

Non-native Invasive Plants

Southern Appalachians

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National Forests in NC

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Jane Hargreaves image



Oriental Bittersweet

On

Steroids



Non-native Plants

In US estimate over 7000 nonnative plants

In Southern Appalachians between 14-15% of the flora are nonnative, 300 -400 trees, shrubs and herbs

Species	Year Introduced	Origin
Princess Tree <i>Paulownia tomentosa</i>	1834	East Asia
Mimosa <i>Albizia julibrissin</i>	1745	Asia, Iran
Tree of Heaven <i>Ailanthus altissima</i>	1784	Asia
Multiflora Rose <i>Rosa multiflora</i>	1868	Japan, Korea, China
Chinese Privet <i>Ligustrum sinense</i>	1852	China
Japanese Meadowsweet <i>Spiraea japonica</i>	1870's	Japan, Korea, China
Japanese Knotweed <i>Polygonum cuspidatum</i>	1800's ???	East Asia
Autumn Olive <i>Elaeagnus umbellulata</i>	1830	China, Japan
Oriental Bittersweet <i>Celastrus orbiculatus</i>	1870	China, Japan
Kudzu <i>Pueraria montana</i>	Early 1900's	China, Japan
Japanese Honeysuckle <i>Lonicera japonica</i>	1806	Japan, Korea, China
Chinese Yam <i>Dioscorea polystachya</i>	Early-Mid 1900's ???	China
Chinese Silvergrass <i>Miscanthus sinensis</i>	Early 1900's ???	China, Japan
Japanese Stiltgrass <i>Microsetgium vimineum</i>	1919	East Asia, India
Garlic Mustard <i>Aillaria petiolata</i>	Early-Mid 1800's	Europe
Coltsfoot <i>Tussilago farafara</i>	1700's ????	Europe

Species to evaluate

- *Centaurea jacea* (Brown Knapweed)
- *Akebia quinata* (Five-leaf Akebia)
- *Citrus trifoliata* (Trifoliate Orange)
- *Phalaris arundinacea* (Reed Canary Grass)
- *Buddleja davidii* (Butterfly-bush)
- *Ampelopsis brevipedunculata* (Porcelain-berry)
- *Wisteria sinensis* (Chinese Wisteria)

Highly Diverse Landscape



Possible to distinguish environmental conditions or plant communities where invasive exotic species likely to be found

Within the Southern Blue Ridge Mountains Topography and Aspect are Key!!

