



## Invasive Plants Facts and Figures

### Definition

**Invasive Plant:** Plants that have, or are likely to spread into native or minimally managed plant systems and cause economic or environmental harm by developing self-sustaining populations and becoming dominant or disruptive to those systems.

### Where do most invasive species come from?

#### How do they get here and get started?

- Most originate long distances from the point of introduction
- Horticulture is responsible for the introduction of approximately **60%** of invasive species.
- Conservation uses are responsible for the introduction of approximately **30%** of invasive species.
- Accidental introductions account for about **10%**.
- Of all non-native species introduced only about 15% ever escape cultivation, and of this 15% only about 1% ever become a problem in the wild.
- The process that leads to a plant becoming an invasive species, Cultivation – Escape – Naturalization – Invasion, may take over 100 years to complete.

### What characteristics make invasive species so successful in our environment?

- Lack predators, pathogens, and diseases to keep population numbers in check
- Produce copious amounts of seed with a high viability of that seed
- Use successful dispersal mechanisms – attractive to wildlife
- Thrive on disturbance, very opportunistic
- Fast-growing
- Habitat generalists. They do not have specific or narrow growth requirements.
- Some demonstrate allelopathy – produce chemicals that inhibit the growth of other plants nearby.
- Have longer photosynthetic periods – first to leaf out in the spring and last to drop leaves in autumn
- Alter soil and habitat conditions where they grow to better suit their own survival and expansion.



## Why do we care?      What is the big deal?

### Ecological Impacts

- Impacting/altering natural communities at a startling rate.
- Alter plant/insect/animal interactions that have developed over millennia
- Disrupt natural ecological process – such as a field turning to forest
- Reduce biodiversity – reduce the diversity of plants, animals, birds, and insects on a local and regional scale
- Following habitat destruction invasive species are the number one threat to the integrity of natural areas.
- Currently over 100 million acres of land in the United States is infested with invasive species.
- Each year an additional 3 million acres are lost; an area three times the size of Delaware.
- 4600 acres of publicly owned land are lost each day to invasive species.
- Purple loosestrife alone has reduced the biomass of 44 native plant species , and continues to spread at a rate of 300,000 acres/year
- 42% of all species on the Federal Endangered Species List are listed in part due to invasive species and for 18% invasive species are the sole reason for their listing.
- Migratory songbird declines may be linked in part to invasive species.
- According to the National Audubon Society more than 200 bird species are in decline and facing significant threats. Of these, invasive plant species are a threat to over one-third.

### Economic Impacts

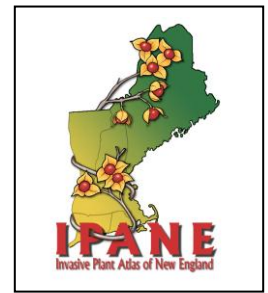
Invasives are not only harmful to the environment but it hurts in the pocketbook as well

A study by the Office of Technology Assessment calculated costs to the US economy caused by invasive species. This does not take into account environmental or health impacts

- 15 invasive Plant species have cost the US economy \$603 million over 85 years
- \$100 million is spent annually to control aquatic weeds alone
- Invasive species cost the US economy \$138 billion annually, with invasive plants making up \$34.7 billion
- Weeds in gardens, lawns and golf courses cost 1.5 billion annually
- Purple loosestrife is estimated to cost \$45 million each year in forage losses and control costs.
- *Hydrilla verticillata*, an aquatic weed, costs \$10 million in recreation losses on just two lakes.

### What Can I Do

- Learn how to identify invasive plants
- Volunteer for a local land trust/town to help control invasive plants
- Report sightings of invasive plant species in natural settings to <http://nbiin.ciesin.columbia.edu/ipane/earlydetection/sightings.jsp>
- Sponsor a talk or walk in your town on invasive plants
- Educate yourself and neighbors about this increasing problem
- Use non-invasive plants in your home landscape
- Ask you local garden center/nursery to stop selling problematic plants



## **Invasive Plant Atlas of New England Project Summary**

Invasive plants and noxious weeds are a serious problem in New England. Prior to the Invasive Plant Atlas of New England (IPANE), there was no concerted program in the region to detect, assess, control, or provide educational material on invasive plants and noxious weeds. An early detection network for both invasive plant species and noxious weeds has now been established in New England. This network consists of a searchable database of historic and current records and an on-line interactive website. Herbarium specimens are used to obtain historic distributions and the current status is assessed by a corps of project-trained volunteers who gather field data throughout the six state region. These data are verified and entered into a database from which a web site atlas with, in addition to the searchable database, text, images, and maps that show the distribution of invasive species in the region over space and time has been constructed. The database and web atlas support the early detection network by supplying users with early detection alerts and other information as well as trained staff who can assist in this work. Research is being conducted on the spread of invasives species and noxious weeds. IPANE maintains a variety of educational materials, organize conferences, and distribute a newsletter as well as offer technical assistance to a wide range of stakeholders. This approach offers both assistance on a current problem and a proactive approach to deterring new invasions. For more project information please visit the project website at [www.ipane.org](http://www.ipane.org). The project is a collaboration of the New England Wild Flower Society, University of Connecticut, The Center for International Earth Science Information Network (CIESIN) and the Silvio O. Conte National Fish and Wildlife Refuge.

The Invasive Plant Atlas of New England's (IPANE) mission is to create a comprehensive web-accessible database of invasive and potentially invasive plants in New England that will be continually updated by a network of professionals and trained volunteers. The database will facilitate education and research that will lead to a greater understanding of invasive plant ecology and support informed conservation management. An important focus of the project is the early detection of, and rapid response to, new invasions.



## IPANE Early Detection Species by State

SPECIES	ME	NH	VT	MA	RI	CT
<b>TREE</b>						
<i>Ailanthus altissima</i>	?	?	?	+	+	+
<i>Paulownia tomentosa</i>	0	0	0	1	1	+
* <i>Phellodendron amurense</i>	0	?	?	+	?	1
<b>SHRUBS</b>						
<i>Lonicera maackii</i>	0	0	0	+	0	+
<i>Rubus phoenicolasias</i>	0	0	0	+	+	+
* <i>Salix cinerea</i>	?	?	?	?	?	?
<b>WOODY VINES</b>						
* <i>Akebia quinata</i>	?	?	?	+	?	+
* <i>Clematis terniflora</i>	?	1	?	+	?	+
<i>Lonicera japonica</i>	1	2	?	+	+	+
<i>Pueraria montana</i> subsp. <i>lobata</i>	0	0	0	+?	0	+
<b>HERBACEOUS PLANTS</b>						
<i>Butomus umbellatus</i>	1	0	+	1	0	1
<i>Cardamine impatiens</i>	2	+	3	3	0	+
<i>Cirsium palustre</i>	0	H	0	H	0	0
<i>Cynanchum rossicum</i>	1	1	0	+	2	+
<i>Elsholtzia cilitata</i>	2	0	2	+	0	+
<i>Froelichia gracilis</i>	0	4	3	+	1	+
<i>Glaucium flavum</i>	0	0	0	+	+	H
<i>Heracleum mantagazzianum</i>	3	?	1	+	?	+
<i>Impatiens glandulifera</i>	+	0	1	+	0	2
<i>Lepidium latifolium</i>	0	1	0	+	0	+
* <i>Mycelis muralis</i>	3	1	1?	2	0	0
<i>Polygonum perfoliatum</i>	0	0	0	3	1	+
<i>Ranunculus ficaria</i>	1	1	0	+	1	+
* <i>Rorippa amphibia</i>	H?	0	0	+	0	0
<i>Senecio jacobaea</i>	2	0	0	3	0	0
<b>GRAMINOID PLANTS</b>						
* <i>Aira caryophylla</i>	0	1?	1?	+	0	+
<i>Arthraxon hispidus</i>	0	0	0	H	0	1
<i>Carex kobomugi</i>	0	0	0	H	2	0
* <i>Festuca filiformis</i>	+	?	0	+	1?	+

<i>Glyceria maxima</i>	0	0	0	1	0	1?
<i>Microstegium vimineum</i>	0	0	0	+	+	+
* <i>Miscanthus sacchariflorus</i>	?	?	?	+	0	2
AQUATIC PLANTS						
<i>Cabomba caroliniana</i>	0	+	0	+	+	+
<i>Callitriche stagnalis</i>	?	1	?	?	?	1
<i>Egeria densa</i>	0	2	0	+	1	+
<i>Eichhornia crassipes</i> (naturalized)	0	0	0	0	0	0
<i>Glossostigma diandrum</i>	0	0	0	0	1	3
<i>Hydrilla verticillata</i>	1	0	0	1	0	+
<i>Hydrocharis morsus-ranae</i>	0	0	+	0	0	0
<i>Myriophyllum aquaticum</i>	0	0	0	1?	1?	3
<i>Myriophyllum heterophyllum</i>	+	+	0	+	+	+
<i>Myriophyllum spicatum</i>	1	3	+	+	?	+
<i>Najas minor</i>	0	1	+	+	0	+
<i>Nymphoides peltata</i>	1	0	+	1	1	H
<i>Pistia stratiotes</i> (naturalized)	0	0	0	0	0	0
<i>Potamogeton crispus</i>	1	3	+	+	+	+
<i>Salvinia molesta</i> complex (naturalized)	0	0	0	0	0	0
<i>Trapa natans</i>	0	1	+	+	0	+
<i>Butomus umbellatus</i>	1	0	+	0	0	1
<i>Cardamine impatiens</i>	1	2	0	1	0	+
<i>Cirsium palustre</i>	0	H	0	H	0	0
<i>Cynanchum rossicum</i>	1	1	0	+	2	+
<i>Froelichia gracilis</i>	0	1	3	+	0	+
<i>Glaucium flavum</i>	0	0	0	+	+	H
<i>Heracleum mantagazzianum</i>	3	+	0	+	?	+
<i>Impatiens glandulifera</i>	+	0	?	+	0	H
<i>Lepidium latifolium</i>	0	0	0	+	0	+
<i>Polygonum perfoliatum</i>	0	0	0	0	1	2
<i>Ranunculus ficaria</i>	1	1	0	+	1	+
<i>Senecio jacobaea</i>	1	0	0	3	0	0
0 = No known occurrences, 1 = 1 occurrence, 2 = 2 occurrences, 3 = 3 occurrences, + = 4 or more occurrences, H = historic occurrences about which the current status is unclear and the reports are more than 25 years old, ? = number of occurrences unclear or unsubstantiated						

