Invasive Species
Threats, Identification, and Control

FoHVOS New Jersey Invasive Species **Strike Team**

Presented by Michael Van Clef, Ph.D.,
Strike Team Program Director

FoHVOS New Jersey Invasive Species Strike Team

Our Mission

We work to **protect natural lands**, with their full abundance and diversity of native plants and animals, from future damage **through coordinated strategic invasive species management**. Active mapping, data analysis, engaging in community outreach and training, and practicing early detection and rapid response (ED/RR) to new threats; we are the **only entity solely dedicated** to protecting rare species and special places from invasive species throughout New Jersey.

STEWARDSHIP = *Mitigation of human impacts on natural systems*

Our Methods

Mapping, Data Analysis & Reporting: *Gather / synthesize data and update comprehensive statewide database* made available to all, free of charge.

Outreach: *Publicizing* threats posed by invasive species and value of native plant gardening through public programs, tabling events, and plant buy-backs.

Training: *Regularly working in the community,* providing workshops to professionals and the public covering information about invasive species threats, control techniques and fostering local Strike Teams to amplify our efforts.

Search & Eradicate: *Early Detection and Rapid Response* is key to the success of preventing future damage from invasive species. As resources allow, infestations are either eradicated or controlled through a strategic plan.

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FoHVOS Strike Team Staff

- Lisa Wolff, *FoHVOS Executive Director*
- Mike Van Clef, *Stewardship Director & Strike Team Program Director*
- Catherine Atwood, Land Steward
- Dana Christensen, *Land Steward*
- Beth Craighead, *Senior Land Steward*
- Brian Kubin, *Land Steward*
- Leslie Kuchinski, *Operations Manager*
- Sebastian Vargas, *Program Support*

Steering Committee

- Emile DeVito, *New Jersey Conservation Foundation*
- Ken Klipstein, *New Jersey Water Supply Authority*
- Kristi MacDonald, *Raritan Headwaters Association*
- Kristen Meistrell, *New Jersey Audubon*

Technical Advisory Committee

- Thom Almendinger, *Duke Farms*
- Michele Bakacs, *Rutgers Cooperative Extension*
- Kerry Barringer, *Flora of North America Association*
- Heather Corbett, NJ Bureau of Marine Fisheries
- Chris Doyle, *Limnologist*
- Art Gover, *Penn State Wildland Weed Management (retired)*
- Rachel Mackow, *Wild Ridge Plants*
- Emily Mayer, Raritan Headwaters Association
- Christopher Smith, *NJ Division of Fish & Wildlife*
- Robert Somes, *NJ Division of Fish & Wildlife*
- Carole Stanko, *NJ Division of Fish & Wildlife*
- Rosa Yoo, *NJ Forest Service*

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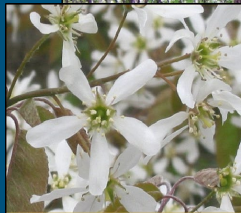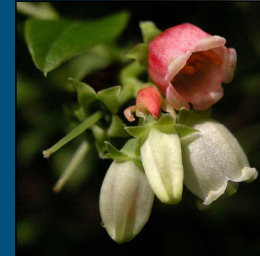
Why do we care?
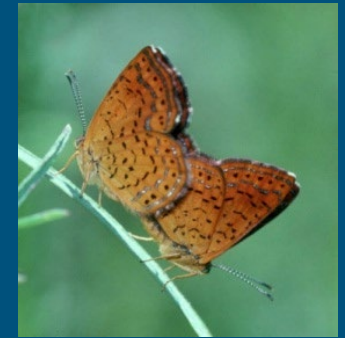

SO MANY GOOD THINGS

New Jersey's Flora
2,000 native species & 1,000 non-native species

New Jersey's Fauna

62 Land Mammals

28 Marine Mammals

44 Reptiles

35 Amphibians

85 Freshwater Fish

336 Marine Fish

180 Dragonflies and Damselflies

151 Butterflies

480 Birds

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The Goal

HEALTHY FORESTS!

Complete vertical structure
Advance regeneration
Species diversity

Diverse herb layer, tree and shrub
seedlings, mature shrubs,
tree saplings,
sub-canopy trees, canopy trees
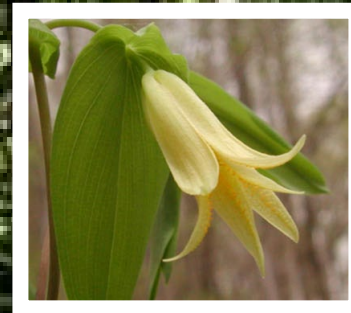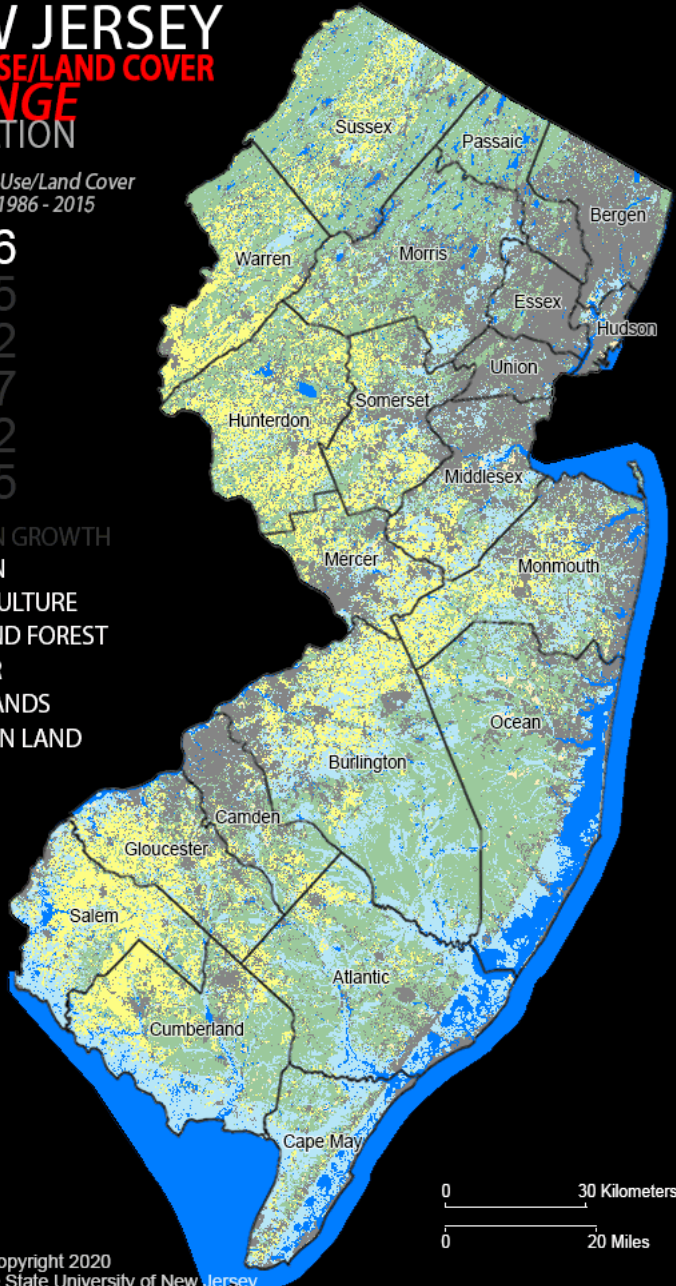
New Jersey Land Use

Broad Land Cover Classes

- 30% developed
- 15% agricultural
- 55% natural cover
  (40% forested)

Protected Lands

- Open Space 21%
- Preserved Farmland 2.5%

Q: How much is unprotected and undeveloped?

A: 2 million acres

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The Mess We've Made…

- Habitat Destruction
- Overabundant Deer
- Invasive Species
- Agricultural Soil Modifications

- Altered Fire Regimes
- Altered Stream Flows
- Habitat Fragmentation
- Global Climate Change

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The Numbers

10,000+
non-native plant introductions

1,000
established non-native plants

50
widespread invasive plants

99
emerging invasive plants

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An Invasive Plant…

1. Introduced to an area outside of its natural range
2. Grows densely and excludes other species
3. Drastically reduces biodiversity at all levels
4. Interrupts the natural functions of an ecosystem

Pictured: Garlic Mustard Infestation

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Attributes of Invasive Plants

- *DEER DON'T EAT THEM*
- Tolerant of wider variety of soil types
- Tolerant of wider variety of light levels
- Mature quickly and produce lots of seeds

Winged Burning Bush

Garlic Mustard

Japanese Barberry

Why are invasives bad?
A broken web…

Species	January	February	March	April	May	June	July	August	September	October	November	December
Autumn Olive					Flowers				Fruit	Fruit		
Gray Dogwood					Flowers	Flowers			Fruit			
Arrowwood						Flowers			Fruit			
Red Chokeberry					Flowers				Fruit	Fruit		
American Hazelnut				Flowers					Fruit			
Blackhaw Viburnum					Flowers			Fruit	Fruit			
Bayberry					Flowers				Fruit	Fruit	Fruit	
Virginia Rose	Fruit	Fruit	Fruit			Flowers	Flowers			Fruit	Fruit	Fruit
Winterberry	Fruit	Fruit	Fruit		Flowers					Fruit	Fruit	Fruit
Wild Black Cherry					Flowers		Fruit					
Flowering Dogwood				Flowers	Flowers				Fruit	Fruit		
Foxglove Beardtongue	Seeds	Seeds	Seeds			Flowers			Seeds	Seeds	Seeds	Seeds
Black-eyed Susan	Seeds	Seeds	Seeds			Flowers	Flowers	Flowers	Flowers	Seeds	Seeds	Seeds
Goldenrods	Seeds	Seeds	Seeds						Flowers	Flowers	Seeds	Seeds
Asters	Seeds	Seeds	Seeds						Flowers	Flowers	Seeds	Seeds
Common Milkweed						Flowers	Flowers	Seeds	Seeds	Seeds	Seeds	Seeds