North facing slopes

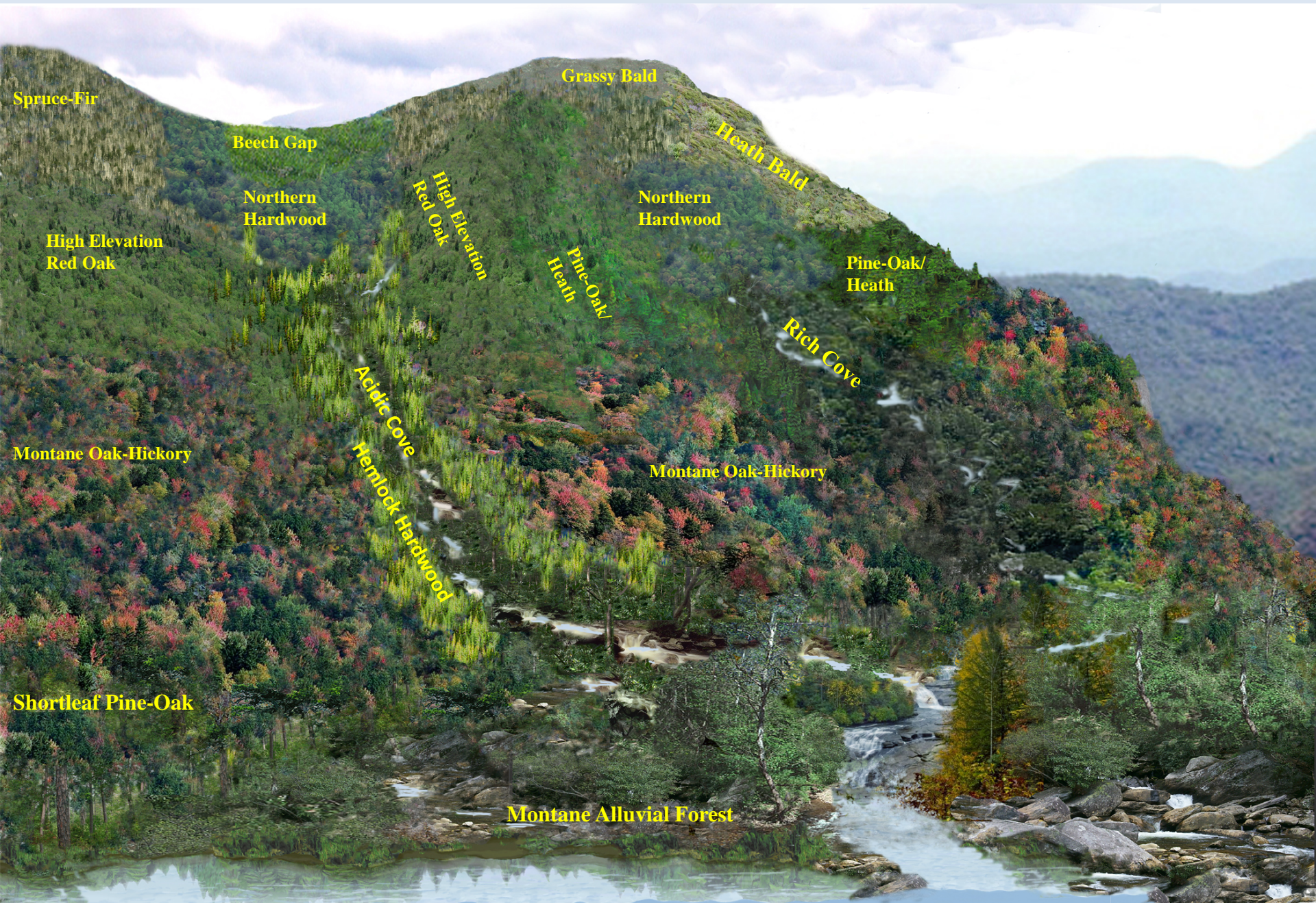
Ridges and south facing slopes

Cove forests and riparian areas



Where is there a greater likelihood of encountering nonnative invasive plants

Plant Communities in Southern Appalachian Landscape



Spruce-Fir

Beech Gap

Northern
Hardwood

High Elevation
Red Oak

Grassy Bald

Heath Bald

Northern
Hardwood

High Elevation
Red Oak

Pine-Oak/
Heath

Pine-Oak/
Heath

Rich Cove

Montane Oak-Hickory

Acidic Cove

Montane Oak-Hickory

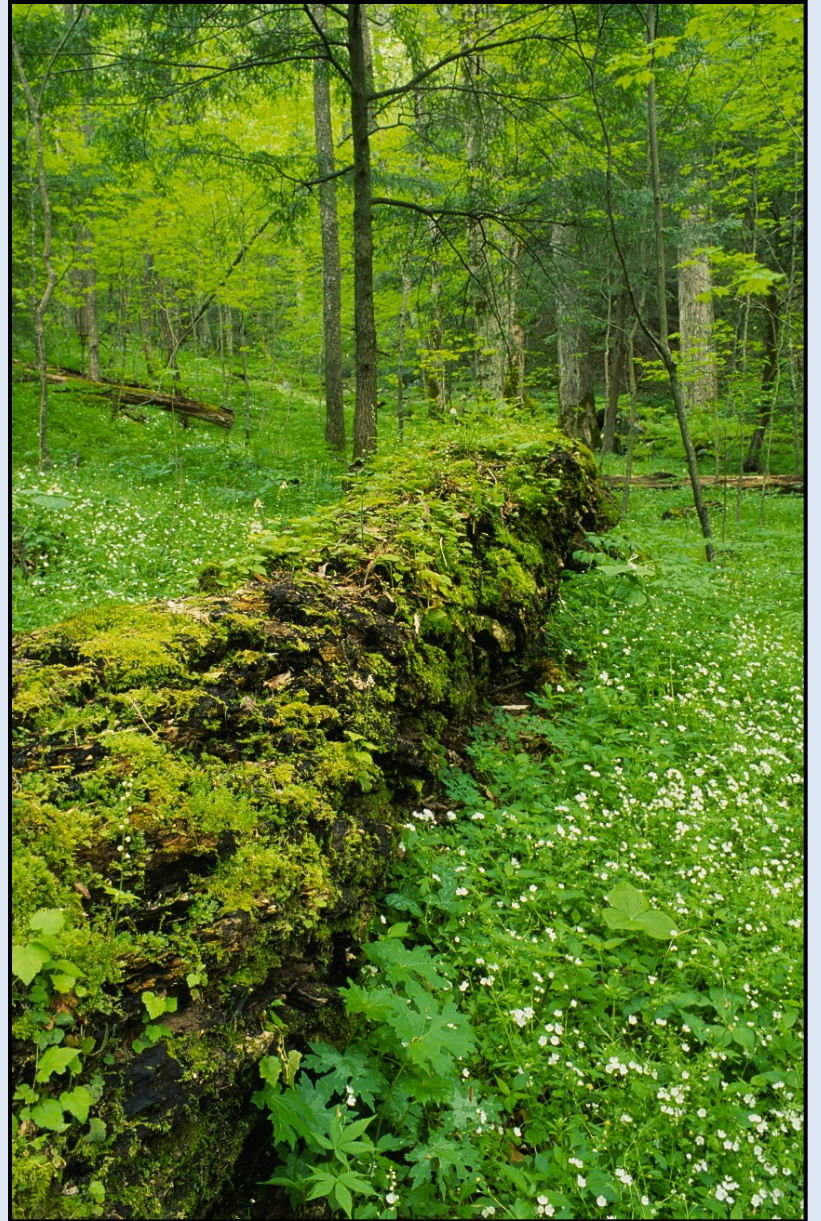
Hemlock-Hardwood

Shortleaf Pine-Oak

Montane Alluvial Forest



Rich Cove Forest

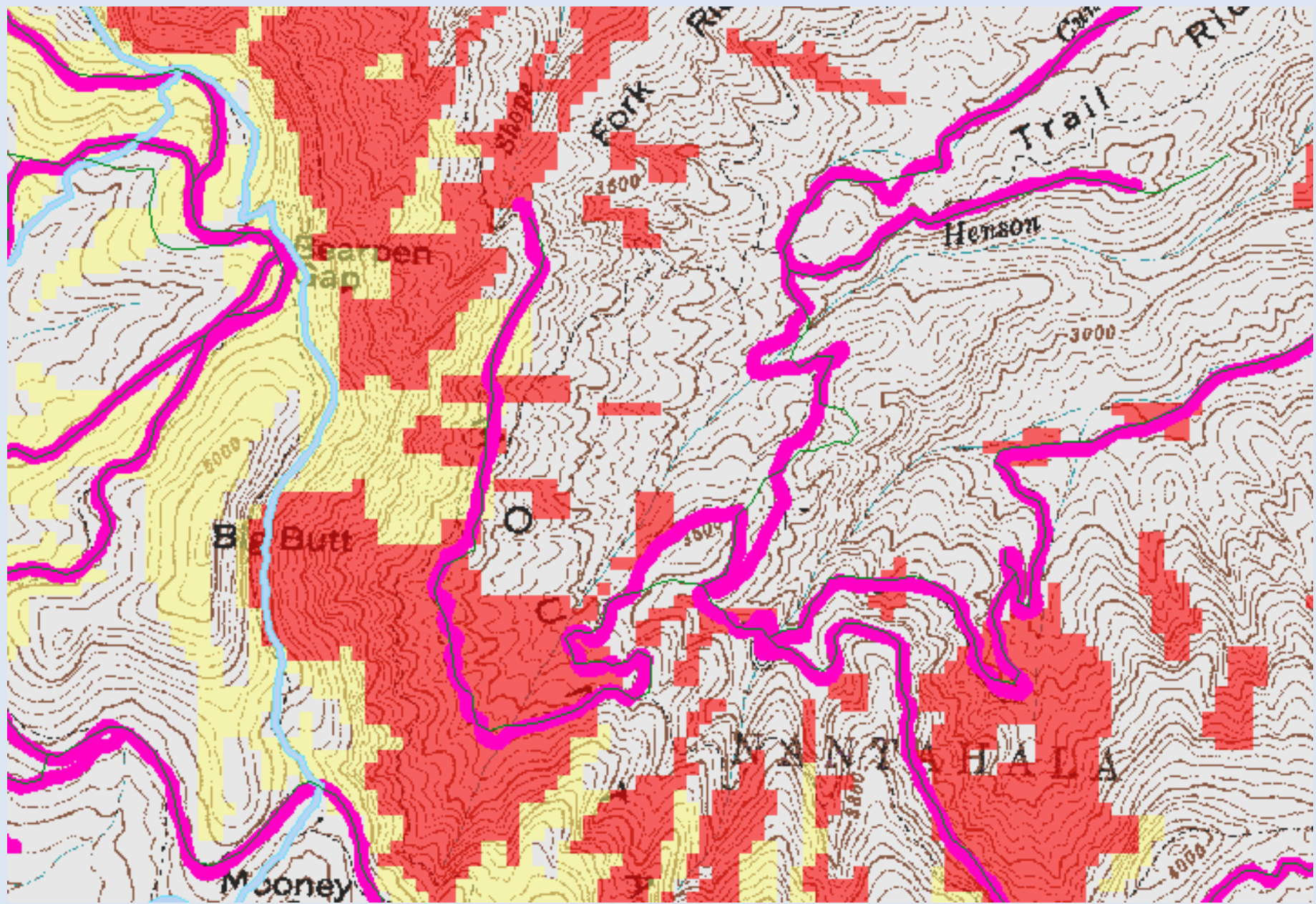




Streamside Acidic Cove Forest

Acidic Cove Forest - Rhodo Hell





**Japanese Knotweed impacting Virginia
Spiraea**



Whiteoak Creek, Macon County

		Canopy Density [†]	Rich Cove Forest	Montane Alluvial	Acidic Cove [‡]	Mesic Oak-Hickory	Northern Hardwood Cove	Northern Hardwood Slope	High Elevation Red Oak	Pine Oak Heath	Dry-Mesic Oak Hickory	Grassy Bald	Heath Bald	Fraser Fir	Number of partially or completely closed canopy forest communities potentially infesting
Trees															
Tree of Heaven	<i>Ailanthus altissima</i>	1,2	2	2	1	2	0	0	0	?	2	0	0	0	4
Princess Tree	<i>Paulownia tomentosa</i>	1,2	2?	2?	1?	2	0	0	0	2	2	0	0	0	3
Mimosa	<i>Albizia julibrissin</i>	1,2	2	2	1	2	0	0	0	0	2	0	0	0	4
Shrubs															
