U.S. National Early Detection and Rapid Response System for Invasive Plants

North Carolina Sandhills EDRR Training Workshop

North Carolina Exotic Pest Plant Council, North Carolina Sandhills Weed Management Area
Weymouth Woods-Sandhills Nature Preserve, Southern Pines, North Carolina – November 4, 2010

Agenda

9:00-9:10. *Welcome* – Rick Iverson (President, NC-EPPC) and Margaret Fields (TNC), and Tracy Rush (NCSWMA)

9:10-10:00. *EDRR – Introduction and Overview* - Randy Westbrooks, USGS
- **Handout 1:** National EDRR System Overview – Fact Sheet
- **Handout 2:** Traditional Approaches – Evolving Framework
- **Handout 3:** NC EDRR System – Organizational Framework

10:00-10:30. *NCDA Noxious Weed Program Overview* - Rick Iverson, NCDA
- **Handout 4:** Witchweed Eradication Program – Fact Sheet
- **Handout 5:** NC EDRR Target List

10:30-10:45. Break

10:45-11:00. *Cogongrass, a Serious Threat to the Sandhills Region* - Rick Iverson
- **Handout 6:** Cogongrass Fact Sheet

11:00-12:00. *Other Federal/State Regulated EDRR Species* – Fact Sheets - Rick Iverson

12:00-1:00. Lunch in Town

1:00-2:00. *Non-regulated EDRR Species* – Fact Sheets - Randy Westbrooks

2:00-2:15. *EDDMapS and other Online Invasive Species Resources* - Margaret Fields, TNC
- **Handout 7:** Field Survey Data Collection Form
- **Handout 8:** Online Resources

2:15-2:30. *Plant Specimen Collection and Preparation* - Carol Ann McCormick, UNC-Chapel Hill

2:30-2:45. Break

2:45-3:30. *Sandhills Weed Management Area Overview* - Tracy Rush, NCSWMA

3:30-4:00. *Next Steps for Building EDRR Capacity in the Sandhills Region* – Group Discussion
- **Handout 9:** Guidelines and Next Steps for Building EDRR Capacity
- **Handout 10:** Stakeholders and Volunteers – Sandhills Early Detection Network
- **Handout 11:** SCC Online IVS Training Program – Train the Next Generation
- **Handout 12:** Student Weed Stopper Program
- **Handout 13:** Rapid Assessment Guidelines
- **Handout 14:** NC EDRR Program Contacts

4:00. Adjourn

Sandhills EDRR Workshop Contacts, November 4, 2010

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Area: Archival of Field Data Records

Invasive Plants - Coming to America……

Overview of the U.S. National Early Detection and Rapid Response System for Invasive Plants.

By: Randy G. Westbrooks, Leslie J. Mehrhoff, and John D. Madsen. October 26, 2010

Introduction. Throughout history, as people colonized the Earth, they brought cultivated plants and domesticated animals along with them. Since European settlement of North America began in the 1500s, over 50,000 types of plants and animals (species, varieties, and hybrids) have been introduced to the United States. While most of these species provide great benefits to human society, a small percentage of them have escaped from cultivation and pose a threat to food and fiber production, and/or natural areas. To date, about 4,200 species of introduced plants, or about 8.4% of total introductions, have escaped from cultivation and established free-living populations in the country.

Scientists at Cornell University estimate that losses to the American economy due to introduced invasive species are now over $138 billion per year. Of this total, costs and losses due to invasive plants are now at least $50 billion per year. Unlike chemical pollutants that can be eliminated from use and will eventually break down in the environment, invasive species can reproduce and spread, causing ever increasing harm. Our biggest challenge is to control invasive species faster than they can reproduce and spread.

Since only about 2% of the U.S. population is now engaged in agriculture or land management, there is less awareness of this issue than in generations past. Clearly, land owners and managers, gardeners and horticulturalists, and others who have a strong connection to the land, have a major role to play in ongoing efforts to deal with this '*silent ecological explosion*'.

Early Detection and Rapid Response – The Preferred Management Strategy for Addressing New Invasive Species. Currently, there are numerous agencies as well as interagency groups involved with invasive plant management across the United States – including **State Invasive Species Councils** (e.g., the Maryland Invasive Species Council), and **Cooperative Weed Management Areas** (e.g., the South Fork WMA, Wyoming). Such agencies and groups routinely employ a number of strategies to manage widespread invasive plants through prevention, control,

Photo Caption: Beach Vitex (*Vitex rotundifolia*) a new invader from Asia - overrunning primary ocean dunes at DeBordieu Beach, Georgetown, South Carolina.

and public outreach. However, it is always a challenge to address new invasive plants - even though Early Detection and Rapid Response (EDRR) is clearly the preferred management strategy for preventing the establishment and spread of new and emerging species. Implementation of the principles and practices of EDRR for new invasive plants on a single land unit is a rather

straightforward process that aims to protect biodiversity and/or the production capacity of the land. This is accomplished by taking steps to *contain the infestation,* to *stop further seed production,* and to *exhaust the seed reserve in the soil*. However, efforts to address new invasive species that occur on multiple land units, and across multiple jurisdictions, typically require the cooperation of numerous agencies, as well as impacted and potential stakeholders, to be effective. By the mid-1990s, it was clear that a cooperative approach for weed prevention was needed – a **National EDRR System for Invasive Plants**.

Development of a National EDRR Framework. Development of a National EDRR System to address invasive plants on multiple land units was first adopted as a long range goal by the Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW) at its first bi-annual program planning retreat in Shepherdstown, WV, in 1998. Since that time, the U.S. Geological Survey (USGS), the Invasive Plant Atlas of New England (IPANE), and more recently, the Invasive Plant Atlas of the MidSouth (IPAMS), have been working with agencies and organizations across the nation to develop such a system.

Conceptually, the National EDRR System is a coordinated framework of interagency partner groups that are working together to increase EDRR capacity through:

- **Interagency Coordination** (by State Invasive Species Councils and State EDRR Committees);
- **Early Detection and Reporting** of suspected new plants to state officials (by trained volunteers, agency field personnel, conservationists, and scientists);
- **ID and Vouchering** of suspected new plants (by cooperating botanists and herbaria);
- **Archival** of new plant records in regional and national plant databases [e.g., the Invasive Plant Atlas of New England (UCONN), the Invasive Plant Atlas of the Mid-South (MSU), and the USDA Plants Database];
- **Rapid Assessment** of new plant species for invasiveness (by federal and state scientists); and,
- **Rapid Response** to confirmed new invaders [by Cooperative Weed Management Areas (eradication of weeds within a defined area); by Invasive Plant Task Forces (eradication of specific new weeds, (e.g., the Carolinas Beach Vitex Task Force); and by Single Agency-led Weed Eradication Programs (e.g., the USDA-Carolinas Witchweed Eradication Program, and the CA Dept. of Food and Agriculture].

Once fully developed across the United States, the National EDRR System for Invasive Plants will provide an important second line of defense against invasive plants. It will also serve to complement federal efforts to prevent unwanted introductions at U.S. ports of entry. With both prevention and early detection systems in place, the nation will be more able to defend against "plants out of place".

The Role of Land Managers and the Public in Addressing New Invasive Plants. Land managers and the public can greatly assist in the effort to prevent the introduction and spread of exotic invasive plants. Here's how.

1. *Help Prevent the Problem*….. Use native or non-invasive exotic plants for landscaping and restoration projects.
2. *Take Action*….. Eradicate new invasive plants on lands that you own or manage.
3. *Get Involved*….. Report unknown plants to state and federal officials.
4. *Volunteer*….. Help remove invasive species from area parks and public lands.
5. *Tell Somebody*….. Help raise awareness of the problem.

Contact Information

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Early Detection and Rapid Response System for Invasive Plants in the U.S.
Evolving Framework - 1997-2010. Handout #2

Processes and Functions	Traditional Roles and Responsibilities	Emerging EDRR Partners and Partnerships
Interagency Coordination	**FICMNEW (National Level)**	**- NISC (National Level)** **- State Invasive Species Councils** **- State Interagency Working Groups** **- State EDRR Committees** **- Designated State EDRR Coordinator**
Early Detection and Reporting	**Plant Regulatory Surveys** (e.g., APHIS CAPS Program)	**- Volunteer Early Detection and Reporting Networks** (e.g., IPANE, IPAMS, BAEDN) **- Public and Private Land Managers**
Reporting Contacts	**State Weed Regulatory Official**	**- State EDRR Coordinator** **- Other Designated EDRR Contacts**
Plant ID and Vouchering	**Cooperating Botanists and Herbaria**	
Data Archival	**Herbarium Records**	**Online Invasive Plant Atlases** (e.g., IPANE, PLANTS Database, etc.)
Rapid Assessments	**- State/Federal Plant Regulatory Officials** (Weed Risk Assessments)	**Cooperating Plant Scientists**
Delimiting Surveys	**- Impacted Land Managers; Others as Designated**	
Decision Makers for Action	**- Impacted Stakeholders** (e.g., Land Owners/Managers, Regulatory Agencies, etc.) **- Potential Stakeholders** (e.g., Land Managers Downstream)	
Field Eradication Program	**Single Agency-Led Programs** (Single Land Unit or Single Agency Scope)	**- Invasive Plant Task Forces** (Single Species Focus, Multiple Land Units and Interagency Scope) **- Cooperative Weed Management Areas (**Geographic Focus)
Monitoring (Appraisal Surveys)	**- Impacted Land Managers; Others as Designated**	
Prevention and Containment Measures	**- Federal/State Plant Regulatory Agencies** (e.g., Quarantines)	**Land Owners and Managers** (e.g., Vehicle/Equipment Sanitation, Weed Free Hay, etc.)
Outreach and Education	**- Federal/State Plant Regulatory Agencies** (Primarily Regulated Species)	**- EDRR Outreach Coordinator** **- Cooperating Educators**

North Carolina EDRR System for Invasive Plants – Organizational Framework. October, 2010. Handout #3

International Level

ISSG – International EDRR Working Group	Global Early Warning System
North America – Weeds Across Borders Conference	North America Early Warning System

National Level

National Invasive Species Council	Interagency Coordination – All Taxa
FICMNEW	Interagency Coordination - Weeds

State Level

State Invasive Species Council	NC-EPPC	Interagency Coordination
State EDRR Committee		State EDRR Work Plan
Committee Co-Chairs, Principal EDRR Contacts	R. Westbrooks, USGS R. Iverson, NCDA	
EDRR Training Specialists	M. Fields, TNC R. Westbrooks, USGS	Train-the-Trainer Workshops; Volunteer Training, Online Training
Botanists and Herbaria	Alexander Krings, NCSU	ID and Vouchering
State/Regional Invasive Plant Atlas	SE-EPPC, EDDMapS	Data Archival; Mapping, etc.
Cooperating Federal/State Plant Biologists	R. Westbrooks, USGS	Rapid Assessments; Weed Risk Assessments; EDRR in Natural Areas
Federal and State Weed Scientists	R. Westbrooks, USGS, Others	Control Recommendations, Science and Technical Support
Land Managers and Stewards	Margaret Fields, TNC Nancy Fraley, NPS	EDRR on Public and Conservation Lands
Aquatic Weed Specialists	Rob Emens, NC-DENR	EDRR in Waterways
Federal Weed Regulatory Liaison (APHIS)		Federal Weed Regulatory Issues
State Weed Regulatory Liaison (NCDA)	Rick Iverson, NCDA	- State Weed Regulatory Issues (Quarantines; Regulations) - EDRR on Private Lands
Legislative and Public Affairs Specialists	All Members	Public Awareness, Listing of New Species as Noxious Weeds
State Early Detection and Reporting Network (Contact Directory)		Early Detection and Reporting
Single Agency-Led Weed Eradication Programs (Regulatory Agencies, Land Management Agencies, Private Land Owners	Witchweed Eradication Program (APHIS, NCDA)	EDRR, Surveys, Inventory, Monitoring, and Prevention on Public and Conservation Lands
- Invasive Plant Task Forces - CWMAs	Beach Vitex Task Force	Eradication of New Weeds on Multiple Land Units

APHIS Factsheet

Plant Protection and Quarantine

March 2003

Witchweed: A Parasitic Pest

Witchweed *(Striga asiatica)* is a parasitic plant that attacks some of the most important crops in the United States–corn, sorghum, sugar cane, and rice. It also parasitizes certain weedy grasses.

Unlike most weeds, which merely compete with crops, parasites like witchweed do their damage more directly. They rob nutrients and moisture by tapping directly into the host's root system. Consequently, the host spends energy supporting witchweed growth at its own expense. While a parasitized host, such as a corn plant, may be less productive (produce fewer seeds), each witchweed plant produces as many as 50,000 seeds.

The American witchweed is one of many related parasitic plants native to Africa, India, the Middle East, and China. In these areas it can completely ruin agricultural productivity in affected land. No one is sure how or when witchweed first came to the United States. However, the slender, red-blossomed parasite was first identified in 1955 by a graduate student from India who knew it as the pest that had ruined sorghum production in his country.

Witchweed will grow in the presence of grassy weeds as well as grass host crops, so cotton, peanut, or soybean fields–along with home gardens or idle land–may harbor the pest. Witchweed emerges from the soil beginning in late June and flowers about 2 weeks later. Swollen seed pods follow, liberating thousands of microscopic seeds, which can live in the soil for at least 10 years.

Witchweed's prolific nature and its potential for devastating important American host crops led to a decision to eradicate this pest. Congress first allocated funds for this purpose in 1957. The U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) established a research station and farm where it developed control methods.

Since its discovery in North and South Carolina, witchweed's spread has been halted, and the acreage supporting it has been reduced by 99 percent (from 450,000 acres to about 3,400). Eradication is accomplished in three phases:

- Survey activities find and map all infestations,
- Quarantine activities prevent human spread of witchweed beyond the infested region, and
- Control activities seek to prevent existing plants from producing seeds and to destroy seeds already in the soil.

These activities involve the cooperative efforts of Federal and State governments as well as the general public.

Survey

APHIS and State cooperators have taken steps to prevent this dangerous weed from spreading from infested areas in North and South Carolina. APHIS is offering a $25 reward to anyone who identifies and reports the weed. After receiving a report, officials remove the plant to stop reproduction. Then they destroy seeds already in the soil.

Finding every specimen of the slender, foot–tall witchweed plant is not without obstacles. The cooperation of landowners is essential. Scouts are sent out on foot, in vehicles, and on horseback to find infested sites. People are asked to check their own land and to report the presence of witchweed to an agricultural extension agent or witchweed personnel.

Containment Through Quarantine

Although the tiny witchweed seeds can be spread by wind or water, people are the chief means of dispersal. To prevent the spread of this pest, agricultural quarantines specify conditions for moving soil, plants, or machinery out of infested areas.

Eradication

Eliminating witchweed requires finding and killing plants before they go to seed and eliminating seeds already in the soil.

Herbicides are used on fields infested with witchweed. Extensive field research has provided information on the best chemical or combination of chemicals for the given crop, weed species, and field conditions.

Eliminating the microscopic seeds is another important part of eradication. Some seeds die of natural attrition or sprout only to be killed by an herbicide. However, since witchweed seeds can persist in the soil for a decade, efficient eradication requires accelerating the natural rate of seed germination.

Witchweed seeds can be eliminated from the soil by creating conditions that cause them to germinate when no host is present. This phenomenon is known as suicidal germination. Ethylene gas, a natural ripening agent produced by fruits, vegetables, and flowers, is injected into the soil under proper environmental conditions. It stimulates seed germination, but lacking a host, seedlings die.

Soil fumigation is another alternative, albeit an expensive one. Chemicals such as methyl bromide are used on occasion to assure seed destruction.

North Carolina – Invasive Plant EDRR Target List.

North Carolina Exotic Pest Plant Council – EDRR Committee – October, 2010.
Handout #5

I. Federal and/or State Regulated Early Detection Species (Not Known to Occur in State)

1. Branched Broomrape (*Orobanche ramosa*)
2. British Yellowhead (*Inula britannica*)
3. Cogongrass (*Imperata cylindrica*)
4. Goatsrue (*Galega officinalis*)
5. Japanese Dodder (*Cuscuta japonica*)
6. Giant Hogweed (*Heracleum mantegazzianum*)
7. Caulerpa – Marine Alga (*Caulerpa taxifolia*)

II. Unregulated Early Detection Species (Not Known to Occur in State)

8. Old World Climbing Fern (*Lygodium microphyllum*)
9. Wavyleaf Basketgrass (*Oplismenus hirtellus* Subspecies *undulatifolius*)
10. Floating Hearts: Crested Floating Heart (*Nymphoides cristata*), Water Snowflake (*N. indica*), and Yellow Floating Heart (*N. peltata*)

III. Federal and/or State Regulated EDRR Species (Limited Distribution in State)

11. Mile-a-minute Vine (*Persicaria perfoliata*)
12. Beach Vitex (*Vitex rotundifolia*)
13. Benghal Dayflower (*Commelina benghalensis*)
14. Bushkiller (*Cayratia japonica*)
15. Canada Thistle (*Cirsium arvense*)
16. Giant Salvinia (*Salvinia molesta*)
17. Hydrilla (*Hydrilla verticillata*)
18. Itchgrass (*Rottboellia cochinchinensis*)
19. Oriental Bittersweet (*Celastrus orbiculatus*)
20. Puncturevine (*Tribulus terrestris*)
21. Purple Loosestrife (*Lythrum salicaria*)
22. Small Broomrape (*Orobanche minor*)
23. Tropical Soda Apple (*Solanum viarum*)
24. Witchweed (*Striga asiatica*)

IV. Unregulated EDRR Species (Limited Distribution in State)

25. Deeprooted Sedge (*Cyperus enterianus*)

V. Other Invasive Plants of Special Concern (Limited Distribution in the State)

26. Chinese Tallow (*Triadica sebifera*)
27. Garlic Mustard (*Alliaria petiolata*)
28. Saltcedar (*Tamarix ramosissima*)

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Handout #6

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Cogongrass
Scientific Name: *Imperata cylindrica* (L.) Beauv.
Family: Poaceae

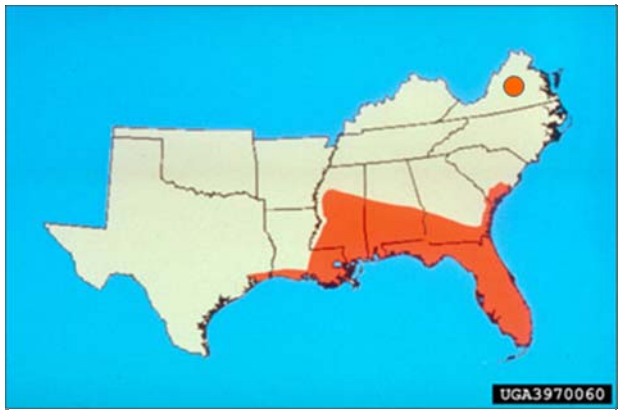
Description: A perennial, colony-forming grass up to 6' tall – with no apparent above-ground stem. **Leaves** arising from the ground, with off-center, whitish midrib and finely serrated margins, up to 6' long, up to 1" wide, stiff, with a sharp, pointed apex. **Flower heads** 2-8" long, silvery-white and cylindrical, in a large, fuzzy panicle. **Seeds** light and fluffy, spread by primarily by wind. **Rhizomes** whitish, branched, scaly, with sharp tips – forming a very dense underground mat.

Habitat: Cogongrass thrives in a wide variety of habitats, and is tolerant of shade, full sun, high salinity, drought, flooding, mowing, and fire. It currently affects forests, pastures, roadways and wetlands across most of the southeastern U.S. *(excluding North Carolina).*

Native Range: Southeast Asia.

Pathways of Introduction and Spread: Cogongrass was accidentally introduced into the U.S. as a packing material in shipping crates in Mobile, Alabama, around 1911. Later, it was intentionally introduced into Alabama as a pasture grass, and for erosion control. It reproduces and spreads via wind-borne seeds (up to 3,000 per plant) and rhizomes fragments. The feather-light, seeds can be carried as far as 15 miles by wind. The fragmented rhizomes are unwittingly spread by people through contaminated hay, soil, and soil – as well as by machinery, equipment, and vehicles. Blood Grass, which is a variety of Cogongrass, has been also sold as an ornamental grass in some parts of the country.

U.S. and Canada Distribution:



Ecological and Economic Impacts:
Cogongrass has been called the perfect weed. It affects 35 crops and infests 1.25 billion acres in 73 countries around the world. It is an extremely aggressive invader that forms dense, circular infestations with thick ground level mats that act as a

physical barrier to the establishment of other types of plants. In the process, it outcompetes native plants for nutrients, rooting space, moisture, and sunlight. It is also allelopathic – it produces chemicals that suppress the growth of other plants. By overwhelming native plants, it drives out ground-nesting wildlife such as turkey and bobwhite quail, as well as the endangered gopher tortoise, which depends on native grasses and legumes. While cogongrass roots are very fire tolerant, the plant is extremely flammable, and can cause fast-moving wildfires (to more than 840^{o} F) that consume native plants and animals and disrupt the natural fire regime.

Control Strategies: The first step in controlling cogongrass is to remove ground level thatch and older leaves by a controlled burn during the summer. It reduces biomass, stimulates regrowth from the rhizomes, and allows herbicides to be applied only to actively growing leaves. If tillage of the infested area is possible, disking soon after a controlled burn will cut down on rhizome mass. To prevent spreading, equipment should be thoroughly cleaned after tilling. After 1-4 months of regrowth, a herbicide such as Arsenal (imazapyr) plus glyphosate should be applied. Follow-up treatments in the second and possibly the third year will be needed to eliminate the population.

Regulatory Status: Cogongrass is listed as a U.S. Federal Noxious Weed. As a result, it is automatically listed as a state noxious weed in Alabama, California, Florida, Massachusetts, Minnesota, North Carolina, Oregon, South Carolina, and Vermont.

Online Resources:
- Cogongrass Fact Sheet – BASF:
URL: http://www.cogongrass.org/basfarsenal.pdf

- Cogongrass Fact Sheet – Plant Conservation Alliance:
URL: http://www.nps.gov/plants/alien/fact/imcy1.htm

- Cogongrass Control Fact Sheet - BASF:
URL: http://www.cogongrass.org/basffactsheet.pdf

- Cogongrass Website:
URL: http://www.cogongrass.org/

- U-GA Bugwood Image Gallery:
URL: http://www.invasive.org/species/subject.cfm?sub=2433

- USDA Plants Database:
URL: http://plants.usda.gov/java/profile?symbol=IMCY

U.S. National EDRR System for Invasive Plants.

Field Survey Form. Handout #7

Date:	**Surveyor(s):**	**Site #:**
GPS Coordinates:	**Latitude:**	**Longitude:**
General Location:		
Site Description (Size, Notable Features, etc.):		

Invasive Plants at Site	
Scientific Name:	**Common Name:**

Associated Plants at Site:	
Scientific Name:	**Common Name:**

Notes:

USGS Coastal Plain Field Station, Whiteville, North Carolina. Spring, 2010.
(Adapted from the NAWMA Weed Inventory Field Form).

U.S. National EDRR System for Invasive Plants.

Field Survey Form. Handout #7

Date:	**Surveyor(s):**	**Site #:**
GPS Coordinates:	**Latitude:**	**Longitude:**
General Location:		
Site Description (Size, Notable Features, etc.):		

Invasive Plants at Site	
Scientific Name:	**Common Name:**

Associated Plants at Site:	
Scientific Name:	**Common Name:**

Notes:

USGS Coastal Plain Field Station, Whiteville, North Carolina. Spring, 2010.
(Adapted from the NAWMA Weed Inventory Field Form).

