snow prevents treatment to the ground.
- Triclopyr is transported through the bark with the bark oil.

# IMAZAPYR (Arsenal, Polaris)

- Amino acid inhibitor like glyphosate..
- Works on 2 different amino acids than glyphosate.
- Often used in combination with glyphosate
- Both foliar and residual!
- Meristematic growth inhibitor
- Great for use on:
  - Woody and herbaceous plants
- Can cause injury and death in oaks and ash through root uptake in understory treatments.
- Can even cause "soil flashing" if applied in basal or cut stump treatments.

# Application Basics – (Low Volume Foliar)

- Spray herbicide directly onto foliage of individual plants.
- Use spray pressures and techniques that minimize spray drift.
- Get good coverage on the growing tips and terminal leader.
- If you cannot reach the top, it may require cutting and treating the stump or the following year's sprouts.
- Spray front and back sides of the target clump to ensure adequate coverage.
- Apply the herbicide solution at a volume that wets the crown but minimizes runoff.





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# **Cut Stump Applications Using Water Based Herbicides :**

## **Garlon 3A, Vastlan, Glyphosate**

Treat the stump as soon as possible after cutting. If more than one hour has elapsed since the time of cutting, you will need to use one of the oil-based products. Treat only the exposed cambium area next to the bark and around the entire circumference of the tree.  
Rates: 50/50 herbicide and water.



# **Cut Stump Techniques for Oil-based Herbicides :**

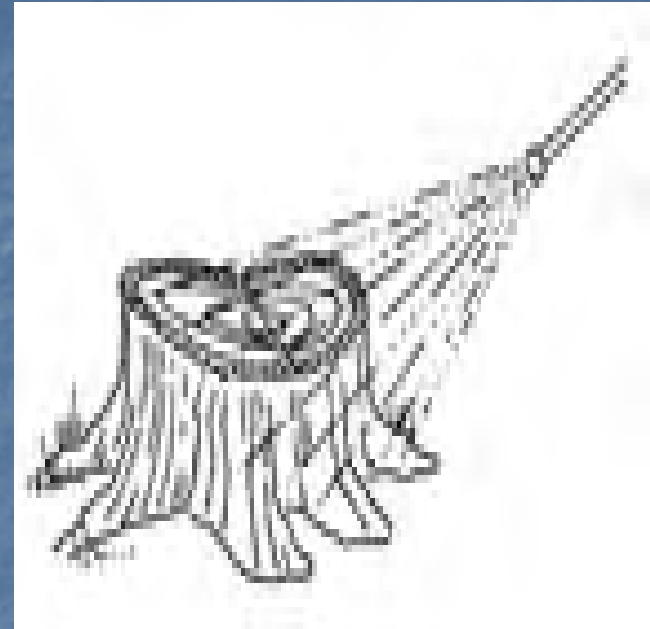
**Garlon 4 and oil (20%/80%), Pathfinder II (RTU)**

Anytime after cutting, including winter months. Do not make applications when snow or water prevent spraying to ground level. Treat the exposed cambium area and the root collar (exposed bark on the side of the stump) down to the soil line. Be sure to treat the entire circumference of the tree. To ensure effective control on large trees, also treat any exposed roots that surround the stump.





**Cut Stump Treatment with  
Rodeo or Garlon 3A**



**Cut Stump Treatment with  
Garlon 4 and oil**

# Basal Bark

- Garlon 4 Ultra and Oil (20%/80%) or Pathfinder II (RTU)
- Individual plant treatment.
- Great option for smooth barked plants like Autumn olive
- Another option for large bittersweet vines. No need to cut the vine then treat the surface.
- Be careful of adjacent desirable plant stems or roots!







# **Some Unique Control Strategies With Herbicides**











# Selectivity with a non-selective herbicide



in combination with glyphosate



# Timing

- Invasive plants often leaf out earlier than native plants
- They also can hold on to their leaves longer.
- This trait can allow for foliar applications of non-selective herbicides to protect native plants.