Privet	<i>Ligustrum sinense/vulgare</i>	2,3,1	3	3	1	0	0	0	0	0	0	0	0	0	2
Japanese Knotweed	<i>Reynoutria japonica</i>	1	1	1	1	0	1	1	0	0	0	0	0	0	0
Multiflora Rose	<i>Rosa multiflora</i>	1,2	2	2	1	2?	2	2	2?	0	0	1?	0	0	4
Japanese Spiraea	<i>Spiraea japonica</i>	1,2,3	2	2	1	2?	2	2?	0	0	0	0	0	0	3
Autumn Olive	<i>Elaeagnus umbellata</i>	1	1	1	1	1	1	1	1	0	1	1?	0	0	0
Vines															
Oriental Bittersweet	<i>Celastrus orbiculatus</i>	2,1,3	2	2	1	2	2	2	0	0	1?	0	0	0	5
Japanese Honeysuckle	<i>Lonicera japonica</i>	2,1,3	2	2	1	2	2	2	0	0	2	0	0	0	6
Kudzu	<i>Pueraria lobata</i>	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Chinese Yam	<i>Dioscorea oppositifolia</i>	2,1,3	2	2	1	2	2	0	0	0	0	0	0	0	4
Herbaceous															
Garlic Mustard	<i>Alharia petiolata</i>	3,2	3	3	1	0	3	3?	0	0	0	0	0	0	3
Japanese Stiltgrass	<i>Microstegium vimineum</i>	2,3	2	2	1	2?	2	2?	0	0	0	0	0	0	3
Coltsfoot	<i>Tussilago farfara</i>	1,2	1	0	1	1	1	1	1	0	0	1	0	0	0
Chinese Silvergrass	<i>Miscanthus sinensis</i>	1,2	1	1	1?	1	1	1	0	0	1	0	0	0	0
Spotted Knapweed	<i>Centaurea biebersteinii</i>	2,3,1	0	0	0	1	0	0	0	1	1	0	0	0	0

1 = mostly open, 2 = partial shade, 3 = fully closed canopy

† Condition sequence indicative of invasiveness, * Condition exotic species most invasive, ‡ Acidic Cove habitat difficult to determine since the community can have a dense Rhododendron layer even when having an open canopy