Online Invasive Species Resources

Handout #8

Center for Invasive Plant Management
URL: http://www.weedcenter.org/

Center for Invasive Species and Ecosystem Health
URL: http://www.invasive.org/

Dow AgroSciences Invasive Plant Management
URL: http://www.dowagro.com/ivm/invasive/invasive.htm

EDDMaps
URL: www.eddmaps.org

Gardensmart Plantwise
URL: http://www.beplantwise.org/

Global Invasive Species Database
URL: http://www.issg.org/database/welcome/

Global Invasive Species Team
URL: http://www.invasive.org/gist/

Invasipedia
URL: http://wiki.bugwood.org/Invasipedia

Invasive Exotic Plant Management Tutorial for Natural Lands Managers
URL: http://www.dcnr.state.pa.us/FORESTRY/invasivetutorial/index.htm

National Biological Information Infrastructure
URL: http://www.nbii.gov/portal/server.pt?open=512&objID=221&mode=2&in_hi_userid=2&cached=true

National Invasive Species Information Center
URL: http://www.invasivespeciesinfo.gov/

National Invasive Species Council:
http://www.invasivespecies.gov/

National Park Service Invasive Species Management:
http://www.nature.nps.gov/biology/invasivespecies/index.htm

North Carolina Department of Agriculture and Consumer Services (info on pesticide licenses)
http://www.ncagr.gov/SPCAP/pesticides/license.htm

North Carolina Division of Parks and Recreation (pdfs of state parks guidelines for invasive species control, planting, and nuisance animal control):
http://www.ncparks.gov/About/natural_resources_stewardship.php

NC Division of Water Resources Aquatic Weed Control Program
URL: http://www.ncwater.org/Education_and_Technical_Assistance/Aquatic_Weed_Control/

NC Exotic Invasive Plants Book
URL: http://www.se-eppc.org/northcarolina/NCDOT_Invasive_Exotic_Plants.pdf

NC Exotic Pest Plant Council
URL: http://www.se-eppc.org/northcarolina/
http://www.facebook.com/#!/pages/North-Carolina-Exotic-Pest-Plant-Council-NCEPPC/126048340782915

NC Native Plant Society Invasive Plants
URL: http://www.ncwildflower.org/invasives/invasives.htm

Protect Your Waters
URL: http://www.protectyourwaters.net/

Southeast Exotic Pest Plant Council
URL: http://www.se-eppc.org/

UF Center of Aquatic and Invasive Plants
URL: http://plants.ifas.ufl.edu/

USDA NRCS Plant database
URL: http://plants.usda.gov/

US Fish and Wildlife Service Invasive Plant Training Program
URL: http://www.fws.gov/invasives/staffTrainingModule/index.htmlManagement

Weeds gone Wild by Plant Conservation Allilance
URL: http://www.nps.gov/plants/alien/index.htm

NC Sandhills Weed Management Area
www.ncswma.org

Books:

Kaufman S. R. and W. Kaufman. 2007. *Invasive Plants guide to identification and the impacts and control of common North American species.* Mechanicsburg, PA: Stackpole Books.

Miller, James H., Chambliss, Erwin B., and Loewenstein, Nancy J. 2010. A field guide for the identification of invasive plants in southern forests Gen. Tech. Rep. SRS 119. Southern Research Station, U.S. Department of Agriculture Forest Service. Asheville, N.C. 126 p.

Strategies for Building New Capacity for EDRR in North Carolina

Handout #9

I. U.S. National Early Detection and Rapid Response System for Invasive Plants.

1. National EDRR System - Fact Sheet – Introduction and Overview.
2. National EDRR System – Traditional Approaches – Evolving Framework.
3. National EDRR System – Rapid Assessment Guidelines.
4. National EDRR System – Field Survey Form.
5. National EDRR System – Student Weed Stopper Program.

II. North Carolina EDRR System – North Carolina Exotic Pest Plant Council.

1. N.C. EDRR System – Organizational Framework.
2. N.C. EDRR System – State EDRR Committee Work Plan.
3. N.C. EDRR System – State EDRR Target List – Fact Sheets.
4. N.C. EDRR System – Potential Stakeholders/Volunteer Groups.

III. Next Steps.

1. **Develop a State Early Detection and Reporting Network**
   - Agency Field Personnel , Volunteers (NC Native Plant Society, Friends of Parks, Professional Associations, Civics Club Members, Master Gardeners, Fishermen, etc.)
   - Train-the-Trainer Workshops; Regional Volunteer Training Workshops
2. **Survey and Monitor Valuable Natural and Managed Resources**
   - Weekend Bio-Blitzes for EDRR Target Species at Parks, Forests, Refuges, etc.
   - Survey of High Risk Sites (e.g., Parks, Forests, etc.)
3. **Report/Submit Suspected EDRR Target Species to Partner Herbaria**
4. **Contribute Field Records to SE-EPPC EDDmapS**
   - Archival of Field Data Records Submitted by the EDRN
   - 'Real-time' Distribution Information on EDRR Target Species
5. **Conduct Rapid Assessments of Newly Reported Species** (USGS, NCDA, NCSU)
6. **Develop Rapid Response/Eradication Initiatives for New Invaders**
   - Assist Single-Agency Led Projects (Generally Regulated Species)
   - Develop Interagency Task Forces (Generally Non-Cropland Species)
7. **Train the Next Generation**
   - Online Invasive Species Management Training Program (SCC – R. Westbrooks)

North Carolina Exotic Pest Plant Council

Early Detection and Rapid Response Target List

Stakeholders and Potential Volunteer Groups

November 4, 2010 Handout #10

I. Federal and/or State Regulated Early Detection Species (Not Known to Occur in State)		
1. Branched Broomrape (*Orobanche ramosa*) (Farms)	Statewide	Farmers
2. British Yellowhead (*Inula britannica*) (Farms)	Statewide	Farmers
3. Cogongrass *Imperata cylindrica* (Forests)	Coastal Plain	Foresters, Land Owners
4. Goatsrue (*Galega officinalis*) (Pastures – Poisonous)	Statewide	Cattle Producers
5. Japanese Dodder (*Cuscuta japonica*) (Stem Parasite on Kudzu, Soybeans, etc.) (Eradicated from the Clemson Botanical Garden in 1994)	Statewide	Foresters, Farmers
6. Giant Hogweed (*Heracleum mantegazzianum*) (Highly Poisonous – Causes Dermatitis Worse than Poison Ivy)	Piedmont	Biologists, Land Managers, Master Gardeners, the Public, Friends of Parks
7. Caulerpa – Marine Alga (*Caulerpa taxifolia*) (Marine Ecosystems)	Coastal Estuaries, Continental Shelf	Fishermen
8. Mile-a-minute (*Persicaria perfoliata*) (Forests)	Statewide	Foresters, Landowners with Timber, Biologists, Native Plant Enthusiasts, Scouts, Friends of Parks

II. Unregulated Early Detection Species (Not Known to Occur in State)		
9 .Old World Climbing Fern (*Lygodium microphyllum*) (Forests)	Piedmont, Coastal Plain	Foresters, Timber Producers, Biologists, Native Plant Enthusiasts, Scouts, Friends of Parks
10. Wavyleaf Basketgrass (Oplismenus hirtellus (L.) P. Beauv. Subspecies undulatifolius (Ard.) U. Scholz) (Forests)	Statewide	Foresters, Timber Producers, Biologists, Native Plant Enthusiasts, Scouts, Friends of Parks
11. Crested Floating Heart (*Nymphoides cristata*) (Water Gardens, Ponds, Lakes)	Statewide	Recreational Boaters, Fishermen (Bass Master Association)

North Carolina Exotic Pest Plant Council

Early Detection and Rapid Response Target List

Stakeholders and Potential Volunteer Groups

III. Federal and/or State Regulated EDRR Species (Limited Distribution in State)		
12. Beach Vitex (*Vitex rotundifolia*)	Piedmont, Coastal Plain	Beach Community Residents
13. Benghal Dayflower (*Commelina benghalensis*) (Farms; NCDA Research Farm, Goldsboro, NC)	Piedmont, Coastal Plain	Farmers
14. Bushkiller (*Cayratia japonica*) (Forest Canopies)	Piedmont	Foresters, Timber Producers, Biologists, Native Plant Enthusiasts, Scouts, Friends of Parks
15. Canada Thistle (*Cirsium arvense*) (Pastures)	Mountains, Piedmont	Farmers
16. Giant Salvinia (*Salvinia molesta*) (Being Eradicated from Pender County)	Statewide	Recreational Boaters, Fishermen
17. Hydrilla (*Hydrilla verticillata*) (Waterways)	Statewide	Recreational Boaters, Fishermen (Bass Master Association)
18. Itchgrass (*Rottboellia cochinchinensis*) (Farms; Right-of-ways)	Coastal Plain	Farmers, State DOT Workers
19. Puncturevine (*Tribulus terrestris*) (Fields, Pastures, Roadsides, Railways, Waste Places Walkways, Parks, Yards, Disturbed Areas)	Statewide	Farmers, State DOT Workers, Railway Workers, Nature Enthusiasts, Scouts, Master Gardeners
20. Purple Loosestrife (*Lythrum salicaria*) (Wetlands)	Statewide	Biologists, Native Plant Enthusiasts, Master Gardeners
21. Small Broomrape (*Orobanche minor*) (Root Parasite on Tomatoes, etc.)	Mountains	Farmers
22. Tropical Soda Apple (*Solanum viarum*) (Pastures, Forests)	Statewide	Cattle Producers, Foresters, Timber Producers, Biologists, Native Plant Enthusiasts, Scouts, Friends of Parks, Master Gardeners
23. Witchweed (*Striga asiatica*) (Farms, Gardens) (USDA-Carolinas Witchweed Eradication Program)	Statewide	Farmers

North Carolina Exotic Pest Plant Council

Early Detection and Rapid Response Target List

Stakeholders and Potential Volunteer Groups

IV. Unregulated EDRR Species (Limited Distribution in State)		
24. Deeprooted Sedge (*Cyperus enterianus*) (Drainage Ditches)	Piedmont, Coastal Plain	Land Managers,

V. Other Invasive Plants of Special Concern (Limited Distribution in State)		
25. Chinese Tallow (PCP) *Triadica sebifera*	Coastal Plain	Foresters, Timber Producers, Land Managers, Biologists, Native Plant Enthusiasts, Scouts, Friends of Parks
26. Garlic Mustard (*Alliaria petiolata*) (Forests)	Mountains, Piedmont	Foresters, Timber Producers, Biologists, Native Plant Enthusiasts, Scouts, Friends of Parks
27. Oriental Bittersweet (*Celastrus orbiculatus*)	Statewide	Foresters, Timber Producers, Biologists, Native Plant Enthusiasts, Scouts, Friends of Parks
28. Saltcedar (*Tamarix* sp.) (Riparian Areas)	Coastal Areas	Biologists, Coastal Residents

Summary of EDRR Cooperators, Stakeholders, and Volunteer Groups:

- Agency Field Personnel (e.g., Park Rangers State DOT, NCDA Nursery Inspectors, Educators (College Instructors and Instructors), County Extension Agents, Federal IVS Specialists, etc.)

- Biologists, Boaters, Cattlemen, Coastal Residents, Farmers, Fishermen, Foresters, Friends of Parks, Industry Representatives, Land Managers, Master Gardeners, Native Plant Enthusiasts, Railway Workers, Scouts, Timber Producers

SOUTHEASTERN COMMUNITY COLLEGE
Explore...Discover...Learn...Grow...
910-642-7141

Environmental Science Technology Program

Invasive Species Management

Introduced invasive species such as Chinese Wisteria (*Wisteria sinensis*) are the number two threat to native plants and animals in the U.S., and cause over $150 billion in losses to the American economy, annually. Efforts to control invasive species are piecemeal and under-funded. Compounding the problem is a lack of trained technicians to assist with control and management efforts. People seeking invasive species management positions generally have training in biology, forestry, agronomy, or related fields – but generally no training or field experience in controlling invasive species.

Despite its attractive foliage and sweet aroma, Chinese Wisteria (*Wisteria sinensis*) is an invasive plant that strangles American trees, such as these loblolly pines in Whiteville, N.C.

In response to this need, Southeastern Community College is offering the first ever college-level program to train invasive species field managers. Under this program, students may complete classes for continuing education requirements, a Certificate of Invasive Species Management, or an Associate in Science degree in Environmental Science Technology with a second year focus in invasive species management.

SCC Environmental Science Interns at Lake Waccamaw State Park, Lake Waccamaw, N.C.

Career Opportunities…….

Federal Agencies
- USDA Forest Service
- USDA Natural Resources Conservation Service
- U.S. Fish and Wildlife Service
- Bureau of Land Management
- National Park Service

State Agencies
- State Departments of Transportation
- State Departments of Agriculture
- State Departments of Natural Resources
- State Forestry Service
- State Parks

County Agencies and Municipalities
- Cooperative Extension Service
- County Weed & Pest Departments
- City Parks Departments, etc

Private Industry
- Landscaping Companies
- Environmental Consulting Firms
- Invasive Plant Control Companies
- Pest Control Companies

…….and many more!

For more information, call Rebecca Westbrooks at 910-642-7141, Ext. 291.
Contact her by e-mail at rwestbrooks@sccnc.edu.
4563 Chadbourn Hwy, P.O. Box 151, Whiteville, NC 28472 USA
Visit SCC on the Internet at www.sccnc.edu.

Southeastern Community College – IVS Management Training Program

PROGRAM COURSES & DESCRIPTIONS

		Credit Hours:
IVS 110	**Introduction to Invasive Species** (Internet Course) Ecology and Biology of Invasive Species, Economic Impacts, Survey of Major Invasive Species Taxa (Plants, Aquatic Nuisance Species, Insects and Diseases, Injurious Wildlife, General Management Approaches, Sociological Aspects, Ethical Considerations	**3 Hours**
IVS 210	**Overview of Invasive Species Management Strategies** (Internet Course) Foreign Pest Prevention, Port of Entry Exclusion, Early Detection, Survey, Containment and Eradication, Control Methods (Chemical, Cultural Mechanical, Biological), Interagency Committees and Partnerships, Weed Management Areas, Invasive Plant Task Forces, Outreach and Education.	**3 Hours**
IVS 211	**Overview of Invasive Species Management Programs** (Internet Course) - Federal/State Animal and Plant Regulatory Programs (USDA APHIS, State Departments of Agriculture, etc.) - Federal/State/Local Management Programs (National Park Service, California Department of Food and Agriculture, etc.) - Interagency Programs and Projects	**3 Hours**
IVS 220	**Invasive Plant Survey Methods** (Internet Topics, Field Studies) Detection, Delimiting, and Appraisal Survey Methods, Data Synthesis and Archival	**4 Hours**
IVS 221	**Invasive Plant Control Methods** (Internet Topics) Containment, Eradication and Control Methods, Equipment Operation, Care and Maintenance, Safety.	**3 Hours**
IVS 260	**State Pesticide License Exam Preparation** (Internet Course)	**1 Hour**
GIS 110	**Introduction to GPS and GIS Mapping** (Internet Course)	**1 Hour**
	Total Credits =	**18 Hours**

NOTE: Program Content is Subject to Change.

Date: December 20, 2009

Invasive Plants - Coming to America.

National Early Detection and Rapid Response System for Invasive Plants – Student Weed Stopper Program.

Randy G. Westbrooks, Leslie J. Mehrhoff, John D. Madsen, and Victor Maddox

January 19, 2010

Introduction. Currently, a **National Early Detection and Rapid Response (EDRR) System for Invasive Plants** is being developed to help minimize the establishment and spread of non-native invasive plants in the United States. Primary strategies to increase capacity for EDRR include: **early detection and reporting** of suspected new plants to appropriate officials (by trained volunteers and agency field personnel); **ID and vouchering** of submitted specimens (by cooperating botanists); **archival** of new plant records in regional and national plant databases [e.g., the Invasive Plant Atlas of New England (IPANE)]; **rapid assessment** of new plant species for invasiveness (by federal and state scientists); and **rapid response** to confirmed invaders (by impacted land owners/managers, and invasive plant task forces).

The Role of Educators. Educators across America can help address the problem by talking about invasive species in their science classes, and by stressing the importance of using non-invasive plants in the landscape that will not escape and establish free living populations outside of cultivation. Educators can become directly involved in the effort to develop a National EDRR System for Invasive Plants by forming **Student Weed Stopper Programs** to encourage students to report the appearance of unusual plants and animals in their communities. A primary goal is to help students become critical observers in their home environment and the natural world. The Student Weed Stopper Program involves *classroom and laboratory activities, field studies*, and *monitoring* of Weed Stopper Zones as outlined below.

I. Classroom and Laboratory Activities – Learn About Invasive Species.

Main Objective – Learn about the introduction, biology, impacts, and spread of invasive species.
Activity 1 – *Introduce Students to Invasive Species* – Use PPT presentations and live specimens to provide an overview of the invasive species problem.
Activity 2 – *Develop a Weed Stopper Target List* - A list of new invasive species in your area.
Activity 3 – *Develop Outreach Materials* - Develop Weed Stopper fact sheets and wanted posters for display during National Invasive Weed Awareness Week (late February).
Activity 4 – *Tell Somebody* - Host an Invasive Species Awareness Day at school during National Invasive Weed Awareness Week in late February (Invasive Plants on Display, Invasive Species Symposium).

Example Widespread Species: Dandelion, English Ivy, Kudzu, Chinese Tallow, Oriental Bittersweet, Purple Loosestrife, China Berry.

Example Weed Stopper Species: Hydrilla, Beach Vitex, Giant Salvinia, Cogongrass, Bush Killer.
Basic Supplies and Materials: Digital Images, Plant Specimens, Hand Lenses.

II. Field Studies – See the Impacts of Invasive Species on Native Plants and Animals.

Main Objective – Learn about invasive species of local concern.

Activity 1 – *Take a Field Trip* - Take a class field trip to a nearby park, refuge, or beach that is being impacted by invasive species. Take pictures, and use standard field data forms to collect data on invasive species observed during the field trip.

Basic Supplies and Materials: Plastic Bags for Collecting Plants, North American Weed Mgt. Association Field Data Collection Forms, Hand Lenses, Digital Camera, Insect Repellent, First Aid Kit.

III. Take Action - Set up a Student Weed Stopper Program.

Main Objective – Set up a Student Weed Stopper Network Program to help detect new invasive species in your area.

Activity 1 – *Establish Weed Stopper Zones* – Put up a large area map showing where students live – designate Weed Stopper Zones near their homes that students can monitor.
Activity 2 – *Monitor Weed Stopper Zones* – Ask students to monitor and report on their assigned zones once a month during the school year.
Activity 3 – *Identify and Study* exotic plants that are reported by the students. The County Extension Service and local colleges can provide assistance with hard to identify specimens
Activity 4 – *Archive Weed Stopper Data* – Compile information on invasive plants reported (species name, associated native species, GPS coordinates, total area, total area infested). Submit the information to a regional Invasive Plant Atlas (e.g., Invasive Plant Atlas of New England, Invasive Plant Atlas of the Mid-South, or the Southeast Exotic Pest Plant Council – EDDMapS). Botanists with these organizations will determine if the specimens are new county, state, or national records.
Activity 5 – *Report New Invasive Plant Records* – New county, state, and national plant records should be reported to state university scientists, the State Department of Agriculture (agricultural weeds), or the State Department of Natural Resources (aquatic weeds, weeds of natural areas). *Rapid response depends on receiving such reports.*
Activity 6 – *Get Involved* - Encourage students and their families to participate in Volunteer Invasive Plant Removal Days at area refuges and parks.

Supplies and Materials: Weed Stopper Target List, Weed Stopper Fact Sheets, Personal Digital Cameras (where available), Large Area Map with GPS Coordinates, GPS units (where available).

CONTACT INFORMATION
Randy G. Westbrooks, USGS BRD 233 Border Belt Drive, Whiteville, NC 28472 **Phone:** 910-648-6762 **E-mail:** rwestbrooks@usgs.gov
Leslie J. Mehrhoff, Invasive Plant Atlas of New England UCONN, 75 N. Eagleville Road, Storrs, CT 06269-3043 **Phone:** 860-486-5708 **E-Mail:** les.mehrhoff@uconn.edu
John Madsen and Victor Maddox Invasive Plant Atlas of the MidSouth, Mississippi State University 2 Research Blvd., Starkville, MS 39759 **Phone:** 662-325-2428; **E-mail:** jmadsen@gri.msstate.edu **Phone:** 662-325-2313; **E-mail:** vmaddox@pss.msstate.edu

U.S. National EDRR System for Invasive Plants

Rapid Assessment Guidelines for Non-Native Invasive Plants

Spring, 2010 Handout #13

1. Scientific Name, Synonyms, Common Names, Images (Close up, Habitat)

2. Current Distribution (World, U.S., State EDRR Zones of Concern)

3. **Biology and Ecology**

4. History of Invasiveness.

5. Regulatory Status (other Countries, Federal, State, Local)

6. Pathways of Introduction and Spread

7. Impacted Stakeholders and Resources

8. Potential Stakeholders and Resources

9. Control/Containment/Eradication Methods

10. Potential for Success as an EDRR Initiative (Total Eradication from EDRR Zones of Concern)

11. Estimated Cost of Eradication/Acre

12. Potential Funding Sources

13. Short Term/Long Terms Impacts if no action is taken.

North Carolina - EDRR Target Species – November, 2010.

I. Federal and/or State Regulated Early Detection Species (Not Known to Occur in State)
Branched Broomrape (*Orobanche ramosa*)
British Yellowhead (*Inula britannica*)
Cogongrass (*Imperata cylindrica*)
Goatsrue (*Galega officinalis*)
Japanese Dodder (*Cuscuta japonica*)
Giant Hogweed (*Heracleum mantegazzianum*)
Caulerpa – Marine Alga (*Caulerpa taxifolia*)
Mile-a-minute Vine (*Persicaria perfoliata*)

II. Unregulated Early Detection Species (Not Known to Occur in State)
Old World Climbing Fern (*Lygodium microphyllum*)
Wavyleaf Basketgrass (*Oplismenus hirtellus* Subspecies *undulatifolius*)
Crested Floating Heart (*Nymphoides cristata*)

III. Federal and/or State Regulated EDRR Species (Limited Distribution in State)
Beach Vitex (*Vitex rotundifolia*)
Benghal Dayflower (*Commelina benghalensis*)
Bushkiller (*Cayratia japonica*)
Canada Thistle (*Cirsium arvense*)
Giant Salvinia (*Salvinia molesta*)
Hydrilla (*Hydrilla verticillata*)
Itchgrass (*Rottboellia cochinchinensis*)
Puncturevine (*Tribulus terrestris*)
Purple Loosestrife (*Lythrum salicaria*)
Small Broomrape (*Orobanche minor*)
Tropical Soda Apple (*Solanum viarum*)
Witchweed (*Striga asiatica*)

IV. Unregulated EDRR Species (Limited Distribution in State)
Deeprooted Sedge (*Cyperus enterianus*)

V. Other Invasive Plants of Special Concern (Limited Distribution in the State)
Chinese Tallow (*Triadica sebifera*)
Garlic Mustard (*Alliaria petiolata*)
Oriental Bittersweet (*Celastrus orbiculatus*)
Saltcedar (*Tamarix ramosissima*)

North Carolina Exotic Pest Plant Council

State Early Detection and Rapid Response Plan

July 15, 2008

I. State EDRR Coordinating Committee.

Committee Co-Chairs:	Randy Westbrooks, USGS, Whiteville, NC. Phone: 910-648-6762 E-mail: rwestbrooks@usgs.gov. Rick Iverson, NCDA, Raleigh, NC. Phone: 919-733-6930 (Ext. 246) E-mail: rick.iverson@ncagr.gov.
NC Early Detection and Reporting Network Coordinator	
Specimen Identification and Vouchering	Alexander Krings, NC State University, Raleigh, NC Tel : 919-515-2700 E-mail: Alexander_Krings@ncsu.edu Eric Schuettpelz (to be confirmed) Biological Sciences UNC at Wilmington 601 S. College Road Wilmington, NC 28403-5915 Tel: 901-962-3470 Fax: 910-962-4066 Email: eschuettpelz@nescent.org Katherine Mathews Dept of Biology 132 Natural Science Bd Western Carolina University Cullowhee, NC 28723 Tel: 828-227-3659 Fax: 828-227-7066 Email: kmathews@email.wcu.edu Zack Murrell Appalachian State University

	P.O. Box 32027 572 Rivers Street Boone, NC 28606-2027 Email: murrellze@appstate.edu Dr. Alan Weakley Herbarium/NC Botanical Garden Univ North Carolina Coker Hall, CB3280 Chapel Hill, NC 27599-3280 Tel: 919-962-0578 Fax: 919-962-6930 Email: weakley@unc.edu
Rapid Assessment (new invaders):	Rob Richardson NC State University Raleigh, NC Phone: (919) 515-5653 E-mail: rob_richardson@ncsu.edu Randy Westbrooks USGS 233 Borderbelt Dr PO Box 279 Whiteville, NC 28472 Tel: 910-648-6762 Fax: 910-648-6763 Email: rwestbrooks@intrstar.net Rick Iverson, NCDA Plant Industry Division 1060 MSC Raleigh, NC 27699 Tel: 919-733-6931 x246 Fax.: 919-733-1041 Email: rick.iverson@ncagr.gov
Survey and Mapping	Margaret Fields, TNC One University Place Suite 290 Durham, NC 27707 Phone: 919-403-8558, Ext. 1019 E-mail: mfields@TNC.ORG
Rapid Response/ Public and Private Conservation Lands:	Randy Westbrooks, rwestbrooks@intrstar.net Rick Iverson, NCDA, rick.iverson@ncagr.gov Rob Richardson, NCSU, rob_richardson@ncsu.edu Rob Emens NC-DENR 1611 MSC