Invasive plants ≠ insect food ≠ bird food

The timing isn't a coincidence…
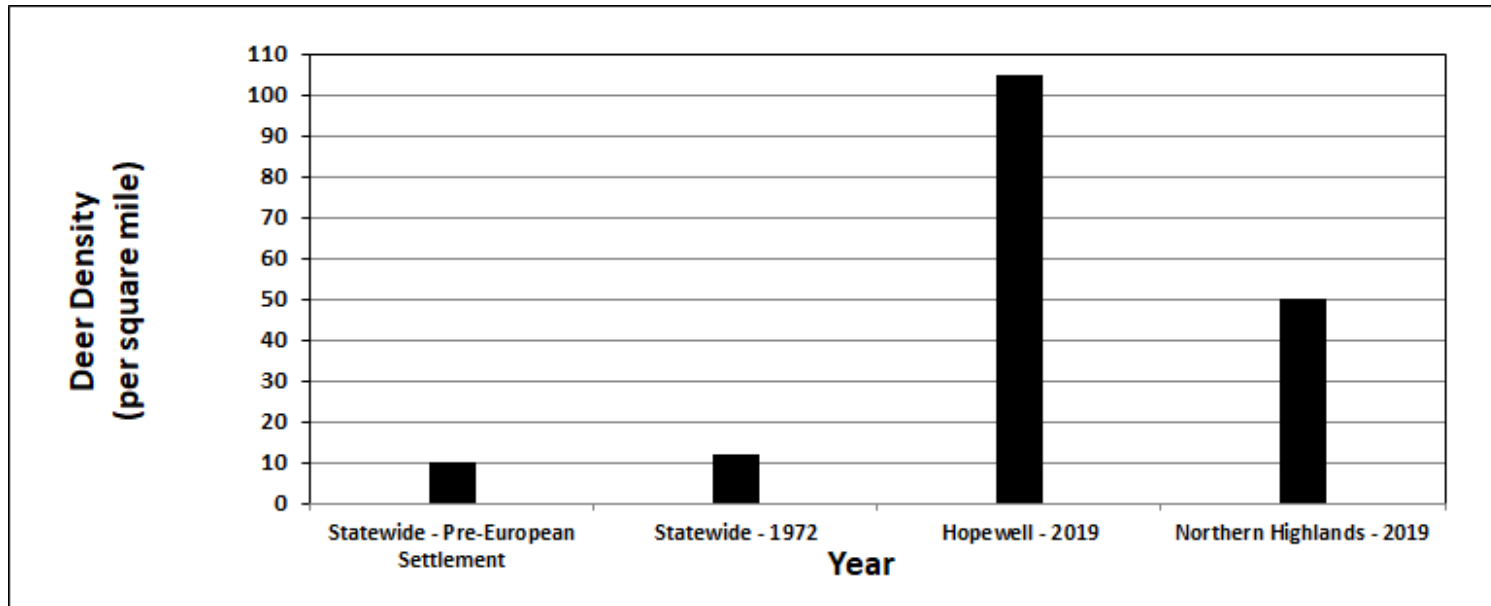
- Invasive Plant History
  - Prior to 1950's: Few species, Japanese Honeysuckle only notable invader. Others included Tree-of-Heaven and Multiflora Rose
  - Beginning in 1980's: Growing populations, expansive Japanese Stiltgrass and Japanese Barberry infestations
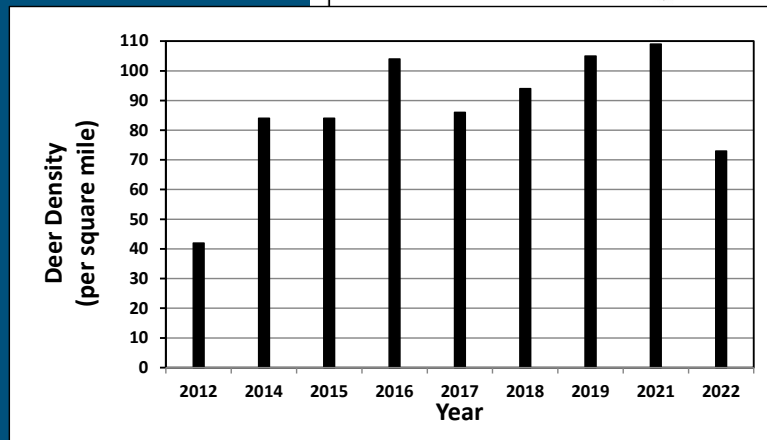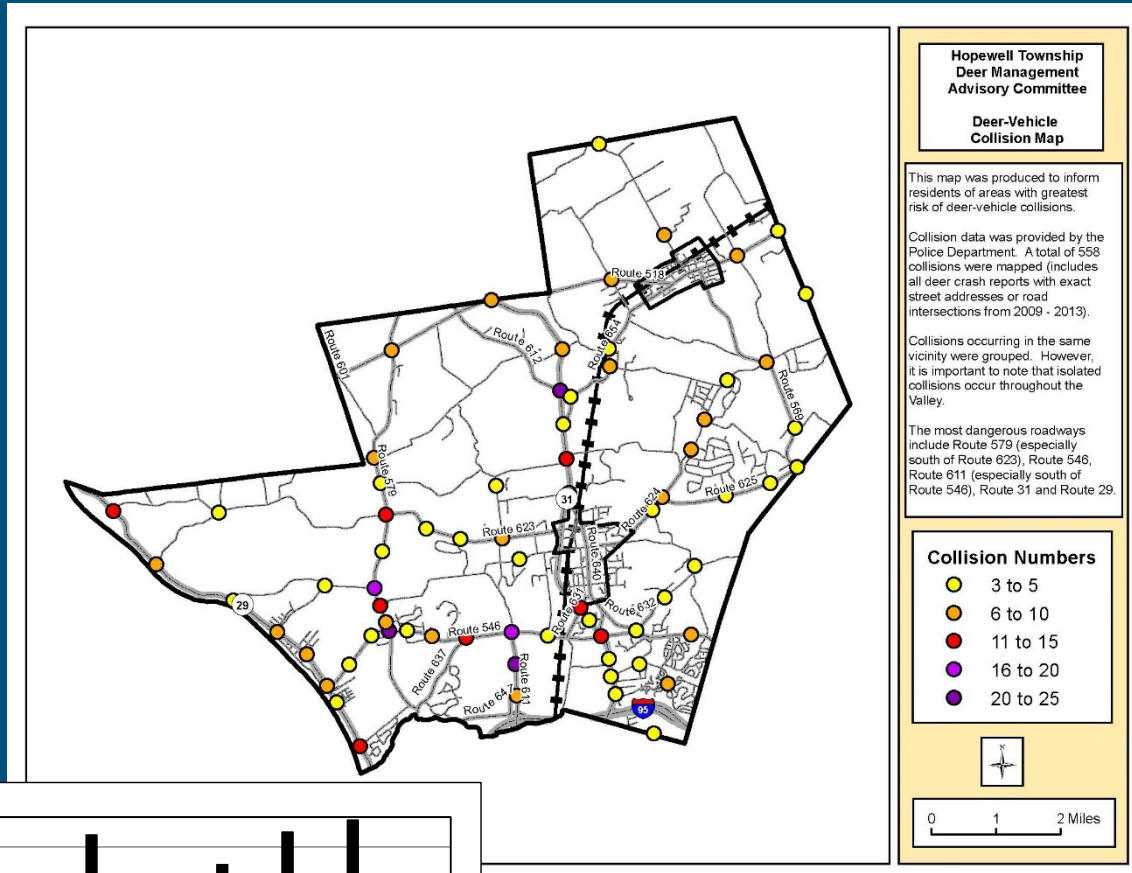 - Currently: Many widespread species and growing list of emerging species

OVERABUNDANT DEER

STEWARDSHIP =
Mitigation of human
impacts on natural systems

Deer Population Estimate Results

- Published literature suggests that <u>10 deer per square mile</u> is associated with low rates of Lyme disease, deer-vehicle collisions and healthy forests.

- Historic estimates also report <u>10 deer per square mile</u>

Hopewell Township Deer Management Advisory Committee

Deer-Vehicle Collision Map

This map was produced to inform residents of areas with greatest risk of deer-vehicle collisions.

Collision data was provided by the Police Department. A total of 558 collisions were mapped (includes all deer crash reports with exact street addresses or road intersections from 2009 - 2013).

Collisions occurring in the same vicinity were grouped. However, it is important to note that isolated collisions occur throughout the Valley.

The most dangerous roadways include Route 579 (especially south of Route 623), Route 546, Route 611 (especially south of Route 546), Route 31 and Route 29.

Collision Numbers
- 3 to 5
- 6 to 10
- 11 to 15
- 16 to 20
- 20 to 25

Deer Management Slides

The Root of the Problem: Deer Overabundance

Excellent deer Habitat

+

Insufficient deer management

=

Health, Economic, and Ecological Damage

Forest fragmentation produces excellent deer forage along with supplemental feeding from agriculture and suburbia

Lack of hunting access and focus on "trophy" bucks. Herd reduction requires a shift in focus to does.