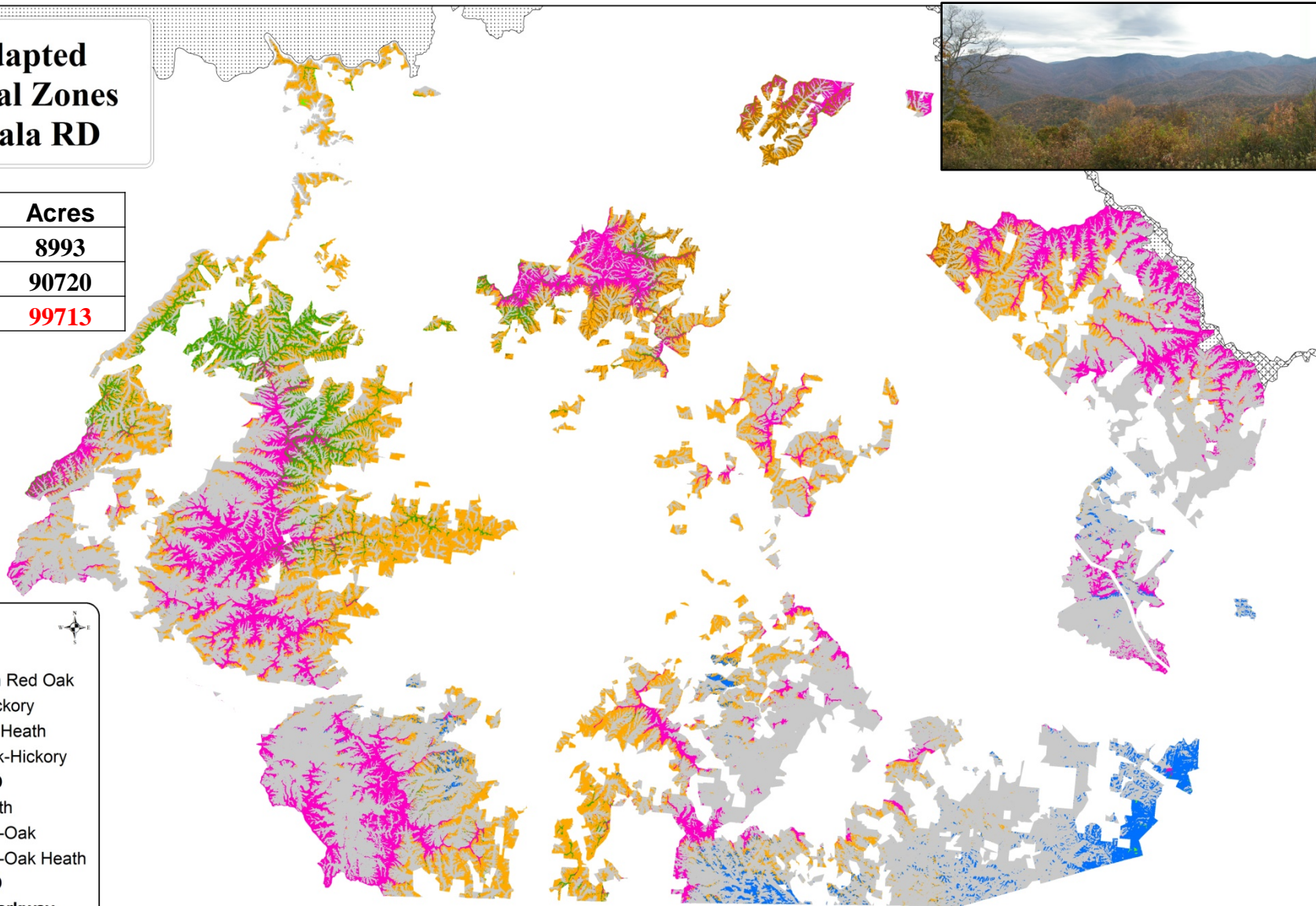
	Canopy Options	Rich Cove Forest	Montane Alluvial	Acidic Cove	Mesic Oak-Hickory	Northern Hardwood Cove	Northern Hardwood Slope	High Elevation Red Oak	Pine Oak Heath	Dry-Mesic Oak Hickory	Grassy Bald	Heath Bald	Fraser Fir
Community Exotic species totals, completely open to closed canopy	1,2,3	16	16	16	11?	11	7?	2?	1?	7?	1?	0	0
Community Exotic species totals, closed canopy or partially open	2,3	10?	12?	0	6?	7	3?	0?	1?	4	0	0	0
Community Exotic species totals, closed canopy	3	2	2	0	0	1	0?	0	0	0	0	0	0



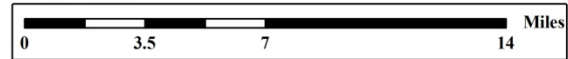
Fire Management

Fire Adapted Ecological Zones Nantahala RD

Type	Acres
Pine	8993
Oak	90720
Total	99713



- Legend**
- Oak Nantahala RD**
 - High Elevation Red Oak
 - Mesic Oak-Hickory
 - Chestnut Oak Heath
 - Dry-Mesic Oak-Hickory
 - Pine Nantahala RD**
 - Pine-Oak Heath
 - Shortleaf Pine-Oak
 - Shortleaf Pine-Oak Heath
 - Nantahala RD
 - Blue Ridge Parkway
 - Great Smoky Mt Park



Incomplete Information on Fire and Invasive Exotic Plant Species Response

Exotic Species may affect :

- **Fire Intensity**
- **Fire Severity**
- **Fire Extent**
- **Fire Return Interval**
- **Fire Sprouting Potential**

Fire occurrence may affect NNIS:

- **Vegetative Recruitment**
- **Reproductive Vigor**
- **Survival**
- **Spread**

Information on response based on :

- **experimental fire research studies (few)**
- **Observations in the field post-burn (most)**
- **Grey literature**
- **Assumptions with similar sister species**