	Raleigh, NC 27699 Tel: 919-733-3558 rob.emens@ncdenr.gov Nancy Fraley National Park Service 67 Ranger Dr Asheville, NC 28805 Tel: 828-296-0850 Nancy_Fraley@nps.gov
EDRR Outreach and Education Coordinator	

II. EDRR Target Species.

State Early Detection (ED) Species (Non-native invasive plants which threaten but do not already occur in North Carolina)	**Federal/State Regulated Species:** Broomrape *Orobanche (ramosa) & minor* (All) British Yellowhead *Inula britannica* (All) Cogongrass *Imperata cylindrica* (All) Goatsrue *Galega officinalis* (All) Japanese Dodder *Cuscuta japonica* (All) Giant Hogweed *Heracleum mantegazzianum* (All) Caulerpa – Marine Alga (*Caulerpa taxifolia*) (All) Mile-a-minute vine – *Polygonum perfoliatum* (All) Puncturevine – *Tribulus terrestris* (All) **Other Species:** Old World Climbing Fern (CP,P) *Lygodium microphyllum* Floating hearts *Nymphoides cristata* (crested floating heart), *N. peltata* (yellow floating heart) & *N. indica* (water snowflake) (All) aquatic
State EDRR Species (Non-native invasive plants which are limited in distribution yet potentially pose a severe threat to NC resources)	**Federal/State Regulated Species:** Benghal Dayflower (CP) *Commelina benghalensis* Giant Salvinia (All) *Salvinia molesta* Hydrilla (*Hydrilla verticillata*) Itchgrass (CP) (*Rottboellia cochinchinensis*) Purple Loosestrife *(*All*) Lythrum salicaria* Tropical Soda Apple (All) *Solanum viarum* Witchweed (CP) *Striga asiatica* Beach Vitex (PCP) *Vitex rotundifolia* Bushkiller (P) *Cayratia japonica* Canada Thistle (MP*) Cirsium arvense* **Other Species:** Chinese Tallow (PCP) *Triadica sebifera* Deeprooted Sedge (CP,P) *Cyperus enterianus*

***EDRR Zones of Concern:** Coastal Plain (CP), Piedmont (P), Southern Blue Ridge (M), or All

III. State EDRR Detection and Reporting Network (Contact Directory of Agency Field Personnel and Trained Volunteers).

Partner Agencies	**Field Personnel - Contact Information**
The Nature Conservancy	Margaret Fields, mfields@TNC.ORG
The NC Native Plant Society	Alice Zwadski Tom Harvill
NC Beach Vitex Project	Dale Suiter, FWS, Dale_Suiter@fws.gov (919-856-4520, Ext. 18)
USDA APHIS	Anthony Man-Son-Hing USDA, APHIS 920 Main Campus Dr Suite 200 Raleigh, NC 27606 Tel: 919-855-7331 Fax; 919-855-7391 Email: Anthony.man-son-hing@aphis.usda.gov
USDA Forest Service	Jim Miller USFS Devall Drive Auburn University, AL 36849 Tel: 334-826-8700 Fax: 334-821-0037 miller@forestry.auburn.edu Gary Kaufman
USDA NRCS	(Johnny Randall to check for contacts)
U.S. Geological Survey	Randy Westbrooks, rwestbrooks@intrstar.net (910-648-6762)
U.S. Fish and Wildlife Service	Dale Suiter, FWS, Dale_Suiter@fws.gov (919) 856-4520, Ext. 18)
USDI National Parks	Nancy Fraley, Nancy_Fraley@nps.gov
NC DENR	Rob Emens Division of Water Resources rob.emens@ncmail.net NC Wildlife Resources Commission
NC State Parks	Emily Hill
NC Forestry Commission	Rob Trickel

NC DOT	Derek Smith, dcsmith@ncdot.gov
NC State University University	Rob Richardson, rob_richardson@ncsu.edu
NCDA, Witchweed Eradication Program	Rick Iverson, rick.iverson@ncmail.net
Farmers in the NC Witchweed Quarantine Area	Rick Iverson, rick.iverson@ncmail.net
NC Bass Masters Association (Aquatic Weeds)	Bill Frazier (Rob Emens to send contact information)
NC Association of Certified Foresters (Forest Weeds such as Cogongrass)	Rob Trickel
U.S. Ports of Entry – Maritime Ports (Port of Wilmington, NC; Port of Morehead City, NC)	
U.S. Ports of Entry – International Airports (Wilmington International Airport, Raleigh International Airport, Charlotte-Douglas International Airport)	
Sand Hills Weed Management Area	
Lake Gaston Weed Control Council	
Duke Energy	Ken Manuel
Wilmington Army Corps of Engineers	

IV. Rapid Assessment Guidelines

A. Rapid Assessment Target Species:	
B. Rapid Assessment Guidelines (Evaluation of New Exotic Plants for Invasiveness)	a. Identity, Biology, Ecology b. Current Distribution (World, U.S., State EDRR Zones of Concern) c. History of Invasiveness d. Regulatory Status (other Countries, Federal, State, Local) e. Pathways of Introduction and Spread f. Impacted Stakeholders and Resources g. Potential Stakeholders and Resources h. Control/Containment/Eradication Methods i. Potential for Success as an EDRR Initiative (Total Eradication from EDRR Zones of Concern) j. Estimated Cost of Eradication/Acre k. Potential Funding Sources l. Short Term/Long Terms Impacts if no action is taken.

V. Rapid Response Initiatives – Eradication of Confirmed EDRR Target Species

A. Established Cooperative Weed Management Areas	Crested floating heart (*Nymphoides cristata*)
B. Established Invasive Plant Eradication Task Forces (e.g., Carolinas Beach Vitex Task Force)	**NC Beach Vitex Project** - Melanie Doyle, Ft. Fish Aquarium, Carolina Beach, NC. melanie.doyle@ncmail.net; 910-458-8257, Ext. 250
	NC Giant Salvinia Task Force Rob Emens NCDENR PTI proposal pre-proposal due June 30, 2010 Randy Westbrooks Rob Richardson Wayne Batten (ex-officio) Mark Heilman (SePro) Rick Iverson
	NCDA Itchgrass Eradication Project - Rick Iverson, NCDA, Raleigh, NC
C. Established Agency Invasive Plant Eradication Programs	**NC Witchweed Eradication Program** Rick Iverson, NCDA, rick.iverson@ncmail.net; 919-733-6930 (Ext. 246)
D. Potential EDRR Initiatives	Itchgrass?

Appendix 1. State, Regional, and National EDRR Information Systems (Archival of Invasive Plant Distribution Records).

National Databases	**USDA Plants Database** URL: http://plants.usda.gov/ Director: Scott Peterson Phone: 225-775-6280 E-mail: scott.peterson@la.usda.gov
	APHIS National Agricultural Pest Information System (NAPIS) URL: http://ceris.purdue.edu/napis/ NC State Coordinator: Ken Ahlstrom NCDA&CS, Plant Industry 1060 MSC Raleigh, NC 27699 Tel: 919-733-6930 x 236 Ken.ahlstrom@ncagr.gov
	USGS NBII EDRR Framework URL: http://edrr.nbii.gov/portal/server.pt Director: Annie Simpson, USGS BRD NBII, Reston, VA Phone: 703-648-4281 E-mail: asimpson@usgs.gov
Regional Databases	**Invasive Plant Atlas of the New England** URL: www.ipane.org Director: Leslie J. Mehrhoff, UCONN, Storrs, CT. Phone: 860-486-5708 E-mail: les.mehrhoff@uconn.edu
	Invasive Plant Atlas of the Mid-South URL: http://www.gri.msstate.edu/ipams/ John Madsen, Director, MS State Phone: 662-325-2428); E-mail: jmadsen@gri.msstate.edu
	Southeast Exotic Pest Plant Council (EDDMAPS) URL: http://se-eppc.org Director: Chuck Bargeron, University of Georgia Phone: 229-386-3298 E-mail: cbargero@uga.edu
	Invaders Plant Database (Northwestern U.S.) URL: http://invader.dbs.umt.edu/ Director: Peter Rice, Director, University of Montana Phone: 406-243-2671 E-mail: peter.rice@umontana.edu

Appendix 2. State Geographical Index (Natural and Administrative Land Units to help in identifying habitats at risk, impacted and potential stakeholders, as well as responsible agencies and organizations).

NATURAL AND ADMINISTRATIVE LAND UNITS			
Political Units	**State**	North Carolina – Official Website: http://www.ncgov.com/	
	Counties	http://en.wikipedia.org/wiki/List_of_counties_in_North_Carolina	
	Cities, Towns, Villages	http://www.sog.unc.edu/library/cities.html	
Local Land Units	**Public Lands**	National Parks, Monuments, Battlefields in NC	http://usparks.about.com/blpknc.htm
		U.S. Fish and Wildlife Service Refuges in NC	http://www.fws.gov/southeast/maps/nc.html http://www.fws.gov/Refuges/profiles/ByState.cfm?state=NC
		National Forests in NC	http://www.cs.unca.edu/nfsnc/
		Natural Resources Conservation Service	http://www.nc.nrcs.usda.gov/
		NC Plant Conservation Program	http://www.ncagr.gov/plantindustry/plant/plantconserve/index.htm
		Military Installations in NC	http://military-hotels.us/north-carolina/nc-bases.html
		NC State Parks and Historic Sites	http://www.ncparks.gov/Visit/main.php
		NC State Forests	http://en.wikipedia.org/wiki/List_of_North_Carolina_state_forests
		NC DENR Managed Lands	
		Federal and State DOT	http://www.ncdot.org/
	Private Lands	TNC Ecological Preserves	http://www.nature.org/wherewework/northamerica/states/northcarolina/preserves/
		NC Land Trusts	http://www.ctnc.org/ltmap.htm

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Beach Vitex
Scientific Name: *Vitex rotundifolia* L. *f*
Family: Verbenaceae

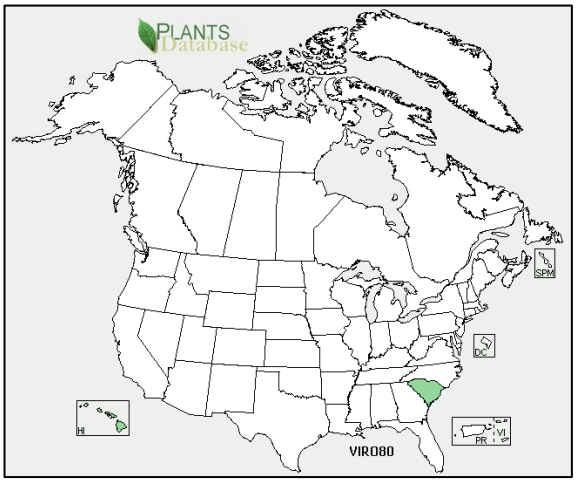
Description: A deciduous woody vine that grows up to 12 or more feet in diameter, and can produce rooting runners up to 60 feet long. **Leaves** round, silvery gray-green, 1-2 in. long, with a spicy fragrance. **Flowers** purplish-blue, 1 in. in width, produced in small clusters at the ends of branches. **Fruits** round, 1/4 in. in diameter, purplish-black when ripe. Reproduction is by seeds and by stem fragments that root at the nodes.

Habitat: Beach vitex occurs naturally on oceanfront dunes in its native range. It prefers sandy soil, but will grow well in a variety of soil types and climates.

Native Range: China, Korea, Taiwan, and Japan south to Malaysia, India, Sri Lanka, Mauritius, and Australia.

NOTE: Beach vitex is also said to be native to Hawaii (Wagner et al. 1999). However, due to the extreme isolation of this island chain, Beach vitex was, no doubt, unintentionally introduced there through human activities at some time in the past.

Pathways of Introduction and Spread: Beach vitex was introduced to the Southeastern United States in the mid-1980's by the N.C. State University Arboretum for use as an ornamental and for coastal dune stabilization. By the mid-1990's, dune restoration specialists with the U.S. Army Corps of Engineers began to notice beach vitex spreading from original plantings on South Carolina beaches, crowding out native dune plants, spreading along beaches by seeds and vegetative fragments. The brittle stems tend to break off during high tides and are carried away by long shore currents to infest new areas.



U.S. and Canada Distribution:

Ecological and Economic Impacts: Beach vitex forms monoculture infestations that displace native beach dune species and degrade sea turtle habitat. The plant also releases allelopathic compounds from the root system that inhibits the growth of other plants. Due to chemical alkanes (hydrocarbons with single bonds between the atoms) in the cuticles of leaves and fruits, soil beneath the plant becomes strongly hydrophobic. This prevents the establishment and growth of other plants. In addition to being drought tolerant, salt tolerant, and fast-growing, beach vitex is a prolific seed producer. Seed production can be as high as 10,000 to 20,000 seeds per square meter. The round

seeds are rolled along the beach by strong winds, and are move to other areas by long shore currents. Beach vitex is also a major threat to sea turtle reproduction. The roots grow around sea turtle nests and sometimes prevent hatchlings from emerging. Hatchlings that do emerge can become trapped in the thick tangle of vegetation and perish before reaching the ocean.

Control Strategies: Experience has shown that it is difficult – *if not impossible* - to remove single plants or scattered populations of Beach Vitex plants by hand –the plant readily grows back from roots that remain deep in the soil. The only effective way to eliminate the plant is to cut back the plant to the surface and treat the cut stumps with an approved herbicide such as imazapyr (Habitat and others). Plants that are cut for removal should be properly disposed of to avoid infesting new areas.

Regulatory Status: Beach vitex is regulated as a state noxious weed in the coastal counties of North Carolina and Virginia.

Town/County Ordinances that prohibit the planting of Beach Vitex have been established by Bald Head Island, Caswell Beach, Ocean Isle Beach, North Topsail Beach, Topsail Island, and Pine Knoll Shores in North Carolina. Ordinances have been established in Pawleys Island, Georgetown County, Isle of Palms, Kiawah Island, Folly Beach, and the Town of Edisto Beach, in South Carolina.

A Weed Risk Assessment was conducted for listing Beach Vitex as a U.S. Federal Noxious Weed in 2006. *However, it has not been officially listed as an FNW because it is considered by some scientists to be native to Hawaii***. Otherwise, Beach vitex meets the definition of a quarantine significant pest because it occupies a very small portion of its potential ecological range in the United States, and because it poses a serious threat to certain natural and biological resources (the stability of ocean front dunes and the plant and animal communities that occupy them), as well as the value of beach front property.

Based on the APHIS Weed Risk Assessment, the overall pest risk potential of beach Vitex in the United States is **medium-high**. The likelihood of introduction is **high**. The consequences of introduction are **medium**, since the plant has serious environmental impacts, but a low potential for economic impacts on agricultural production systems. But, if permitted to spread unabated, the plant could have a very significant impact on the value of beachfront properties in the Carolinas and elsewhere.

Wagner, W., D. Herbst, and S Shomer. 1999. Manual of the Flowering Plants of Hawaii. University of Hawaii Press. Bishop Museum Press. Volume 1 – 988 pp. Volume 2 - 1919 pp.

Online Resources:

Beach Vitex Task Force Website.
URL: http://www.beachvitex.org/

Beach Vitex Image - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=11609

Beach Vitex Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=VIRO80

APHIS Factsheet

Plant Protection and Quarantine

March 2003

Witchweed: A Parasitic Pest

Witchweed *(Striga asiatica)* is a parasitic plant that attacks some of the most important crops in the United States–corn, sorghum, sugar cane, and rice. It also parasitizes certain weedy grasses.

Unlike most weeds, which merely compete with crops, parasites like witchweed do their damage more directly. They rob nutrients and moisture by tapping directly into the host's root system. Consequently, the host spends energy supporting witchweed growth at its own expense. While a parasitized host, such as a corn plant, may be less productive (produce fewer seeds), each witchweed plant produces as many as 50,000 seeds.

The American witchweed is one of many related parasitic plants native to Africa, India, the Middle East, and China. In these areas it can completely ruin agricultural productivity in affected land. No one is sure how or when witchweed first came to the United States. However, the slender, red-blossomed parasite was first identified in 1955 by a graduate student from India who knew it as the pest that had ruined sorghum production in his country.

Witchweed will grow in the presence of grassy weeds as well as grass host crops, so cotton, peanut, or soybean fields–along with home gardens or idle land–may harbor the pest. Witchweed emerges from the soil beginning in late June and flowers about 2 weeks later. Swollen seed pods follow, liberating thousands of microscopic seeds, which can live in the soil for at least 10 years.

Witchweed's prolific nature and its potential for devastating important American host crops led to a decision to eradicate this pest. Congress first allocated funds for this purpose in 1957. The U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) established a research station and farm where it developed control methods.

Since its discovery in North and South Carolina, witchweed's spread has been halted, and the acreage supporting it has been reduced by 99 percent (from 450,000 acres to about 3,400). Eradication is accomplished in three phases:

- Survey activities find and map all infestations,
- Quarantine activities prevent human spread of witchweed beyond the infested region, and
- Control activities seek to prevent existing plants from producing seeds and to destroy seeds already in the soil.

These activities involve the cooperative efforts of Federal and State governments as well as the general public.

Survey

APHIS and State cooperators have taken steps to prevent this dangerous weed from spreading from infested areas in North and South Carolina. APHIS is offering a $25 reward to anyone who identifies and reports the weed. After receiving a report, officials remove the plant to stop reproduction. Then they destroy seeds already in the soil.

Finding every specimen of the slender, foot–tall witchweed plant is not without obstacles. The cooperation of landowners is essential. Scouts are sent out on foot, in vehicles, and on horseback to find infested sites. People are asked to check their own land and to report the presence of witchweed to an agricultural extension agent or witchweed personnel.

Containment Through Quarantine

Although the tiny witchweed seeds can be spread by wind or water, people are the chief means of dispersal. To prevent the spread of this pest, agricultural quarantines specify conditions for moving soil, plants, or machinery out of infested areas.

Eradication

Eliminating witchweed requires finding and killing plants before they go to seed and eliminating seeds already in the soil.

Herbicides are used on fields infested with witchweed. Extensive field research has provided information on the best chemical or combination of chemicals for the given crop, weed species, and field conditions.

Eliminating the microscopic seeds is another important part of eradication. Some seeds die of natural attrition or sprout only to be killed by an herbicide. However, since witchweed seeds can persist in the soil for a decade, efficient eradication requires accelerating the natural rate of seed germination.

Witchweed seeds can be eliminated from the soil by creating conditions that cause them to germinate when no host is present. This phenomenon is known as suicidal germination. Ethylene gas, a natural ripening agent produced by fruits, vegetables, and flowers, is injected into the soil under proper environmental conditions. It stimulates seed germination, but lacking a host, seedlings die.

Soil fumigation is another alternative, albeit an expensive one. Chemicals such as methyl bromide are used on occasion to assure seed destruction.

Eradication Within Reach

The large number of acres involved and the high seed production of this pest have made eradication a slow process. However, this parasite has been eradicated from 99 percent of the infested land. In 1995, the North Carolina Department of Agriculture assumed responsibility for eradication activities in that State. APHIS personnel continue eradication activities on the remaining 400 infested acres in South Carolina. APHIS will continue to provide support to these States for surveys to verify eradication and for post–eradication treatments.

Report Witchweed

Report any suspect witchweed plant by calling 1–800–206–WEED. (Outside of the Carolinas, call APHIS at 1–919–716–5590.)

For more information on witchweed and other noxious weeds, as well as additional APHIS programs, visit the APHIS Web site at http://www.aphis.usda.gov. Use the "Comments" link to send an e-mail request for additional information.

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Benghal Dayflower, Tropical Spiderwort
Scientific Name: *Commelina benghalensis* L.
Family: Commelinaceae

Description: An annual or perennial herb. **Stems** creeping or ascending, succulent, 5-15" long, branched, rooting at the nodes. **Leaves** alternate, ovate to elliptic. **Leaf sheaths** often with red hairs at the apex. **Bracts** subtending the flower funnel-shaped. **Aerial flowers** lilac or blue, petals very small. **Subterranean flowers** whitish, cleistogamous (unopening, self pollinating), arising from basal shoots. **Fruit** a capsule with two seeds. **Seeds** ribbed, grayish-brown, very small.

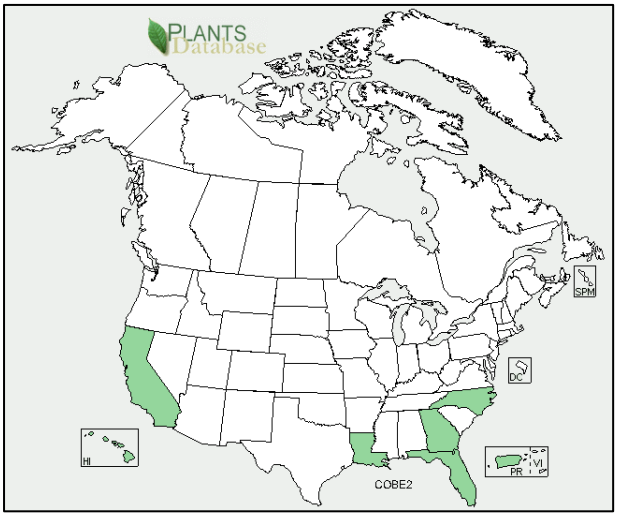
Image: Benghal dayflower in cotton.

Habitat: A weed of moist places, roadsides, waste places, along dikes, on banks of irrigation ditches, in cultivated fields, around field borders, in wet pasturelands, gardens.

Native Range: Asia and Africa.

Pathways of Introduction and Spread: Benghal dayflower was introduced to the U.S. as a contaminant of seeds, spices and other condiments. It was also probably introduced as a general hitchhiker on various types of imported cargo and commodities. It was first detected in the U.S. in 1963.

U.S. and Canada Distribution:



Ecological and Economic Impacts: Benghal dayflower is considered to be one of the worst weeds in the world. It affects at least 29 crops in 25 countries. It is also an alternate host of the nematode *Meloidogyne incognita*, and the groundnut rosette virus. The plant reproduces by seeds and stolons. One plant can produce as many as 1,600 seeds. It is a special problem in fields and pastures where it forms dense stands that crowd out other low growing crops and grasses.

The tremendous increase in the presence of Benghal dayflower in the southeastern U.S. since the mid-1990s has been associated with a number of major changes in cropping systems. Among these changes are the elimination of cultivation as a method for weed control (*which leads to total dependence on chemical control methods*), a reduction in the use of pre-emergence herbicides with soil residual activity in cotton crops, reliance on glyphosate for weed control in glyphosate resistant crops (*which does not control Benghal dayflower very well*), and a large increase in cotton acreage in Georgia (*primarily due to eradication of the boll weevil*).

Control Strategies: Prevention, early detection, and rapid response are critical in preventing the establishment and spread of this invasive plant. Mechanical control of the plant is usually ineffective because broken pieces of the stem readily root at the nodes and continue growing. Many herbicides are ineffective against the weed. This is because the seeds continue to germinate after the first flush of summer weeds and because seeds are produced aerially and underground as well.

Regulatory Status: Tropical spiderwort is listed as a U.S. Federal Noxious Weed. It is regulated as a state noxious weed in Alabama, California, Florida, Massachusetts, Minnesota, North Carolina, Oregon, South Carolina, and Vermont.