Lyme Disease
Deer-Vehicle Collisions
Agricultural Losses
Landscape Planting Losses
Degraded Forests
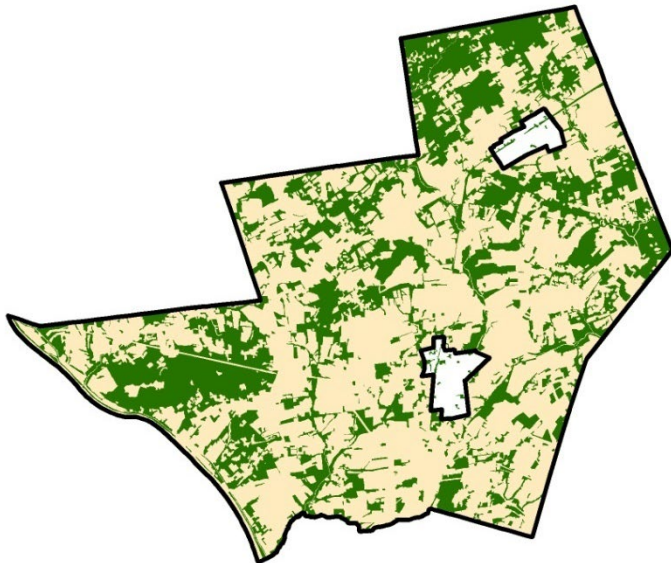
Forest Fragmentation in Hopewell Valley

While still containing over 15,000 acres of forest habitat (shown in green), forest edges, fields and suburban landscapes are numerous and serve as more productive deer habitat than forest interiors.

How do you lose a forest? One gap at a time…

Large gaps in the forest canopy should result in lush growth of new trees and shrubs, but...

…excessive deer browse encourages growth of less palatable invasive species such as Wineberry and Japanese Stiltgrass.

Where do we go from here?

These very small seedlings of
tulip poplar and spice bush
WILL REGENERATE THIS FOREST
IF THE DEER HERD IS BALANCED.

The Good...

The Bad...

and The Ugly!

"I now suspect that just as a deer herd lives in mortal fear of its wolves,
so does a mountain live in mortal fear of its deer. And perhaps with better cause,
for while a buck pulled down by wolves can be replaced in two or three years,
a range pulled down by too many deer may fail of replacement in as many decades."

-Aldo Leopold

Damage to Forest Health
- Loss of native shrubs & herbs
- Loss of tree seedlings to replace fallen canopy trees
- Loss of native fauna dependent upon native flora
- Increases amount of invasive plants that are unpalatable to deer

Emerging invasive species

are new to a specific area and have demonstrated the **potential** to become widespread invasive species.

Milan Havlis © www.havlis.cz

Japanese Aralia

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2022 Target Species

99 plants + 45 "animals"=
144 TARGET SPECIES

Target and Watch Species
- **Stage 0 = 112**
- **Stage 1 = 38**
- **Stage 2 = 29**
- **Stage 3 = 15**

- **49 Watch Species**
- **94 Widespread Species**

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Stage 0 Examples

Sickleweed

Japanese Spirea

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Stewardship "Wisdom"

STEWARDSHIP = Mitigation of human impacts on natural systems

Knowing what you **know** and knowing what you **don't know**…

Knowing what you **can** do and knowing what you **can't do**…

Pushing in the direction of nature's flow…

…within the context of perpetual human influences…
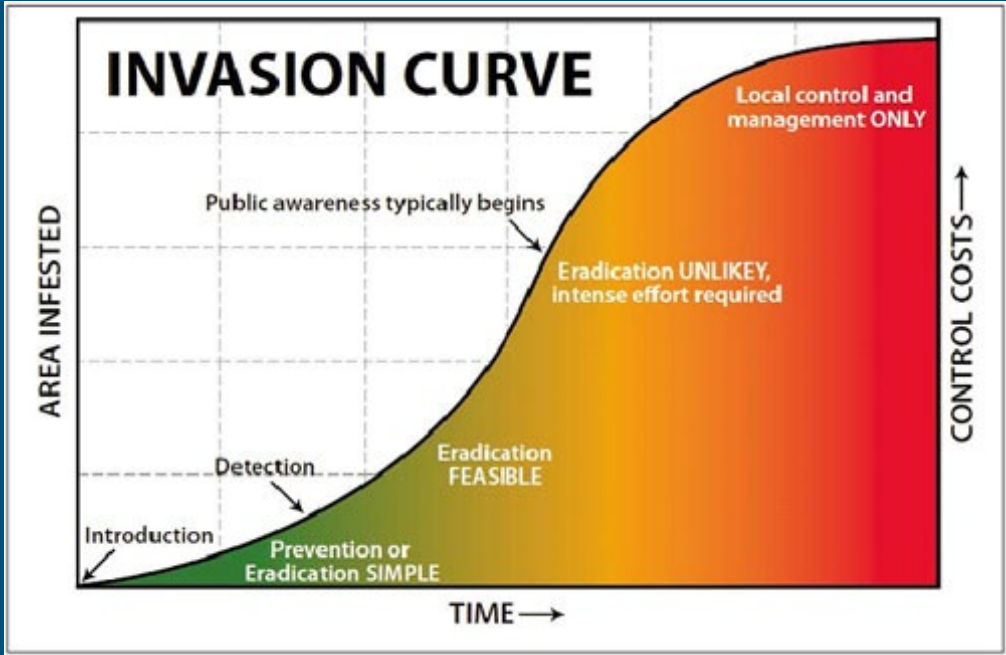
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An ounce of prevention…

…can avoid pounds of ecological damage!

Above: A single plant of Chinese silvergrass that was eradicated by the Strike Team. Below: An unchecked infestation located outside of New Jersey.

Work smarter now
or whine harder later!

INVASION CURVE

Local control and management ONLY

Public awareness typically begins

Eradication UNLIKELY, intense effort required

AREA INFESTED

CONTROL COSTS →

Detection

Eradication FEASIBLE

Introduction

Prevention or Eradication SIMPLE

TIME →

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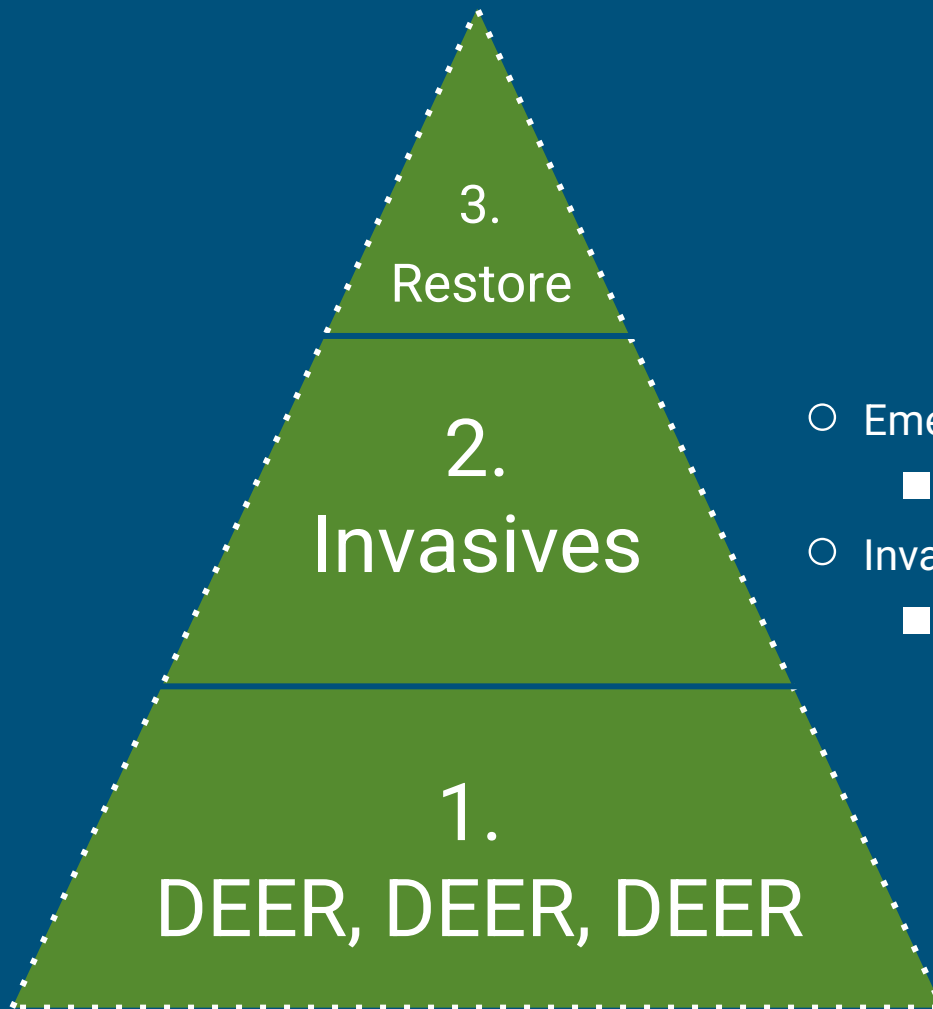Invasive Species
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A Simple Model

Suspected Relationship Between Native and Non-Native Plant Abundance in Relation to Land Use Intensity and Deer Abundance

Please note brief explanations provided below chart and species susceptibility table.

		Past Agricultural Use	
		Present	**Absent**
Deer Abundance	**High**	Invasive Plants: ↑↑↑	Invasive Plants*: 0 ---> ↑
		Native Plants: ↓↓↓	Native Plants: ↓↓↓
	Low	Invasive Plants: ↑↑	Invasive Plants: ↓↓↓
		Native Plants: ↑	Native Plants: ↑↑↑

*Invasive plants are slow to establish on unaltered forest soils even when deer abundance is high. However, infestations often occur quickly in forest gaps after canopy trees fall (presumably in response to increased light).