Transport on Clothes

Boots

**PPE if coming from infested
area**

Invasive may increase intensity of Burns



Princess Tree more competitive in sites with more open canopy and mineral soils



**Fire impacted
canopy on
Ridges**



**Princess Tree
germinates under
the partially open
canopy but does
not seem to persist**





2.25mm

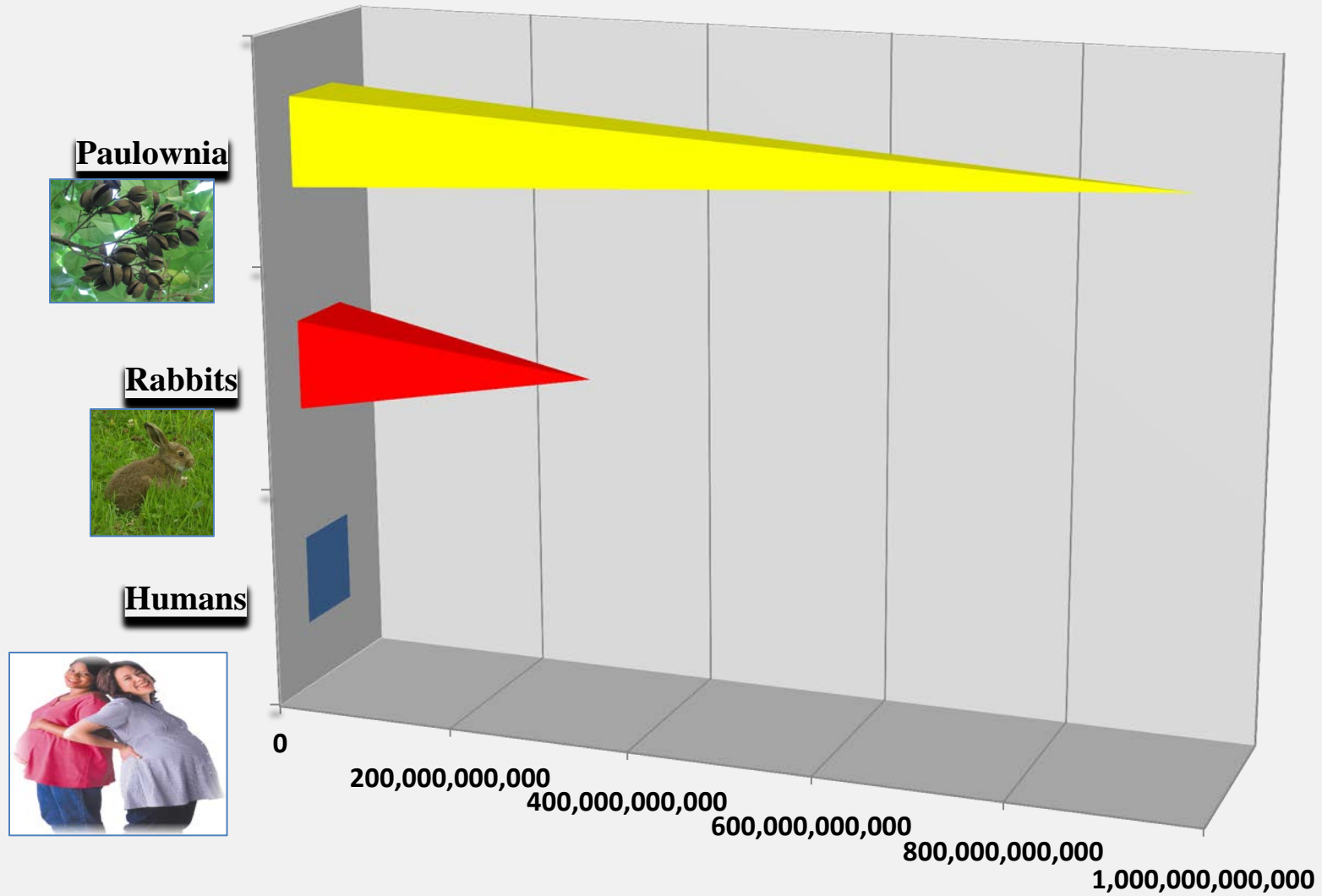


Seedlings grow quickly,
can flower from seed
within 5-8 years.

Estimates of seed
production in mature
trees - 20 million



Reproductive rate

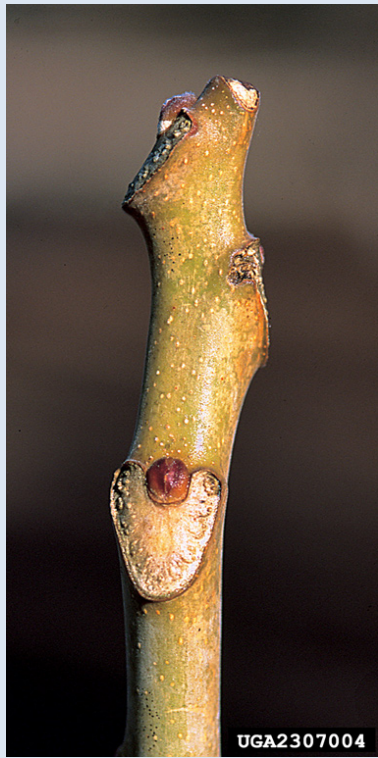




Chinese Silvergrass

Miscanthus sinensis

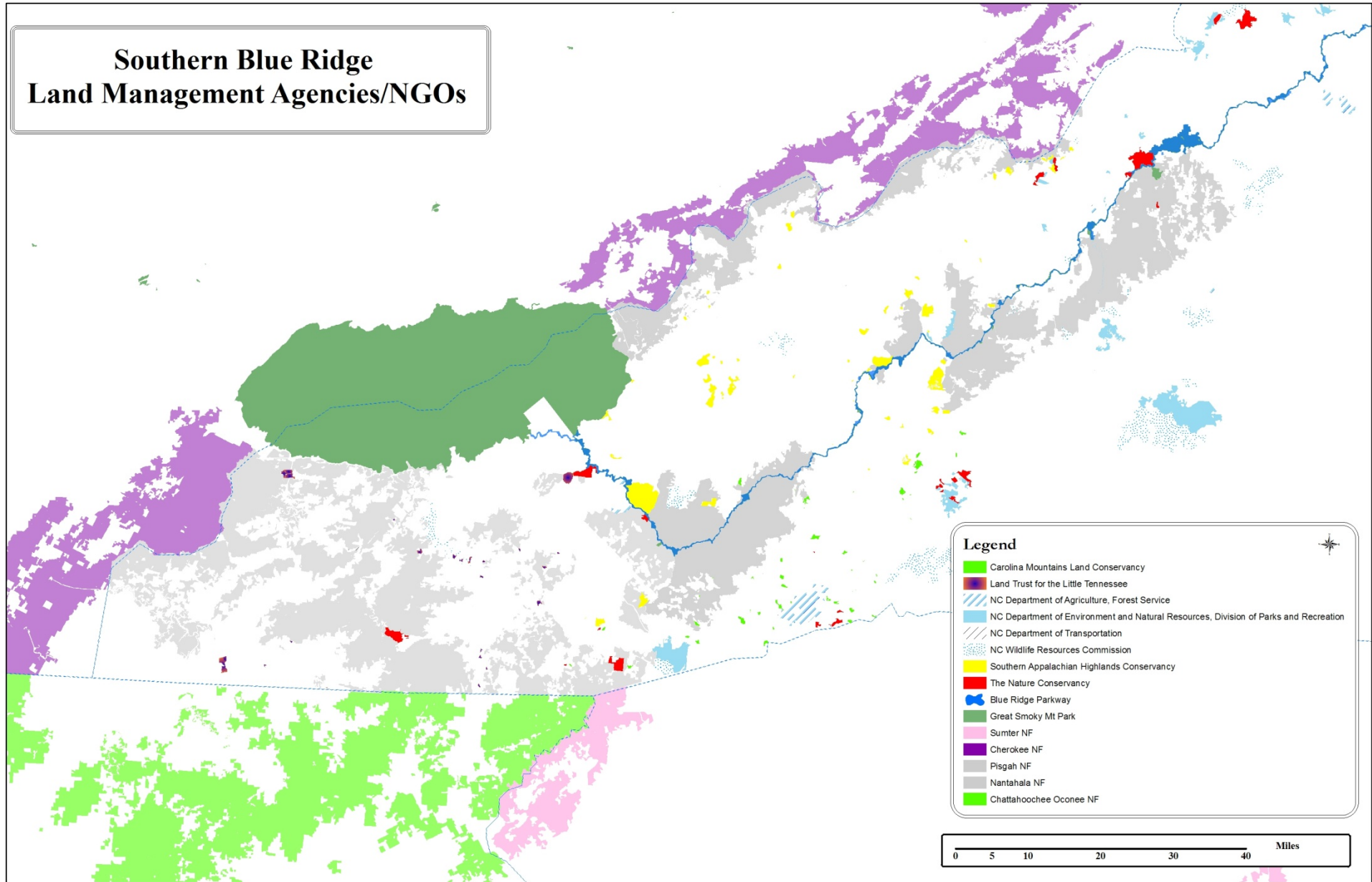
**Changes fire intensity if
present within prescribed
burn, increases with fire
activity**