Online Resources:

Benghal Dayflower Domestic Pest Evaluation – USDA APHIS PPQ.
URL: http://www.invasive.org/eastern/other/dayflower.html

Benghal Dayflower Fact Sheet – Randy Westbrooks, USDA APHIS PPQ.
URL: http://www.invasive.org/eastern/other/spiderwort.html

Benghal Dayflower Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=4551

Benghal Dayflower Profile – ISSG Global Invasive Species Database.
URL: http://www.issg.org/database/species/ecology.asp?si=1367&fr=1&sts=&lang=EN

Benghal Dayflower Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=COBE2

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

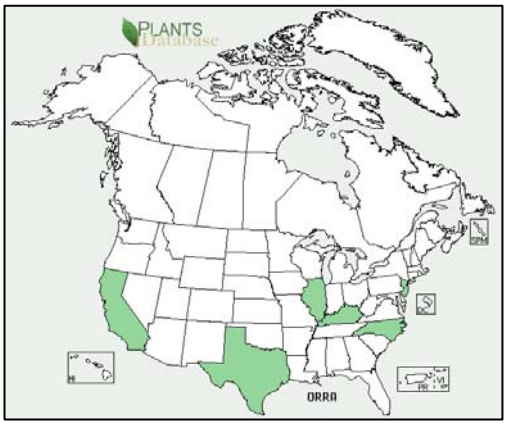
Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Branched Broomrape
Scientific Name: *Orobanche ramosa* L.
Family: Orobanchaceae

Description: An annual, biennial, or perennial herb – depending on the host; plant lacking chlorophyll, yellow or yellowish-violet; **stems** simple or branched, 4-16' tall, swollen at the base, attached to host roots, glandular puberulent; **leaves** reduced to scales, 0.1-0.4" long, ovate to ovate-lanceolate, acute; **inflorescence** 0.7-10", lax to moderately dense, glandular pubescent; **bract** 0.2-0.4" long, ovate-lanceolate; **bracteoles** linear-lanceolate, about the size of the calyx; **pedicels** 0.03-0.4"; **calyx** 0.2-0.3"; **corolla** 0.4-0.8", sub-erect and inflated at the based, white or yellow to violet or bluish, usually pale; **filaments** inserted 0.1-0.2" above the base of the corolla; **stigmas** white, cream or pale blue; **fruit** a capsule, 0.2-0.4" long, with numerous dust-like seeds.

Habitat: Ornamental and vegetable crop fields.

Native Range: Mediterranean area of southern Europe.



Pathways of Introduction and Spread: Branched broomrape was introduced to the U.S. as a contaminant of commodities and possibly machinery or equipment. The seed is dispersed by human activities, farm machinery, water, and wind.

U.S. and Canada Distribution:

Ecological and Economic Impacts: Branched broomrape is a parasitic weed of numerous crops and associated weeds around the world – *especially tomatoes*. Certified seed and clean nursery stock should be used to avoid introducing it into production fields. Orobanche seeds are very small and can be separated from most types of crop seeds. However, the seeds are also easily transported on contaminated equipment and in irrigation or flood water. The seed may survive in the soil for many years, so repeated annual monitoring of infested sites is essential

Control Strategies: Hand pulling plants before flowering, planting trap crops to induce germination without attachment, and burying the seed with deep inversion plowing can help control infestations. Fumigation of the soil with methyl bromide or other fumigants is the only effective short term method for eradicating the seeds from the soil.

Regulatory Status: Branched broomrape is listed as a U.S. Federal Noxious Weed. As a result, it is automatically listed as a state noxious weed in Alabama, California, Florida, Massachusetts, Minnesota, North Carolina, Oregon, South Carolina, and Vermont.

Online Resources:

- Branched Broomrape Article – Wikipedia.
URL: http://en.wikipedia.org/wiki/Orobanche_ramosa

- Branched Broomrape Fact Sheet – CDFA.
URL: http://www.cdfa.ca.gov/phpps/ipc/weedinfo/orobanche.htm

- Branched Broomrape Fact Sheet – South Australia.
URL: http://www.daff.gov.au/__data/assets/pdf_file/0010/146719/broomrape.pdf

- Branched Broomrape Fact Sheet – Texas Invasives.
URL: http://www.texasinvasives.org/invasives_database/detail.php?symbol=ORRA

- Branched Broomrape Images - USGA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=4579

- Branched Broomrape Profile - U-CA – IPM Online.
URL: http://www.ipm.ucdavis.edu/PMG/WEEDS/broomrape.html

- Branched Broomrape Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=ORRA

- North Carolina Noxious Weed List.
URL: http://www.ncagr.gov/plantindustry/plant/weed/noxweed.htm

U .S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.
Marika Godwin, Coordinator, Invasive Species Alliance of Nova Scotia. Wolfville, NS, Canada.

Common Names: British Yellowhead, Meadow Fleabane, Yellow Starwort
Scientific Name: *Inula britannica* L.
Family: Asteraceae

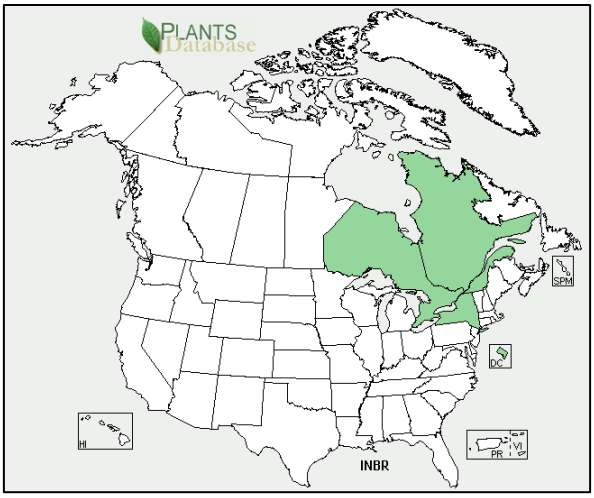
Description: A biennial or perennial herb, 6-30" tall. **Stems** hairless to densely covered with appressed hairs. **Leaves** simple, alternate, narrow, 1.5-6" long, 0.5-1" wide, tapering to a blunt point, smooth or finely toothed, slightly hairy above, densely hairy below. **Flowers** sunflower-like, single or in clusters of 2-3, bright yellow, up to 1" across, blooming in July-August. **Ray flowers** (outer ring of petals) long and narrow, usually twice as long as surrounding bracts. **Bracts** surrounding flower head linear, in two rows with little overlap. **Fruits** are light brown achenes with feather-like hairs for wind dispersal. **Reproduction** is by seeds, short rhizomes, and root fragments. It is common to have a mother plant surrounded by 8-10 satellite plants that are connected by rhizomes.

NOTE: correct identification requires close examination of the flower parts, including bracts (linear, in two rows, hardly overlapping, green, soft), rays (long, narrow), and pappus (very fine hairs surrounding each flower). It is sometimes confused with other native plants such as horseweed (*Conyza canadensis*), which is an annual erect herb with toothed leaf margins.

Habitat: Moist habitat types including riparian areas, marshes, wet meadows, ditches, wet grasslands, and wet woods. It may also occur in or near plant nurseries where *Hostas* are grown or sold.

Native Range: Europe and temperate Asia.

Pathways of Introduction and Spread: British yellowhead was accidentally introduced to the U.S. in the early 1900s – most likely as a contaminant of *Hosta* or daylily rootstock. It was first collected in Nassau County, New York, in 1915. The seeds are spread by wind. The seeds and root fragments are also spread as a contaminant of potting soil.



U.S. and Canada Distribution:

Ecological and Economic Impacts: British yellow head was recognized an aggressive weed at several plant nurseries in Michigan around 1990. It has been primarily found in *Hosta* plants imported from the Netherlands and has led to concern over its potential as an aggressive weed in the United States. Roots and rhizomes of the plant become intertwined with the root systems of *Hosta* and remain even after the *Hosta* rootstocks are washed and shipped. It is also very aggressive in field-grown (cultivated) *Hostas*.

Manual Control. Small infestations should be hand pulled. Rhizomes and root fragments should be properly disposed of to prevent reinfestations.

Chemical Control. British yellowhead can be controlled using readily available, general use herbicide for broadleaf weeds such as clopyralid (Transline), dicamba (Banvel), and glyphosate (Roundup).

Regulatory Status: It is being listed as a U.S. Federal Noxious Weed. When listed, it will also be regulated as a state noxious weed in Alabama, California, Florida, Massachusetts, Minnesota, North Carolina, Oregon, South Carolina, and Vermont.

Online Resources:
British Yellowhead Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/browse/detail.cfm?imgnum=1294025

British Yellowhead Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=INBR

British Yellowhead – Weed of the Week. USDA Forest Service.
URL: http://na.fs.fed.us/fhp/invasive_plants/weeds/british-yellowhead.pdf

Guide for Identification of *Inula Britannica* - Massachusetts Introduced Pests Outreach Project.
URL: http://massnrc.org/pests/linkeddocuments/inulahandout.pdf

Inula Pest Alert - National Plant Board.
URL: http://permanent.access.gpo.gov/websites/www.aphis.usda.gov/npb/inuladetail-1.html

Inula, British elecampane - *Inula britannica* From: MSU Extension Bulletin E-2875, "Identification and management of Inula britannica in Michigan nurseries"
Michigan State University Extension Bulletins can be ordered for $0.50 from the MSU extension bulletin office.
URL: http://web2.msue.msu.edu/bulletins/viewitem.cfm?INVKEY=E2875

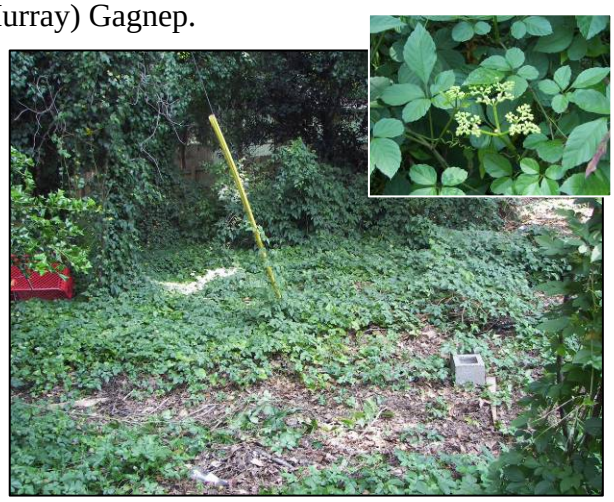
Inula britannica L. An Aggressive Weed Alert.
Alabama Cooperative Extension System ANR-1227
URL: http://www.aces.edu/pubs/docs/A/ANR-1227/ANR-1227.pdf

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks. U.S. Geological Survey, Whiteville, North Carolina. USA.
Marika Godwin, Coordinator, Invasive Species Alliance of Nova Scotia. Wolfville, NS, Canada.

Common Name: Bushkiller, Sorrel Vine
Scientific Name: *Cayratia japonica* **(**Thunb. ex Murray) Gagnep.
Family: Vitaceae



Description: A perennial, twining vine, up to 40' long. **Leaves** pedately compound with 5 leaflets [the lateral leaflets (two per side) form a small pinna on each side of the leaf], alternately arranged on the main stem, margins toothed, tendrils opposite from each leaf. **Flowers** in umbels, salmon/orange, cup-shaped, late summer. **Fruit** a white or black berry, with 2-4 triangular shaped seeds.

Image: Bushkiller infestation in Charlotte, North Carolina. June, 2007. Image by R. Westbrooks.

Note: In its native range, Bushkiller reproduces by seeds and vegetative fragments. However, fruiting has not been documented in North America. Vegetative reproduction apparently occurs by root fragments and adventitious roots when the roots are cut or disturbed.

Similar Native Species: Virginia creeper (*Parthenocissus quinquefolia*) has palmately compound leaves, and has blue berries.

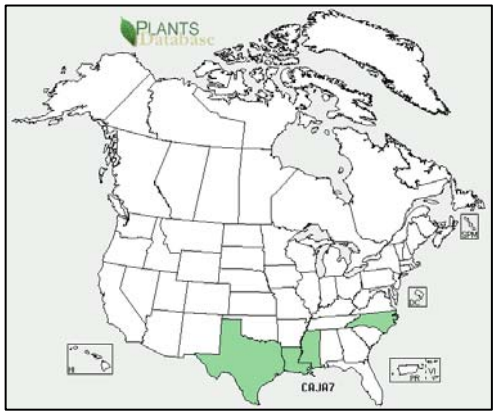
Image: Virginia creeper with palmate leaves. Image by R. Westbrooks.

Habitat: Bushkkiller tolerates shade and full sun. It grows in damp deciduous riparian areas, developed and cultivated areas, and gardens.

Native Range: Southeast Asia, Australia.

Pathways of Introduction and Spread: Bushkiller was probably introduced as an ornamental vine. It was first collected outside of cultivation in Louisiana in 1964.

U.S. and Canada Distribution:



Ecological and Economic Impacts: Bushkiller climbs up and over other plants, and forms a dense canopy that blocks out sunlight. The canopy also causes supporting plants to be top heavy and susceptive to uprooting in windstorms, and breakage during heavy snowfalls.

Control Strategies: Bushkiller is difficult to control once it becomes established. A three year chemical effort at the Mercer Botanic Garden in Texas has only reduced the infestation by 30%. Manual removal may be an option. However, pulling and digging it out should be continued over an extended period of time to further spread and to exhaust the energy reserves in the root system.

Regulatory Status: Bushkiller is regulated as a Class B state noxious weed in North Carolina.

Native Alternatives: Virginia Creeper (*Parthenocissus quinquefolia*).

Online Resources:

Bushkiller Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=13557

Bushkiller Profile - Bugwood Wiki.
URL: http://wiki.bugwood.org/Cayratia_japonica

Bushkiller Profile – Invasive Plant Atlas of the Midsouth (IPAMS).
URL: http://www.gri.msstate.edu/ipams/Species.php?SName=&CName=Bushkiller

Bushkiller Profile - USDA Plants Database.
URL:http://plants.usda.gov/java/profile?symbol=CAJA7

Bushkiller Profile - Native Woody Plants of Arkansas (Henderson State University).
URL: http://www.hsu.edu/default.aspx?id=6367

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

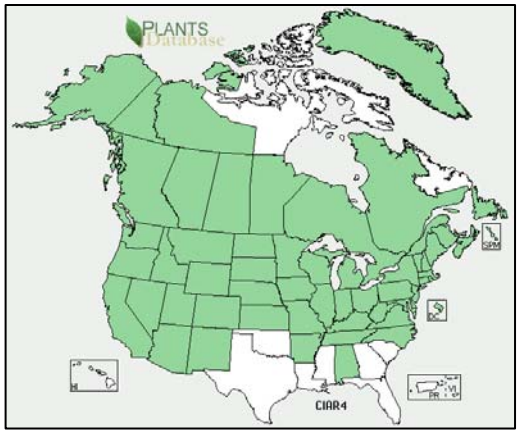
Common Name: Canada Thistle
Scientific Name: *Cirsium arvense* (L.) Scop.
Family: Asteraceae

Description: A tall, erect, spiny, perennial, herbaceous plant, with creeping rootstock that grows up to 4' tall. **Stems** branched, ridged, and slightly hairy. **Leaves** lance-shaped, simple, irregularly lobed, 2-6' long, with prickly margins, borne singly and alternately along the stem. **Flowers** fragrant, purple to white, up to 0.5" in diameter, in rounded, umbrella-shaped clusters, late June to August. **Fruit** an achene, up to 1.5" long, with a feathery **pappus** that allows them to be dispersed by wind. One plant can produce up to 5,000 seeds that can germinate 8-10 days after the flowers open. The **fibrous tap roots** may extend six feet deep. **Horizontal roots** stemming from the tap roots can produce new shoots.

Habitat: Canada thistle occurs in open habitats such as prairies, savannas, fields, pastures, and open forests. It does best in disturbed upland sites, but also invades wet areas such as streambanks and wet meadows.

Native Range: Europe and Asia.

Pathways of Introduction and Spread: Canada thistle was accidentally introduced into North America in the 1600s, probably as a contaminant of crop seeds. It produces an abundance of plumed seeds that are easily dispersed by the wind. Most of the seeds will germinate within a year, but some may remain viable in the soil for up to 20 years or more. It is also spread by water, farm machinery, as a contaminant of crop seed and hay, and in livestock droppings.



U.S. and Canada Distribution:

Ecological and Economic Impacts: In the U.S. and Canada, Canada thistle is considered one of the most serious of all agricultural weeds. In recent years, it has been recognized as a problem in natural areas. Canada thistle poses a threat to disturbed natural areas such as prairies, barrens, savannas, sand dunes, fields, and meadows. It outcompetes other plants through shading, competition for nutrients and water, and through allelopathy.

Manual Control: Repeated mowing or cutting the plant close to the ground will reduce an infestation within 3-4 years. Cutting and mowing should be done at least three times per year – before flowering. Equipment used in infested areas should be cleaned to avoid further spread of the plant.

Chemical Control:. Canada thistle can be effectively control with generally available herbicides. Clopyralid (Transline and others) + 2,4-D provides good control in agricultural production areas. However, it may damage native forbs and shrubs. Glyphosate (Roundup and others) is a non-selective herbicide that impacts Canada thistle by reducing the number of root buds and regrowth of secondary shoots.

Regulatory Status: Canada thistle is regulated as a state noxious weed in Alaska, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Hawaii, Idaho, Indiana, Iowa, Kansas, Kentucky, Maryland, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Dakota, Utah, Washington, Wisconsin, and Wyoming. It was declared a noxious weed in the state of Vermont in 1795.

Online Resources:

Canada Thistle Fact Sheet – USDA Forest Service – Weed of the Week Series.
URL: http://na.fs.fed.us/fhp/invasive_plants/weeds/canadian-thistle.pdf

Canada Thistle Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=2792

Canada Thistle Profile – ISSG Global Invasive Species Database.
URL: http://www.issg.org/database/species/ecology.asp?fr=1&si=413&sts=

Canada Thistle Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=CIAR4

Canada Thistle Stewardship Abstract – The Nature Conservancy.
URL: http://wiki.bugwood.org/Cirsium_arvense

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Caulerpa, Killer Alga
Scientific Name: *Caulerpa taxifolia* (Vahl) C. Agardh
Synonyms: *Fucus taxifolius* Vahl
Family: Caulerpaceae

Description: A bright green marine alga, with feathery, fern-like fronds that extend upward from a main stem (creeping stolons). **Fronds** laterally flattened, 0.2-0.3" in diameter, 1-6- in length in shallow water, 15-24" cm in length in deeper water, up to 9' in height. **Small side frond branchlets** are constricted at the base where they attach to the midrib of each frond, are opposite in their attachment to the midrib, curve upwards, and are narrow towards the tip. The invasive aquarium clone is morphologically identical to native populations of the species.

Habitat: Found on a variety of substrates in marine habitats, including rocks, sand, and mud. It usually grows in shallow coastal lagoons. However, it has been recorded at depths of more than 100' in the Mediterranean.

Native Range: Caribbean coasts, Gulf of Guinea, t he Red Sea, East African coast, Maldives, Seychelles, northern Indian Ocean coasts, southern China Sea, Japan, Hawaii, Fiji, New Caledonia and Australia.

Known introduced range: Mediterranean Sea, coastal California, and the vicinity of Sydney, New South Wales, Australia.

Image Source: *C. taxifolia* Profile.
URL: http://www.ridnis.ucdavis.edu/Caulerpataxifolia.html

Pathways of Introduction and Spread:
Caulerpa taxifolia is widely used as an ornamental species in home and public aquaria. The cold tolerant invasive aquarium strain was introduced to the Mediterranean Sea in wastewater from the Oceanographic Museum at Monaco in 1984. As a result of small fragments that were spread by boat anchors and fishing gear, it now covers over 30,000 acres of the sea floor off six Mediterranean countries. Early eradication was not attempted, and the infestation is now considered to be uncontrollable in the Mediterranean.

In June, 2000, the invasive aquarium strain was discovered in southern California, in the Agua Hedionda Lagoon, and again 75 miles north of there in Huntington Harbor. Genetic studies have shown that the California strain and strains in the vicinity of Sydney, New South Wales, Australia, are genetically identical to the Mediterranean strain of the plant.

U.S. and Canada Distribution: Since the California infestations were detected at an early stage, eradication efforts were initiated in 2001. After six years and more than $7 million, the plant was declared to be eradicated from these two sites in July, 2007. It is not known to occur elsewhere in the United States or Canada.

Ecological and Economic Impacts: The aquarium strain of Caulerpa taxifolia is very invasive and smothers other species of algae, seagrasses, as well as sessile invertebrate communities. It does this by outcompeting other species for nutrients and light, or by the toxic effects of its caulerpenyne compounds. Large monospecific seafloor meadows of the plant have vastly reduced native species diversity and fish habitat. This has had a very dramatic impact on commercial fishing in invaded areas.

Physical Control: Colonies of Caulerpa in Croatia were controlled by covering them with black PVC plastic. Small patches of the plant have been removed by divers in the Mediterranean.

Chemical Control: Infestations of Caulerpa in southern California were eradicated by covering and sealing them with PVC tarpaulins and injecting liquid chlorine underneath. Application of coarse sea salt was moderately successful in controlling the plant in Australia.

Regulatory Status: Caulerpa is listed as a U.S. Federal Noxious Weed. It is regulated as a state noxious weed in Alabama, Massachusetts, North Carolina, Oregon, South Carolina, and Vermont.

Online Resources:

- *Caulerpa taxifolia* Images - Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=4715

- *Caulerpa taxifolia* in California.
URL: http://www.wired.com/science/discoveries/news/2000/07/37444

- *Caulerpa taxifolia* Profile - Global Invasive Species Database.
URL: http://www.issg.org/database/species/ecology.asp?si=115&fr=1&sts=&lang=EN U-GA

- Caulerpa taxifolia Profile - USDA Plants Database:
URL: http://www.plants.usda.gov/java/profile?symbol=CATA5

- Caulerpa taxifolia Article – Wikipedia.
URL: http://en.wikipedia.org/wiki/Caulerpa_taxifolia

- What is Caulerpa? Southern California Caulerpa Action Team.
URL: http://www.sccat.net/#what-is-caulerpa-1e86c8

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey, Whiteville, North Carolina. USA.

Common Name: Chinese Tallow
Scientific Name: *Triadica sebifera* (L.) Small
Family: Euphorbiaceae
Synonyms: *Croton sebiferum* L. *and Sapium sebiferum* (L.) Roxb.

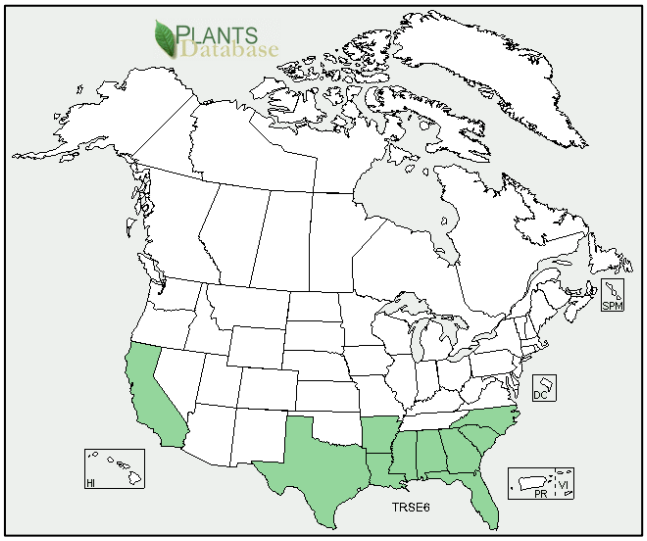
Description: A deciduous tree reaching 60' in height. **Leaves** alternate, heart-shaped, 2-3" long with a long, pointed tip. When injured, the leaves exude a milky sap. **Flowers** yellowish, on 8" dangling spikes, April – June. **Developing Fruit** greenish three-lobed, in clusters at the ends of branches. **Mature fruit** black, opening to reveal white, popcorn-like wax covered seeds.

Habitat: Tallow tree invades a variety of disturbed sites (stream banks, ditches, as well as upland dry sites) and will live in a variety of soil conditions (alkaline, saline, and acidic).

Native Range: China.

Pathways of Introduction and Spread: Chinese tallow tree was introduced into South Carolina in 1776 for ornamental purpose and for seed oil production (to make candles, soap, and etc.).

U.S. and Canada Distribution:



Ecological and Economic Impacts: Chinese tallowtree is a serious threat because of its ability to invade undisturbed forests and other natural areas. It can displace native vegetation and alter soil conditions due to the high tannin content of the leaf litter. The milky, white sap is a skin irritant and diarrheic in humans.

Manual Control: Mechanical control is not recommended because plants readily resprout from roots. However, controlled burns can be effective in controlling the plant during the growing season.

Chemical Control: Chinese tallowtree can be effectively controlled with general use herbicides such as triclopyr (Garlon and others), imazapyr (Arsenal and others), and hexazinone (Velpar and others).