# Invasive Plant Atlas of New England



## Early Detection

Early detection, coupled with a rapid assessment and a quick and effective response is viewed as one of the best and most cost-efficient ways of dealing with problems. This is as true with non-native plant species that invade minimally managed habitats as it is with health and medicine or with agricultural pests. Some potentially invasive plants are bound to arrive in the New England region or within one of the 6 states that comprise New England. The goal of this project is to effectively deal with new incursions of potentially invasive species.

Too frequently, non-native species become established without anyone taking immediate notice. Although botanists and conservationists usually notice new incursions relatively early in their history, there is not overall public concern about a species perceived ability to increase and dominate minimally managed habitats until it is extensively established. It is only after a species has become so widespread and eminently visible that the public take notice. By this time we have to react to its spread in order to attempt its control. One of the goals of the Invasive Plant Atlas of New England (IPANE) is to shift the perception of a problem to a point where management is less costly and has a greater chance for success.

“Early Detection and Rapid Response” is one of 9 critical components of the National Invasive Species Council’s Management Plan, “An Action Plan for the Nation” <http://www.invasivespeciesinfo.gov/council/actionc.shtml>. This plan stresses the importance of coordinated efforts of all stakeholders. A methodology for dealing with early detection, rapid assessment, and rapid response has been established as part of the Invasive Plant Atlas of New England. The “Rapid Responders” database will be used to establish teams of experts who can, once a new incursion has been reported, assess the situation and prepare an action plan for the invasive species at a particular site. Actions plans suggest responses that are likely to be quick, effective, and can be tracked to make sure that everything possible is done to slow or arrest the spread of a potentially invasive species in a state or the region.

## **Links to Legal Status of Invasive Plant Species in the Six New England States**

### **Connecticut**

CT Invasive or Potentially Invasive plant lists from IPANE

[http://nbii-nin.ciesin.columbia.edu/ipane/ctcouncil/CT\\_Invasive\\_Plant\\_List.htm](http://nbii-nin.ciesin.columbia.edu/ipane/ctcouncil/CT_Invasive_Plant_List.htm)

CT DEP Non-Native Invasive Plant Species Program

<http://www.ct.gov/dep/site/default.asp> (Search "Invasive")

Public Act No. 03-136: An Act Concerning Invasive Plants

<http://www.cga.ct.gov/2003/act/Pa/2003PA-00136-R00SB-01046-PA.htm>

Public Act No. 04-203: An Act Concerning Fines for Banned Invasive Plants

<http://www.cga.ct.gov/2004/act/Pa/2004PA-00203-R00SB-00547-PA.htm>

### **Maine**

Maine Natural Areas Program Invasive Plants

[http://www.mainenaturalareas.org/docs/program\\_activities/invasive\\_plants.php](http://www.mainenaturalareas.org/docs/program_activities/invasive_plants.php)

### **Massachusetts**

Massachusetts Prohibited Plant List

[http://www.mass.gov/agr/farmproducts/Prohibited\\_Plant\\_Index2.htm](http://www.mass.gov/agr/farmproducts/Prohibited_Plant_Index2.htm)

### **New Hampshire**

New Hampshire Department of Agriculture, Markets, and Food Invasive Species Program

[http://nh.gov/agric/divisions/plant\\_industry/plants\\_insects.htm](http://nh.gov/agric/divisions/plant_industry/plants_insects.htm)

### **Rhode Island**

Rhode Island Invasive Species Council's List of Invasive Plants

<http://www.uri.edu/ce/rinhs/invasives/list.htm>

Rhode Island Invasive Species Council (Mission)

<http://www.uri.edu/ce/rinhs/invasives/index.htm>

### **Vermont**

Invasive Plant Information for Vermont

<http://www.uvm.edu/mastergardener/invasives/invasivesindex.html>

Noxious Weed List- VT Agency of Agriculture

<http://www.vermontagriculture.com/ARMES/plantindustry/plantPathology/weeds/index.html>



## **Invasive Plant Atlas of New England** **Volunteer Contacts**

If you have any questions about how to proceed, please don't hesitate to phone or e-mail.

### **University of Connecticut**

Department of Ecology and Evolutionary Biology  
University of Connecticut  
Storrs, CT 06269-3043  
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Phone: 860-486-4157

Dr. Leslie J. Mehrhoff – Botanical Expert and Project Leader

e-mail: [les.mehrhoff@uconn.edu](mailto:les.mehrhoff@uconn.edu)

Phone: 860-486-5708



## **Waiver of Liability Hold Harmless Agreement**

The undersigned volunteers hereby release \_\_\_\_\_  
of (town) \_\_\_\_\_ (state) \_\_\_\_\_ of any and all  
liability for any personal injury or accident incurred by them while pursuing activities of the  
Invasive Plant Atlas of New England volunteers of the New England Wild Flower Society on the  
above mentioned property owners land. Volunteers release all landowners of this liability when  
they join the Invasive Plant Atlas of New England Program. Volunteers are involved in the  
monitoring of the invasive plant species occurring in throughout New England

We appreciate your cooperation and support of our programs. Please feel free to contact Sarah  
Trenor at 860-486-4157 with any comments, questions or concerns.

Volunteer Signatures

Date

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____



## **Your Field Pack** And what should be in it

Whenever going into the field it is important to have the appropriate field and safety equipment with you. The easiest way to do this is to carry a small backpack or bag; but what should be inside? Below is a list of items that you may want to carry in the field.

- Compass
- Pens & pencils
- Notepad
- Reference materials
- Insect repellent
- Sunscreen
- First Aid Kit
- A hat
- More insect repellent
- Pocket knife
- A piece of rope or string measured to the length of one meter or a tape measure
- A couple large ziplock bags (to write inside if it is raining)
- Large plastic trash bag for field collecting specimens
- Water
- Snack
- Bug baffler
- Rain Gear
- Extra socks, shirt
- Flagging tape
- Camera
- Flashlight
- GPS System (if you have one)
- Topo map of the area
- Hand lens (maybe even some binoculars, if your interested in birds or trees)
- Calculator
- Your IPANE handbook



## Field Safety Tips

The following is a list of tips and reminders regarding safety in the field:

- Be aware of ticks (Lyme disease) and mosquitoes (Eastern Equine Encephalitis). Wear insect repellent and light-colored clothing (easier to spot ticks), long pants, long shirtsleeves and a hat to prevent ticks from sneaking up on you. Pull your socks up over your pant cuffs, too! Please see the public health information on our website for more information.
- Always go into the field with a partner, if possible.
- Always let someone know you are going into the field, and let them know when you expect to return.
- If you are allergic to bees, make sure you have your Ana-kit or Epi-Pen with you, and that your partner is aware that you are allergic and may need assistance.
- Always bring a small first-aid kit.
- Watch your footing and go slowly. “An ounce of prevention is worth a pound of cure!”
- Never drink anything with an umbrella in it.
- Bring plenty of water.
- Never go into the field without a map and compass.
- Leave yourself plenty of time to get out of the woods in daylight.
- Be on the look-out for poison ivy and sumac (another advantage of wearing long pants and sleeves).
- Wear plenty of sunscreen.
- If you are in a rocky area, be aware of the possibility of encountering a snake — timber rattlesnakes and copperheads, though rare, do exist in southern New England.
- Bring a cellular phone if you have one.
- Know the weather before you head out.
- If you become tired, rest or turn back. Most accidents occur when people are tired and not paying close attention (or have been drinking something with an umbrella in it).