Agency/NGOs Interviewed

- USFS – Cherokee, Sumter, Chattahoochee, Nantahala/Pisgah
- NPS -- Blue Ridge Parkway, Great Smoky Mts
- NC Parks and Recreation
- NC Wildlife Resources Commission
- NC Division of Forest Resources
- The Nature Conservancy
- The Land Trust for the Little Tennessee
- Southern Appalachian Highlands Conservancy
- Carolina Mountain Land Conservancy
- Biltmore Estate

Southern Blue Ridge Land Management Agencies/NGOs



Trees		Abundance/Distribution
Tree of Heaven	<i>Ailanthus altissima</i>	low to high elevation
Mimosa	<i>Albizia julibrissin</i>	low elevation
Princess Tree	<i>Paulownia tomentosa</i>	low - mid elevation
Shrubs		
Japanese Barberry	<i>Berberis thunbergia</i>	limited, low - mid elevation
Thorny Olive	<i>Elaeagnus pungens</i>	limited
Autumn Olive	<i>Elaeagnus umbellata</i>	low - high elevation
Privet	<i>Ligustrum sinense/vulgare</i>	low- mid elevation
Bush Honeysuckle	<i>Lonicera maackii/tatarica/morrowii</i>	limited, low elevation, calciphile
Japanese Knotweed	<i>Reynoutria japonica</i>	low - high elevations
Multiflora Rose	<i>Rosa multiflora</i>	low-high elevations
Wineberry	<i>Rubus phoenicolasius</i>	low - mid elevation
Japanese Spiraea	<i>Spiraea japonica</i>	low - high elevations, calciphile
Vines		
Porcelain-berry	<i>Ampelopsis brevipedunculata</i>	low - mid elevation
Oriental Bittersweet	<i>Celastrus orbiculatus</i>	low - high elevation
Chinese Yam	<i>Dioscorea polystachya</i>	low - mid elevation
English Ivy	<i>Hedera helix</i>	low elevation, home sites
Japanese Honeysuckle	<i>Lonicera japonica</i>	low - mid elevation
Kudzu	<i>Pueraria lobata</i>	low - mid elevation
Chinese Wisteria	<i>Wisteria sinensis</i>	low elevation
Herbs		
Garlic Mustard	<i>Alliaria petiolata</i>	scattered, low -mid elevations
Spotted Knapweed	<i>Centaurea stoebe ssp macranthos</i>	low elevation
Japanese Stiltgrass	<i>Microstegium vimineum</i>	dense, low - mid elevations
Chinese Silvergrass	<i>Miscanthus sinensis</i>	low - high elevations
Coltsfoot	<i>Tussilago farfara</i>	low - high elevation



Evergreen Shrub
Thicket

HERO (Existing) Closed Canopy
Typically Dense Evergreen Shrub
Minimal Herb Diversity

Northern Hardwood
Rhododendron Cove

Catastrophic Fire/
Major Disturbance

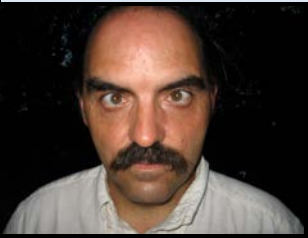
Infestation

High Severity Moderate Frequency
Fire Establishment Difficult

Maintenance
Low Severity
Low Frequency

No / Very
Infrequent Fire

Partially Open HERO
Dispersed Evergreen Shrub



Dispersed Deciduous Shrub
Moderate Grass/Sedge/Herb

Moderate frequency
Moderate-High Severity

Low frequency
Low Severity

HERO (Existing)
Closed Canopy, Moderately Dense
Deciduous Shrub, Low to Moderate Herb
Diversity, Often Dense Sedge



HERO (Existing)
Closed Canopy Open Shrub
Diverse Herb/Sedge

No / Very
Infrequent Fire

No/Very
Infrequent Fire

Maintenance
Low -Moderate
Severity Fire

Moderate Frequency
Moderate - High Severity

Low frequency
Low Severity

Northern Hardwood Slope
Open or Closed Shrub

Catastrophic Fire/
Major Disturbance

Maintenance
Low -Moderate Severity
Low-Moderate Frequency

High Frequency
Low-Moderate
Severity

Rich Grass/Herb

Maintenance
Low -Moderate Severity
High Frequency

Open HERO Woodland
Widely Dispersed Shrub
Moderate Grass/Herb

High Frequency
Low-Moderate
Severity

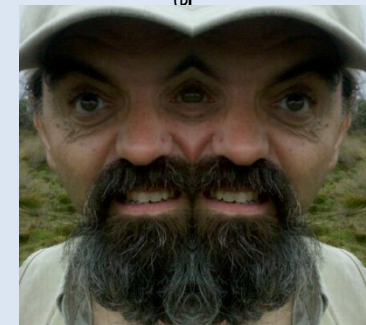
Maintenance
Low -Moderate Severity
Low-Moderate Frequency

Other Disturbance leading to complex dynamics

- High Winds
- Ice storms
- Insect outbreaks
- Grazing

**Critical ??-
????????????????**

*Exotics -- Oriental Bittersweet,
Coltsfoot



Strategies

Species Based ----- Eradicate most visible (often Kudzu infestations)

Small Infestations ----- Small garlic mustard, stilt grass patches, only fruiting specimens

Site Driven ----- Most Often for land trusts

Capacity to Control in the long term

Presence of Rare Species/Unique Habitats

Prior to Vegetation Manipulation (Prescribed Burns/timber harvest)