April 13<sup>th</sup> low volume foliar w/ Garlon 3A

4 weeks after treatment











**Glossy Buckthorn Treated with 5% Accord XRT 2<sup>nd</sup> week of October 2009  
7 MAT**







Common Buckthorn Treated Nov 14, 2010, and 8 Months After Treatment



# Honeysuckle Control

- Foliar control with triclopyr alone is not as effective as glyphosate in the late summer to fall.
- Glyphosate on honeysuckle, even when the leaves begin to turn yellow, is very effective.
- If triclopyr is used, add another product to the mix (Escort, imazapyr, Milestone).

# Barberry

- Usually easy to control with Glyphosate or Garlon.
- Early bud break species, use Garlon to control in spring.
- Glyphosate later in season to fall.



# Knotweed Control

- If possible, a combination of glyphosate, imazapyr and Escort will work well.
- 8-10%, 1/4%, 4 oz per 100 gals respectively
- Need to be careful on root zone applications with imazapyr
- I have used the Milestone or triclopyr in early season applications and followed up with glyphosate later.

# APPLICATION AROUND WETLANDS

- Can apply up to edge of wetlands as long as it is not a broadcast application.
- Cut stump or basal stem treatments are “not” broadcast treatments.
- Must stay 25 feet away from water for broadcast application.
- Key factor is whether or not pesticide will be directly applied to water, and what the label allows.
- Would advise against application to areas that one knows will result in getting pesticides in the water.
- Discuss these situations, especially with the Board of Pesticides Control before making applications.



# APPLICATION AROUND WETLANDS

- Many invasive plants Loosestrife, Phragmites, Knotweed, and Glossy Buckthorn can grow in and around wetlands.
- The herbicide label specifies whether one can apply in a wetland or how close the application can be made to a wetland.
- State regulations may be stricter than a federal label.
- To apply to a wetland area, an applicator needs to be certified in aquatics.

# APPLICATION AROUND WETLANDS

- If broadcast herbicide applications are required within 25 feet of a wetland, consult the Maine Board of Pesticides Control.
- A variance may be required prior to application.
- An application to a wetland, or an area with standing water most likely will require a permit from the Maine DEP.
- Both organizations are very good to work with “proactively”.
- Make sure your site plan indicates the need to determine whether a permit and applicator with the appropriate licensing may is required before any applications are made.



# Do you need a commercial or private applicator license?

## You need a commercial license when making applications:

- on property you or your employer do not own or lease
- for compensation or under contract
- on property open to use by the public
- as a government employee

## You need a private license when making applications:

- on property you or your employer own or lease
- to produce an agricultural commodity as defined in [Title 22 Section 1471-C\(1\)](#)
- when making aerial applications to an agricultural commodity on property you or your employer own or lease

*Slide borrowed from Megan Patterson,  
Maine BPC*

# Applicator certification/licensing requirements

## Commercial licenses

- Exams
  - Core, Forestry, Aerial, Regulations, and Oral Master's
- Minimum passing score
  - 80\*
- Licensing fee
  - \$105 for a three-year license
- Recertification requirements
  - 9 credit hours form master
  - 6 credit hours for operator
- Spray contracting firm?

## Private licenses

- Exams
  - Core, Forestry, Aerial
- Minimum passing score
  - 80
- License fee
  - \$15 for a three-year license
- Recertification requirements
  - 6 credit hours every three years

*Slide borrowed from Megan Patterson,  
Maine BPC*



# Herbicide Application By Unlicensed Individuals

- Landowners can apply “general use” pesticides on their own property.
- Unless the property is open to the public or government property.
- General Use means Not Restricted Use (Federal or State).
- State of Maine restricts aquatically labeled products.
- Glyphosate (non-aquatic), Garlon 4 Ultra, Pathfinder II are General Use

# Aquatic Use Labels for Common Brush Control Herbicides

- **Rodeo**– Has had the aquatic use labeling for several years. Glyphosate products with surfactant are not aquatic labeled.
- **Arsenal Applicator Concentrate and Polaris (Imazapyr)** – Several of the 4 lb and 2 lb active imazapyrs have aquatic uses on the label now.
- **Triclopyr** – Corteva's Garlon 3A and Vastlan both have aquatic uses.
- All are Restricted Use under Maine's Pesticide Regulations.