## Public Health Information Resources

1. Insect Bites Repellants
  - <http://www.mass.gov/dph/cdc/factsheets/fstickbites.htm>
2. Lyme Disease
  - <http://www.mass.gov/dph/cdc/factsheets/fslyme.pdf>
3. West Nile Virus
  - <http://www.mass.gov/dph/cdc/factsheets/fswnv.pdf>
4. Eastern Equine Encephalitis
  - [http://www.mass.gov/dph/cdc/factsheets/fswnv\\_eee.pdf](http://www.mass.gov/dph/cdc/factsheets/fswnv_eee.pdf)
5. Giardia
  - <http://www.mass.gov/dph/cdc/factsheets/fsgiar.pdf>
6. Babesiosis
  - <http://www.mass.gov/dph/cdc/factsheets/fsbab.pdf>



# **Invasive Plant Atlas of New England**

## **Field Survey Methodology and Instructions.**

### **Introduction**

The Invasive Plant Atlas of New England is a web accessible atlas of invasive plant species for the New England region. The atlas supports early detection of invasive plant species and rapid response, as well as ecological studies of invasive plant species and their spread across the landscape. Included in the Atlas are images of and descriptive data about individual invasive plants and a database documenting the distribution of those species in the New England region. The Atlas is intended to provide public access to an online, interactive resource of regionally invasive vascular plants, including both historic and current data. The Atlas provides an extremely effective tool for students and researchers, land managers, conservationists, scientists, government agencies, the nursery industry, and other interested parties.

This project is a cooperative effort between the University of Connecticut, the Silvio O. Conte National Fish and Wildlife Refuge, the Center for International Earth Science Information Network (CIESIN), and the New England Wild Flower Society. Each cooperator plays a distinct, critical role in the project. The University of Connecticut receives and maintains all data collected by the public and trained volunteers, analyzing that data, and posting it on the IPANE web site. Additionally, UCONN has begun ecological modeling of many invasive species in an attempt to predict likely locations for future invasives species infestations. The Silvio O. Conte National Fish and Wildlife Refuge will be hosting a variety of educational and outreach programs and events. The Refuge is offering reference services on particular topics related to the invasive species problem, including identification, alternatives, and control. Reference materials and images are also available on loan or for sale. The Conte Refuge is also administering the New England Invasive Plant Group, a network of organizations, agencies and individuals concerned about invasive plant issue in the region. All three partners are involved in the establishment of an early detection and rapid response network. The IPANE network will attempt to stop new incursions of invasive species in the region or individual states through rapid evaluation and control efforts.

No part of this project can proceed without the widespread and thorough collection of data. Similar to breeding bird surveys and herpetological surveys, a project of this size depends on citizen volunteers to gather and submit data. Until the creation of IPANE, there had been a paucity of data on the abundance, distribution and spread of invasive plant species in the region. The lack of scientific data has become apparent to groups attempting to create lists of invasive species on the state, regional, and national level. Scientific, repeatable data collection is necessary to evaluate species invasiveness. IPANE data collection is designed to eventually have the entire region surveyed for invasive and potentially invasive plant species. Only through the collection of data from the entire region can we locate the front line of species invasions, and thereby plan effective control efforts.



## **Training**

IPANE is recruiting, training, and coordinating volunteers to conduct invasive plant species surveys. Since its inception in 2001, over 923 volunteers have been entered in our database. Multiple training programs are offered in the region every year. At these programs, a volunteer or small group of volunteers will choose a topographic quad to work on in that year.

## **Assigned Surveys**

Within each quad, IPANE staff will identify five or six public access lands for assigned surveys. The assigned areas may be owned by the town, a local land trust, the state, etc. They also vary greatly in size and natural community composition. Within each of these assigned areas, volunteers conduct multiple samples using the established field form (see below), being sure to sample from each habitat type found on the property. A thorough walk-through of each assigned survey area will be necessary to ensure all invasive species present are accurately represented in the sampling.

## **Opportunistic Surveys**

In addition to the assigned surveys we encourage volunteers to report other observations of invasives within their assigned quad. Local volunteers will be most familiar with landscapes within their quads. Although plots are the basis of this survey, volunteers should not focus so intently on their plots that they miss unusual species elsewhere. If they spot an unusual invasive, they should set up a plot, record the data on a field form, and send it in. Opportunistic surveys are very valuable in locating many of the more unusual species. Opportunistic surveys may be conducted in many different locations: roadsides, ponds lakes, and streams outside an assigned area, and on private property.

If seeking to conduct an invasive plant survey on private property, landowner permission must be acquired. The local volunteer is required to contact the landowner and obtain permission.

## **Data collection**

A field form has been developed specifically for use during this project. This form will guide the volunteer through the data collection process and should be used in conjunction with this written methodology until the volunteer is experienced in collecting the data. One field form should be used for each plot from which data is collected (see plots below)

## **Pre-screening Assigned Sites**

When beginning the survey of an assigned natural area, it is important for each volunteer or group of volunteers to become familiar with the lay of the land, the different habitat types that occur, and where the known invasive species occur. The entire property may be pre-screened prior to any forms being filled out. Once volunteers have a feel for the landscape, locations to establish plots can be decided upon. Of course, each individual may approach this pre-screening process differently. Pre-screening of the assigned site may be easy if the site is small and easily



traversed, however, a large site in the hundreds or even thousands of acres may be more difficult to pre-screen. It is acceptable for volunteers to conduct surveys as they walk the property initially, but be sure to survey all habitat types present and be on the lookout for small populations of unusual or less common species.

## **Plots**

After a property has been pre-screened volunteers need to select invasive species infestations in which to establish a data-gathering plot. A data-gathering plot should be established at each location they find species infestations in their assigned survey property. The number of plots they establish and collect data from will depend on the species composition, degree of infestation and size of their assigned survey site. One of the most difficult tasks facing the volunteer will be determining, in some cases, where a plot should be established. They may, and in most cases, fill out multiple forms within their assigned site: one assignment area does not dictate one form. One assignment area may require twenty different forms. Multiple plots should be done in each assigned natural area. Be sure to represent all habitats within the area. For example, if the natural area contains a pond, a wetland, a maple forest, and an oak forest, at least one plot should be done in each.

Each location where invasive species are encountered should be initially surveyed. Remember, it is important to sample infestations from all the different habitat types present, and to survey from locations of all species encountered. Multiple samples from disjunct species infestations are preferred, but there is a limit. If a volunteer has already collected data on Japanese knotweed infestation from three similar but disjunct locations at the assigned site, there is no reason to fill out more forms for this species alone. If it co-occurs with a new or previously undocumented species at that site, they must collect the data.

The survey plot itself is a 20 meter diameter circle. The area within this plot contains the information gathered for the field form. One field form should be used for each plot. Please comment on the field form about the condition of the landscape immediately outside the plot. Is it similar to the landscape within the plot? Less invaded? More invaded?

One of the most difficult aspects of using this survey methodology is the collection of negative data. For modeling and predictive studies we are seeking the collection of data from plots that do not have any invasive species present within them (negative data). The easiest way to approach the collection of negative data is to establish one plot within each habitat where invasive species are found. This plot should be established in an area where no invasive species are present. In some instances this may not be possible because the entire habitat may be infested. Establish negative data plots in an area of uniform, non-infested habitat, and complete all applicable sections of the field form. In large blocks of similar habitat, where you have set up multiple positive data plots use a 5:1 ratio of infested versus non-infested plots.

## **Documentation**



For each species encountered, a different level of documentation will be required. In some instances, no documentation will be needed; in other cases a specific photograph or a full herbarium specimen is required. Please refer to the species documentation table contained in the handbook and on the IPANE website to determine the level of documentation required.

Maps containing the locations of all positive and negative data plots within an assigned site are required. Each assignment volunteers receive will contain a section of a USGS topographic map for the area of the assigned site. Maps will accompany each site assignment. If volunteers are using GPS units to locate each plot, and have accurate readings for each plot there is no need to return the marked up map.



## Step by Step Instructions to Complete Invasive Plant Survey Forms

What follows is line-by-line instructions for the proper completion of the data collection form for invasive species. Please follow these instructions closely, and fill in the form as completely as possible.

1. **Assignment Area Site Code:** This is a code that identifies the quad and assigned site you are working on. It consists of the USGS quad code and a sequence of numbers and letters established by IPANE. You can find the appropriate code on your assignment cover sheet. Please transfer this to your field form, map, and any photographs or specimens you submit. This number allows us to track the assigned sites not only this year but in the future.
2. **Electronic Submission Number:** When you submit your field form electronically via the IPANE web site, you will be given an electronic submission number. Record this number on the field form, which you keep for you files, and place it on any maps or herbarium snippets or specimens, you will forward to UCONN as documentation for this form. It is extremely important you place this number on any correspondence you submit in regard to the field form you have submitted electronically. Keep this number for your files.
3. **Site Information:** Please list the state, county, and town where the survey plot is located. This information will be provided to you on the assignment cover sheet. You just need to transcribe it onto the form.
4. **Date observed:** Date or dates of your survey.
5. **Locality:** Please give specific directions to the locality of the plants or plot you are describing on the field form. When measuring distances, be consistent; use feet, yards, miles, or tenths of miles, but do not switch back and forth in one description. Also, please use cardinal directions (N, S, E, W), not left or right. The locality information you provide on your field forms is critically important. It will be used for GIS mapping, future field checks, and repeat visits.

In some instances this will be easy – simply listing the closest named entity will be enough. For trailheads, visitor centers, campgrounds, and other named places, the locality description will be easy – just list the name of the site and a specific location descriptor (i.e. Dolly Copp Campground, 150 feet north of campsite 12). In other situations, if you do not have a GPS unit you will need to give directions from the nearest named entity. For roadsides, and other un-named locations, a locality may be tricky to describe. In this situation, a distance and directional measurement from a known and fixed point would be best (i.e. 150 yards west of mile post 7 on the Kancamagus Highway on the eastbound road shoulder).