Regulatory Status: Chinese tallow is regulated as a state noxious weed in Florida, Louisiana, Mississippi, and Texas.

Online Resources:

Chinese Tallow Fact Sheet – USDA Forest Service – Weed of the Week Series.
URL: http://www.na.fs.fed.us/fhp/invasive_plants/weeds/chinese_tallow.pdf

Chinese Tallow Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=3079

Chinese Tallow Profile – ISSG Global Invasive Species Database.
URL: http://www.issg.org/database/species/ecology.asp?fr=1&si=712&sts

Chinese Tallow Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=TRSE6

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Cogongrass
Scientific Name: *Imperata cylindrica* (L.) Beauv.
Family: Poaceae

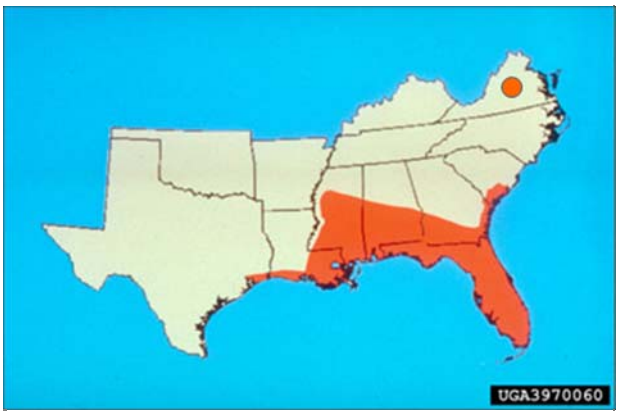
Description: A perennial, colony-forming grass up to 6' tall – with no apparent above-ground stem. **Leaves** arising from the ground, with off-center, whitish midrib and finely serrated margins, up to 6' long, up to 1" wide, stiff, with a sharp, pointed apex. **Flower heads** 2-8" long, silvery-white and cylindrical, in a large, fuzzy panicle. **Seeds** light and fluffy, spread by primarily by wind. **Rhizomes** whitish, branched, scaly, with sharp tips – forming a very dense underground mat.

Habitat: Cogongrass thrives in a wide variety of habitats, and is tolerant of shade, full sun, high salinity, drought, flooding, mowing, and fire. It currently affects forests, pastures, roadways and wetlands across most of the southeastern U.S. *(excluding North Carolina).*

Native Range: Southeast Asia.

Pathways of Introduction and Spread: Cogongrass was accidentally introduced into the U.S. as a packing material in shipping crates in Mobile, Alabama, around 1911. Later, it was intentionally introduced into Alabama as a pasture grass, and for erosion control. It reproduces and spreads via wind-borne seeds (up to 3,000 per plant) and rhizomes fragments. The feather-light, seeds can be carried as far as 15 miles by wind. The fragmented rhizomes are unwittingly spread by people through contaminated hay, soil, and soil – as well as by machinery, equipment, and vehicles. Blood Grass, which is a variety of Cogongrass, has been also sold as an ornamental grass in some parts of the country.

U.S. and Canada Distribution:



Ecological and Economic Impacts:
Cogongrass has been called the perfect weed. It affects 35 crops and infests 1.25 billion acres in 73 countries around the world. It is an extremely aggressive invader that forms dense, circular infestations with thick ground level mats that act as a physical barrier to the establishment of

other types of plants. In the process, it outcompetes native plants for nutrients, rooting space, moisture, and sunlight. It is also allelopathic – it produces chemicals that suppress the growth of other plants. By overwhelming native plants, it drives out ground-nesting wildlife such as turkey and bobwhite quail, as well as the endangered gopher tortoise, which depends on native grasses and legumes. While cogongrass roots are very fire tolerant, the plant is extremely flammable, and can cause fast-moving wildfires (to more than 840^{o} F) that consume native plants and animals and disrupt the natural fire regime.

Control Strategies: The first step in controlling cogongrass is to remove ground level thatch and older leaves by a controlled burn during the summer. It reduces biomass, stimulates regrowth from the rhizomes, and allows herbicides to be applied only to actively growing leaves. If tillage of the infested area is possible, disking soon after a controlled burn will cut down on rhizome mass. To prevent spreading, equipment should be thoroughly cleaned after tilling. After 1-4 months of regrowth, a herbicide such as Arsenal (imazapyr) plus glyphosate should be applied. Follow-up treatments in the second and possibly the third year will be needed to eliminate the population.

Regulatory Status: Cogongrass is listed as a U.S. Federal Noxious Weed. As a result, it is automatically listed as a state noxious weed in Alabama, California, Florida, Massachusetts, Minnesota, North Carolina, Oregon, South Carolina, and Vermont.

Online Resources:
- Cogongrass Fact Sheet – BASF:
URL: http://www.cogongrass.org/basfarsenal.pdf

- Cogongrass Fact Sheet – Plant Conservation Alliance:
URL: http://www.nps.gov/plants/alien/fact/imcy1.htm

- Cogongrass Control Fact Sheet - BASF:
URL: http://www.cogongrass.org/basffactsheet.pdf

- Cogongrass Website:
URL: http://www.cogongrass.org/

- U-GA Bugwood Image Gallery:
URL: http://www.invasive.org/species/subject.cfm?sub=2433

- USDA Plants Database:
URL: http://plants.usda.gov/java/profile?symbol=IMCY

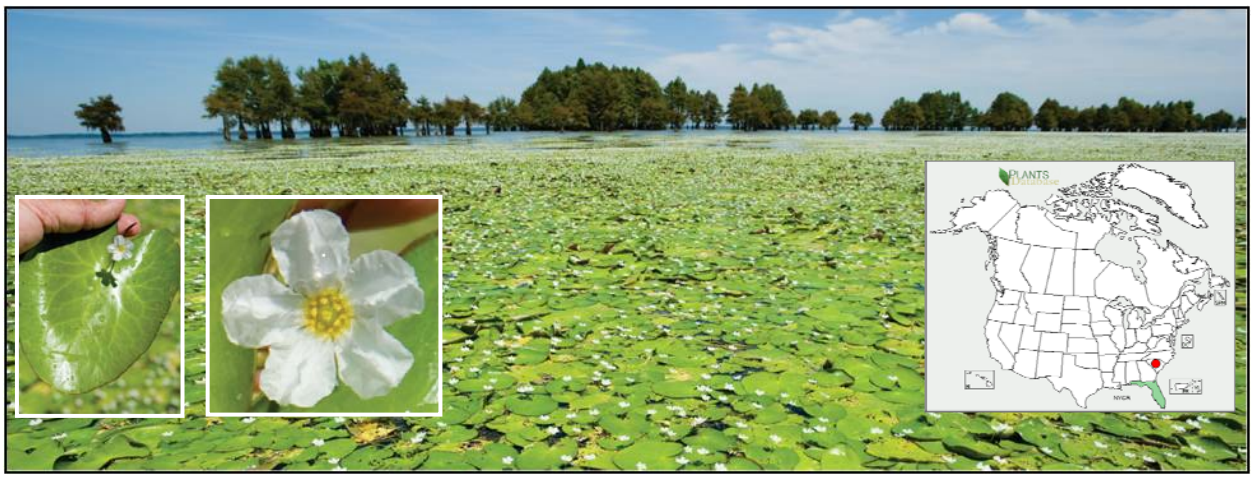
U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.
Larry McCord, Santee Cooper, Moncks Corner, South Carolina. USA.

Common Name: Crested Floating Heart
Scientific Name: *Nymphoides cristata* (Roxb.) O. Ktze.
Family: Menyanthaceae

Description: An herbaceous aquatic plant with floating stems from a buried rootstock. **Slender tuberous roots** dangle from the stem-leaf node. **A Single Heart-shaped Leaf** with smooth margins, cordate base, and short petiole at the tip of each stem. **Flowers** white, with membranous margins, 0.3-0.9" wide, petal lobes with a ruffled crest (like a rooster's comb) along the upper midvein, blooming from summer to fall. **Fruit** an oblong capsule, with smooth, rounded seeds.



Plant Images: Crested Floating Heart on Lake Marion, South Carolina. Photos courtesy of Jim Huff, Santee Cooper, Moncks Corner, South Carolina.

Similar Plants: Big Floating Heart (*N. aquatica*), Little Floating Heart (*N. cordata*), and Water Snowflake (*N. indica*).

Habitat: Crested floating heart grows in ditches, canals, ponds, and lakes.

Native Range: Asia.

Pathways of Introduction and Spread: Crested floating heart was first introduced to the U.S. as a water garden plant. Once established in a waterway, fragments of the plant are spread by wind, flowing water, boats, and trailers.

Crested Floating Heart in Florida: Free living populations of Crested floating heart were first observed in cypress swamps and water management canals in southeast Florida in the late 1990s. Within a few years, large canals and suburban lakes in the central and eastern parts of the state had become infested. There is serious concern about this plant because herbicides that control other floating and emergent invasive plants have had little effect on it. *It is still being sold in the water garden trade*.

Crested Floating Heart in South Carolina: Crested floating heart was first detected in a 20 acre cove near Eutaw Creek at the southeastern end of Lake Marion (Orangeburg County), South Carolina, in August, 2006. This was the first time that free living populations of the plant had

been found outside of Florida. The plant was most likely introduced into the Santee Cooper Lake System (Lake Marion and Lake Moultrie) from backyard water gardens, or by recreational boaters. Initial applications of herbicides that control other aquatic weeds were largely ineffective – *as already seen in Florida*. Low water levels experienced during of 2007-2008, as well as freezing winter temperatures also had little effect on the plant. By mid-2007, about half of the cove at Eutaw Creek was covered by the plant. By late 2008, the plant had spread to other areas of the lake, both downstream and upstream from the original infestation. In 2009, it was estimated that about 2,000 surface acres of Lake Marion are infested with the plant. It has also been found in nearby Lake Moultrie, as well as the Santee River below the Lake Marion dam. Crested floating heart has also been detected in a golf course pond on Pawleys Island, South Carolina (Jack Whetstone, Clemson University, Georgetown, South Carolina. Personal Communication, May 19, 2010).

Control Strategies: In October, 2009, Santee Cooper aerially sprayed 350 surface acres of Lake Marion that had become infested with the plant. Currently, Santee Cooper is using a tank mix of glyphosate (Touchdown Pro) plus imazamox (Clearcast), combined with TopFilm (a pesticide adjuvant/sticker), or the surfactant AquaBuph, in efforts to control Crested floating heart. Santee Cooper has also found that endothall (Aquathol K) provides short term control of the plant in enclosed water bodies with still water. Early results from the 2009 treatment effort show a small reduction in total surface acres infested in the Santee Cooper lakes.

The Role of Volunteers in Detection and Reporting of Crested Floating Heart: Based on suitable habitat for the plant, biologists estimate that Crested floating heart could ultimately infest as much as 40% of the 160,000 acre Santee Cooper Lake System if it is not controlled. Therefore, in 2010, Santee Cooper is planning to conduct early detection and delimiting surveys across the lake system, and will conduct additional treatments, based on the effectiveness of the 2009 control program. However, surveys are also needed on the Santee River and on area golf courses. At this point, it is critical that preventative measures be taken by boaters and water garden enthusiasts to minimize the spread of this new invader. New infestations should be reported to state officials, and eradicated to prevent further establishment and spread. *This is a good example of the field work that EDRR volunteers could do to assist agencies such as SC-DNR and Santee Cooper in their efforts to detect and manage new invasive species such as Crested floating heart.*

Regulatory Status: Crested floating heart is not currently being regulated anywhere in the U.S.

Online Resources:

Crested Floating Heart in Lake Marion, South Carolina. Southeast Exotic Pest Plant Council – EDDMapS. URL: http://www.eddmaps.org/southeast/distribution/point.cfm?id=633409

Crested Floating Heart Profile – U-FL Center for Aquatic and Invasive Plants.
URL: http://plants.ifas.ufl.edu/node/291

Crested Floating Heart Supplier – The Water Garden, Chattanooga, TN.
URL: http://www.watergarden.org/Pond-Supplies/Lily-like-Aquatics/White-Snowflake

Florida's Floating Heart Fact Sheet – Comparison of the Four Floating Heart Species that Occur in Florida. Colette Jacono, U.S. Geological Survey, Gainesville, Florida.
URL: http://plants.ifas.ufl.edu/misc/pdfs/nymphoides.pdf

New Nymphoides in Lake Marion. S.C. Aquatic Plant Management Society Newsletter. 28(1):3. URL: http://www.scapms.org/images/may2007news.pdf

Santee Cooper plans aerial spraying to fight invasive lilies. The DigitelCharleston. 10-1-2009.
URL: http://charleston.thedigitel.com/green/santee-cooper-plans-aerial-spraying-fight-invasive-6353-1001

Draft Date: May 19, 2010.

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.
Bernard Martin, City of North Charleston, South Carolina.

Common Name: Deeprooted Sedge
Scientific Name: *Cyperus entrerianus* Boeckeler
Synonyms: *Cyperus luzulae* auct. non (L.) Rottb. ex Retz., *Scirpus luzulae* auct. non L.
Family: Cyperaceae

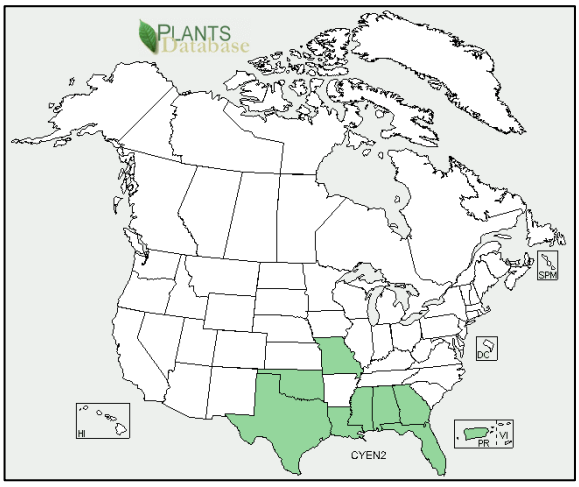
Description: A robust grass-like plant that grows up to 40" tall. **Rhizomes** deeply set, thick.ark purple to black leaf bases. **Leaves** basal, glossy, and flat or V-shaped. **Leaf bases** dark purple to black. **Inflorescence** terminal, with 5-11 elongate rays, ending in densely clustered spikelets.

Habitat: A weed of wet, disturbed areas such as highway ditches and field margins.

Native Range: South America.

Pathways of Introduction and Spread: Accidentally introduced into the United States via rice culture. It was first reported about 20 miles north of Brownsville (Cameron County), Texas, in 1941. It is now being spread across the southern U.S. by construction and agricultural activities, and roadside mowing.

U.S. and Canada Distribution:



Ecological and Economic Impacts: Currently, Deeprooted sedge is beginning to displace native vegetation in undisturbed habitats. Unless it is controlled it will continue to spread, and will infest agricultural and forest production areas, wetlands, riparian zones, and urban areas. Studies show that large plants can produce a million viable seeds per year, and it can overwinter in much of the South.

Control Strategies: Tillage (even repeated disking) temporarily suppresses seed production of Deeprooted sedge, but regrowth is rapid following rainfall. Mowing prevents additional seeding, but opens areas for germination of new seedlings and spread of established plants from underground rhizomes.

Several herbicides have been found to be effective in controlling Deeprooted sedge. Effective herbicides include glyphosate (Roundup – 2 qt./acre), hexazinone (Velpar – 2 pts./acre), MSMA (2 lb./acre), 2,4-D + Dicamba (Weedmaster – 2 pt./acre) and picloram (Grazon P + D; 2 qt./acre).

Image: Deep rooted sedge seedling.

Equipment sanitation is important in preventing the spread of Deeprooted sedge. Any vehicle, machine, or equipment that is used in an infested area should be cleaned before it is moved to another site to minimize the spread of seeds and rhizomes.

Regulatory Status: Deeprooted sedge is not currently regulated by any state or federal agencies within the United States.

Online Resources:

Deeprooted Sedge – An Overlooked Aggressive Weed in the Southeastern United States. Fact Sheet. U.S. Fish and Wildlife Service et al.
URL: http://www.invasive.org/eastern/other/ypentrflyer.pdf

Deeprooted Sedge – Control and Suppression Fact Sheet – Charles Bryson – IL DNR.
URL: http://dnr.state.il.us/Stewardship/cd/other/contol-deeprootedsedge.pdf

Deeprooted Sedge Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=10954

Deeprooted Sedge Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=CYEN2

Rosen, D., R. Carter, and C. Bryson. 2006. The spread of *Cyperus entrerianus* (Cyperaceae) in the southeastern United States and its invasive potential in bottomland hardwood forests. Southeastern Naturalist 5:333-344.
URL: http://www.valdosta.edu/~rcarter/Rosen.Carter.Bryson.2006.pdf

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Garlic Mustard
Scientific Name: *Alliaria petiolata* (M. Bieb.) Cavara & Grande (Brassicaceae)
Family: Brassicaceae
Synonyms: *Alliaria alliaria* (L.) Britton, *Alliaria officinalis* Andrz ex M. Bieb., *Erysimum alliaria* L., *Sisymbrium alliaria* (L.) Scop.

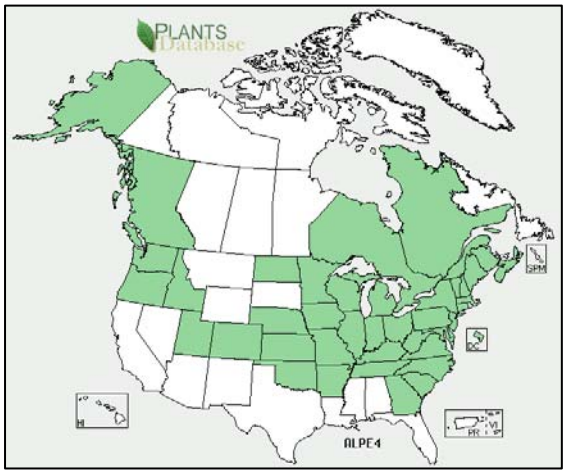
Description: A cool season, biennial herb. **First year plants** are basal rosettes with heart-shaped, evergreen leaves, 1-6" long. **Second year plants** produce a flowering stalk, 1-4' tall. **Leaves** strongly toothed, triangular in shape, alternately arranged on the flowering stalk. **Flowers** white, with four petals in the shape of a cross, 6 mm in diameter, in button-like clusters. **Fruit** a slender pod (silique) with oblong, black, shiny seeds. The plants are easily recognized by a garlic odor that is present when any part of the plant is crushed, and by the toothed, triangular leaves.

Habitat: Natural forests, planted forests, riparian zones, and urban areas. Invasion is more likely in moist shaded soil of river floodplains, forest edges, and other disturbed areas, such as along trails and roadways. It prefers moist, rich soil, but is found in sand, loam, clay, limestone, and sandstone substrates. It is less common on acidic soils.

Native Range: Europe.

Pathways of Introduction and Spread: Garlic mustard was introduced to North America for cooking purposes. It can be used as a garlic flavored herb, and is high in vitamins A and C. The seeds are transported by water, animals, and humans.

U.S. and Canada Distribution:



Ecological and Economic Impacts:
Garlic mustard poses a severe threat to native plants and animals in forest ecosystems. A high shade tolerance allows Garlic mustard to form dense stands in mature woodlands. Once established in an area, it degrades habitat for wildlife by outcompeting native plants for light, moisture, nutrients, and space. The plants also produce allelopathic compounds that inhibit seed germination of other species.

Manual Control: Manual removal of the plant, including the entire root system, is effective for eliminating small infestations of Garlic Mustard. Larger infestations should be cut at ground level to prevent seed production.

Chemical Control: Glyphosate (Roundup) is effective in controlling Garlic mustard. One method is to spot treat Garlic mustard plants in the rosette stage during the dormant season. This will minimize damage to desirable native species. Fire can also be used to stimulate the seeds in the soil to germinate. Once they have germinated, they can be controlled with the chemical.

Regulatory Status: Garlic Mustard is regulated as a state noxious weed in Alabama, Connecticut, Massachusetts, Minnesota, New Hampshire, Oregon, Vermont, and Washington.

Online Resources:

Garlic Mustard Fact Sheet - Canadian Wildlife Service.
URL: http://www.cws-scf.ec.gc.ca/publications/inv/p8_e.cfm

Garlic Mustard Fact sheet – USDA Forest Service – Weed of the Week Series.
URL: http://www.na.fs.fed.us/fhp/invasive_plants/weeds/garlic_mustard.pdf

Garlic Mustard Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=3005

Garlic Mustard Profile – ISSG Global Invasive Species Database.
URL: http://www.issg.org/database/species/ecology.asp?si=406&fr=1&sts=sss&lang=EN

Garlic Mustard Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=ALPE4

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Giant Hogweed
Scientific Name: *Heracleum mantegazzianum* Sommier & Levier
Family: Apiaceae

Description: A biennial or perennial herb in the carrot family growing to 15' tall, with a taproot or fibrous roots. **Stems** hollow, 2-4" in diameter, with dark reddish-purple blotches and bristles. **Leaves** compound, deeply lobed, with three leaflets, up to 5' wide. **Inflorescence** a flat-topped umbel, up to 2.5' across with numerous small white flowers, late spring to early summer. **Fruits** elliptical, producing up to 1,500 seeds per flower head.

Habitat: Giant hogweed has established free living populations in many of the places where it was first introduced in the United States. The plant does particularly well in disturbed areas with moist soil such as vacant lots, uncultivated or waste areas, riverbanks, along roadways, and in agricultural lands.

Native Range: Eastern Europe.

Pathways of Introduction and Spread: Giant hogweed was intentionally introduced to the United States as an ornamental plant. The earliest U.S. record is from Highland Park (near Rochester) in 1917. The dried fruits, which are used as a spice in Iranian cuisine (golpar) are often intercepted at U.S. ports of entry. Once the plant becomes established in an area, birds consume the fruits and spread the seeds.

U.S. and Canada Distribution:

Ecological and Economic Impacts:
From an ecological perspective, Giant hogweed is an aggressive competitor. Because of its large size and rapid growth, it can quickly dominate invaded ravines and stream banks. This substantially reduces the amount of suitable habitat available for native plants and wildlife. During the winter months, Giant hogweed dies back, leaving bare ground that can lead to an increase in soil erosion.

From an economic standpoint, Giant hogweed is a very serious threat to human health. Exposure to the sap causes a skin reaction known as photodermatitis that results in large painful blisters with eruptions (*similar to poison ivy – but much worse*). If exposed to sunlight, the blisters leave permanent purple scars. The large hollow stems are a special hazard to unsuspecting children who like to use them as pea-shooters or telescopes. Contact with the eyes can lead to temporary or permanent blindness.

Cultural Control: Due to the extensive underground root system, mowing of Giant hogweed is not effective.

Chemical Control: Both pre- and post-emergent herbicides, plus competitive vegetation are used to manage Giant hogweed. Effective pre-emergent herbicides include pendamethalin (Pre-M and others) and clopyralid (Transline and others). Post-emergent herbicides include glyphosate (Roundup, Rodeo, and others) and triclopyr (Garlon and others).

Regulatory Status: Giant hogweed is listed as a U.S. Federal Noxious Weed. It is regulated as a state noxious weed in Alabama, California, Connecticut, Florida, Massachusetts, Minnesota, New Hampshire, North Carolina, Oregon, Pennsylvania, South Carolina, Vermont, and Washington.

Online Resources:

Giant Hogweed – Domestic Pest Evaluation - USDA APHIS PPQ.
URL: http://www.invasive.org/eastern/other/hogweed.html

Giant Hogweed Fact Sheet - USDA Forest Service – Weed of the Week Series.
URL: http://www.na.fs.fed.us/fhp/invasive_plants/weeds/giant-hogweed.pdf

Giant Hogweed Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=4536

Giant Hogweed Poster – USDA APHIS PPQ.
URL: http://www.invasive.org/eastern/other/poster_phhogweed.pdf

Giant Hogweed Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=HEMA17

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.
Brittany Cartrette, Southeastern Community College. Whiteville, North Carolina. USA.

Common Name: Giant Salvinia, Kariba weed
Scientific Name: *Salvinia molesta* D.S. Mitchell
Family: Salviniaceae

Description: A free floating aquatic fern with a horizontal rhizomes (lies below the water surface) and two types of fronds in whorls of three (2 floating and 1 submerged). **Floating fronds** are positioned opposite to each other on the plant stem, up to 1.5" long, oblong in shape, with a distinctive fold in the center, and vary in color from light green to golden brown. Upper surface of the floating frond has rows of **'egg-beater' tipped hairs** that trap air and enable the plant to float. **Submerged fronds** function in water and nutrient uptake. The mature plant produces **egg-shaped spore sacs** containing infertile spores. Reproduction is by stem fragmentation and budding.