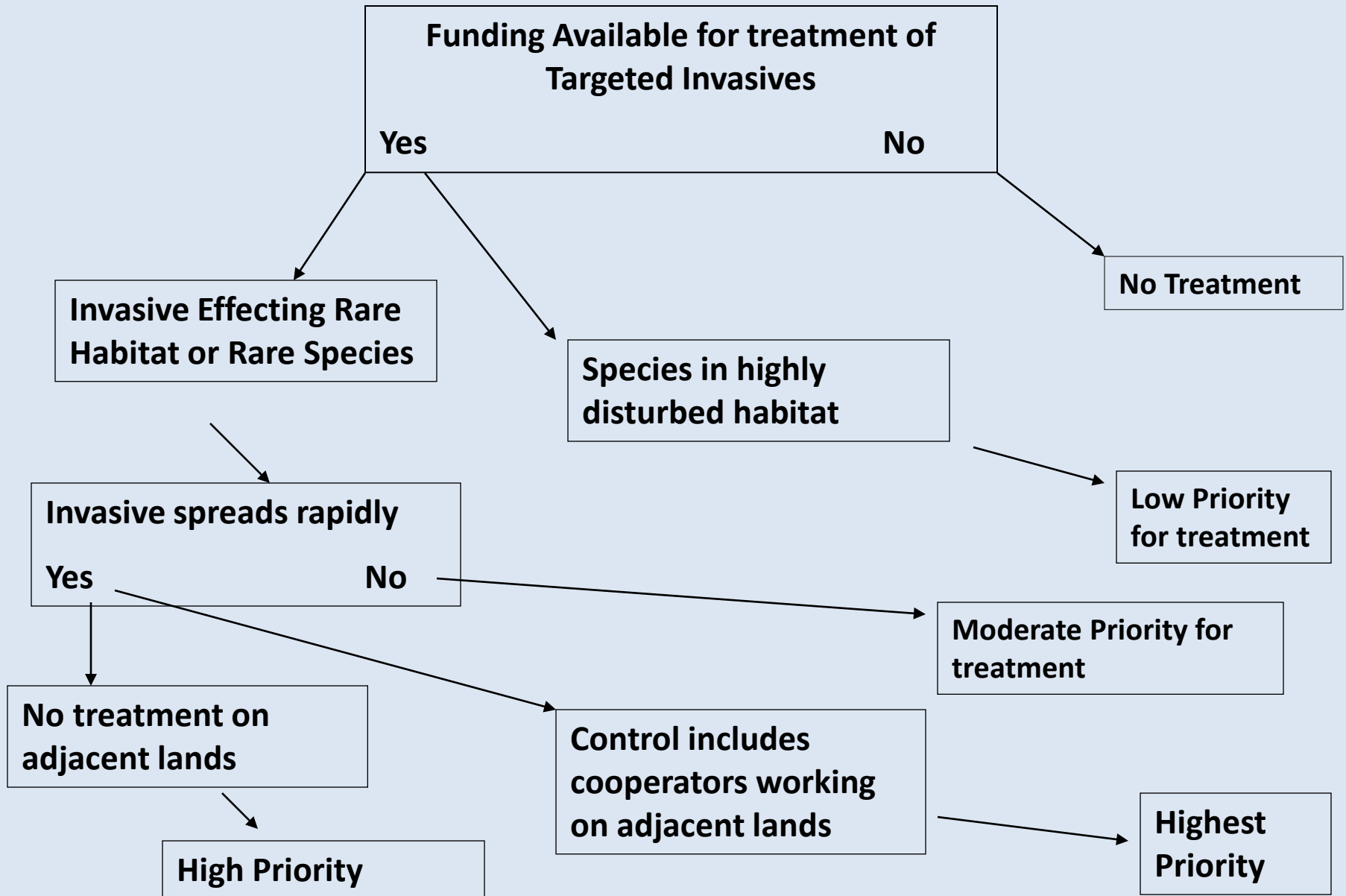
Adjacent landowner controlling invasive also

A photograph showing a person in a green shirt and blue jeans working in a dense thicket of kudzu and Virginia Spiraea. The person is standing on a rocky bank, surrounded by lush green vegetation. The kudzu is a thick, tangled mass of vines with large, heart-shaped leaves, while the Virginia Spiraea is a more upright, bushy plant with smaller, lanceolate leaves. The scene is set near a riverbank, with rocks and some debris visible in the foreground. The text "Kudzu Impacting Virginia Spiraea" is overlaid in yellow in the upper right corner, and "Cheoah River" is overlaid in yellow in the lower left corner.

**Kudzu Impacting
Virginia Spiraea**

Cheoah River

Decision Tree for Control



Goats

A large herd of white goats is grazing on a lush green hillside. The goats are scattered across the frame, some facing the camera and others looking away. The background features rolling green hills and distant mountain ranges under a blue sky with light clouds. The overall scene is a natural, outdoor setting.

Costs ----- Between \$700-1000/month with 12 goats/acre
Typically in 1 acre paddock

Tire less works, but need to remove them before they result in unanticipated consequences