If you have a GPS unit, always provide GPS coordinates for each plot you are collecting data from. Please attach a copy of a topographic map (provided to you in your assignment



packet) indicating locations of each plot. Please provide a key and use different symbols or colors to distinguish which plots have positive data and which are negative. There is no need to submit a map if you provide GPS coordinates (see below).

- Coordinates:** If you have your own personal GPS unit, please record the latitude and longitude from the center of the infestation. Most GPS units, even small handheld models such as the Garmin 12, are fairly accurate. However, there is still a degree of error in all units due to the curvature of the earth and other factors. Most systems can correct for this degree of error, if prompted to do so. Check your instruction manuals. **Please indicate whether you have corrected the coordinates for error.** Please also indicate on your field form the make and model of your GPS and what datum it is using to collect the data. Typical datums are 1923, 1927, and 1983. The datum refers to which series year topographic maps the GPS unit is referencing. Most GPS units allow you to select the datum it is collected in.

Please determine the altitude of the infestation you are collecting data from by referring to the USGS topographic map segment you received in your assignment packet. Record this on our form. **Do not use any GPS unit to determine altitude they are extremely unreliable.**

- Habitat type table:** Using the Habitat Type Key below enter the numerical indicator of the habitat type where the invasive species are growing in the table on page 2 in the habitat type column. The habitat types were designed to be intentionally broad, encompassing many “micro” habitats within them. Please try to use the habitat types provided, but if the site you are surveying does not seem to fit, use the “other” category. If you use the “other” category, please describe the habitat in the space provided at the bottom of the habitat type table.

Usually you will have to enter one habitat type per form, because the plot you have established will be in a uniform habitat type. If your plot does span two distinct habitat types, enter the correct habitat identifying number next to the appropriate species. However, most often, if you need to add a second habitat type to the form you should consider relocating your plots so they are in a uniform habitat type.

### **Habitat Type Key**

**Edge:** *Edge* habitats are a zone where one habitat area gradates into another. Typically it is where an open area interfaces with a forested (wooded) area. The three most typical edge habitats are wetland edge, forest edge, and field edge. Pond edge, road edge, and disturbed edge are three more examples. Some obvious examples of edge habitat include where forest meets field, and where forest meets roadside or parking lot. These zones are known as “induced edges” if they are caused by humans (mowed field, controlled burn, clear-cut edge) or if caused by a short-term natural phenomenon that reversed succession (such as wildfire or flood).



In contrast, an “inherent edge” is a natural edge, such as those caused by changes in environmental conditions (soil/substrate, soil moisture, altitude, etc.). An example would be the interface of a forested habitat and a shrub wetland habitat, or where the forest reaches tree line in an alpine area. Both inherent and induced edges could fall into the “edge” habitat types on this field form. For practical purposes, the most likely edge habitat you are going to encounter will be near roadsides, fields, and parking lots. Use your best judgment!

*Edge* habitats as used on this field form do NOT refer to a change in forest or wetland *TYPE* (i.e. from a northern hardwood forest to a spruce-fir forest or a shrub marsh to herbaceous). Please indicate on the field form in the habitat section what type of edge you are describing.

1) **Upland/wetland-** a border between mesic and wet soils, it may be indicated by the canopy type. For example, you may move from a beech, birch, maple forest to a shrub wetland, or herbaceous wetland.

2) **Field/forest edge-** see definition of field and forest below. This is the border between a forest and a field, fairly self-explanatory.

3) **Lake shore-** terrestrial pond or lake shore at its border with an upland or wetland habitat.

4) **Roadside:** This habitat type is found along the edges of major and minor roadways, highways, and parking lots. This can be the sand along the road edge, an embankment, or the mowed area along the road edge or in the median. Include areas contained within highway cloverleaves, rotaries, rest areas, and scenic vista pullouts. Generally, the effect of this habitat extends for a distance of 15 feet beyond the road edge, or 15 feet beyond the maintained road buffer (i.e. the mowed areas along highways).

**Forests:** If a plot is placed in a forest, please indicate the dominant canopy tree species. You should refer to a common field guide to trees such as “Golden Guide” or “Peterson’s” if you are unfamiliar with trees. You may circle more than one species if there is a co-dominance of forest types. We are looking for the **dominant canopy species**, not all species present in the canopy and are not concerned with the understory species.

Some clues about the different forest types:

5) **Aspen/birch-** early succession mostly likely to occur after clearing

6) **White Pine-** frequently the first tree to come into old pastures

7) **Oak/Pine-** dry acid soils, mid-late successional

8) **Cottonwood/Silver Maple-** flood plain forest, most often on the banks of large rivers and on deltas.

9) **Beech/birch/maple-** climax forest on mesic, mid-elevation – more frequent in northern New England



**10) Oak/hickory**-climax forest of mesic-dry soil – more frequent in southern New England

**11) Pitch Pine**- extremely dry sites, often with scrub oaks

**12) Hemlock**- often on steep, north slopes such as ravines, but occurring in many habitats, often producing deep shade

**13) Spruce/fir**-high elevation and bogs more frequent in northern New England

### **Wetlands**

*A note about wetlands:*

*A wetland is an area that is either permanently saturated or saturated seasonally for a long enough period for hydric soils to develop (demonstrating characteristics such as high organic matter, dark or gray color, mucky consistency, etc.) and to support the presence of hydrophytic vegetation (adapted to tolerate saturated conditions).*

### **14) Herbaceous Wetland:**

The herbaceous wetland habitat is predominantly vegetated by non-woody species, particularly grasses, sedges, and rushes. Examples of this habitat type include wet meadows and freshwater marshes. Some species you would be likely to encounter in an herbaceous wetland could be fresh water cordgrass (*Spartina pectinata*), sallow sedge (*Carex lurida*), cottongrass (*Eriophorum* spp.), white beak rush (*Rhynchospora alba*), deer's hair (*Trichophorum cespitosum*), and Canada bluejoint (*Calamagrostis canadensis*). *Hummock and hollow topography is typical in many herbaceous wetlands, with pools of water found in many of the hollows.*

**15) Bog:** The predominant feature of bogs is sphagnum moss. They are unique peat lands, which are highly acid and nutrient poor, with organic soil held in a mat that is often floating above water. Common bog species are Pitcher Plant, sundew, and cranberries. Bogs often have a well-developed shrub layer around the fringes of an open mat of sphagnum.

**16) Fen:** a fen is another peat land, which also has a mat of organic matter but is more nutrient rich and tends to be less acidic than bogs. The major difference is that fens are dominated by sedges and forbs rather than sphagnum moss. Groundwater influence is the cause of this difference. Fens can be distinguished from herbaceous wetland by the mat formation of organic material. Fens tend to be more even with little open water in pools and ditches.

**17) Shrub Wetland:** The shrub wetland is usually characterized by predominant dense shrub growth with a few scattered and stunted trees. One example might be a bog peatland, with an abundance of leather-leaf (*Rhododendron groenlandicum*), sheep-laurel (*Kalmia angustifolia*), and high-bush blueberry (*Vaccinium corymbosum*) in the shrub layer and with the scattered black spruce (*Picea mariana*) and tamarack (*Larix laricina*) trees throughout.

**18) Cedar Swamp-** Whether dominated by northern white cedar (*Thuja occidentalis*), a northern New England species, or Atlantic white cedar (*Chamaecyparis thyoides*), a more coastal species; most cedar swamps have a sparse shrub and herbaceous layer, due to the dense shade produced by the cedars. The composition of these layers is similar to that found in a red maple swamp (see below).

**19) Red maple swamp:** This habitat type will have more canopy cover than the shrub wetland and is dominated by red maple (*Acer rubrum*) as an over story. Again you may want to consult a tree guide to be sure of your species. Many forested wetlands also have a substantial shrub component in the understory, which may include species such as speckled alder (*Alnus incana*), wild raisin (*Viburnum nudum* var. *cassinoides*), winterberry (*Ilex verticillata*), and mountain holly (*Nemopanthus mucronatus*). Common herbaceous species in a forested wetland include skunk cabbage (*Symplocarpus foetidus*), cinnamon fern (*Osmunda cinnamomea*), and interrupted fern (*Osmunda claytoniana*).

**20) Salt Marsh:** The salt marsh is a specific type of herbaceous wetland that is regularly flooded by ocean tides. Found along the seacoast, the salt marshes are vegetated by plant species adapted to saline conditions. Common species of the salt marsh include saltmeadow cordgrass (*Spartina patens*), smooth cordgrass (*Spartina alterniflora*), black-grass (*Juncus gerardii*), glasswort (*Salicornia depressa*), seaside plantain (*Plantago maritima*), and seaside goldenrod (*Solidago sempervirens*).

**Aquatic:** The aquatic habitat type refers to those areas that have standing water for most of the year, such as a pond or stream. Vegetation of aquatic areas are typically referred to as “floating,” as in the white water-lily (*Nymphaea odorata*) or yellow water-lily (*Nuphar variegata*), “submersed” as in many of the pondweeds (*Potamogeton* spp.) or coontail (*Ceratophyllum demersum*), or “emergent” as in cattail (*Typha* spp.) or pickerel-weed (*Pontederia cordata*). Please use the aquatic version of the Invasive Plant Survey Form for any of the following categories. These forms are contained in the volunteer handbook or can be downloaded from the Invasive Plant Atlas of New England web site <http://nbii-nin.ciesin.columbia.edu/ipane/volunteers/volunteers.htm>.