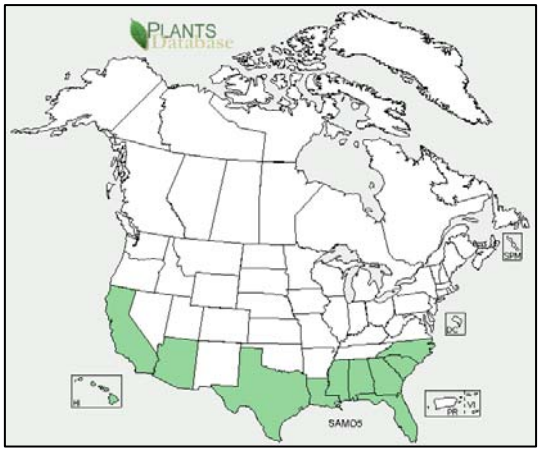
Image: Giant Salvinia in the River Bend Swamp, Pender County, N.C. September, 2002. Images by R. Westbrooks.

Habitat: Giant Salvinia can invade almost any kind of freshwater system. It prefers tropical, sub-tropical, or warm temperatures, and grows best in nutrient rich still or slow-moving waters such as ditches, canals, ponds, lakes, and rivers. It grows best at a water temperature of 68-86^{o} F. It can only tolerate salinity levels of 10% that of seawater.

Native Range: Southeastern Brazil and northeastern Argentina.

Pathways of Introduction and Spread: Giant Salvinia was first imported by the pet trade to be used in aquariums and garden ponds. Since then, it has escaped into the wild. Once in a waterway, it is spread by flowing water, as well as boats and other equipment into new areas.

U.S. and Canada Distribution:



Ecological and Economic Impacts: Giant Salvinia is one of the worst weeds in the world. It only takes a single small plant to form a floating mat called 'sudd' on the surface of standing water – up to 3' thick. The mats clog and prevent access to waterways, and block out sunlight which is needed by algae and other aquatic plants for photosynthesis. This leads to oxygen depletion of infested waters. As it dies and decays, decomposers use up even more of the oxygen in the water. It also prevents the natural exchange of gases between the water and the atmosphere – which leads to stagnation of the water body. Ultimately, this will kill any plants, insects, or fish that are living under the mats. The mats also provide ideal conditions for breeding of mosquitoes that carry disease.

Preventative Measures: Prevention is the most important strategy for managing Giant Salvinia. Once it becomes established and widespread in a water body, it is very difficult to control. *Under ideal conditions, it can double its mass in 5-7 days, if not quickly addressed*. On a local level, a monitoring program should be instituted to ensure that Giant Salvinia is detected and quickly addressed if it is accidentally introduced into a water body. Boat and trailer inspections, as well as signage at boat ramps will help to raise awareness of the problem.

Manual and Physical Control: Large infestations may be mechanically harvested to open up access to a water body. However, removal operations in large waterways should be followed by chemical treatment to minimize regrowth of remaining plants. Infestations in small water bodies may be removed by hand, or by draining the water and allowing the plant to desiccate.

Chemical Control: A number of herbicides are effective in controlling Giant Salvinia plants. Examples include **diquat** (Reward – a contact herbicide) and **fluridone** (Sonar – a systemic herbicide taken up from the water column). It is important to remember that contact herbicides such as diquat will control only the plants that it touches. Systemic herbicides such as fluridone are ideal for controlling salvinia in small, contained water bodies with standing water. All of the plants with submerged fronds will take up the chemical from the water and be killed. However, it will not stay concentrated in large, open water bodies and flowing waterways.

Biological Control: In some places, biological control is the most effective method for managing Giant Salvinia. A good example is the South American Salvinia weevil (*Cyrtobagous salviniae*), which showed excellent results in controlling Salvinia on Lake Moondarra in Queensland, Australia, in the early 1980s, and elsewhere. However, biological control is NOT a panacea for managing Giant Salvinia. In spite of its success in controlling Giant Salvinia in some places, the Salvinia weevil was not successful in controlling Salvinia in Kakadu National Park in the Northern Territory of Australia. *This is because the potential ecological range of a biological control agent is sometimes not the same as the weed being controlled. Sometimes, the agents will not survive and reproduce in new regions in which the target plants are adapted*.

Regulatory Status: Giant Salvinia is listed as a U.S. Federal Noxious Weed. It is regulated as a state noxious weed in Alabama, Arizona, California, Colorado, Connecticut, Florida, Massachusetts, Mississippi, Nevada, North Carolina, Oregon, South Carolina, Texas, and Vermont.

Online Resources:

Giant Salvinia Image - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=2785

Giant Salvinia Profile – ISSG Global Invasive Species Database.
URL: http://www.issg.org/database/species/ecology.asp?si=569&fr=1&sts=sss

Giant Salvinia Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=SAMO5

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Goatsrue
Scientific Name: *Galega officinalis* L.
Family: Fabaceae

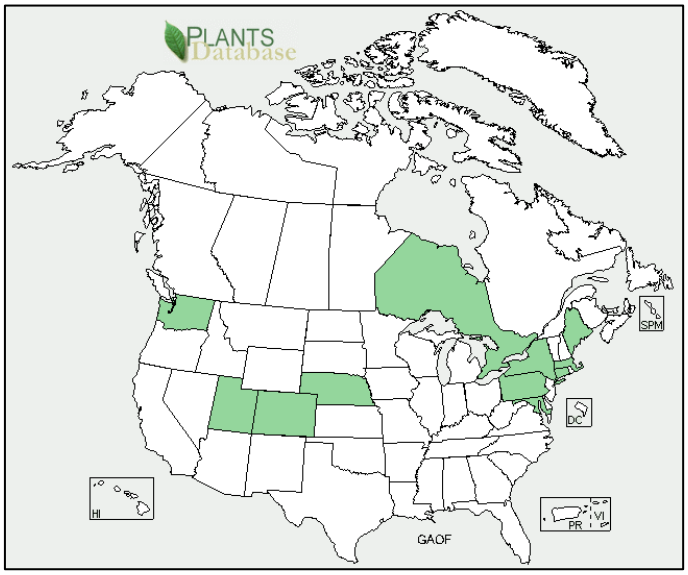
Description: A shrubby, herbaceous, multi-stemmed, perennial plant that grows up to 6' in height. **Stems** hollow and tubular. **Leaves** alternate, compound, oddly pinnate with 6-10 pairs of leaflets. **Leaflet** with small hair-like projection on its tip. **Stipule** (leaf-like appendage at based of leaf stem) is sagittate (arrow-shaped, toothed, and lobed). **Flowers** pea-like, white to purple, arranged in terminal or axillary racemes, June to Frost. **Fruits** short pods, 1-9 seeds. Seeds bean-shaped, dull yellow, remaining dormant until scarified. Seed life in the soil is 10 years or more.

Habitat: Disturbed areas such as streambanks, low pastures, and ditches.

Native Range: Eastern Europe.

Pathways of Introduction and Spread: Goatsrue was first introduced into the U.S. as a potential pasture forage in 1891 by a professor at Utah State University. Seeds drop to the ground when mature and may be spread by water, animal manure, or machinery.

U.S. and Canada Distribution:



Ecological and Economic Impacts: Goatsrue forms dense thickets that crowd out native plants, and is poisonous to livestock. Due to alkaloids in the plant, animals generally avoid it. This contributes to the establishment and spread of the plant in rangelands. *The long term effort that is required to eradicate the plant (decades) makes early detection and rapid response to incipient infestations all the more critical.*

Mechanical Control – Mowing, clipping, cutting, and shallow cultivation are not effective in control of Goatsrue. The plant will flower and produce seeds even when very small.

Cultural Control – Alternate cropping and row crops are effective deterrents for Goatsrue. Cultivation helps to induce germination of the seeds in the soil. Chemicals can then be used to eradicate the seedlings.

Chemical Control - Use of selective herbicides is the primary control method used in Utah. Application rates are typically 1 lb. of active ingredient of 2,4-D per acre and 0.5 lb. active ingredient of Dicamba per acre.

The crowns of treated plants may remain viable for up to seven years unless retreated until dead, or excavated and removed.

Regulatory Status: Goatsrue is listed as a U.S. Federal Noxious Weed. As a result, it is automatically listed as a state noxious weed in Alabama, California, Florida, Massachusetts, Minnesota, North Carolina, Oregon, South Carolina, and Vermont.

Online Resources:

- Goatsrue Pest Evaluation – Art Miller, USDA APHIS PPQ.
URL: http://www.invasive.org/eastern/other/goatsrue.html

- U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=4535

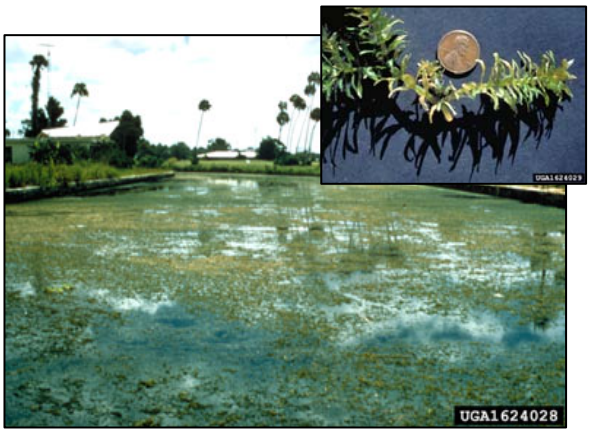
- USDA Plants Database:
URL: http://plants.usda.gov/java/profile?symbol=GAOF

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks. U.S. Geological Survey, Whiteville, North Carolina. USA.
Brittany Cartrette. Southeastern Community College, Whiteville, North Carolina.

Common Name: Hydrilla
Scientific Name: *Hydrilla verticillata* (L.) F. Royle
Family: Hydrocharitaceae



Description: A submersed, rooted aquatic plant that can grow at depths of 20'. **Stems** slender branched, up to 25' long. **Leaves** strap-like and pointed, in bottle-brush whorls of 3-8, up to 0.8" long, 0.1" wide, with serrated margins. **Leaf midribs** reddish in color, undersides with small sharp teeth. **Flowers** tiny, white, with 6 petals, on long stalks. **Reproduction** occurs sexually through the production of seeds. It also occurs vegetatively by fragmentation of the stem, or by sprouting of axillary turions (in the leaf axils) and subterranean turions (attached to the roots).

Genetic Forms: Hydrilla occurs in both monoecious (both male and female flowers on the same plant) and dioecious (male and female flowers on different plant) forms. The dioecious form occurs in the southeastern U.S., California, Poland, Malaysia, Indonesia, and Panama. The monoecious form has been found in the Mid-Atlantic Region of the U.S. (Potomac River near Washington, D.C.), in India, and Indonesia.

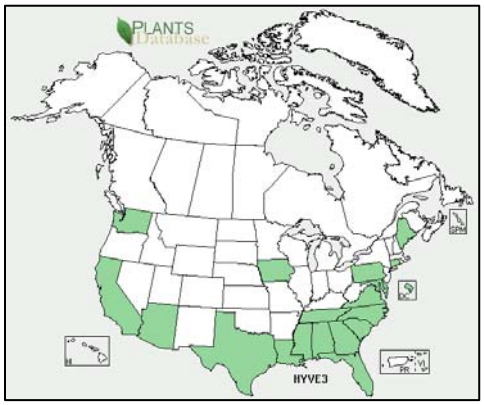
Similar Plants: Hydrilla can be confused with Brazilian elodea (*Egeria densa* Planch.) and Canadian waterweed (*Elodea canadensis* Michx.). The leaf midrib of Brazilian elodea is smooth; the leaf midrib of Hydrilla is toothed. The leaves of Canadian waterweed occur in whorls of three along the stem and are up to 0.2" wide.

Habitat: Hydrilla invades slow-moving or still water systems, such as ditches, ponds, lakes, rivers, and tidal zones (up to 7% salinity). It can grow in water a few inches deep, to water that is more than 20' deep. It can grow in low to high nutrient conditions. In the U.S., southern populations overwinter as perennials; northern populations (e.g., Connecticut) die back and re-grow from turions in the hydrosoil. It can also grow in very low light conditions (1% of full sunlight). This last characteristic gives is a distinct competitive advantage over most other aquatic plants.

Native Range: Africa or Asia – now widespread around the globe.

Pathways of Introduction and Spread: Hydrilla was first introduced into the U.S. in the late 1940s as an aquarium plant from Ceylon (now Sri Lanka). It is now spread primarily as fragments on boats and boat trailers.

U.S. and Canada Distribution:



Ecological and Economic Impacts: Hydrilla is one of the worst aquatic weeds in the United States. It forms dense submersed mats at the surface of the water that can cover hundreds of acres. The dense mats reduce water flow, clog irrigation and hydroelectric equipment, interfere with recreation (boating, fishing, swimming), outcompete native aquatic plants, alter water chemistry, and reduce oxygen levels. In Florida, millions of dollars are spent annually in efforts to keep Hydrilla under "maintenance control".

Physical and Mechanical Control: Lake draw downs are sometimes used in reservoirs with water control structures to allow exposed plants to die and decompose. This is effective if done while the turions are developing in the fall, and prior to their regrowth in the spring. Mechanical harvesters are sometimes used to remove hydrilla from the water for disposal on dry land.

Chemical Control: A number of registered herbicides are used for temporary control of hydrilla. Examples include contact herbicides such as copper sulfate (Komeen and others), diquat (Reward), endothall (Aquathol and others); as well as the systemic herbicides fluridone (Sonar) and bensulfuron methyl (Londax and others).

Biological Control: The triploid White Amur (*Ctenopharyngodon idella*), a sterile grass carp from China, has been used under permit to control infestations of hydrilla in some states, in contained water bodies. They are effective in canals systems (e.g., the Imperial Irrigation District of southern California), in small ponds, and lakes, where the fished can be contained, and the removal of all aquatic vegetation is acceptable. A number of insects, including two weevils, two leaf-mining flies, and an aquatic moth, have been introduced to control hydrilla.

Regulatory Status: Hydrilla is listed as a U.S. Federal Noxious Weed. It is regulated as a state noxious weed in Alabama, Arizona, California, Colorado, Connecticut, Florida, Maine, Massachusetts, Mississippi, Nevada, New Mexico, North Carolina, Oregon, South Carolina, Texas, Vermont, and Washington.

Online Resources:
Hydrilla Fact Sheet – USDA Forest Service – Weed of the Week Series.
URL: http://na.fs.fed.us/fhp/invasive_plants/weeds/hydrilla.pdf

Hydrilla Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/weedcd/species/3028.htm

Hydrilla Profile – Center for Aquatic and Invasive Plants – University of Florida.
URL: http://plants.ifas.ufl.edu/node/183

Hydrilla Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=HYVE3

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy Westbrooks. U.S. Geological Survey, Whiteville, North Carolina. USA.
Brittany Cartrette. Southeastern Community College, Whiteville, North Carolina.

Common Name: Itchgrass
Scientific Name: *Rottboellia cochinchinensis* (Lour.) W.D. Clayton
Family: Poaceae
Synonyms: *Aegilops exaltata* L., *Manisuris exaltata* (L.) Kuntze, and *Rottboellia exaltata* (L.) L. f

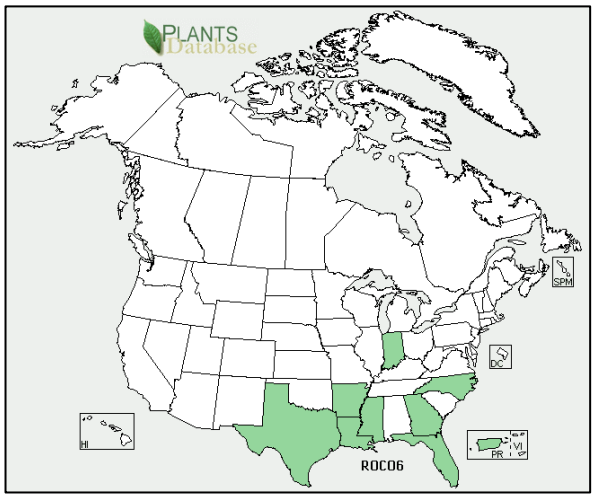
Description: A profusely tillering, erect annual grass that grows up to 12' tall, and has brace roots near the base of the plant. **Stems and leaves** covered with stiff, irritating hairs. **Leaf blades** 6-18" long, 0.2-0.8" wide, and flat. **Inflorescence** a jointed, cylindrical spike let, 1-6" long. **Seed production** starts about 6-7 weeks after emergence and continues throughout the growing season.

Habitat: Itchgrass occurs in agricultural areas, range and grasslands, along roadsides, and other open, well-drained sites around the world. It has a wide tolerance for shade, and can survive in habitats with full sun to full shade of thickets and forests.

Native Range: Old world tropics; now widespread throughout the tropics around the world.

Pathways of Introduction and Spread: Itchgrass was introduced and spread in the U.S. as a crop seed contaminant. It is also spread on soil contaminated equipment, machinery, and vehicles.

U.S. and Canada Distribution:



Ecological and Economic Impacts: Itchgrass invades agricultural fields and other disturbed areas. It is considered to be one of the worst invaders of sugarcane in the world – causing losses of 20-70% in some places. It is also a serious problem in corn, cotton, peanut, upland rice, and other crops in tropical regions of the world. The plant is also unpalatable to livestock, and the hairs on the stems and leaves can cause severe skin irrigation.

Mechanical Control: Itchgrass is controlled in East Africa by a combination of cultivation followed by fallowing for at least two years. A controlled burn is first conducted to destroy the seeds on the surface of the soil. Next, it is plowed to stimulate the germination of the seeds near the surface of the soil. Once seeds germinate, deep plowing is done to bury the seedlings. After this, the land is left fallow until the buried seeds die and the land is considered free from the weed.

Chemical Control: A number of soil applied herbicides have been found to be effective in control of itchgrass. These include trifluralin (Treflan and others) and pendamethalin (Prowl and others) in soybean and sugarcane. Pendamethalin has also been effective for controlling the weed in corn, although seed production may occur in later emerging plants.

Regulatory Status: Itchgrass is listed as a U.S. Federal Noxious Weed. It is regulated as a state noxious weed in Alabama, Arkansas, California, Florida, Massachusetts, Minnesota, Mississippi, North Carolina, Oregon, South Carolina, Texas, and Vermont.

Online Resources:

Itchgrass Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=4568

Itchgrass Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=ROCO6

Itchgrass Profile – ISSG Global Invasive Species Database.
URL: http://www.issg.org/database/species/ecology.asp?si=772&fr=1&sts=&lang=EN

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Japanese Dodder
Scientific Name: *Cuscuta japonica* Choisy
Family: Cuscutaceae

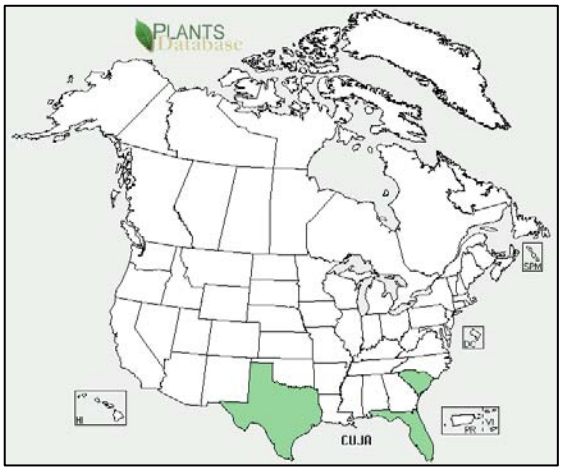
Description: An annual, parasitic vine. **Stems** many-branching, fleshy, circular, pale yellow with red spots and striations. **Leaves** minute, scale-like, about 0.07" long. **Flowers** abundant, pale yellow, sessile, August-October. **Fruit** a round, 2-celled, 4-seeded capsule. **Seeds** 2.5-3 mm in length, 0.07-0.11" in diameter, dented, pale straw to blackish in color. A single plant can produce over 2,000 seeds, which can remain viable in the soil for up to 20 years.

After dodder **seeds** germinate, a rootless and leafless seedling is produced that grows out in search of a host. Once the seedling comes in contact with a suitable host, it produces a **haustorium** which invades the vascular tissue of the host plant stem, in the same way that a Witchweed radicle attaches to the root of a corn plant. If the seedling cannot find a suitable host, it will die within a few weeks. Once attached to a host plant, dodder grows very fast – up to 6" per day, and its connection to the ground withers away.

Habitat: Japanese Dodder grows in a wide range of habitats; cultivated crops, perennial crops, pastures, abandoned lands, fence rows, ditchbanks, and residential areas.

Native Range: Asia.

Pathways of Introduction and Spread: Introduced and spread as a medicinal herb, as well as a contaminant of seed shipments, spices, baggage, and straw. Dodder seeds are commonly intercepted as contaminants of commercial seed shipments entering the United States. It has also been intercepted as a contaminant of imported baggage, spices, and straw. Any imported seed shipment found to contain seed of any dodder species is denied entry and the commodity is either devitalized or returned to country of origin (Westbrooks, 1989). The seeds and sticky stem fragments are spread by birds and animals, as well as human activities associated with pruning and gardening.



U.S. and Canada Distribution:

Ecological and Economic Impacts: Severe infestations can kill host plants. It poses a severe threat to crops such a soybean, alfalfa, asparagus and tomatoes, as well as horticultural plants. Japanese Dodder kills the host plant by robbing it of water and nutrients. Left uncontrolled, it can kill large portions of a host plant, and a complete large tree within two to three years. Dodder infestations weaken a host plant, making it susceptible to other pests and diseases, and may eventually kill the host. Dodder is also thought to be a vector for various plant pathogens including several 'yellowing' viral diseases, citrus tristeza, citrus stubborn, and citrus greening disease. Host plants include, but are not limited to fruit trees, tomatoes, potatoes, corn, carrots, soybeans, eggplant, cucumber, peas, tobacco, and soybean, and nursery stock.

Control Strategies: Control methods include hand roguing, pruning, and the use of herbicides to kill the parasite. Hand roguing and pruning are often used in landscape settings where the use of herbicides would damage other plants. In areas where herbicides can be used, **pre-emergent herbicides** are used to prevent dodder seeds from germinating. **Post-emergent herbicides** such as glyphosate (Roundup) are used to kill dodder seedlings before they become attached to the host plant, and to kill mature vines after they have become attached to a host plant. In settings where the host can be sacrificed, **systemic herbicides** such as triclopyr (Garlon) can be injected into host plants such as large trees. This kills the host plant as well as the parasite, and ensures that it will not be spread and further.

Online Resources:

- Cuscuta Profile – USDA APHIS PPQ – Randy Westbrooks. 1991.
URL: http://www.invasive.org/eastern/other/cuscuta.html

-Japanese Dodder Fact Sheet – Texas Invasives.
URL: http://www.texasinvasives.org/invasives_database/detail.php?symbol=CUJA

- Japanese Dodder Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=CUJA

- Japanese Dodder Images: U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=5446

- Markmann, C. 2006. Summary of Dodder (*Cuscuta japonica*) Biology, Concerns, and Management. California Department of Food and Agriculture.
URL: http://www.cdfa.ca.gov/phpps/ipc/noxweedinfo/pdfs/jdodder_summary.pdf

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Mile-a-Minute Vine, Asiatic Tear Thumb
Scientific Name: *Persicaria perfoliata* (L.) H. Gross
Family: Polygonaceae
Synonyms: *Polygonum perfoliatum* L., *Ampelygonum perfoliatum* (L.) Roberty & Vautier

Description: An herbaceous, annual, trailing vine. **Stems** narro w, delicate, highly branched, armed with recurved barbs, also present on the underside of the leaf blades. **Stem nodes** surrounded by distinctive circular, cup-shaped leafy structures called **ocreae** (formed by the fusion of two stipules at the base of a leaf stalk). **Leaves** light green, shaped like an equilateral triangle, alternate. **Flowers** small, white and inconspicuous, emerging from within the ocreae. **Fruit** berry-like, deep blue, in clusters at terminals, mid-July – first frost. **Seed** a glossy, black or reddish-black achene, persisting in the soil for at least six years.