Generally works best for dense infestations

Inventory

Most incomplete or out of date / 10 years old

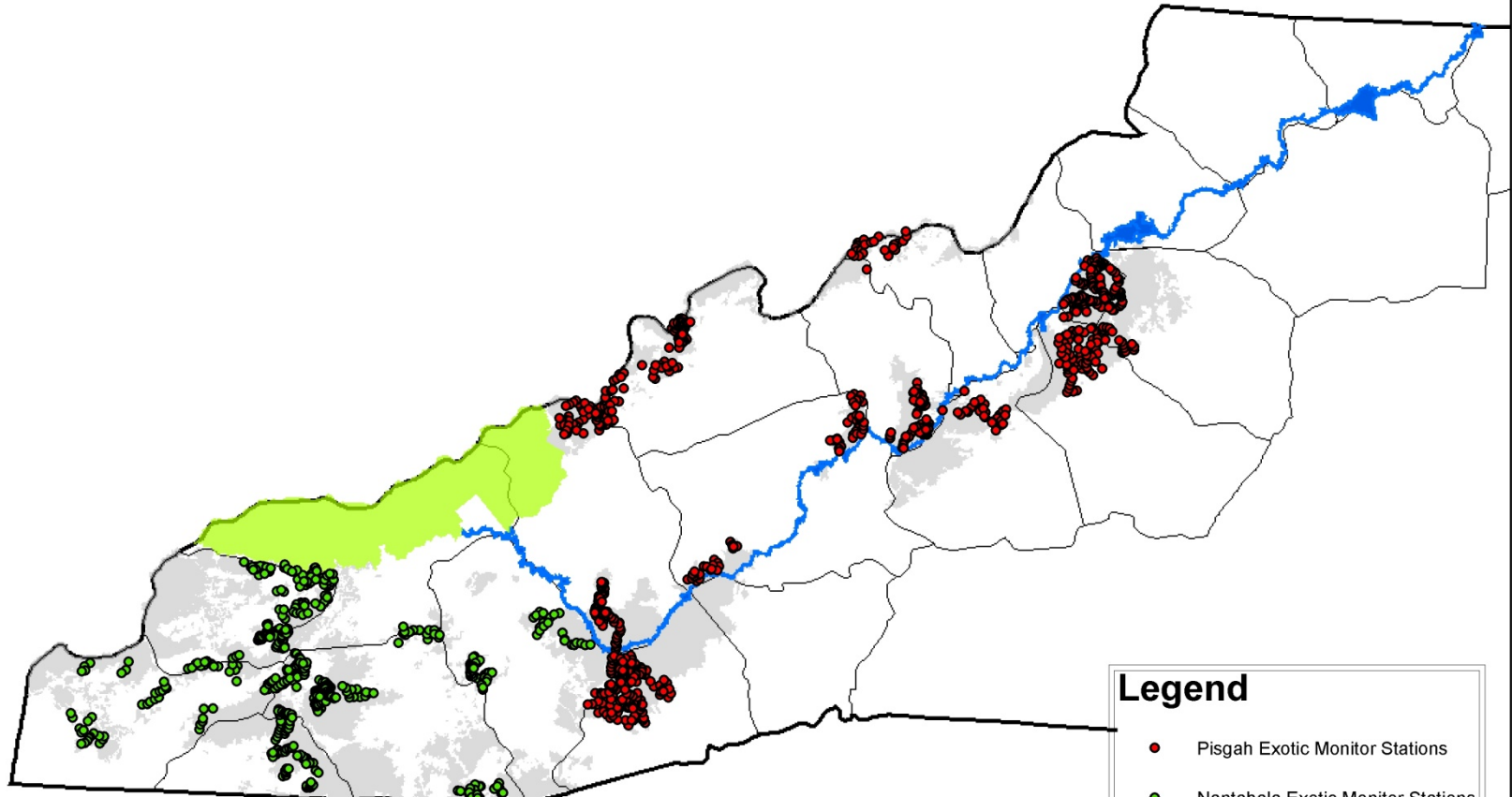
Used as a guide to direct control projects

Smokies has spatial data on 900 sites

TNC has majority of invasive plant managed sites intensely mapped including control efforts

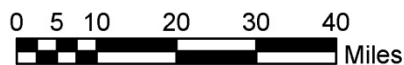
Exotic Plant Species Monitor Stations

2002/2003 Nantahala & Pisgah NF



Legend

- Pisgah Exotic Monitor Stations
- Nantahala Exotic Monitor Stations
- Great Smoky Mountains NP
- Blue Ridge Parkway NP
- USFS



Monitoring

Permanent Plots --- Infrequent
Photo Points --- 1/3 respondents
Control Trials --- 1/3 respondents
Observations --- Always



Failures/Difficulties

- **Microstegium -- pulling, weed eaters, chemicals, flooding with seed dispersal easily eliminates earlier success**
- **Reed Canary Grass --- dense rhizomes, uncertain on timing**
- **Wisteria – ineffective chemical treatment**
- **Chinese Yam – difficult to broadcast spray in sensitive areas, very waxy leaf coat, bulbils**
- **Dense Vines in rare habitats**
- **Garlic Mustard – Sensitive areas, can spread really rapidly**

Microstegium vimineum

Japanese Stiltgrass

Growth reduces competition

Very abundant





Can you control heavily infested area

Viable Oriental Bittersweet Seed in Wreath



Garlic Mustard

Alliaria petiolata





Japanese Knotweed

Chemical control may
have affected adjacent
shrubs via root
translocation t

Chinese Yam

Cinnamon Yam



UGA1148131



**Dioscorea
polystachya**

Dioscorea polystachya

Chinese/Cinnamon Yam

Shan Yao



Medicinal Use

- **Used in traditional Chinese Medicine**
- **Beneficial to stomach and spleen**
- **Tonic for lungs and kidney**
- **Strengthen resistance to disease**
- **Roots Japanese vegetable**
- **\$5/15 bulblets**

Limitations





- *Inadequate Funding*
- *Incomplete Operation Plans*
- *Incomplete Environmental Documentation*
- *Opposition to chemicals from landowners*
- *Lack of volunteers for specific sites*
- *Commitment from Administrators*

Volunteers

- **Costs to implement – often requires twice the costs of standard control**
- **Only as good as the time can devote to recruit returning volunteers**
- **Best benefit education and Outreach**
- **Can be excellent eyes for new infestations**

Working with AmeriCorps NC Parks and Recreation

Before treatment



After Treatment



Outreach Efforts

- **Smokies has certification for gravel quarries – inspect to be weed free**
- **SACWMP with Nursery Plant Avoidance List**
- **SACWMP with Boot Brush and Education Display**

Avoid use of contaminated materials for stabilization



Trailhead Boot Brush

Opportunity to Educate



THE SPREAD OF INVASIVE EXOTIC PLANTS

What are they?

Exotic plants are species that did not historically grow in our region. These plants are considered invasive if they grow or spread rapidly and are not kept in check by natural controls.

Why are they a problem?

Invasive exotic plants out-compete native plants for sunlight, water, nutrients and growing space. This causes a decline in biodiversity, displaces rare plants, and decreases food supplies for mammals, birds and insects.

How can you help?

- Clean shoes, clothes, and pets to prevent spreading seeds
- Landscape your yard and garden with native plants and seed
- Learn how to identify these plants and educate your friends
- Get involved in volunteer monitoring and control projects

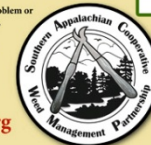
Want more information?

The Southern Appalachian Cooperative Weed Management Partnership (SACWMP) is working cooperatively to protect and restore the significant natural heritage of the Southern Appalachians by preventing, detecting and controlling invasive exotic plants. This partnership relies heavily on volunteers to monitor and control invasive exotic plants in our forests.

For more information about the problem or how you can be part of the solution,

Please visit our website:

www.sacwmp.org



Please use the boot brush below
to remove dirt and seeds from your shoes
before and after hiking. Thank you!

Questions