**21) Lake-** a still body of water, including ponds for our purposes.



**22) Stream-** a small rapid moving body of water, including creeks and brooks for our purposes.

**23) River-** a larger, generally slower moving body of water.

**24) Dune:** The dune habitat type refers to the sandy beach dunes common along Cape Cod and in portions of Rhode Island. Plant species associated with dune communities include beach grass (*Ammophila breviligulata*), dune grass (*Leymus mollis*), dusty miller (*Artemisia stellariana*) (introduced), and sometimes rugosa rose (*Rosa rugosa*) (introduced).

**25) Open areas:** This habitat category refers to upland fields, open barrens, grasslands, balds, and rocky outcrops. These are areas without an abundance of tall woody species casting shade, and could have a very wide variety of vegetation. Don't confuse this category with the wetland categories of shrub wetland or herbaceous wetland—the areas that fall into “open areas” are upland (as opposed to wetland) in nature. They are typically dry and maintained by natural processes, not mowing or plowing.

**26) Old Field:** Old fields are lands that have in the past been used for agricultural or forestry purposes and are now in the process of reverting to a natural state. They are typified by an abundance of shrub and immature tree species. In fact, you may want to call them shrublands. These areas are not to be confused with shrub wetlands; old-field sites are universally upland sites with mesic or dry soils. In the past they have been maintained in an open state through human influences. Typical old field shrub colonizers are birch (*Betula* sp.) cherry (*Prunus* sp.) eastern white pine (*Pinus strobus*), and many invasive species such as autumn olive, multiflora rose, and common buckthorn.

**27) Stream bank:** This habitat covers the immediate banks of a perennial river or stream and its primary channel. The primary channel may or may not have water flowing through it at all times of the year. Depending on the river size or stream, the area contained in this habitat varies. Small vernal or seasonal streams do not qualify under this habitat. Do not confuse this with a floodplain forest, which falls in the forested wetland habitat type.

**28) Yard/Garden:** This category includes the maintained lands around a home or commercial establishment. This would include the landscaped area around a visitor's center, campground offices, shopping plaza, town green, etc., but the key word is landscaped. This category also includes private vegetable or flower gardens, even if they are community gardens.

**29) Agricultural Field:** This category includes crop fields, pasture land, managed fallow fields, hay fields, and nursery lands. This habitat includes the edge zone around the agricultural lands as well. There is no size specification. This does not include a private home vegetable garden. See Yard/Garden.



**30) Right-of-Way:** This habitat, although artificial, is extremely important to a surprising number or rare or uncommon plant and animal species. Included here are power line, railroad, gas line, and communications rights of way. These areas are typically mowed or sprayed on a bi- or semi-annual basis to keep vegetation low. They are also hotspots for invasive species infestations. Include only the area directly affected by these rights-of-way. Road and property rights-of-way do not fall into this category.

**31) Other:** Any other habitat you may encounter that does not fit neatly into one of the categories described above. Please name and describe the habitat in detail.

## 12. Table 2 Site Conditions

### **What are the environmental site conditions at the site where invasives are found?**

The following questions are not exclusive of one another. You may circle more than one in each category. The questions relate to the conditions within the plot established, not the overall assigned public access land.

#### **Canopy Closure**

0-25% full sun or very little shade;

26-50% partial sun, some shading but still mostly open;

51-75% moderate shade, mostly closed canopy but with a significant amount of light still reaching the ground;

76-100% deep shade with a closed canopy with very little light penetration to the ground.

In addition to sunlight penetration to figure out the canopy cover, you may also want to look up at the canopy and use the percent cover sheet we have provided in the handbook to estimate the amount of canopy closure. If surveying in the early spring, late autumn, or winter use your best judgment of what the site is like through most of the day/growing season.

**Aspect:** if on a slope, in which compass direction is the slope facing.

#### **Soil moisture**

*xeric* - very dry,

*dry mesic* - moderately dry soil (like garden soil that you do not water),

*moist mesic* - moderately moist soil (like garden soil that you do water),

*saturated* - soil that is very wet or muddy: the water would be bubbling out from under you shoes

*inundated* - soil with standing water soil: your feet are underwater.

Use your best judgment of what the site experiences for the majority of the growing season.



### 13 Comments

This space is provided for volunteers to comment on any factor concerning the plot or the overall site they feel is pertinent to the survey, but there is not data collection field to convey this information. Particularly comment on the overall condition of the landscape around the assigned public access area or opportunistic survey location.

### 14. Reporter

If you are a trained IPANE volunteer please enter your name and the identification number assigned to you at the training program. If you are a non-trained volunteer please enter your name and in the ID# field on the form enter your complete address and telephone number.

### 15. Table 3 Species Data Collections

**Species:** Multiple lines are given down the left side of the table to allow data gathering on multiple species in one plot. Invasive species sometimes grow in multiple species groups, by providing you with the ability to record information on a suite of species we are saving you time and several trees by only having to fill out one form per plot.

**Habitat Type** Insert the numerical code from table one that identifies the habitat(s) that occur in the plot being surveyed.

**Abundance:** This is fairly straightforward and simple. How many plants are there of each species within the plot? Do not get bogged down in trying to figure out if those two stems are one plant or two plants. If you know some of the ecology of certain species you can easily figure out if a plant arises from a single stem or multiple stems. If it looks like one plant - it is. If it looks like two plants, then it is two plants. This is why we have provided ranges of plant numbers, instead of requiring you always to do exact counts.

**Distribution:** Estimate how the species is distributed within the 20m diameter plot. See the diagram in your notebook for a visual representation of this concept.

**Percent Cover:** Estimate the percent each species covers in your plot. Please use the percent cover sheet (in your handbook) to determine the estimate.

#### **Reproduction**

**Vegetative:** Are the species spreading from root sucker, stolons, or branch rooting? In some cases you will need to understand the ecology and biology of the species to determine this. Examples of vegetative spreaders are common reed, Japanese knotweed, multiflora rose, and oriental bittersweet

**Sexual:**

*flowers* - Is there evidence of the species flowering this year?

*pollinators* - If the species is in flower is there evidence pollination e.g. insects, hummingbirds, butterflies etc. visiting the flowers?

*fruit* - Are the species developing mature fruit and/or seed at this location?

**Both:** Is there evidence of both vegetative and sexual spreading of these species?

**Seedlings present:** please record if there are seedlings present of any of the invasive species.

**Documentation:** Photograph or specimen taken, yes or no? Please refer to the species documentation table to determine if a photograph, plant snippet, or full herbarium specimen is required. Certain species require different levels of documentation.

**Associated Vegetation:** To the best of your ability, list at least three dominant species within the plot other than the invasive species you are documenting.

**Data submission**

**Directions for Online Submission of IPANE Forms**

1. Go to <http://invasives.eeb.uconn.edu/ipane/>
2. In the Navigation Menu on the left side of the page locate the “**Volunteers**” box and click on it
3. Click on “**Online Reporting Form**”, then on “**Login**”
4. Enter your **Username** and **Password** in their respective boxes and click “**Submit**”(If you don’t remember your Username and/or Password please email ipane@uconn.edu)
5. Click on “**Enter Data**”
6. If the form you are entering is a **TERRESTRIAL FORM** click the button to the immediate left of “**Yes**” to select it (a black circle should appear inside it); If you are entering an **AQUATIC FORM** click the button to the immediate left of “**No**” to select it (a black circle should appear inside it)
7. Under “**Assignment Area Site Code**” click on the site where the plot is located to highlight/select it (a dark box will appear around the site name and the text will turn white); If the plot is not located in any of the listed sites select “**None**”
8. Under “**State**” select the state where the plot is located by clicking on it to highlight it
9. Click “**Submit**”
10. Under “**County**” select the county where the plot is located by clicking on it to highlight it and then click “**Submit**”
11. Under “**Town**” select the town where the plot is located by clicking on it to highlight it and then click “**Submit**”