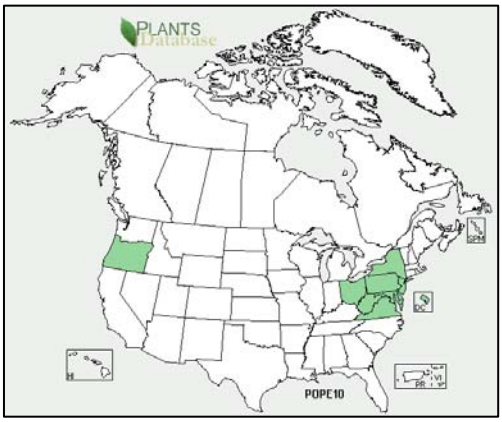
Habitat: Mile-a-minute grows in open and disturbed areas, forest edges, moist thickets, wetlands, streambanks and roadsides. Like kudzu, it does especially well on forested sites that have been clear cut. It tolerates some shade, but climbs up over other plants to reach areas of higher sunlight. It prefers sites with high soil moisture and abundance of leaf litter, but can survive in low moisture conditions.

Native Range: Eastern Asia and the Philippines.

Pathways of Introduction and Spread: Mile-a-minute vine was first collected in the U.S. in Portland, Oregon (1890), and Beltsville, Maryland (1937). Both populations were eliminated, or did not survive. Current infestations of the plant in the Mid-Atlantic Region of the U.S. can be traced to an infested shipment of Holly seeds that was imported from Japan by a plant nursery in York County, Pennsylvania, in the late 1930s. At first, the owner of the nursery was interested in the new plants that germinated along with the holly plants – *so he allowed it to reproduce*. Later attempts to eradicate the plant failed and it began to spread. Mile-a-minute vine is spread by water, animals, and as a contaminant of nursery stock. The fruits are buoyant for 7-9 days and thus can be transported for great distances in streams and river. The fruits are also spread long distances by birds. The seeds bear an **elaiosome*** that encourages short distance spread by ants. Chipmunks, squirrels, and deer have also been observed eating the fruits (viable seeds have been found in deer scat). The seeds will survive in the soil for at least six years.

***Elaiosomes** are fleshy structures attached to the seeds of many plant species that are rich in lipids and proteins. Plants have elaiosomes to attract ants, which take them to their nest and feed them to their larvae. After this, the seeds are taken to their waste disposal area, where the seeds germinate.

U.S. and Canada Distribution:



Ecological and Economic Impacts: The rapid growth of Mile-a-minute vine allows it to totally cover native vegetation, blocking sunlight, potentially killing plants below, and preventing the establishment of new vegetation. This reduces their ability to photosynthesize, which weakens and eventually kills them. The heavy mass of vines also makes large trees top heavy, and thus susceptible to uprooting in windstorms and breakage during ice and snowstorms. Left unchecked, large infestations can greatly reduce biodiversity of native plants – and associated wildlife in an area. It also interferes with reforestation of pine plantations and regeneration of logged forests.

Cultural Control Methods: A number of steps can be taken to discourage the introduction of Mile-a-minute vine into an area. This includes avoiding the creation of gaps or openings in existing vegetation. Vegetative buffers should also be maintained along streams and forest edges to help shade out and prevent the establishment of the weed.

Manual and Mechanical Control: Manual removal of vines may be conducted throughout the summer if tough gloves and protective clothing are used to protect the skin. However, hand pulling of seedlings is best done on young stems and leaves – before the before the recurved barbs harden. Mowing or trimming is also a good way to prevent further seed production.

Chemical Control: A number of pre-emergence herbicides are effective in controlling Mile-a-minute vine, including sulfometuron methyl (Oust), hexazinone (Velpar L), imazapyr (Arsenal), atrazine (Aatrex), and imazethapyr (Pursuit). Effective post-emergence herbicides include glyphosate (Roundup) and imazapyr (Arsenal).

Biological Control: A number of potential biological control agents for Mile-a-minute vine have been identified in China. The weevil *Rhinoncomimus latipes* Korotyaev is regarded as the most promising agent. It was approved for field release by USDA APHIS in 2004.

Regulatory Status: Mile-a-minute is regulated as a state noxious weed in Alabama, Connecticut, Massachusetts, North Carolina, Ohio, Pennsylvania, South Carolina.

Online Resources:
Mile-a-minute Vine Fact Sheet – Plant Conservation Alliance.
URL: http://www.nps.gov/plants/alien/fact/pepe1.htm

Mile-a-minute Vine Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=3065

Mile-a-minute Vine Profile – ISSG Global Invasive Species Database.
URL: http://www.issg.org/database/species/ecology.asp?si=582&fr=1&sts=&lang=EN

Mile-a-minute Vine Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=POPE10

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Old World Climbing Fern
Scientific Name: *Lygodium microphyllum* (Cav.) R. Br. (Lygodiaceae)
Family: Lygodiaceae
Synonyms: *Ugena microphylla* Cav.

Description: A perennial climbing fern with dark brown, wiry rhizomes, up to 90' long. **Main rachis** (leaf stalk above petiole) wiry, stemlike. **Fronds** (leaves) opposite, singly compound, 2-5" long. **Leaflets** (pinnules) usually unlobed, stalked; **leaf-blades** usually glabrous below; **fertile leaflets** generally unlobed, fringed with enrolled tissue that covers the sporangia along the leaf margin. **Reproduction** is by spores.

NOTE: Japanese climbing fern, a closely related invader that also occurs in the southeastern U.S., is very similar, but has pinnae that are usually twice compound.

Habitat: Old world climbing fern generally occurs in moist habitats such as Cypress wetlands, tree islands, floodplains, wet prairies, marshes, hammocks, edges of waterways, and roadside ditches. But, it also grows in dry pine flatlands and disturbed areas. It thrives in low-light, under-story environments.

Native Range: Africa, Australia and Southeast Asia.

Pathways of Introduction and Spread: OWCF was first introduced in to the U.S. as a potted plant. It was first found naturalized in the U.S. in south Florida in 1965. Each plant produces millions of spores that are spread by wind, water, even animals, people, equipment, and vehicles. Therefore, new infestations can become established great distances from existing populations.

U.S. and Canada Distribution:

Ecological and Economic Impacts: OWCF can form dense mats that totally cover *and* smother understory vegetation, as well as shrubs as trees. It also poses a serious fire hazard in mature forests. Thick mats of dead fronds that grow in trees act as a fire ladder, bringing wild fires up

into the tree canopy – creating crown fires that can kill trees and native bromeliads that would normally survive ground-based fires.

The long mats also create an avenue for spread of fire in wetland areas where surface waters usually provide a natural barrier. This complicates the use of prescribed fire as a management tool in an infested area. Large-scale chemical and mechanical control efforts are expensive, often temporary in effect. Therefore, *early detection and rapid response* is critical addressing this invader.

Control of Small Patches: Pull out the entire plant (including the roots) and dispose properly, or spray the leaves with an approved herbicide when the plant is actively growing and not stressed by drought, flood, or frost.

Control of Large Patches Climbing into Trees: Cut the plant at waist height – leave a gap of 10-12" between the vines and the roots. Pull the vines away from underlying vegetation. Cut enough of the plant to leave a gap of 10-12" between the cut and rooted portions of the vine. The rooted portion of the plant and spore seedlings should be treated with a herbicide.

Recommended Herbicides:
A. Dry Habitats: Glyphosate (Roundup and others) (dieback within a few weeks). Metsulfuron (Escort and others) (dieback within in several months).
B. Habitats in Water or near Water: Glyphosate (Rodeo and others).

Recommendations for Disposal: Remove fern materials from equipment and shoes before leaving infested sites; store work clothes in a plastic back until it can be washed. Remove fern material from equipment and shoes, and then bag clothing until it can be washed. Fern material usually has viable spores and should not be used for mulching or composting.

Regulatory Status: Old world climbing fern is being listed as a U.S. Federal Noxious Weed. It is currently regulated as a state noxious weed in Alabama and Florida.

Online Resources:

- Old World Climbing Fern Fact Sheet – *Identification & Biology of Non-Native Plants in Florida's Natural Areas*. Langland and Burks, University of Florida.
URL: http://plants.ifas.ufl.edu/misc/pdfs/lygmic.pdf

- Old World Climbing Fern Fact Sheet – Find it and Kill it. FL-EPPC.
URL: http://plants.ifas.ufl.edu/misc/pdfs/LYGO-Find-and-Kill_2ndCP.pdf

- Old World Climbing Fern Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=3046

- Old World Climbing Fern Profile – ISSG - Global Invasive Species Database.
URL: http://www.issg.org/database/species/ecology.asp?si=880&fr=1&sts=sss

- Old World Climbing Fern Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=LYMI

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey, Whiteville, North Carolina. USA.
Marika Godwin, Coordinator, Invasive Species Alliance of Nova Scotia. Wolfville, NS, Canada.

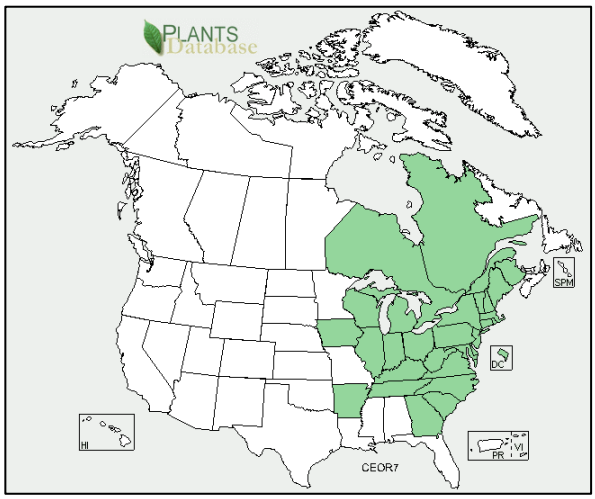
Common Name: Oriental Bittersweet
Scientific Name: *Celastrus orbiculatus* Thunb.
Family: Celastraceae

Description: A deciduous, woody, twining vine or trailing shrub, up to 60' long, with separate male and female plants. **Stems** up to 4" in diameter. **Leaves** alternate, light green, glossy, rounded with finely toothed margins, 2-5" long. **Flowers** small, greenish, in clusters at leaf axils along the stem, spring to early summer. **Fruit** a globular bright yellow berry, splitting open at maturity to reveal three red arils (specialized growth that covers the seeds), each with 1-2 seeds. **Outer root surface** is typically bright orange.

American bittersweet (*Celastrus scandens* L.), which is similar, has leaves that are twice as long as Oriental bittersweet leaves, and are tapered at each end. The flowers and fruits occur in clusters at the tips of the stems (left side of image).

Images: Oriental Bittersweet in Connecticut. Les Mehrhoff, UCONN.

Habitat: Oriental bittersweet is often found in old homesteads, gardens, open fields, fencerows, salt marsh and forest edges. It is tolerant of shade, which allows it to invade forested areas.



Native Range: Eastern Asia, Japan, Korea and China.

Pathways of Introduction and Spread: Oriental bittersweet was introduced to the U.S. as an ornamental vine in the 1860s. In spite of its invasive characteristics, it is still harvested and used in making ornamental displays. The plant is also dispersed by birds that eat the fruits, and vegetatively through root suckering.

U.S. and Canada Distribution:

Ecological and Economic Impacts: Oriental bittersweet vine can totally cover low growing vegetation and kill it by shading and breakage. It forms a large mass of vines high in trees which makes them top heavy, which can lead to uprooting during wind storms. This also makes trees more vulnerable to breakage during heavy snowfalls. The prolific vines encircle a tree and can eventually girdle and kill it.

Image: Oriental bittersweet girdling a tree in Connecticut. Les Mehrhoff, UCONN.

In spite of being listed as a state noxious weed in North Carolina, mountain crafters continue to use Oriental bittersweet in making decorative wreaths. However, American bittersweet has similar fruits and could be used to make colorful wreaths as well. In the northeastern U.S., Oriental bittersweet is displacing American bittersweet, which occurs in similar habitats, through competition and hybridization.

Image: Oriental Bittersweet Wreath - Farmer's Market, Asheville, N.C. September 14, 2008.

Manual Removal: Hand pulling and removal are only effective on young plants and small infestations. To do this, the vines should be repeatedly cut back and the root system pulled up until the food reserves in the roots are exhausted.

Chemical Treatments. Chemical treatment of Oriental bittersweet foliage is best done when surrounding native plants are dormant. When practical, the site can be mowed early in the season, and treated with a herbicide as the foliage starts to grow back. For small infestations, the top vines should be cut and removed. Following this, cut surface of the rooted stems should be painted or sprayed with triclopyr (Garlon - a brush killer) or glyphosate (Roundup and others). Treated areas should be continually monitored and addressed for seedling germination and regrowth of mature vines.

Regulatory Status: Oriental bittersweet is regulated as a state noxious weed in Connecticut, Massachusetts, New Hampshire, North Carolina, and Vermont. In North Carolina, it is regulated as a Class C State Noxious Weed.

Native Alternatives: American Bittersweet (*Celastrus scandens*), Trumpet honeysuckle (*Lonicera sempervirens*), Trumpet creeper (*Campsis radicans*), passionflower vine (*Passiflora lutea*), Dutchman's pipe (*Aristochloa microphylla*) and Native wisteria (*Wisteria frutescens*).

Online Resources:

Oriental Bittersweet Fact Sheet – Plant Conservation Alliance.
URL: http://www.nps.gov/plants/alien/fact/ceor1.htm

Oriental Bitter Sweet Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=3012

Oriental Bittersweet Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=CEOR7

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

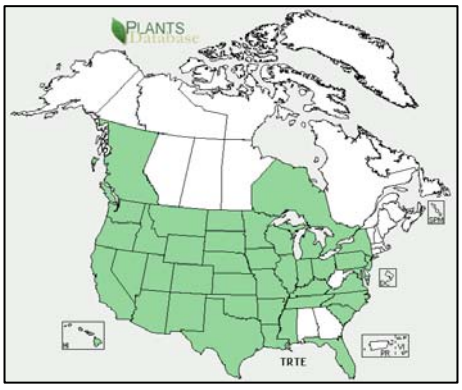
Common Name: Puncturevine, Goathead
Scientific Name: *Tribulus terrestris* L.
Family: Zygophyllaceae

Description: An herbaceous perennial, patch-forming plant, with a deep taproot (up to 9'); an annual in colder climates. **Branching** stems radiate from the crown to a diameter of 2-5'. **Leaves** opposite, hairy, 1-3" long, pinnately compound, with 3-7 pairs of leaflets. **Flowers** yellow, with five petals, 0.5" wide, developing singly in the leaf axils. **Fruit** a round, spiny bur that splits into 4-5 hard burs. **Burs** with 2-3 sharp spines, enclosing the seeds. **Seeds** viable in the soil for 3-7 years.

Habitat: Puncturevine grows in crop fields, pastures, along roadsides and railways, in waste places, walkways, parks, yards, and other disturbed areas. It grows best on dry sandy soil, but will tolerate other types of soil. It is intolerant of freezing temperatures.

Native Range: Southern Europe and Asia.

Pathways of Introduction and Spread: Puncturevine was accidentally introduced into the U.S. and Canada and is spread as a contaminant of seeds and as a hitchhiker on vehicles and equipment. It is also intentionally planted as a dietary supplement. Extracts from the plant are promoted as a supplement to increase sexual drive and muscle mass in men. It has also been recommended for treating serious illnesses such as cancer, kidney ailments, and blood pressure problems.



U.S. and Canada Distribution:

Ecological and Economic Impacts: When allowed to grow untreated, Puncturevine develops a thick mat that hides the sharp burs. It competes aggressively with turf and field crops for water and nutrients. Livestock should not be grazed in areas that are infested with the plant. The sharp burs can injure the mouth, digestive tract, and feet of grazing animals. The plant is particularly toxic to sheep – causing photodermatitis (sensitivity to light) with skin lesions, blindness, and death in young animals. Hay contaminated with the sharp burs is also very dangerous to livestock. The sharp burs are dangerous to people and pets, and will puncture bicycle and small truck tires.

Manual and Cultural Control: Small patches of the plant can manually removed by chopping off the plant from the taproot with a hoe before seeding. This is effective because the plant does not root from the stem or stem fragments. Mowing is not an effective method of control because

the plant grows very close to the ground. Another approach is to crowd out the invader by providing good competition from desirable plants such as turf grasses.

Chemical Control: Pre-emergent herbicides applied in late winter to mid-spring to control germinating seedlings include oryzalin (Surflan and others), benefin (Balan and others), or trifluralin (Treflan and others). Post-emergent herbicides that control plants after they have emerged from the soil include 2,4-D (2,4-D Amine 4 and others), glyphosate (Roundup and others), and Dicamba (Banvel and others). These are most effective if applied when the plants are small and young.

Biological Control: Two weevils, including *Microlarinus lareynni* and *M. lypriformis,* which are native to Europe, were introduced into the western U.S. in 1961 for control of Puncturevine. The larvae of the weevils attack the seeds and stem of the plant. Refer to WWW.goathead.com for more information.

Regulatory Status: Puncturevine is regulated as a state noxious weed in Arizona, California, Colorado, Idaho, Iowa, Michigan, Nevada, North Carolina, Oregon, South Dakota, and Washington. Puncturevine is regulated as Class B Noxious Weed in Durham and New Hanover Counties, North Carolina.

Online Resources:

Goathead.com – Commercial Source for Puncturevine Weevils. Information about the Plant and the Weevils. URL: http://www.goatheads.com/

How Tribulus Terrestris Works. How Stuff Works Website.
URL: http://health.howstuffworks.com/health-illness/wellness/natural-medicine/alternative-medicines/tribulus-terrestris.htm

Puncturevine Images – U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=3937

Puncturevine Profile – CDFA Encycloweedia.
URL: http://www.cdfa.ca.gov/phpps/ipc/weedinfo/tribulus-terrestris.htm

Puncturevine Profile – U-CA IPM Online.
URL: http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74128.html

Puncturevine Profile – USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=trte

Puncturevine Profile – Washington State Noxious Weed Control Board.
URL: http://www.nwcb.wa.gov/weed_info/Tribulus_terrestris.html

Tribulus Terrestris Profile and Article – Wikipedia.
URL: http://en.wikipedia.org/wiki/Tribulus_terrestris

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

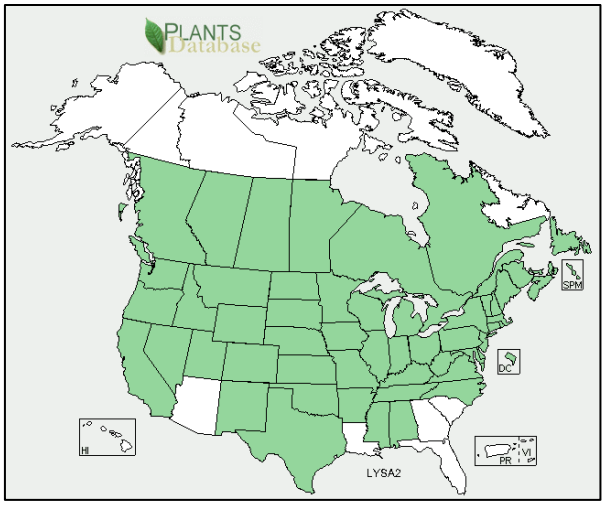
Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Purple Loosestrife
Scientific Name: *Lythrum salicaria* L.
Family: Lythraceae

Description: An herbaceous, perennial plant with separate stems that grow from a single woody root mass that forms clonal colonies. **Stems** reddish-purple, square in cross section, erect in stature, up to 5' tall. **Leaves** lanceolate, 2-5" long, narrow, with a heart-shaped or rounded based, sessile, downy, arranged opposite or in whorls of three, turning bright red in the fall. **Flowers** reddish-purple, 0.4-0.8" in diameter, with 6 petals and 12 stamens, flowering throughout the summer. **Fruit** a capsule, 0.12-0.16" long, with numerous minute seeds. A mature plant may have 30-50 flowering stems which are capable of producing 2-3 million seeds per year.

Habitat: Purple loosestrife invades freshwater wet meadows, tidal and non-tidal marshes, river and stream banks, pond edges, reservoirs, and ditches.

Native Range: Europe and Asia.



Pathways of Introduction and Spread: Purple loosestrife was introduced to the northeastern U.S. and Canada in the 1800s, for ornamental and medicinal uses. It is still widely sold as an ornamental, except in states where its sale and distribution is prohibited.

U.S. and Canada Distribution:

Ecological and Economic Impacts: Once it becomes established on a site, Purple loosestrife degrades wildlife habitat by outcompetes and replaces native flowering plants, grasses, and sedges. Dense stands of the plant also crowd out native wetland species and reduce habitat for waterfowl.

From an economic standpoint, purple loosestrife reduces palatability of hay, reduces water flow in irrigation systems in the western U.S., and reduces waterfowl viewing and hunting opportunities.

Physical and Manual Control: Small infestations of young plants may be hand pulled, well before seed set. Removal of the roots is important in preventing the plant from resprouting.

Chemical Control: Small infestations of older plants should be chemically treated late in the growing season before seed set with a contact herbicide such as glyphosate (e.g., Rodeo for wetlands or Roundup for uplands).

Biological Control: The best approach for management of large infestations of purple loosestrife if through biological control. Three insects from Europe that have been approved by the USDA for use as biological control agents on Purple loosestrife include a root-mining weevil (*Hylobius transversovittatus*), and two leaf-feeding beetles (*Galerucella calmariensis* and *Galerucella pusilla*).

Regulatory Status: Purple loosestrife is regulated as a state noxious weed in Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Florida, Idaho, Indiana, Iowa, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New Mexico, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, and Wyoming.

Native Alternatives: Blazing Star [*Liatris spicata* (L.) Willd.].

Online Resources:

Biological Control of Purple Loosestrife – Bernd Blossey. In Van Driesche, R. et al., 2002.
URL: http://www.invasive.org/eastern/biocontrol/11PurpleLoosestrife.html

Biology and Biological Control of Purple Loosestrife – U-GA Bugwood Network.
URL: http://www.invasive.org/weeds/loosestrife/

Purple Loosestrife Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=3047

Purple Loosestrife Profile – ISSG Global Invasive Species Database.
URL: http://www.issg.org/database/species/ecology.asp?fr=1&si=93

Purple Loosestrife Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=LYSA2

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Saltcedar
Scientific Name: *Tamarix ramocissima* Ledeb.
Family: Tamaricaceae

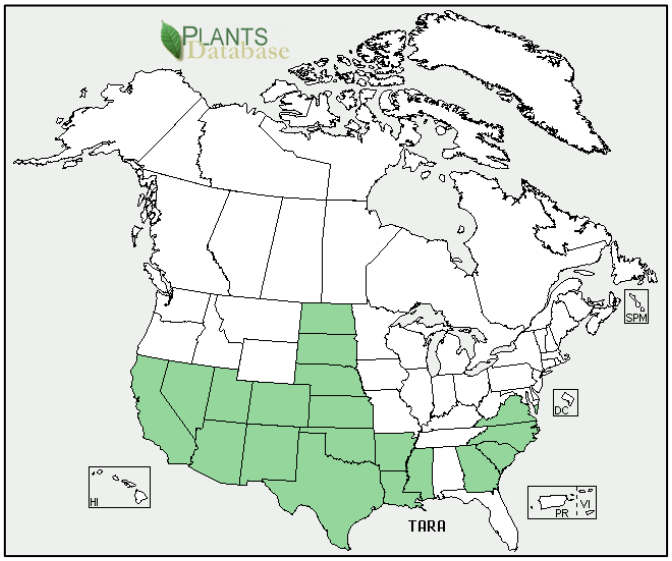
Description: An evergreen shrub or small tree that can grow up to 30' tall. **Leaves** small, scale-like, gray-green in color, overlapping along the stem. **Bark** smooth, reddish on younger plants, brown and furrowed with age. **Flowers** pale pink to white, in dense spike-like plumes, spring to late fall. **Fruit** a capsule with tiny (0.04" in diameter) seeds; the capsule has a tuft of hair that aids in dispersal by wind. **Reproduction** is by seeds that are spread by air and water, as well as root expansion. Each plant can produce up to 600,000 seeds annually.

Habitat: Saltcedar invades streambanks, sandbars, lake margins, wetlands, moist rangelands, and saline environments. Seedlings require exposure to saturated soil for extended periods of time to become established. It prefers moist environments, but can be found in dry soils as well. It can grow on highly saline soils up to 15,000 ppm soluble soil, and can tolerate alkali conditions as well.