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The Stewardship Effort Hierarchy

3.

Restore

2.

Invasives

1.

DEER, DEER, DEER

Invasive Species Strategy

○ Emerging Invasive Species Control / Eradication

 ■ Stage 0, then Stage 1, etc.

○ Invasives on High Conservation Value Areas

 ■ Rare species habitat, old forests, etc.

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Results!

Since Inception in 2008

Acres Searched

800,000

Populations Detected

20,000

Eradications Completed

5,000

Important Note!

35% of sites have <u>NO</u> emerging species. Plus, 45% of sites have <10 populations

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United States Forest Service

Goals

- Strategic control across 9,000 acres
- Implement existing plans for 30 private forest landowners
- Develop Forest Stewardship Plan for Higbee WMA
- Eliminate 100 acres of Linden Viburnum
- Restore over 60 acres of dense infestations (control and tree planting)
- Plant 15,000 trees in the Sourlands - 75 private lands plus public lands
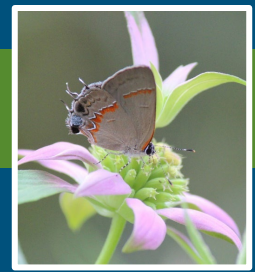
Partners

- Mercer County Parks – Baldpate Mountain
- Morris County Parks – Mahlon Dickerson
- New Jersey Audubon – Cape May Point State Park

- Sourland Conservancy – Multiple Private Forest Landowners
- Strike Team - 30 Private Forest Landowners

Contracts

- **Essex County Parks**
  - Hilltop Reservation
  - Mopping up tremendous efforts to eliminate Japanese Aralia and other species

- **Morris County Parks**
  - Tourne, Pyramid Mountain, Lewis Morris
  - Pushing back Japanese Aralia and Oriental Photinia

- **Morristown National Historic Park**
  - Maintaining and Improving relatively clean areas
  - Controlling high priority emerging species

- **Princeton**
  - Herrontown Woods and Mountain Lakes
  - Pushing back Japanese Aralia (as ED/RR) & others

Training & Outreach Efforts   - 2021

- Educational Presentations, Tabling Events, and Training Sessions
  - Includes invasives, natives, deer and customized
  - Multiple "Volunteer Stewardship Team" events
  - 18 events reaching 600 people (still COVID impacts)

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Volunteer Stewardship Teams

- Friends of Great Swamp

- Watchung Reservation Invasive Plant (WRIP) Strike Force

- Hilltop Reservation

- Foote's Pond

- Many, many more!!

"The lesson I take from more than a decade of volunteer and professional land stewardship is that remarkable progress is the predictable result of steady, low-technology land management."

- Jennifer Hillmer, Land Steward

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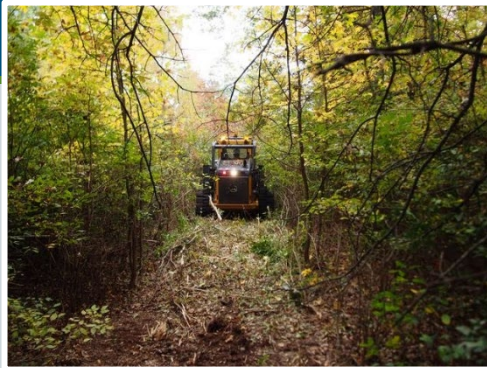
Duke Farms
Forest Health Monitoring Program

Ecological ES Solutions

Presented by Michael Van Clef, Ph.D.,
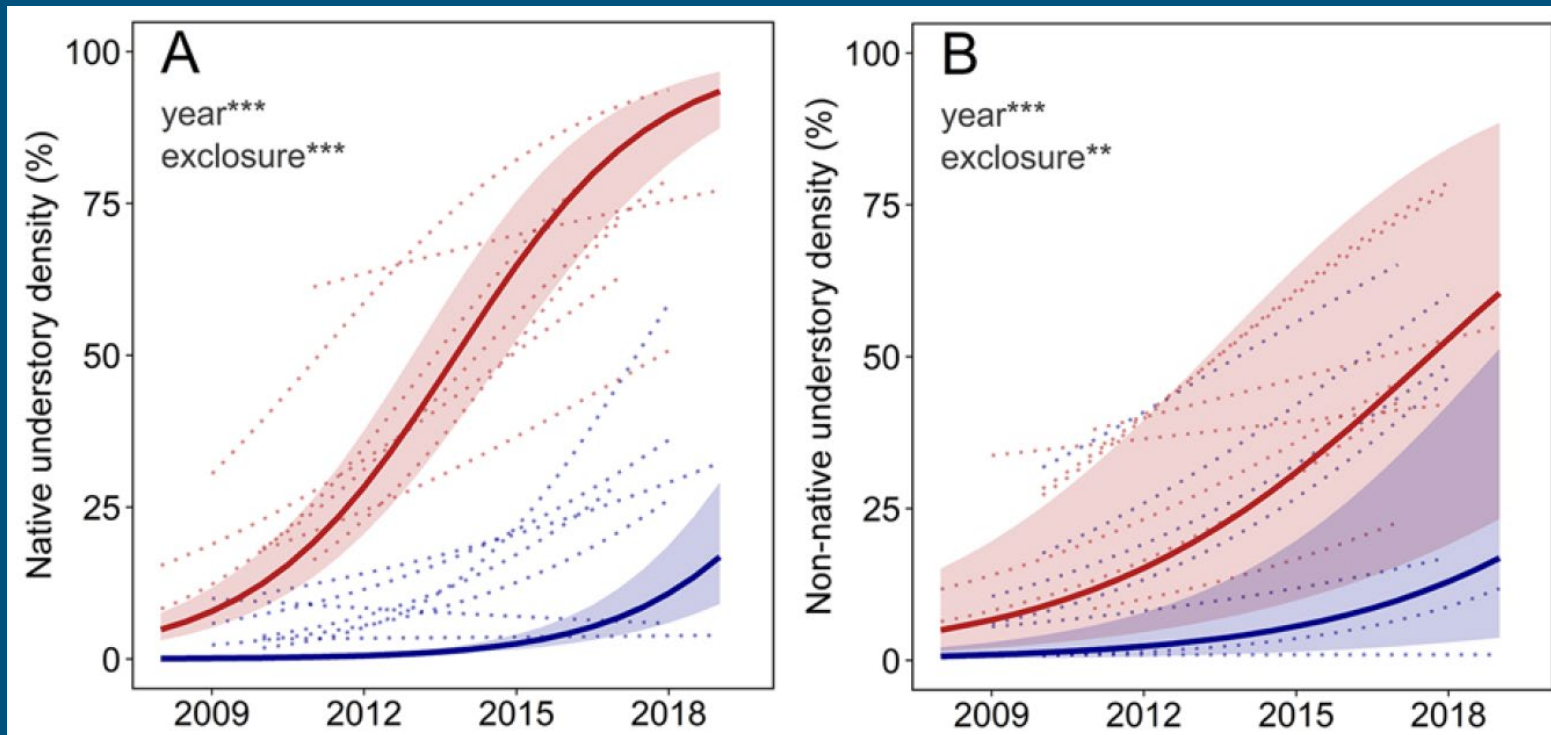Ecological Solutions

Forest Secchi - Woody Plants

○ ***Native Species**
   ○ Exclosed: Increased from
      23% to 72% (4.9% per year)
   ○ Non-Exclosed: Increased from
      6% to 26% (2.0% per year)

○ ***Non-Native Species**
   ○ *Exclosed: Increased from
      20% to 50% (3.0% per year)
   ○ *Non-Exclosed: Increased from
      10% to 34% (2.4% per year)
      [Increases primarily from Multiflora Rose]

○ **Ratio of Native : Non-Native Cover**
   ○ Exclosed: 1.1 to 1.4
   ○ Non-Exclosed: 0.6 to 0.8

Control Methods

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2022 DO NOT PLANT LIST
PLANTS ON THIS LIST ARE _COMMONLY AVAILABLE_ FOR PURCHASE