12. Under “**Minor Designation**” select the nearest locality to the plot (i.e. the name of a hill, a village, etc.) that will help to locate it by clicking on it to highlight it; If none of the listed places are near the plot select “**No Match**” by clicking on it
13. Click “**Submit**”
14. Under “**Locality**” type, in the adjacent box, the description that will help someone to locate the plot (found under “Locality” on your IPANE form); If there is nothing on your IPANE form to enter in the box type “**Blank**” in the box
15. Under “**Date Observed**” enter the date the plot was created in the following format **MM/DD/YYYY** (please note the slashes are required)
16. Under “**How did you measure your coordinates**” select (click) the button to the immediate left of “**Map**” if you used a map to determine the coordinates of the plot or select the button to the immediate left of “**GPS**” if you used GPS to determine the coordinates of the plot
17. Under “**Which datum did you use or was used on the map**” use the scroll bar (click on the downward pointing arrow next to “Select”) to select the datum (i.e. NAD27, NAD83, WGS84) that was used (click on it to highlight) (\*\*NOTE\*\* It may be helpful to identify the datum utilized by the map(s) or GPS unit you are using BEFORE you actually do your sampling. If you have any difficulty or questions please consult the training manual. If you are using Maptech.com or TopoZone.com to determine your coordinates, please make sure you pay attention to the datum you are using.)
18. If your coordinates are in **DECIMAL DEGREES**, enter the **Latitude** under “**Latitude in decimal degrees**” and the **Longitude** under “**Longitude in decimal degrees**”; If your coordinates are NOT in decimal degrees leave these fields blank
19. If your coordinates are in **DEGREES, MINUTES, SECONDS** enter the **Latitude** under “**Latitude in Degrees Minute Seconds**” and the **Longitude** under “**Longitude in Degrees Minute Seconds**”; If your coordinates are NOT in degrees, minutes, seconds leave these fields blank
20. If your coordinates are in **DEGREES MINUTES.MINUTES** you can convert them to **Decimal Degrees** by using the following:
  - A. Divide the MINUTES.MINUTES by 60 (the result should be a decimal number less than 1)
  - B. Add the number obtained in part A to the DEGREES to obtain the equivalent coordinate in decimal degrees
  - C. Example – if your coordinate was 42 degrees and 39.807 minutes, you would divide 39.807 by 60 (which is 0.66345) and then add that to 42 for a resulting coordinate in decimal degrees of 42.66345
21. Under “**Altitude**” enter the altitude of the plot in **FEET** (If your altitude is in meters you can use the converter at [http://www.onlineconversion.com/length\\_common.htm](http://www.onlineconversion.com/length_common.htm) to change it from meters to feet)
22. Under “**Comments from the bottom of the first page**” enter any comments or notes from the “Comments” section of the form in the box; If there are no comments leaves the box blank
23. Click “**Submit**”
24. Select the “**Habitat**” by clicking on the button to the immediate left of the corresponding habitat (i.e. Field/Forest); In the rare case that none of the habitats listed matches the habitat of the plot and you must select “**Other,**” please consult the training manual.

25. Under “**Is this plot along a trailside?**” click the button to the immediate left of “**Yes**” if the plot is located along a trailside or the button to the immediate left of “**No**” if the plot is NOT located along a trailside
26. Under “**Canopy Closure**” click on the button that corresponds to the canopy closure of the plot
27. Under “**Aspect**” click on the button that corresponds to the aspect of the plot
28. Under “**Soil Moisture**” click on the button that corresponds to the soil moisture of the plot
29. Click “**Submit**”
30. Under “**Species**” use the scroll bar to locate your first invasive species (from the back of your IPANE form) and click on it to highlight it; If no invasives were found in the plot (it is a “Negative Plot”) select “**No invasive species**”
31. Under “**Abundance**” use the scroll bar to locate the corresponding abundance for the species entered in step 30; If no invasives were found in the plot select “**No invasives**”
32. Under “**Distribution**” use the scroll bar to locate the corresponding distribution for the species entered in step 30; If no invasives were found in the plot select “**No invasives**”
33. Under “**Percent Cover**” use the scroll bar to locate the corresponding percent cover for the species entered in step 30; If no invasives were found in the plot leave this on “**Select-**”
34. Under “**Reproduction**” click the boxes to the immediate left of all of the types of reproduction that apply to the species entered in step 30; If a type of reproduction doesn’t apply leave the box unchecked (empty)
35. Under “**Documentation**” use the scroll bar to locate the corresponding type of documentation (i.e. specimen or photograph) for the species entered in step 30; If no invasives were found in the plot select “**No invasives**”; If there is no documentation select “**None**”
36. If you have another species to enter (for this plot) click “**Enter another species**” and repeat steps 30-36; If this is the last species to enter (for this plot) click “**This is the last species**”
37. Click “**Submit**”
38. Under “**Associated Vegetation**” enter any associated vegetation in the box; If you did not record any leave the box blank
39. Click “**Submit**” (after you hit this submit button you cannot go back to make changes to this form, contact IPANE staff if you need to make changes)
40. \*\*\*\*\*This step is extremely important\*\*\*\*\* Write down the **Electronic Submission Number** in the TOP RIGHT CORNER of your IPANE form under “**Electronic Submission Number**” and also **WRITE THIS NUMBER ON ALL SPECIMENS AND/OR PHOTOGRAPHS PERTAINING TO THIS PLOT**
41. If you have another form to enter click “**Another form**” and repeat steps 6-41; If this is your last form click “**Logout**”

**Invasive Plant Atlas of New England (IPANE) Survey Form**  
**The New England Wild Flower Society**  
*(Please refer to guidelines for the use of this form)*  
**Aquatic Version 6/9/06**

Assignment Area Site Code \_\_\_\_\_ Electronic Submission Number \_\_\_\_\_

Site Information: State \_\_\_\_\_ County \_\_\_\_\_ Town \_\_\_\_\_ Date observed: \_\_\_/\_\_\_/\_\_\_

Locality (Closest named entity on the topo quad. Attach photocopy of map)

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Coordinates: Latitude \_\_\_\_\_ Longitude \_\_\_\_\_  
 Altitude(ft) \_\_\_\_\_ **please circle** - GPS or map estimate Datum (e.g. NAD 1927) \_\_\_\_\_

Depth of water \_\_\_\_\_ (ft)

**Site Conditions** (please circle)

<b>Water body type</b>	lake	pond	river	stream
<b>Substrate</b>	muck	sand	gravel	rocks
<b>Water velocity</b>	standing	smooth flow	rapids	
<b>Water clarity</b>	clear	slightly turbid	very turbid	
<b>Nutrient level</b>	nasty	swimable		
<b>Salinity and tide</b>	tidal brackish	tidal fresh	non-tidal	

**Comments**

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Reporter:

Name \_\_\_\_\_ ID# \_\_\_\_\_

*Funded by the United State Department of Agriculture*

Mail documentation to: IPANE Volunteer Coordinator, New England Wild Flower Society, 180 Hemenway Rd., Framingham, MA 01701-2699



**Invasive Plant Atlas of New England (IPANE) Survey Form**  
**The New England Wild Flower Society**  
*(Please refer to guidelines for the use of this form)*  
**Terrestrial Version 6/9/06**

Site Form \_\_\_\_\_ Plot Form \_\_\_\_\_

Assignment Area Site Code \_\_\_\_\_ Electronic Submission Number \_\_\_\_\_

Site Information: State \_\_\_\_\_ County \_\_\_\_\_ Town \_\_\_\_\_ Date observed: \_\_\_ / \_\_\_ / \_\_\_

Locality (Closest named entity on the topo quad. Attach photocopy of map)

\_\_\_\_\_

\_\_\_\_\_

Coordinates: Latitude \_\_\_\_\_ Longitude \_\_\_\_\_  
 Altitude(ft) \_\_\_\_\_ please circle - GPS or map estimate Datum (e.g. NAD 1927) \_\_\_\_\_

Habitat Types (please fill in number on back, spend no more than 30 sec to decide)

Edge	Forest continued	Wetlands	Miscellaneous	Miscellaneous
1) Upland/wetland	8) Oak	16) Herbaceous marsh	23) Dune	30) Rocky outcrops
2) Field/forest	9) Floodplain Forest	17) Bog	24) Open field	31) Beach
3) Lake edge	10) N. hardwood	18) Fen	25) Old field	32) Rocky coast
4) Roadside	11) Upland red maple	19) Shrub wetland	26) Stream bank	33) Abandoned lot/old home site
<b>Forests</b>	12) Oak/hickory	20) Cedar swamp	27) Yard/garden	
5) Aspen/birch	13) Pitch pine	21) Red maple swamp	28) Ag. Field	
6) White pine	14) Hemlock	22) Salt marsh	29) right-of- way	
7) Oak/pine	15) Spruce/fir			

34) Other habitat (Please explain, up to 254 characters) \_\_\_\_\_

Is this plot along a trailside? Yes \_\_\_\_\_ No \_\_\_\_\_

Site Conditions (please circle)

Canopy Closure	0-25%	26-50%	51-75%	76-100%	
Aspect	North   NE	East   SE	South   SW	West   NW	Flat
Soil Moisture	Xeric (dry)	Mesic (moist)	Saturated	Inundated	

Comments

\_\_\_\_\_

\_\_\_\_\_

Reporter:

Name \_\_\_\_\_ ID# \_\_\_\_\_

*Funded by the United States Department of Agriculture*

Mail documentation to: IPANE Volunteer Coordinator, New England Wild Flower Society, 180 Hemenway Rd., Framingham, MA 01701-2699





## How to get Latitude and Longitude Coordinates if you do not have a GPS Unit

1. As accurately as you can place a dot on a paper copy of a USGS topographic map.
2. Go to [www.maptech.com](http://www.maptech.com) on the internet. At the top of the page click on the “online maps” button.
3. Click on the “Maptech MapServer” option.
4. Enter either the town and state or the zip code of the general area of the map dot and click “go”. A map of this area will appear on your computer screen.
5. Place your cursor over the location of the dot on the map on the computer screen. The area to the left of the map will display the latitude and longitude of that location. BE sure that your coordinates are in decimal degrees (DD.DD). Record this information on your data collection form.

## Percent Cover Estimations



1–5%  
(3%)



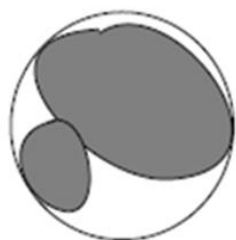
6–25%  
(12%)



26–50%  
(32%)



51–75%  
(58%)



51–75%  
(68%)



76–100%  
(83%)

Examples of percent cover estimates with the associated cover range. (From *Delineating Bordering Vegetated Wetlands*; a handbook, MA Department of Environmental Protection Division of Wetlands and Waterways, March 1995).