# Weather Effects on Herbicide Applications

## Weather

- Precipitation
- Wind  
(speed & direction)
- Temperature
- Humidity

# Rain or Heavy Dew

- Herbicides need to be applied to surfaces to be absorbed into plant or watered into the soil.
- Applications before heavy rains can prevent this from occurring.
  - Wasted application (\$)
  - Pesticide washes off to another area?
  - May have to retreat.
- Spraying in heavy dew.
  - If the leaf is saturated with heavy dew, the added droplet and surfactant can cause the leaf to expel the water and in effect lose the active ingredient.
  - One should know how much dew is present prior to application to minimize active ingredient loss.



# Precipitation – Rainfastness

- Rainfastness is a common term we use for pesticide applications.
- Applicators should select pesticides with rainfastness traits necessary for the weather projections at the time of application.
- For instance, Triclopyr can pass through the leaf cuticle usually within 30 minutes, while Glyphosate takes almost 2 hours or more to fully penetrate the leaf.
- Adjuvants called stickers can help “stick” the active ingredient to the surface once the droplet has dried to prevent wash off after application.
- Selection of a pesticide with good rainfastness characteristics is an important factor when rain is predicted.

# Wind

- Wind has both SPEED and DIRECTION which can affect your pesticide application.
- If you are applying a pesticide in the form of a spray droplet, wind speed and direction are “extremely” important factors one should be aware of prior to pulling the trigger!
- Wind can carry your spray droplet away from your intended target and deposit it offsite.
- This event is defined as “Drift”



# Spray Drift

Spray drift occurs when pesticides move onto non-targeted areas during application. This can cause damage to desirable vegetation, and lead to unwanted environmental, financial, or public relation consequences.

# Temperature and Humidity

- Temperature and Humidity can affect the evaporation of your spray droplets.
- If evaporation happens before it reaches your intended target-
  - You can lose efficacy
  - It may result in an off-site movement of the active ingredient as a vapor particle.
  - **Volatility!**
- Once temperatures exceed 85 degrees and humidity is low (below 50), evaporation of small droplets can be quick and troublesome.



# Temperature Inversions

During a temperature inversion:

- A layer of warmer air may develop above a cooler layer
- This can happen at any altitude and can be a thick or thin layer.
- Temperature inversions can hold spray particles aloft for several minutes to hours, allowing for long distance movement away from the intended target
- Usually, inversion conditions occur late evening and into the morning when the winds are calm



# Temperature Inversions

- Decrease the dispersion of droplets that are too small to quickly settle out.
- Result in a higher air concentration of these small droplets.
- Increase the potential for off-target effects.
- Increase the distance at which off-target effects can be observed.
- Increase the size of the area affected.
- Cause the direction of any drift to be unpredictable
- The State of Maine regulations specifically state that applications are made when winds exceed 2 mph.
- The purpose of this regulation is to eliminate the possibility of applying during an inversion



# Summary

- Monitor the uncontrollable factors (rain, wind, temperature, etc)
- Use of proper equipment and chemistry
- Select the appropriate pesticide formulation
- Larger droplets are good
- Minimize nozzle pressure
- Shorten the distance from nozzle to target
- Use drift control agents and buffers if necessary
- Determine any sensitive areas prior to treatment
- If weather conditions do not favor your equipment, pesticide formulation, and site, do not make the application!
- Move to a more favorable location or wait for another day.

**Questions?**