Scientific Name	Common Name	Problem Type
Herbaceous Plants		
Cabomba caroliniana	Carolina fanwort	Emerging
Egeria densa	Brazilian waterweed	Emerging
Eichhornia crassipes	common water hyacinth	Emerging
Ludwigia peploides (ssp. glabrescens)	creeping waterprimrose	Emerging
Marsilea quadrifolia	European waterclover	Emerging
Myriophyllum aquaticum	parrotfeather	Emerging
Myriophyllum spicatum	Eurasian water-milfoil	Widespread
Nasturtium officinale	watercress	Widespread
Nymphoides peltata	yellow floating heart	Emerging
Pistia stratiotes	water lettuce	Emerging
Stratiotes aloides	water soldier	Emerging
Arundo donax	giant reed	Potential
Butomus umbellatus	Flowering Rush	Potential
Carex flacca	blue-green sedge	Potential
Cenchrus purpurescens	black fountain grass	Potential
Cenchrus setaceus	black fountain grass	Potential
Eragrostis curvula	weeping lovegrass	Emerging
Miscanthus sinensis	Chinese silvergrass	Emerging
Saccharum ravennae	hardy pampas grass	Potential
Achyranthes japonica	Japanese chaff flower	Potential
Acorus calamus	American sweetflag	Widespread
Aegopodium podagraria	goutweed	Potential
Artemisia stelleriana	oldwoman	Emerging
Arum italicum	Italian arum	Potential
Belamcanda chinensis	blackberry lily	Potential
Corydalis incisa	purple keman	Emerging
Corydalis solida	spring fumewort	Emerging
Cyrtomium falcatum	Japanese net-veined holly fern	Potential
Hesperis matronalis	Dame's rocket	Potential
Hosta ventricosa	blue plantain lily	Emerging
Houttuynia cordata	chameleon-plant	Potential
Hyacinthoides hispanica	Hispanic hyacinthoides	Potential
Iris pseudacorus	yellow iris	Widespread
Lamiam galeobdolon	yellow archangel	Potential
Leucojum aestivum	snowbell	Potential
Lysimachia nummularia	creeping yellow loosestrife	Widespread
Lythrum salicaria	purple loosestrife	Widespread
Oenanthe javanica	Java dropwort	Emerging
Pachysandra terminalis	Japanese pachysandra	Potential
Perilla frutescens	beefsteakplant	Emerging
Persicaria orientalis	kiss me over the garden gate	Emerging
Ranunculus repens	creeping buttercup	Potential
Reynoutria japonica	Japanese knotweed	Widespread
Reynoutria sachalinensis	giant knotweed	Widespread
Reynoutria x bohemica	Bohemian knotwed	Widespread
Salvia glutinosa	Jupiter's distaff	Potential
Scilla siberica	squill	Potential
Silene flos-cuculi	ragged robin	Emerging
Tanacetum vulgare	common tansy	Potential
Vines		
Actinidia arguta	hardy kiwi	Emerging
Ampelopsis brevipedunculata	porcelain-berry	Widespread
Celastrus orbiculatus	Oriental bittersweet	Widespread
Clematis flammula	fragrant clematis	Emerging
Clematis terniflora	Japanese clematis	Widespread
Dioscorea polystachya	Chinese yam	Emerging
Euonymus fortunei	winter creeper	Emerging
Fallopia baldschuanica	Chinese fleeceflower	Emerging
Hedera helix	English ivy	Widespread
Lonicera caprifolium	Italian woodbine	Emerging
Lonicera japonica	Japanese honeysuckle	Widespread
Parthenocissus tricuspidata	Boston ivy	Emerging
Pueraria montana var. lobata	kudzu	Emerging
Wisteria floribunda	Japanese wisteria	Emerging
Wisteria sinensis	Chinese wisteria	Emerging

Scientific Name	Common Name	Problem Type
Shrubs		
Berberis julianae	wintergreen barberry	Potential
Berberis thunbergii	Japanese barberry	Widespread
Berberis vulgaris	common barberry	Emerging
Buddleja davidii	butterflybush	Emerging
Citrus trifoliata	hardy orange	Emerging
Cytisus scoparius	Scotch broom	Emerging
Deutzia scabra	fuzzy pride-of-Rochester	Emerging
Elaeagnus angustifolia	Russian olive	Emerging
Elaeagnus pungens	thorny elaeagnus	Potential
Elaeagnus umbellata	autumn olive	Widespread
Eleutherococcus sieboldianus	five-leaf aralia	Emerging
Euonymus alatus	winged burning bush	Widespread
Euonymus europaeus	European spindletree	Emerging
Frangula alnus	glossy buckthorn	Emerging
Hippophae rhamnoides	seaberry	Potential
Hydrangea paniculata	panicled hydrangea	Potential
Kolkwitzia amabilis	beautybush	Potential
Ligustrum amurense	amur privet	Potential
Ligustrum obtusifolium	border privet	Widespread
Ligustrum ovalifolium	California privet	Emerging
Ligustrum vulgare	European privet	Widespread
Lonicera fragrantissima	sweet breath of spring	Emerging
Lonicera maackii	Amur honeysuckle	Widespread
Lonicera morrowii	Morrow's honeysuckle	Widespread
Lonicera standishii	Standish's honeysuckle	Emerging
Lonicera tatarica	Tatarian honeysuckle	Widespread
Mahonia bealei	Beale's barberry	Emerging
Osmanthus heterophyllus	holly osmanthus	Potential
Photinia villosa	Oriental photinia	Widespread
Rhodotypos scandens	jetbead	Emerging
Ribes rubrum	garden red current	Emerging
Rosa canina	dog rose	Emerging
Rosa lucieae	memorial rose	Potential
Rosa rugosa	seaside rose	Emerging
Rubus armeniacus	Himalaya blackberry	Emerging
Rubus laciniatus	cutleaf blackberry	Emerging
Rubus parvifolius	Western thimbleberry	Emerging
Spiraea japonica	Japanese spiraea	Emerging
Styrax japonicus	Japanese snowbell	Emerging
Symplocos paniculata	sapphire berry	Emerging
Viburnum dilatatum	linden viburnum	Widespread
Viburnum lantana	wayfaringtree	Emerging
Viburnum opulus	Guelder-rose	Emerging
Viburnum plicatum	Japanese snowball	Emerging
Viburnum setigerum	tea viburnum	Emerging
Viburnum sieboldii	Siebold's arrowwood	Emerging
Trees		
Acer ginnala	Amur maple	Emerging
Acer palmatum	Japanese maple	Emerging
Acer platanoides	Norway maple	Widespread
Acer pseudoplatanus	sycamore maple	Emerging
Akebia quinata	chocolate vine	Emerging
Albizia julibrissin	mimosa	Emerging
Alnus glutinosa	European black alder	Emerging
Aralia elata	Japanese angelica tree	Widespread
Broussonetia papyrifera	paper mulberry	Emerging
Cornus kousa	Kousa dogwood	Emerging
Kalopanax septemlobus	castor aralia	Emerging
Koelreuteria elegans	golden raintree	Potential
Magnolia kobus	Kobus magnolia	Potential
Malus toringo	Japanese crabapple	Emerging
Morus australis	Chinese mulberry	Potential
Paulownia tomentosa	princesstree	Widespread
Phellodendron amurense	Amur corktree	Emerging
Populus alba	white poplar	Emerging
Populus x canescens	gray poplar	Emerging
Prunus avium	sweet cherry	Widespread
Prunus subhirtella var. pendula	weeping Higan cherry	Emerging
Pyrus betulifolia	birchleaf pear	Potential
Pyrus calleryana	Callery pear (Bradford pear)	Widespread
Salix matsudana	Chinese willow	Potential
Ulmus parvifolia	Chinese elm	Emerging
Ulmus procera	English elm	Emerging
Ulmus pumila	Siberian elm	Emerging
Zelkova serrata	Japanese zelkova	Emerging

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2022 DO NOT PLANT LIST
PLANTS ON THIS LIST ARE _NOT COMMONLY AVAILABLE_ FOR PURCHASE

Scientific Name	Common Name	Problem Type
Herbaceous Plants		
Callitriche stagnalis	European waterstarwort	Emerging
Didymosphenia geminata	rock snot	Emerging
Hydrilla verticillata	hydrilla	Emerging
Hydrocharis morsus-ranae	European frog-bit	Emerging
Myosoton aquaticum	giant chickweed	Emerging
Najas minor	brittleleaf naiad	Emerging
Nitellopsis obtusa	starry stonewort	Emerging
Potamogeton crispus	curly-leaved pondweed	Widespread
Trapa natans	European water chestnut	Widespread
Arthraxon hispidus	small carpetgrass	Widespread
Carex kobomugi	Japanese sedge	Emerging
Carex macrocephala	largehead sedge	Emerging
Cyperus difformis	variable flatsedge	Potential
Eriochloa villosa	hairy cup-grass	Potential
Microstegium vimineum	Japanese stiltgrass	Widespread
Oplismenus undulatifolius	wavyleaf basketgrass	Emerging
Phalaris arundinacea	reed canarygrass	Widespread
Phalaris canariensis	canarygrass	Emerging
Phragmites australis	common reed	Widespread
Aldrovanda vesiculosa	water wheel plant	Potential
Alliaria petiolata	garlic mustard	Widespread
Ambrosia psilostachya	Western ragweed	Emerging
Anthriscus sylvestris	wild chervil	Widespread
Artemisia annua	annual wormwood	Emerging
Artemisia vulgaris	mugwort	Widespread
Cardamine impatiens	narrowleaf bittercress	Widespread
Centaurea stoebe ssp. micranthos	spotted knapweed	Widespread
Cirsium arvense	Canada thistle	Widespread
Conium maculatum	poison-hemlock	Widespread
Cuscuta japonica	purple stemmed dodder	Potential
Dipsacus fullonum	common teasel	Widespread
Dipsacus laciniatus	cutleaf teasel	Emerging
Elsholtzia ciliata	Vietnamese Balm	Potential
Falcaria vulgaris	Sickleweed	Emerging
Fatoua villosa	hairy crabweed	Potential
Ficaria verna	lesser celandine	Widespread
Heracleum mantegazzianum	giant hogweed	Emerging
Kochia scoparia	bassia scoperia	Potential
Lespedeza cuneata	sericea lespedeza	Widespread
Murdannia keisak	marsh dayflower	Emerging
Salsola tragus	tumbleweed	Potential

Scientific Name	Common Name	Problem Type
Vines		
Humulus japonicus	Japanese hop	Widespread
Persicaria perfoliata	mile-a-minute vine	Widespread
Vincetoxicum nigrum	black swallowwort	Emerging
Vincetoxicum rossicum	pale swallowwort	Emerging
Shrubs		
Rhamnus cathartica	European buckthorn	Emerging
Rhamnus davurica	Dahurian buckthorn	Emerging
Rhamnus utilis	Chinese buckthorn	Emerging
Rosa multiflora	multiflora rose	Widespread
Rubus phoenicolasius	wine raspberry	Widespread
Salix atrocinerea	large gray willow	Emerging
Salix cinerea	gray willow	Emerging
Trees		
Ailanthus altissima	tree-of-heaven	Widespread