## A KEY TO THE SWALLOWWORTS OF NEW ENGLAND

Cynanchum (Vincetoxicum) ASCLEPIADACEAE

1. Corolla lobes deltoid, dark purple with short white hairs ..... *Cynanchum louiseae*
1. Corolla lobes almost twice as long as wide at base, brick red to pale purplish yellow, glabrous ..... *Cynanchum rossicum*

Synonymy:

*Cynanchum louiseae* **Kartesz & Gandhi** = *Cynanchum nigrum* (L.) Pers.  
*Vincetoxicum nigrum* (L.) Moench

*Cynanchum rossicum* (**Kleo.**) **Barb.** = *Vincetoxicum rossicum* (Kleo.) Barb.  
*Vincetoxicum medium* Auct. non R. Br.  
*Vincetoxicum hirundinaria* Medikus [sensu Cronquist]

## JAPANESE STILT-GRASS VS. WHITE GRASS

*Microstegium vimineum* (Trin.) A. Camus – *Leersia virginica* L.

### COMPARISON TABLE

CHARACTER	<i>Microstegium vimineum</i>	<i>Leersia virginica</i>
TRIBE	Andropogoneae	Oryzeae
NATIVE REGION	Asia	Eastern North America
INFLORESCENCE	Terminal spike-like branches	Open panicle
GLUMES	Present	Absent
LEMMA	Awned or awnless	Awnless
FLOWERING INITIATION	mid September	Early to mid August
SHEATH SUMMIT	Hairy along margin and near summit	Glabrous or scaberulous
NODES	Glabrous	Erect hairy
ROOTS	Fibrous	Scaly rhizomes
ANNUAL/ PERENNIAL	Annual	Perennial
FALL COLOR	Yellowish to pale purple	Green to stramineous

### Morphological Differences

#### What you can do | Native and Introduced

[Background](#) | [Problem/Control](#) | [Native or Introduced?](#) | [Insects](#) | [STSP](#) | [Projects](#) | [Resources](#)

### Morphological differences between native and introduced genotypes



Fig. 1. Introduced (background, left, dark leaves) and native *Phragmites* clone (front, right, light green leaves) at Montezuma NWR




The recent development of molecular markers identifying native and non-native populations of *Phragmites* in North America now makes it possible to look for morphological characters potentially distinguishing these lineages. Preliminary observations of populations in New York (Fig. 1), Maryland, Maine, Indiana, Wisconsin, Minnesota, Virginia, Arizona, Washington, and Louisiana as well as examination of numerous herbarium specimens indicate that such morphological differences may exist (Table 1). [**Please note:** We are updating Table 1 as new evidence emerges. Please check frequently or sign up for our email list so you are automatically informed if updates are provided. In the most recent update, various traits were deleted (node coloration, ligule color, stem straightness) because they did not provide consistent separation of native and introduced haplotypes. Others were added (rhizome diameter and color, leaf sheath characters, habitat requirements) ].






Please note that these traits are based on examination of now a considerable number of native and introduced clones but need further confirmation. What has become particularly clear over the past few months is that the various North American haplotypes differ in their morphological characters. And that these characters change over the course of the season


and through the winter. Please also remember that the specimens you see in the field are the result of the genotype and its interactions with the biotic and abiotic environment. The same genotype grown in the moister Northeast will look quite different in the arid West. We are further examining these differences through field visits and by creating an experimental garden in Ithaca where different haplotypes are grown under standardized conditions. [We need your help](#) to identify and map other growing locations of native genotypes. We also need to increase the sample size to assess whether the preliminary evidence for morphological differences between native and introduced genotypes is consistent across populations and lineages. By the end of May we will offer a diagnostic service using the identified morphological characters for those that need or want to know whether their local *Phragmites* patch is native or introduced.

**Click on thumbnails to enlarge images.**

**Table 1. Observed differences between native and introduced *Phragmites* clone**

Trait	Native Haplotypes	Introduced Haplotypes (Haplotype M)	Gulf Coast (Haplotype I)
<b>Leaf sheaths</b>	Fall off in the fall or are very easy removed if they stay on the stem.	Leaf sheaths stay on the plant, occasionally basal ones fall off the stem. Leaf sheaths are difficult to remove (use a twisting motion)	Not known
<b>Stem color at base</b> (spring/summer)  Note: Leaf sheath needs to be removed	 Red to Chestnut	Tan  Very occasionally do lower internodes show a brownish coloration in the winter.	Not known
<b>Stem color at base</b> (winter)  Note: Leaf sheath needs to be removed on introduced haplotype	 Light chestnut to light brown/gray	Tan  	Not known

<p><b>Stem texture</b></p> <p>Note: Run your finger across and up and down the stem after removing the leaf sheath</p>	 <p>Smooth and shiny</p> <p>(Looks polished. Often with dark spots [fungal attack] clustered at nodes in winter). Stem fungus absent in currently known Western and southwestern populations)</p>	<p>Rough and dull</p> <p>(Stems are ribbed. Ridges visible with naked eye. Very Occasionally do basal internodes appear smooth).</p>	<p>Not known</p>
<p><b>Stem flexibility</b></p>	<p>High</p>	<p>Rigid</p>	<p>Not known</p>
<p><b>Stem toughness</b></p>	<p>Low</p>	<p>High</p>	<p>Not known</p>
<p><b>Stem density</b></p>	 <p>Low</p>	 <p>High</p>	<p>High</p>
<p><b>Time of Flowering</b></p>	<p>Early (July-August)</p>	<p>Intermediate ( August September)</p>	<p>Late (October-November)</p>
<p><b>Inflorescence</b></p>	 <p>Sparse</p> <p>Please note that sparse inflorescences not automatically indicate native status!</p>	 <p>Dense</p>	<p>Not known</p>
<p><b>Senescence</b></p>	<p>Early</p> <p><b>Please note that native southwestern genotypes (3 examined in AZ) appear to be evergreen without senescing. Instead, stems branch at the top, and lower leaves fall off.</b></p>	<p>Late</p>	<p>Not known</p>
<p><b>Leaf color</b></p>	<p>Yellow-green</p>	<p>Inland pops: Dark green/gray</p> <p>Coastal pops: yellow-green to dark green/gray</p>	<p>Yellow-green</p>
<p><b>Rhizome density</b></p>	<p>Low</p>	<p>High</p>	<p>Not known</p>

			
<b>Rhizome color</b>	Yellowish	White to light yellow. Rhizomes will darken after excavation.	Not known
<b>Rhizome diameter</b>	Usually under 15mm  Almost perfectly round. Occasionally slightly compressed.	few nodes under 15mm, most >15mm  Mostly compressed (oval)	unknown  unknown
<b>Clonal expansion rate</b>	Slow	Rapid	Rapid
<b>Habitat requirements</b>	Potentially restricted?  All examined native populations grow on moist soils. Sites can be under tidal influence but are never continuously inundated.	Wide range of conditions  Introduced genotypes can grow on fairly dry sites and on sites where rhizomes are continuously inundated.	Unknown

In general, native populations appear to have a lower stem density, and produce a reddish-purple color on their stems and ligules in spring and summer that is not present in non-native populations. When checking for these differences note that the side of the stems exposed to the sun will show the brightest coloration. The reddish color fades somewhat into a chestnut brown in the fall but was still very obvious in October in Virginia; in the winter the red stems turn light to chestnut brown and somewhat gray. Stems of native genotypes are smooth and shiny as if polished, particularly in the winter, while stems of introduced genotypes are dull, rough and ribbed (ridges visible with the naked eye once leaf sheath has been removed). These differences are easy to recognize by running your fingers up and down them stems.

**Please note that a leaf sheath wraps around the stem almost entirely. It is important to remove the leaf sheath when checking for stem morphology or texture.**

For all native genotypes leaf sheaths either fall off by themselves or are very easily removed when handling *Phragmites*. In the introduced genotypes, leaf sheaths may fall off at the base of the stem (which is also occasionally reddish or brownish) but on upper nodes are very difficult to remove (hold a stem close to an internode and use a twisting motion to check). In instances where native and introduced clones grow in close vicinity of each other, differences in stem density and stem toughness become obvious on windy days. Introduced genotypes remain sturdy and erect and move little while native genotypes easily bend and swing in the wind. Stems of introduced genotypes are often almost perfectly straight while stems of native genotypes often grow crooked (Haplotype E, known from the Northeast and Midwest does conform to this pattern but not all other populations).

In the fall and winter, differences in the density of inflorescences are also obvious; introduced genotypes appear to have much denser and larger inflorescences. Observations in New York and Virginia also suggest that native genotypes senesce earlier than introduced genotypes (this is a common phenomenon in introduced species which often show extended growing periods). In addition, an unidentified stem fungus attacks native

genotypes with dark spots often clustered around internodes while introduced genotypes remain fungus free (there appears to be a reduction over the winter in the abundance of this stem spot fungus and not all western populations appear to be attacked).