Native Range: Eurasia and Africa.

Pathways of Introduction and Spread: It is thought that Saltcedar was first introduced into the eastern U.S. as an ornamental plant in the early 1800. It now occurs throughout the central and western U.S., but is most problematic in the desert Southwest. The seeds are spread long distances primarily by air and water.

U.S. and Canada Distribution:



Ecological and Economic Impacts: Salt cedar has long taproots that enable it to invade streambanks, sandbars, lake margins, wetlands, and other environments with a high salt content. It crowds out native riparian species, diminishes early succession habitats, reduces water tables, and interferes with hydrologic processes. Saltcedar degrades native wildlife habitat by outcompeting and replacing native plants, monopolizing limited sources of moisture, and by increasing the frequency, intensity, and effects of fires and floods.

Manual Control: Hand removal of Saltcedar (hand-pulling, digging, root-cutting, weed eaters, Machetes, axes, and etc.) is recommended for small infestations of saplings that are less than 1" in diameter. Root-cutting and bulldozing of larger infestations is somewhat effective, but is costly, labor intensive, and may lead to resprouting. Fire has been used with limited success since the plants often resprout after a fire. Flooding can be used to control the plant if the root crowns remain submerged for at least three months.

Image: Saltcedar on Pawleys Island, South Carolina. April, 2005.

Chemical Control: Saltcedar can be effectively controlled with general purpose weed killers such as glyphosate (Roundup and others) or brush killers such as triclopyr (Garlon and others). The aquatic formulation of glyphosate (Rodeo) should be used if the infestation is near water.

Biological Control: A number of insects are being tested for biological control of Saltcedar. Two of these, a mealybug (*Trabutina mannipara*), and a leaf beetle (*Diorhabda elongata*), have been approved for release.

Regulatory Status: Saltcedar is regulated as a state noxious weed in Colorado, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Texas, Washington, and Wyoming.

Online Resources:

- Saltcedar Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=6515

- Saltcedar Fact Sheet – USDA Forest Service - Weed of the Week Series.
URL: http://www.na.fs.fed.us/fhp/invasive_plants/weeds/saltcedar.pdf

- Saltcedar Profile – Texas Invasives.
URL: http://www.texasinvasives.org/invasives_database/detail.php?symbol=TARA

- Saltcedar Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=TARA

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.
Sudie D. Thomas, USDA NRCS, St. Matthews, South Carolina. USA.
Laura J. Lloyd, Geo-Marine, Inc., Jacksonville, North Carolina. USA.

Common Name: Sawtooth Oak
Scientific Name: *Quercus acutissima* Carruthers
Family: Fagaceae

Description: A medium to large deciduous tree, up to 50' tall. **Leaves** alternate, hairy underneath, broadly lance-shaped, 4-7.5" long, 2.5" wide, with bristly teeth on the margins. **Flowers** small, blooming in early Summer. **Fruits** large acorns, with spreading, curved scales on the involucres – **Nuts** ripe the second autumn after flowering. The trees produce very large amounts of acorns.

Similar Native Plants: Sawtooth oak is similar in form and growth pattern to southern red oak (*Quercus falcata*). The leaves are similar to the leaves of American chestnut (*Castanea dentata*).

Habitat: Sawtooth oak grows best on sunny ridge tops with loamy soil. It is is adaptable to dry, rocky soils. It is often grown as a street tree, in parks, and public campgrounds

Native Range: Eastern Asia

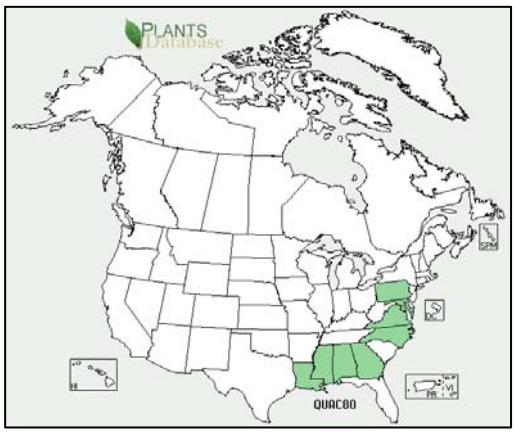
Pathways of Introduction and Spread: Sawtooth oak was first introduced into the U.S. in 1862 as an ornamental tree, but has only become common in cultivation over the past 50+ years. Since then, it has gained favor as a landscape tree because of its attractive form, rapid growth, and tolerance for difficult growing conditions. It has also been widely planted as a source of food for wildlife (especially turkeys).

Ecological and Economic Impacts: Sawtooth oak produces acorns at a very young age (five years) compared to native North American oaks (15-20 years). Early mast production has lead to Sawtooth oak being planted as a wildlife food tree in natural areas and parks. Due to the large crop of acorns, Sawtooth oak seedlings can outcompete the seedlings of native oaks and other species.

According to Dr. Alan Whittemore, with the USDA Agricultural Research Service in Beltsville, MD, there is very little published data on the ecology of Sawtooth oak in North America. However, according to field specialists, Sawtooth oak escapes much more widely in the eastern United States that has been realized.

Free living populations of Sawtooth oak are usually seen in open, disturbed areas. However, once established at a site, it spreads slowly, apparently due to limited dispersal of the large acorns. Planting large stands of Sawtooth oak in natural areas or wildlife food plots is likely to enhance further

establishment and spread of this exotic species in adjacent areas. However, the use of Sawtooth oak as a landscape tree in urban areas probably poses much less of a danger of escape, primarily due to the short seed dispersal distance of the species.



In 2006, an official assessment by the Indiana Department of Natural Resources found no evidence that Sawtooth oak was escaping into natural areas of Indiana. However, the report did conclude that the biology of the species suggests that it could outcompete native species on poor, dry sites such as barrens, dry sand savannas, and dry sand prairies.

In recent years, free living populations of Sawtooth oak (outside of cultivation) have been documented in Alabama, the District of Columbia, Louisiana, Maryland, Missouri, Mississippi, North Carolina, and Pennsylvania. Due to the typical decades long lag phase for introduced trees to demonstrate their ultimate potential for invasiveness, it is recommended that land managers use native oaks instead of exotic trees such as the Sawtooth oak. *The long term unintended consequences of widespread could outweigh the near term benefits that may be seen in using it to help boost game populations or as an ornamental.*

Control Strategies: Seedlings should be manually removed or treated with a broad spectrum herbicide such as glyphosate (Roundup and others). Large trees may be girdled or cut down and stump treated with the chemical.

Regulatory Status: Sawtooth oak is not currently being regulated at the state or federal level in the United States.

Recommended Native Alternatives:

American beech (*Fagus grandifolia*)
- White oak (*Quercus alba*)
- Red oak (*Quercus rubra*)
- Northern red oak (*Quercus rubra*)
- Pin oak (*Quercus palustris*)
- Shagbark hickory (*Carya ovata*)

Online Resources:

An Official Assessment of Sawtooth Oak in Indiana's Natural Areas. Indiana Department of Natural Resources. August 17, 2006.
URL: http://www.in.gov/dnr/files/Official_Sawtooth_Oak_assessment.pdf

Sawtooth Oak Profile – Hiawassee River Watershed Coalition, Inc.
URL: http://www.hrwc.net/sawtoothoak.htm

Sawtooth Oak Profile – Plant Invaders of the Mid-Atlantic Region.
URL: http://www.invasive.org/eastern/midatlantic/quac.html

Sawtooth Oak Profile – Invasive Plant Atlas of the United States.
URL: http://www.invasiveplantatlas.org/subject.html?sub=10086

Sawtooth Oak Profile – USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=QUAC80

Whittemore, A. 2004. Sawtooth Oak (*Quercus Acutissima*, Fagaceae) in North America. Sida, Contributions to Botany. 21:447-454.
URL: http://www.ars.usda.gov/research/publications/publications.htm?SEQ_NO_115=143169

Draft Date: June 8, 2010

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Small Broomrape, Hellroot
Scientific Name: *Orobanche minor* Sm.
Family: Orobanchaceae

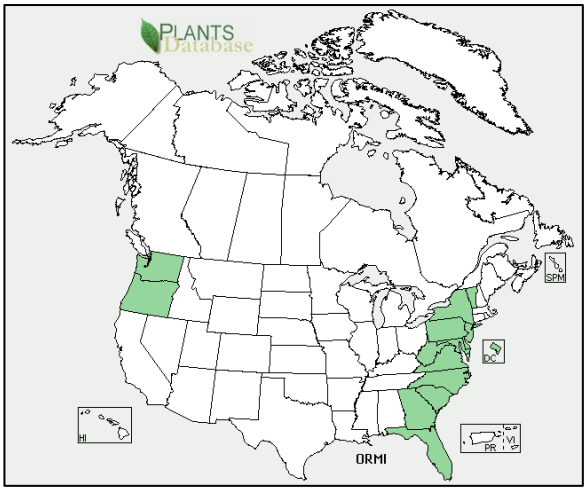
Description: A fleshy, herbaceous, annual, parasitic plant that lacks chlorophyll and attaches to the roots of broadleaf plants such as clover (*Trifolium* spp.). **Stem** yellow to straw-colored, sticky, up to 22" tall. **Leaves** scale-like, scattered and alternate. **Flowers** irregular, snapdragon-like, with purple-tinged petals, 0.5" long, borne on terminal clusters, occurring in the winter and spring. **Seeds** very small (dust-like), and remain viable in the soil for 10 years or more. **Roots** short, unbranched and scaly – they attach to the roots of other plants.

Habitat: Croplands, orchards, roadsides, and other disturbed areas.

Native Range: Middle East and North Africa.

Pathways of Introduction and Spread: Small broomrape was probably introduced into North America with contaminated crop seeds. Plants produce up to 500,000 seeds each, which are spread by wind, equipment, animals and people (shoes, clothes).

U.S. and Canada Distribution:



Ecological and Economic Impacts: There is a concern that Small broomrape may continue to spread and infest crops such as forage legumes (e.g., clover and alfalfa) and leafy green vegetables (e.g., spinach and kale). Heavy infestations can cause crop failure.

Prevention Strategies: The best approach for managing Small broomrape is early detection, containment, and eradication of new infestations. Soil and associated vegetation should not be removed from an infested site. Sites should not be mowed before contacting appropriate state or federal personnel (state department of agriculture or USDA APHIS PPQ). Equipment and shoes should be thoroughly cleaned before leaving an infested site.

Chemical Control: Two herbicides that are recommended for control of Small broomrape. This includes glyphosate (Roundup and others) and Dicamba (Banvel and others).

Surface Heat Treatment: High heat generated by a propane burner can also be used to kill the seeds on the soil surface. Shown at right is a propane burner that was developed by the USDA APHIS Whiteville Plant Methods Center for heat treating infestations of Small broomrape and Japanese Dodder in upstate South Carolina in 1992.

Image: Jimmy Moody, Equipment Specialist with USDA APHIS PPQ, Whiteville, North Carolina, heating treating a Small broomrape infestation near Erskine College in Due West, South Carolina. Summer, 1992.

Regulatory Status: Small broomrape is listed as a U.S. Federal Noxious Weed. It is regulated as a state noxious weed in Alabama, California, Florida, Massachusetts, Minnesota, North Carolina, Oregon, South Carolina, and Vermont.

Online Resources:

Small Broomrape Fact Sheet – USDA Forest Service – Weed of the Week Series.
URL: http://www.na.fs.fed.us/fhp/invasive_plants/weeds/small-broomrape.pdf

Small Broomrape Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=2450

Small Broomrape Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=ORMI

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks. U.S. Geological Survey, Whiteville, North Carolina. USA.

Common Name: Tropical Soda Apple
Scientific Name: *Solanum viarum* Dunal
Family: Solanaceae

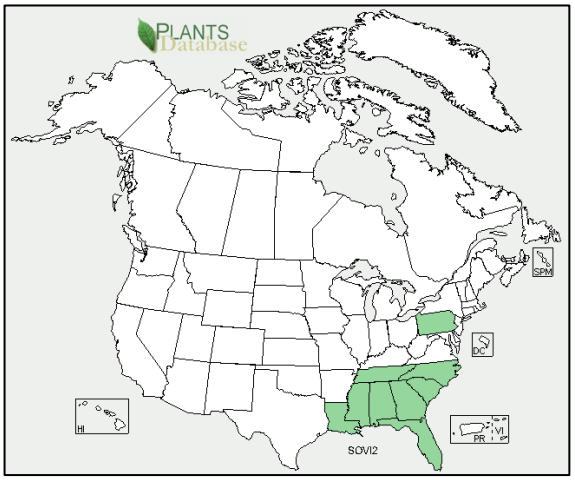
Description: A perennial, shrubby forb, covered in stiff prickles (up to 0.75" long), growing 3-6' in height. **Leaves** alternate, hairy, 4-8" long, 2-6" wide, deeply divided into broad, pointed lobes. **Flowers** tiny, white, with 5 petals and yellow stamens, borne in clusters on stems below the leaves, May-September (year round in Florida). **Immature fruit** pale with dark green veins – resembling immature watermelons. **Mature fruit** yellow, glabrous, globe-shaped, up to 1.5" in diameter, with a sweet smell that attracts livestock and wildlife. Reproduction is primarily by seeds, but it also spreads by root fragments. Each plant can produce approximately 50,000 seeds per year.

Habitat: Tropical soda apple invades open to semi-shade sites such as pastures, ditchbanks, roadsides, croplands, rangelands, open forests, and other natural areas. It is typically found in poorly drained, sandy soils.

Native Range: Argentina, Brazil, and Paraguay.

Pathways of Introduction and Spread: Tropical soda apple, which has been called the '*plant from Hell*', was accidentally introduced into Florida in the 1980s, probably in the gut of cattle imported from South America. It is spread locally by cattle and wildlife that eat the fruits. The seeds are also spread with contaminated manure, hay, seed, and sod from infested areas. It is spread nationally by livestock that originate primarily in Florida. Pastures, stockyards, slaughter houses, truck washes, fairgrounds, and sodded highways are prime areas for survey and early detection of Tropical soda apple.

U.S. and Canada Distribution:



Ecological and Economic Impacts: Tropical soda apple reduces biological diversity in natural areas by outcompeting native plants. In pastures, it forms thick stands that are impenetrable to livestock, wildlife, and humans. It contains solasodine, which is poisonous to humans. It also serves as a host for viruses that infect important vegetable crops such as tomatoes, eggplant, peppers, potatoes, and etc. These pathogens include the cucumber mosaic virus, potato leaf roll virus, tobacco etch virus, tomato mosaic virus, and others.

Manual and Mechanical Control: Incipient infestations can be removed by hand hoeing. Mowing can also be used to stop fruit and seed production in pastures. *Early detection and rapid response is critical in preventing the establishment and spread of this serious invader.*

Chemical Control: Tropical soda apple can be effectively controlled in pastures and non-croplands by the use of contact herbicides such as glyphosate (Roundup and others), hexazinone (Velpar and others), imazapyr (Arsenal and others), picloram (Grazon P+D), and triclopyr (Remedy and others). The best time to treat is when the plants are 6-12" tall and prior to fruiting. Repeated treatments are will be required because the seeds are viable in the soil for several years.

Biological Control: The bacterial pathogen *Ralstonia solanacearum* (E. F. Smith) Yabuuchi is effective in killing Tropical soda apple.

Regulatory Status: Tropical soda apple is listed as a U.S. Federal Noxious Weed. It is regulated as a state noxious weed in Alabama, Arizona, California, Florida, Massachusetts, Minnesota, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Vermont.

Online Resources:

Tropical Soda Apple – Domestic Pest Evaluation – USDA APHIS PPQ.
URL: http://www.invasive.org/eastern/other/tsa.html

Tropical Soda Apple Fact Sheet – USDA Forest Service – Weed of the Week Series.
URL: http://na.fs.fed.us/fhp/invasive_plants/weeds/tropical-soda-apple.pdf

Tropical Soda Apple Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=2446

Tropical Soda Apple Profile – ISSG Global Invasive Species Database.
URL: http://www.issg.org/database/species/ecology.asp?fr=1&si=265&sts=

Tropical Soda Apple Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=sovi2

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Wavyleaf Basketgrass
Scientific Name: *Oplismenus hirtellus* (L.) P. Beauv. Subspecies *undulatifolius* (Ard.) Roem. & Schult.
Family: Poaceae

Description: A shade tolerant, low-growing, stoloniferous perennial grass, from 20-30 cm tall . **Leaves** ovate, elongated, sharply pointed, dark green, 0.5" wide, 1.5-4" long, with rippling waves across the leaf blades. **Leaf sheaths and stems** noticeably hairy with very short hairs*. **Grass spikelets** with long sticky awns, flowering from mid-September to November. The sticky awns allow the grass seeds to adhere to passing animals, people, and vehicles. **Stolons** delicate, 1-3 mm in diameter, creeping beneath leaf litter, rooting and branches from nodes.

**Oplismensus hirtellus* ssp. *setarius*, which is native to the southeastern U.S. and Mexico, and is the closest relative of Wavyleaf basketgrass, has only a few hairs if any on the leaf sheaths and stems.

WLBG is similar in appearance to Japanese stiltgrass [*Microstegium vimineum* (Trin.) Camus], an introduced annual grass which also invades forest understories throughout the eastern U.S. However, the leaves of Japanese stiltgrass have a silvery row of hairs running down the midvein and end in a blunt gradual point. WLBG leaves are rippled across their width and end with an elongated sharp tip.

Habitat: Temperate environments in Coastal Plain, Piedmont, and Montane regions; full canopy hardwood forests, forest margins, and shady riparian zones; does not tolerate direct sunlight; appears adaptable to a wide range of pH.

Native Range: Europe and Asia.

Pathways of Introduction and Spread: It is unclear how WLBG was first introduced to the U.S. It is possible that the plant was a contaminant of discarded hanging baskets in Maryland. Variegated varieties of native bristle basketgrass are sold by plant nurseries in the Mid-Atlantic Region. However, WLBG is not known to be sold in the horticultural trade.

WLBG was first discovered in the U.S. in **Patapsco Valley State Park**, Howard County, MD, by botanist Edward Uebel in 1996. In 2000, it was found growing along a woody stream at the **Hernwood Sanitary Landfill,** Baltimore County, MD.

U.S. and Canada Distribution: WLBG is known to occur in Maryland and Virginia, USA.

Ecological and Economic Impacts: Once it becomes established, WLBG spreads rapidly through wooded natural areas – crowding out native herbaceous plants, and preventing regeneration of native hardwood tree species. Unless it is completely eradicated *soon*, it will continue to spread and will have a devastating impact on the deciduous forests of eastern North America for many decades to come.

Prevention Measures: Since 2006, volunteers with the Anacostia Watershed Society (AWS) have been working to detect and eradicate WLBG from MD and VA. In 2006, AWS volunteers discovered and began eradicating a three acre infestation in **Little Paint Branch Park**, Prince George's County, MD. In 2007, several small colonies and patches of the plant were detected and treated in the **Beltsville Area Research Center-West**, Prince George's County, MD. In 2008, AWS led the effort to establish the **Wavyleaf Basketgrass Task Force.** The task force is focused on mapping and eradication of known infestations, and a public awareness campaign to help detect and report other infestations before they become widespread.

Physical Control: WLBG is easily hand pulled at the roots and nodes. Hand pulling is thought to be more effective than herbicide treatment when the population is small enough for weeding (Westbrooks & Imlay, 2009; Wavyleaf Basketgrass Task Force, 2009).

Chemical Control: WLBG may be effectively treated with a 1-2% solution of glyphosate. Current populations in Maryland (USA) and Virginia are still relatively small and eradication is still possible. General weed killers such as **Roundup** work best late in the year, while grass inhibitors such as **Envoy Plus** (clethodim) are more effective early in the season.

Regulatory Status: Wavyleaf basketgrass is currently not regulated at the local, state, or federal level in the U.S.

Online Resources:

WLBG Fact Sheet – Randy Westbrooks and Marc Imlay, 2009.
URL: http://www.se-eppc.org/southcarolina/WLBG.pdf

WLBG – Maryland Invader of the Month. August, 2007.
URL: http://www.mdinvasivesp.org/archived_invaders/archived_invaders_2007_08.html

WLBG Profile - Global Invasive Species Database – ISSG.
URL:http://www.issg.org/database/species/ecology.asp?si=1557&fr=1&sts=&%20ang=EN&ver=print&prtflag=false

WLBG Task Force – Meeting Minutes. March 31, 2009.
URL: http://www.fs.fed.us/ficmnew/documents/notices/WLBG_TaskForceMinutes_033109.pdf

WLBG Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=21294

WLBG Profile - USDA Plants Database.
URL: http://www.plants.usda.gov/java/profile?symbol=OPHIU2

WLBG in Virginia - Virginia Department of Forestry.
URL: http://virginiaforests.blogspot.com/2008/11/wavyleaf-basket-grass-invasive-exotic.html

U.S. National Early Detection and Rapid Response System for Invasive Plants

EDRR Fact Sheet

Randy G. Westbrooks, U.S. Geological Survey. Whiteville, North Carolina. USA.

Common Name: Witchweed
Scientific Name: *Striga asiatica* (L.) O. Kuntze
Family: Scrophulariaceae

Description: An herbaceous parasitic plant up to 12" tall that attaches to the roots of other plants via a structure known as an haustorium. **Leaves** linear, about 1" long. **Flowers** small, irregular shaped, less than 0.5" in diameter, in loose spikes, normally red or yellow in color. **Seed pods** contain thousands of microscopic seeds. The seeds can survive in the soil for 10 or more years.

Habitat: Witchweed is a root parasite of grasses. It will live anywhere that grasses will grow. This includes croplands, pastures, ditchbanks, open forest areas, etc.

Native Range: Witchweed is native to Asia and Africa.

Pathways of Introduction and Spread: Witchweed was first discovered infesting corn in Columbus County, North Carolina, in July, 1956. It was accidentally introduced sometime before that – perhaps as a contaminant of equipment returning from Africa after WWII, or as a contaminant of imported guano fertilizer. It is spread primarily by contaminated farm equipment. At the height of the infestation, Witchweed infested over 432,000 acres in 38 counties in the eastern Carolinas.

U.S. and Canada Distribution:

Ecological and Economic Impacts: Witchweed parasitizes important grain crops such as corn, sorghum, sugarcane, and rice. Symptoms in host plants include wilting, stunted growth, and chlorosis. The host plant's nutrients are depleted, and energy is spent support the parasite. Globally, Witchweed and related species have a tremendous impact on human welfare because their hosts are often subsistence crops in marginal areas of agriculture in arid and tropical regions. Infestations commonly reduce yields by 5-15% or more.

Control Strategies: The USDA-Carolinas Witchweed Eradication Program and Federal/State Quarantine was first established in 1957 to address Witchweed in the United States. Since that time, the initial infestation of 432,000 acres has been reduced to about 2,100 acres in southeastern North Carolina. Remaining infested acres were released from federal/state quarantine in South Carolina in December, 2009. Once released from quarantine, previously infested acres are surveyed annually for 10 years to ensure that the parasite has actually been eradicated.

Witchweed is controlled by a variety of methods aimed at denying further reproduction (herbicide treatments) and killing the seeds in the soil. Seeds in the soil are killed by direct fumigation (e.g., methyl bromide), or by ethylene injection (which induces suicidal germination of the seeds). Trap crops such as cotton will also induce suicidal germination of Witchweed seeds in the soil.

To date, over $250 million has been spent in eradicating Witchweed from the United States. However, this is a fraction of the costs and losses that would be seen through a permanent 10% loss of the U.S. corn crop of 10-13 billion bushels per year – which is currently worth about $3.66/bushel.

Regulatory Status: Witchweed is listed as a U.S. Federal Noxious Weed. It is regulated as a state noxious weed in Alabama, Arizona: Arkansas, California, Hawaii, Massachusetts, Minnesota, North Carolina, Oregon, South Carolina, and Vermont.

Online Resources:

Witchweed Fact Sheet – USDA APHIS PPQ.
URL: http://www.invasive.org/publications/aphis/fswweed.pdf

Witchweed Images - U-GA Bugwood Image Gallery.
URL: http://www.invasive.org/species/subject.cfm?sub=4576

Witchweed Profile – ISSG Global Invasive Species Database.
URL: http://www.issg.org/database/species/ecology.asp?si=968&fr=1&sts=

Witchweed Profile - USDA Plants Database.
URL: http://plants.usda.gov/java/profile?symbol=STAS2