Categories of Invasive Plant Control Methods

Control Method	Description	Pros	Cons	Notes
Biological	Introduction of a biocontrol agent (e.g., insect, pathogen) from the invasive species' native range	Dramatic reduction in abundance with minimal costs; Minimal site accessibility issues	Limited number of invasive species have agents; Limited potential for unintended consequences if the biocontrol agent 'switches' to non-target species	Requires extensive time and effort to provide effective host-specific agents; Numerous federal regulations provide significantly reduced risk of impacts to non-targets species
Mechanical	Physical removal of all or portions of an invasive species	No requirement for specialized training; Can be performed by volunteers	Very labor intensive; May require specialized equipment; Site accessibility issues, impractical for large infestations; Re-sprouting or further invasive species dissemination may occur	Common techniques include mowing, cutting, pulling and girdling
Chemical	Application of herbicide to all or portions of a plant	Most effective and efficient method in most cases; Staff can be assisted by volunteers	Labor intensive; Site accessibility issues; Requires specialized training/license and equipment; May require repeated applications for more difficult species	Common applications include foliar, cut stump, basal bark and injection; Mechanical and chemical controls may be combined for cut stump and hack-and- squirt methods
Cultural	Removal of invasive species through broad land use activities	Very cost effective	Does not apply well to forest habitats	Primarily applies to agricultural systems, but may apply to the maintenance of early successional natural systems including grasslands; Techniques include prescribed fire and prescribed grazing
Ecological	Allowing natural ecological processes (e.g., competition for light and soil resources) to reduce invasive species over time	Very cost effective; Utilizes natural processes	May not occur in many systems due to persistent or continuing human impacts (e.g., overabundant deer, continual physical disturbance, habitat fragmentation, etc.)	Primarily applies to forest systems; As an example, very strong anecdotal evidence suggests that overabundant deer facilitate infestations by Japanese stiltgrass and other invasive species in forests.

Chemical Control: LEGAL REQUIREMENTS

www.pcpnj.org

❖ NJDEP regulates the use of herbicide in NJ

❖ Who can apply?

✓ Certified "applicators" and "operators"

✓ Non-certified participant under direct supervision of a "certified applicator"

❖ Basic training, testing, fees- available on website

❖ Label containers!

❖ Record of all herbicide applications

❖ Recommended: lock on door of storage facility

❖ Permits for wetland use (approved herbicides)

Chemical Control: MIXING

Chemical:	GLYPHOSATE	TRICLOPYR- AMINE	TRICLOPYR- ESTER
Trade name:	Ex. Round-up, accord	Ex. Garlon 3A	Ex. Garlon 4 ultra, Pathfinder II
Mixes with:	Water	Water	Oil
Signal word:	Caution	Danger	Caution
Plants:	All	Broadleaf/woody	Broadleaf/woody
Technique:	FS, CS	FS, CS	CS, BB
Typical concentration:	FS: 2-5% CS: 50%	FS: 2-5% CS: 50%	CS: 25% BB: 25%

❖ Order of mixing- 1. herbicide, 2. diluent, 3. dye & surfactant

❖ For Foliar Spray - use a surfactant (not necessary for other techniques)

❖ For any technique - dye is helpful for tracking

❖ Be prepared for spills & drips

Chemical Control: SAFETY

- ❖ **Know your conservation objective**
- ❖ Use **nitrile gloves** (avoid latex & leather)
- ❖ Wear **protective eye gear, clothing & shoes**
- ❖ Always spray **below your waist**
- ❖ Spray when ground & stems are **dry**
- ❖ Spray when **no chance of rain/snow**
- ❖ Avoid **excessive wind**
- ❖ Use **proper containers**
- ❖ **Dispose of materials properly**

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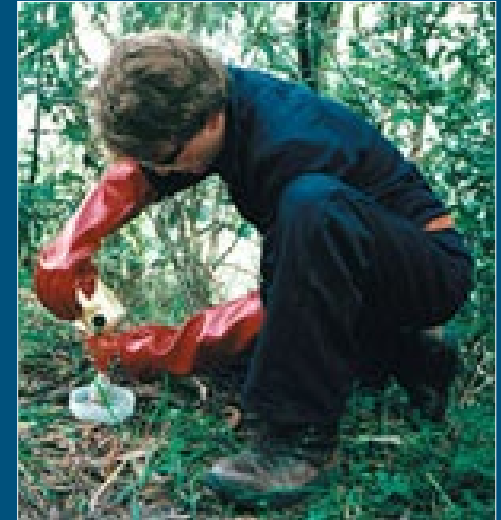
Chemical Control: Foliar Spray (FS)

Technique
- Plants < 4' to avoid spraying over head
- Wet all leaves with herbicide
- Glyphosate: 2%-5% (Ex. Rodeo)
- Triclopyr (amine): 2%-5% (Ex. Garlon 3)
- Use surfactant to increase sticking power
- Use dye to track treatment

Pros
- Effective control
- Cost effective

Cons
- Sensitive to weather conditions
- Potential for drift

When
Annuals: Before seed set each growing season
Deciduous: Growing season
Evergreen: Year round (reduced non-target spraying)

Chemical Control: Cut Stump (CS)

Technique
- Cut *all stems horizontally* and *directly* (6" or less) above the ground, apply herbicide *immediately* on all exposed stumps
- Glyphosate: 50% (ex. Rodeo)
- Triclopyr (ester): 25% (ex. Garlon 4 Ultra)
- Herbicide dye for tracking treatment

Pros
- Effective control
- Targeted control

Cons
- Time consuming
- Stem removal required

When
Year round **except for when sap is rising** (typically early spring). Fall is a highly effective time.

Chemical Control: Basal Bark (BB)

Technique
- Apply continuous band of *directly* to the bark
- Band should be 1 - 2 feet, depending on thickness of tree trunk
- Do not spray until dripping
- Triclopyr (ester): 25% (ex: Garlon 4 Ultra)

Pros
- Effective control
- Targeted control
- Cost effective

Cons
- Not as effective on larger or thick-barked trees

When
Year round
Avoid standing snow
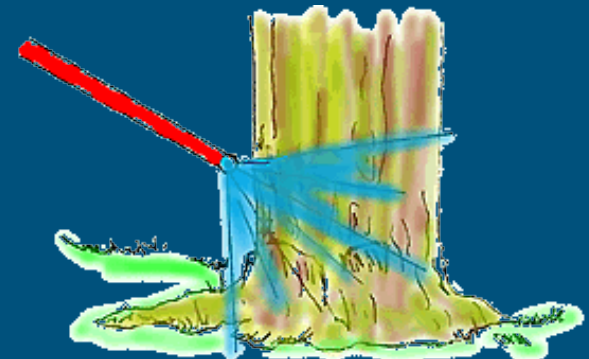
Chemical Control: Hack-and-Squirt (HS)

Technique
- Make one cut for every 2 inches of trunk diameter
- Used for larger or thick-barked trees
- Glyphosate: 50% (Ex. Rodeo)
- Triclopyr (amine): 50% (Ex. Garlon 3)
- Triclopyr (ester): 25% (Ex. Garlon 4 Ultra)

Pros
- Effective control
- Targeted control
- Cost effective

Cons
- Labor intensive
- Not always effective on strongly re-sprouting species

When
Year round

Use HS technique for large trees

Recommended Mix Percentages

Genral Application Method	NJISST Method ID	Glyphosate[1]	Triclopyr amine[2]	Triclopyr ester[3]	Clopyralid[4]	Aminopyralid[5]	2,4-D[6]	Prodiamine[7]	Quizalofop[8]	Surfactant[9]	Dye[10]	Water	Oil-based Diluent[11]
Foliar Spray	FS-1 - 'General Mix A'	3.75	2.50	--	--	--	--	--	--	0.50	Blue	93	--
Foliar Spray	FS-2 - 'General Mix B'	3.00	--	--	--	--	--	--	--	0.50	Blue	97	--
Foliar Spray	FS-3 - 'General Mix C'	5.00	--	--	--	--	--	--	--	0.50	Blue	95	--
Foliar Spray	FS-4 - 'Broadleaf Mix A'	--	2.50	--	--	--	--	--	--	0.50	Blue	97	--
Foliar Spray	FS-5 - 'Broadleaf Mix B'	--	--	1.70	--	--	2.70	--	--	0.50	Blue	95	--
Foliar Spray	FS-6 - 'Tough Aster Mix A'	--	--	--	0.63	--	--	--	--	0.50	Blue	99	--
Foliar Spray	FS-7 - 'Tough Aster Mix B'	--	--	--	--	0.27	--	--	--	0.50	Blue	99	--
Foliar Spray	FS-8 - 'Grass Mix A'	--	--	--	--	--	--	--	0.38	0.50	Blue	99	--
Basal Bark	BB-1	--	--	25	--	--	--	--	--	--	Red	--	75
Cut Stump	CS-1	50	--	--	--	--	--	--	--	--	Blue	50	--
Cut Stump	CS-2	--	50	--	--	--	--	--	--	--	Blue	50	--
Cut Stump	CS-3	--	--	25	--	--	--	--	--	--	Red	--	75
Hack-and-Squirt	HS-1	50	--	--	--	--	--	--	--	--	Blue	50	--
Hack-and-Squirt	HS-2	--	50	--	--	--	--	--	--	--	Blue	50	--
Hack-and-Squirt	HS-3	--	--	25	--	--	--	--	--	--	Red	--	75
Pre-Emergent	PE-1	--	--	--	--	--	--	*	--	--	*	*	

Percentages (volume/volume)

Trees

Callery (Bradford) pear (*Pyrus calleryana*)

Red fall color

Early spring flowers

- pyramidal growth pattern
- oval, glossy leaves
- small, round, gold-speckled fruit

Japanese aralia (*Aralia elata*)

Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); STRONGLY RE-SPROUTING SPECIES (CUTTING NOT RECOMMENDED); For BB, apply from July through September to enhance effectiveness

Look-alikes:
Devil's Walking Stick,
(*Aralia spinosa*)
A Small Native Tree

- Inflorescence 12"-24" long, <u>lacking</u> a central axis
- Often wider than long, with leaf base surrounded or overtopped by foliage
- Main leaf veins <u>extend to leaf margin</u>

- Inflorescence <u>longer</u>, 3'-3.5' with a <u>distinct central stalk</u>
- Main leaf veins <u>branch</u> & <u>diminish at leaf margin</u>
- Typically southern, extends into PA, DE

Japanese maple (*Acer palmatum*)

- Opposite leaves with 5-9 lobes
- Drooping flower clusters May-June
- Reddish wings seeds (samaras)

Hundreds of cultivars, including some cutleaf varieties

Norway maple (*Acer plantanoides*)

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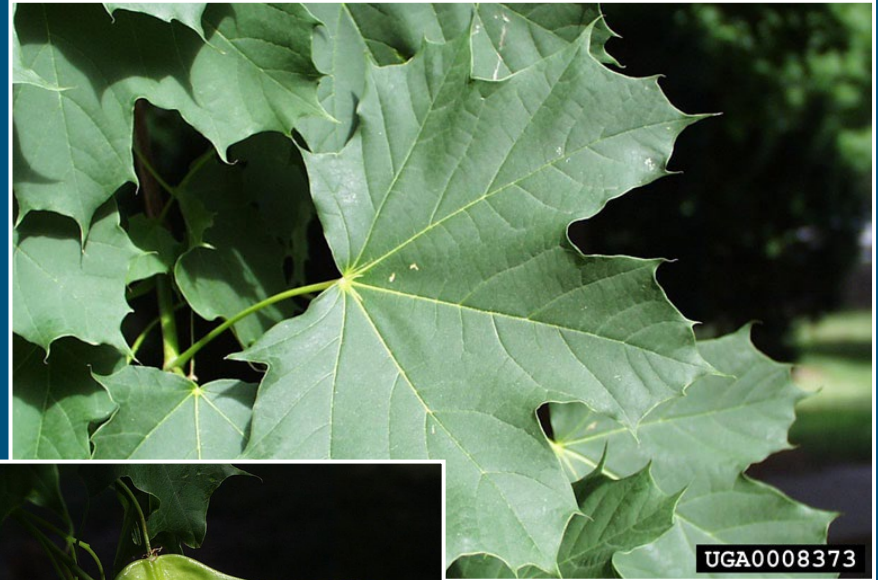
"Crimson King" cultivar

- Opposite leaves producing heavy shade
- Bright yellow/green spring and fall color
- Broken leaves produce milky sap
- Rounded bud
- Fine hair on leaf tips

Siebold's Crabapple (Malus sieboldii)

Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); STRONGLY RE-SPROUTING SPECIES (CUTTING NOT RECOMMENDED); For BB, apply from July through September to enhance effectiveness

Tree-of-Heaven (*Ailanthus altissima)*

- Compound Leaves
- Small foot at leaf base- tiny glad
- Flower clusters/ Samaras
- Peanut butter smell
- Clonal

Shrubs

Common buckthorn (*Rhamnus cathartica*)

3-4 strongly upcurved veins
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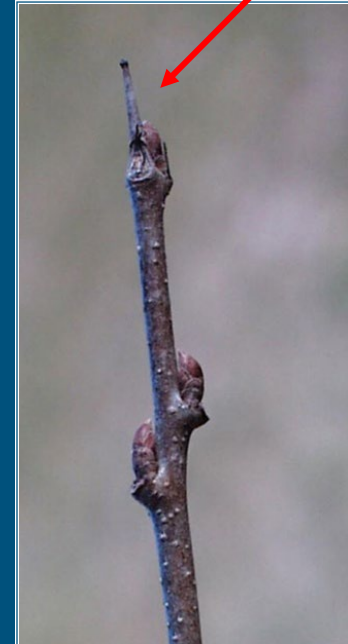
Look-alike: Blackhaw (*Viburnum prunifolium*)
Native shrub

- 16' tall
- Leaves opposite, finely toothed
- Upcurved veins
- Black fruits in clusters
- Showy white flowers
- Reddish tinge to petiole & leaf edge

- Tree to 20' tall
- Leaves nearly opposite, toothed
- Twigs often spine tipped
- Small, yellow flower clusters of 10-15 flowers
- Fruits 4-seeded

Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); STRONGLY RE-SPROUTING SPECIES (CUTTING NOT RECOMMENDED); For BB, apply from July through September to enhance effectiveness

Glossy buckthorn (*Frangula alnus*)

UGA5274031

Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); STRONGLY RE-SPROUTING SPECIES (CUTTING NOT RECOMMENDED); For BB, apply from July through September to enhance effectiveness

Japanese barberry (*Berberis thunbergii*)

- 2-8 feet tall
- Teardrop leaves
- Thin straight thorns
- Flowers April/May
- Fruits Aug-winter

Foliar Spray: FS-2 (Glyphosate 3.00%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); Cut Stump: CS-1 (Glyphosate 50%)

Purple cultivar, "Rose glow", "Crimson Pygmy"

Jetbead (*Rhodotypos scandens*)

Foliar Spray: FS-3 (Glyphosate 5.00%)

Linden viburnum (*Viburnum dilatatum*)

Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); STRONGLY RE-SPROUTING SPECIES (CUTTING NOT RECOMMENDED); For BB, apply from July through September to enhance effectiveness

Native: Arrowwood
(Viburnum dentatum)

- Leaves <u>more deeply toothed & rounder</u>
- <u>Round, dark purple fruits</u>
- Leaves/stems on mature shrubs are <u>not hairy</u>

- Leaves and young stems are fuzzy
- Leaves are variable-- usually less coarsely toothed than Arrowwood
- Fruit is *bright red-* persist into December

Fall/ Winter fruit

Summer fruit

Multiflora Rose (*Rosa multiflora*)
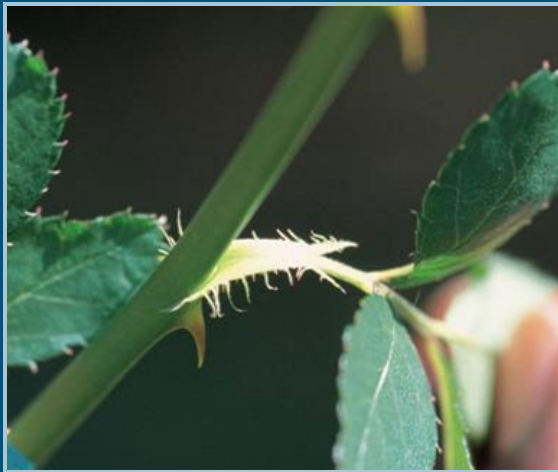
Foliar Spray: FS-2 (Glyphosate 3.00%), Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); Cut Stump: CS-1 (Glyphosate 50%)

Oriental photinia (*Photinia villosa*)

- Shade-tolerant
- Leaves <u>sessile</u>, <u>lacking</u> stem
- Autumn foliage reddish-orange
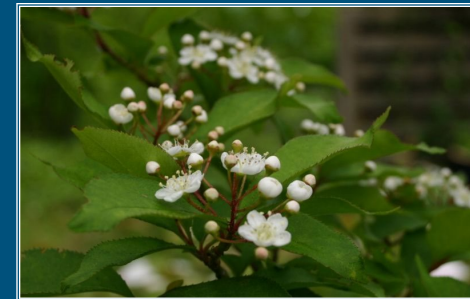- Fruit is <u>bright red</u>

Native: Chokeberry (*Photinia spp.*)
Native Shrub

Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); STRONGLY RE-SPROUTING SPECIES (CUTTING NOT RECOMMENDED); For BB, apply from July through September to enhance effectiveness

- <u>Meadow and edge</u> habitats
- Leaves have <u>0.25" stem</u>
- <u>Deep red</u> or <u>dark-purple</u> fruits

Siebold's Viburnum (*Viburnum seiboldii*)

- Thick, dark, leathery leaves
- Leaves & twigs have a strong <u>rubber scent</u>
- Large terminal bud
- Hairy veins
- Large, flat topped flower clusters- mature from red to black

Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); STRONGLY RE-SPROUTING SPECIES (CUTTING NOT RECOMMENDED); For BB, apply from July through September to enhance effectiveness

Winged Burning bush (*Euonymus alatus*)

- Corky winged branches
- Opposite leaves, finely toothed
- Flowers April-June (4 petals)
- Fruits September to October

Foliar Spray: FS-2 (Glyphosate 3.00%);
Basal Bark: BB-1 (Triclopyr Ester 25%
OR Pathfinder II ready-to-use mixture);
Cut Stump: CS-1 (Glyphosate 50%)

Vines

English ivy (*Hedera helix*)

Over 400 named cultivars!

- Evergreen vine
- Waxy leaves, untoothed
- 3-5 lobes per leaf

Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); Pre-treatment cutting recommended when tall/dense/multi-stem tangles prohibit safe application via FS; Species has thick/waxy leaves, utilize Clean Cut surfactant or equivalent

Japanese honeysuckle (*Lonicera japonica*)

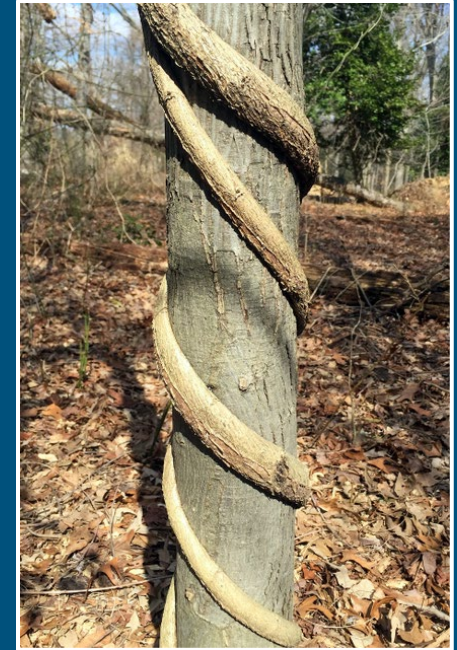Tennessee - EPPC
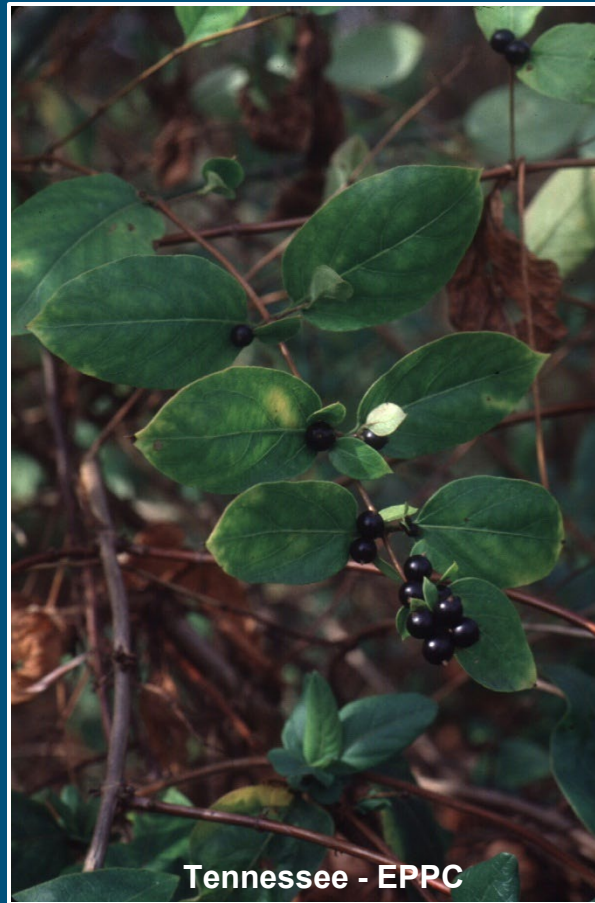
Tennessee - EPPC

Tennessee - EPPC

Foliar Spray: FS-2 (Glyphosate 3.00%); Cut Stump: CS-1 (Glyphosate 50%)

Japanese & Chinese wisteria
(*Wisteria floribunda & sinensis*   )

- Alternate, compound leaves
- Hanging flower clusters in April & May
- Brown seed pods

Mile-a-minute vine (*Polygonum perfoliatum*)

UGA5273091

UGA1149039

Foliar Spray: FS-2 (Glyphosate 3.00%); Pre-Emergent Spray: PE-1 (Prodiamine - See Label Instructions); NJDA has released biological control agents that may ultimately provide effective control - additional control measures recommended for new, small populations only; ANNUAL SPECIES - Must treat before fruit/seed maturation (See phenology guidelines).

Oriental Bittersweet (*Celastrus orbiculatus*)

USDI - National Park Service

James H. Miller, USDA-FS, www.forestryimages.org UGA0016100

Foliar Spray: FS-1 (Glyphosate 3.75%, Triclopyr Amine 2.50%); Basal Bark: BB-1 (Triclopyr Ester 25% OR Pathfinder II ready-to-use mixture); VINE SPECIES; Pre-treatment cutting recommended when tall/dense/multi-stem tangles prohibit safe application via FS.

Porcelainberry
(*Ampelopsis brevipedunculata*)

Look-alikes: *Native grape species*

Porcelainberry bark *does not shred*
fruit is *speckled* and *bright blue*

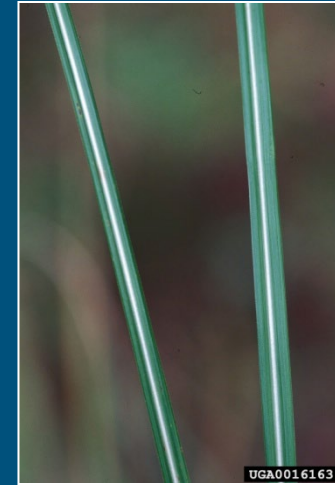# Wintercreeper (*Euonymus fortunei*)

"Blondy" cultivar

- Dark green leaves with lighter veins
- Opposite leaf pattern
- Flowers are 4 parted
- May be evergreen

Grasses & Wildflowers

Chinese silver grass (*Miscanthus sinensis*)

- Showy, silvery flowers in August
- White midrib
- Many cultivars

"Zebrinus" cultivar

Garlic Mustard (*Alliaria petiolata*)

COPYRIGHT J.R. MANHART

Foliar Spray: FS-2 (Glyphosate 3.00%); BIENNIAL SPECIES - Must treat before fruit/seed maturation (See phenology guidelines); Treatment recommended from Mid Fall through Late Winter to avoid damaging most native species

Japanese Knotweed (*Fallopia japonica*)
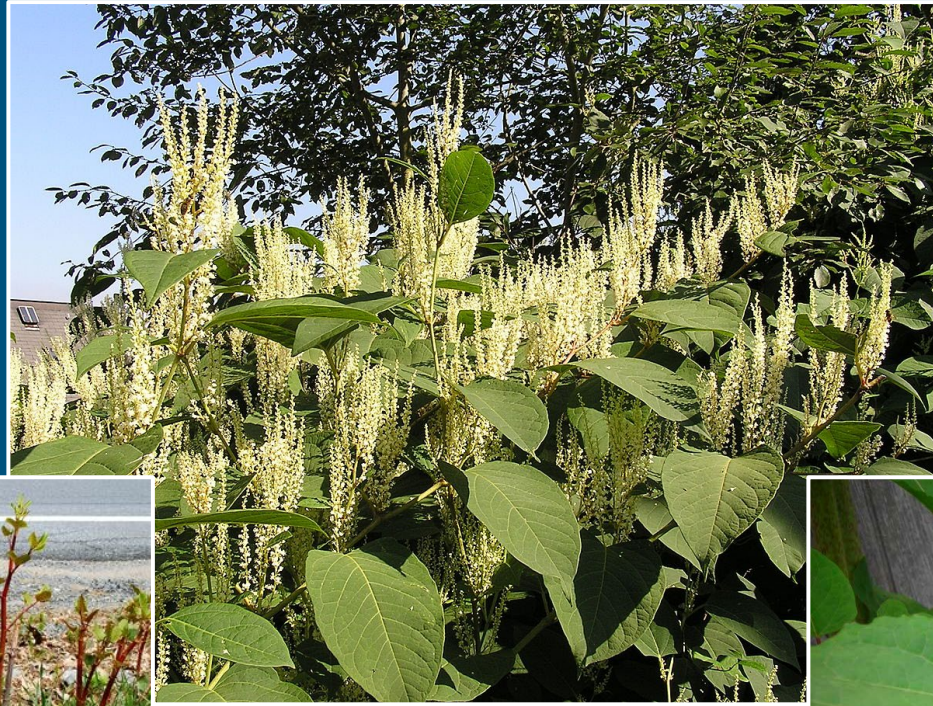
Foliar Spray: FS-2 (Glyphosate 3.00%); Mowing recommneded only as pre-treatment to weaken root system (Perform in June followed by FS in September); September FS applications recommended; Stem injection using glyphosate is highly effective but very time consuming for moderate to large populations (see http://stopknotweednj.com/knotweed_eradication.htm). As necessary, seek aquatic application permit and use wetlands appropriate herbicides and surfactants.

Japanese Stiltgrass (*Microstegium vimineum*)

under tree canopy

Silvery midvein

Stems are smooth

canopy gap

Foliar Spray: FS-2 (Glyphosate 3.00%); Foliar Spray: FS-8 (Quizalofop 0.38%); Pre-Emergent Spray: PE-1 (Prodiamine - See Label Instructions); ANNUAL SPECIES - Must treat before fruit/seed maturation (See phenology guidelines).

Mugwort (*Artemisa vulgaris*)

Similar species: Annual Ragweed (opposite leaves vs. alternate leaves on mugwort)

Foliar Spray: FS-7 (Aminopyralid 0.27%); Apply in early summer; mowing may be utilized as a pre-treatment, but allow 4-8 weeks for re-growth before utilizing FS

Q & A

Michael Van Clef, Ph.D.

- *mvanclef@fohvos.org*
- 908.528.6674
- *FoHVOS.org/invasive-species-strike-team/*

Plants and Birds of Healthy Forests

Clockwise from top left: mountain laurel, witch-hazel, maple-leaved viburnum

Clockwise from top left: blackburnian warbler, black-throated blue warbler, chestnut-sided warbler, ovenbird