Excavations of rhizomes at several sites have also produced consistent differences between native and introduced haplotypes. Native haplotypes have round rhizomes that are yellow and rhizome diameters of less than 15mm. Rhizomes of introduced haplotypes, particularly when freshly excavated and rinsed are white (they darken over time) and compressed (flattened). Although there are some rhizomes with diameters <15mm, most rhizome diameters in introduced genotypes are larger than 15mm (measure in the center of an internode and use largest diameter).



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[Bernd Blossey](#)  
Webmaster: [Jillian Brownlee](#)



Reference List of Websites Related to Invasive Plants  
(originally from Natural Resources Conservation Service links)

The following websites may be extremely useful if you would like additional information:

Category	URL	Reference	Comments
<b>Identification and Fact sheets:</b>			
	<a href="http://www.glifwc.org/invasives/">http://www.glifwc.org/invasives/</a>	Grtr Lks Indian, Fish and Wildlife Commsn.	Brief facts, some photos
	<a href="http://njaes.rutgers.edu/weeds/">http://njaes.rutgers.edu/weeds/</a>	Rutgers University Weed Gallery	NJ Weed info; photos
	<a href="http://www.wssa.net/Weeds/ID/index.htm">http://www.wssa.net/Weeds/ID/index.htm</a>	Weed Science Society of America	Photos, information
	<a href="http://www.dcr.virginia.gov/natural_heritage/invspfactsheets.shtml">http://www.dcr.virginia.gov/natural_heritage/invspfactsheets.shtml</a>	Virginia Natural Heritage Program	Factsheets
	<a href="http://www.nps.gov/plants/alien/factmain.htm">http://www.nps.gov/plants/alien/factmain.htm</a>	Plant Conservation Alliance	Factsheet links
	<a href="http://tncweeds.ucdavis.edu/">http://tncweeds.ucdavis.edu/</a>	Nature Conservancy Invasive Sp. Team	ID and control info
	<a href="http://www.invasivespeciesinfo.gov/plants/main.shtml">http://www.invasivespeciesinfo.gov/plants/main.shtml</a>	USDA National Invasive Species Info Center	Factsheets
	<a href="http://plants.usda.gov/java/factSheet">http://plants.usda.gov/java/factSheet</a>	NRCS Plants Database	Basic plant info, photos
	<a href="http://www.ct.nrcs.usda.gov/invas-factsheets.html">http://www.ct.nrcs.usda.gov/invas-factsheets.html</a>	NRCS Connecticut Invasive Plant ID Sheets	ID Sheets for invasives
<b>Other valuable links:</b>			
	<a href="http://www.invasivespeciesinfo.gov/">http://www.invasivespeciesinfo.gov/</a>	USDA Agricultural Library	Nat'l plans, general info
	<a href="http://plants.ifas.ufl.edu/">http://plants.ifas.ufl.edu/</a>	Center for Aquatic and Invasive Plants	Info on Florida sp.
	<a href="http://www.invasiveplants.net/">http://www.invasiveplants.net/</a>	Cornell University	Biological Control
	<a href="http://www.ipmnet.org/cicp/">http://www.ipmnet.org/cicp/</a>	CICP, IPPC, Nat. IPM Network	Database of info
	<a href="http://www.fws.gov/invasives/">http://www.fws.gov/invasives/</a>	US Fish and Wildlife Service	Links for more info
	<a href="http://www.paflora.org/">http://www.paflora.org/</a>	University of Penn. Flora project	Database of PA records
	<a href="http://www.cal-ipc.org/">http://www.cal-ipc.org/</a>	California Exotic Pest Plant Council	Info for CA
	<a href="http://www.fleppc.org/aboutus.htm">http://www.fleppc.org/aboutus.htm</a>	Florida Exotic Pest Plant Council	Info for Florida
	<a href="http://www.dcr.virginia.gov/natural_heritage/invspdflist.shtml">http://www.dcr.virginia.gov/natural_heritage/invspdflist.shtml</a>	Virginia Native Plant Society	Invasives of Virginia
	<a href="http://www.anr.state.vt.us/dec/waterq/lakes/hm/ans/lp_ans-index.htm">http://www.anr.state.vt.us/dec/waterq/lakes/hm/ans/lp_ans-index.htm</a>	VT DEC	Aquatic invasives in VT
	<a href="http://www.nps.gov/plants/alien/">http://www.nps.gov/plants/alien/</a>	Plant Conservation Alliance-Weeds Gone Wild	National List and Fact Sheets
	<a href="http://www.aphis.usda.gov/plant_health/plant_pest_info/weeds/index.shtml">http://www.aphis.usda.gov/plant_health/plant_pest_info/weeds/index.shtml</a>	APHIS	Noxious Weed List
	<a href="http://www.ncagr.com/plantindustry/plant/weed/noxweed.htm">http://www.ncagr.com/plantindustry/plant/weed/noxweed.htm</a>	NC Dept. of Ag.	Noxious weeds of NC
	<a href="http://www.dnr.sc.gov/water/envaff/aquatic/illegal1.html">http://www.dnr.sc.gov/water/envaff/aquatic/illegal1.html</a>	SC Dept. of Natural Resources	SC Illegal Aquatic Plants
	<a href="http://invader.dbs.umt.edu/">http://invader.dbs.umt.edu/</a>	University of Montana-Missoula	Database for Montana
	<a href="http://www.botany.hawaii.edu/Invasive/default.htm">http://www.botany.hawaii.edu/Invasive/default.htm</a>	University of Hawaii	Hawaii Marine Invasives
	<a href="http://www.macmerik.nl/indexflora.html">http://www.macmerik.nl/indexflora.html</a>	Flora of Europe	General photos

Reference List of Websites Related to Invasive Plants  
(originally from Natural Resources Conservation Service links)



## References and Resources

The following list may be helpful in researching taxa to which you are assigned. It is far from complete, but may include some references you may not be familiar with. These and many other books are in the Newcomb Library at Garden in the Woods, which is open weekdays. If you need special help on the weekends please call in advance.

Brown, Melvin L., and Russell G. Brown. Herbaceous Plants of Maryland. 1984. Good illustrations of some difficult species such as sedges and grasses. Limited range.

Brumback, William E. and Leslie J. Mehrhoff, et al. Flora Conservanda: New England. The New England Plant Conservation Program (NEPCoP) List of Plants in Need of Conservation. *Rhodora* 98, No. 895, 233-361, 1996. A list with the status of each plant in each state. Can be purchased from the Garden in the Woods.

Crow, Garret E. New England's Rare, Threatened and Endangered Plants. 1982. Some illustrations and detailed information on the most threatened species.

Crow, Garret E. and C. Barre Hellquist. Aquatic and Wetland Plants of Northeastern North America. 2000. Keys and illustrations of wetland and aquatic plants.

Fassett, Norman C. A Manual of Aquatic Plants. 1940. Dated nomenclature, but helpful illustrations.

Fernald, Merritt C. Gray's Manual of Botany, 8<sup>th</sup> Edition. 1950. Tried and true. Somewhat superseded by Gleason and Cronquist.

Gleason, Henry A. and Arthur Cronquist. Manual of Vascular Plants. 1991. The most current nomenclature and keys. A single reference for the field. No illustrations.

Gould, Lisa L. and Richard W. Enser, et al. Vascular Flora of Rhode Island. A List of Native and Naturalized Plants. Volume 1 of The Biota of Rhode Island. The Rhode Island Natural History Survey, 1998. Checklist of plants known to occur in Rhode Island. Gives synonyms and status and abundance of each species in Rhode Island.

Godfrey, Robert K. and Jean W. Wooten. Aquatic and Wetland Plants of Southeastern United States. 1979. A useful, illustrated reference for aquatics.

Haines, Arthur and Thomas F. Vining. Flora of Maine. 1998. Some species overlap with other New England states; no illustrations.

Haines, Arthur. The Genus Viola of Maine - A Taxonomic and Ecological Reference. 2001. Provides detailed keys, photos, and descriptions of all species found in Maine.

Haines, Arthur. The Families Huperziaceae and Lycopodiaceae of New England- A taxonomic and ecological reference. 2003. Provides detailed keys, photos, and descriptions of all species and hybrids found in New England.

Hellquist, C. B. Aquatic Vascular Plants of New England. 1980. This is an illustrated series of small volumes.



Holmgren, Noel H. The Illustrated Companion to Gleason and Cronquist's Manual. 1998. Very useful illustrations to accompany Gleason and Cronquist.

Magee, Dennis W. and Harry E. Ahles. Flora of the Northeast. A Manual of the Vascular Flora of New England and Adjacent New York. University of Massachusetts Press, Amherst, MA. 1999.

Martha's Vineyard Sandplain Restoration Project. The Flora of Martha's Vineyard. The Mary P. Wakeman Center, Vineyard Haven, MA. A good resource if working on the island. Provides community descriptions, species status on the island and habitat preferences.

Mohlenbrock, Robert H. The Illustrated Flora of Illinois. 1976-1990. These volumes have excellent botanical drawings of many species. Scope is limited to the state.

Natural Heritage Program Rare Plant Fact Sheets: We have a full set from several states in the library, and many are available on each state's natural heritage program website.

New England Aquarium and MA Department of Environmental Management. A Guide to Aquatic Plants in Massachusetts. 1999. A good introduction to aquatic plants, with simplified keys and drawings. Not all aquatic species included, but a good start! Available from the Aquarium at [www.neaq.org](http://www.neaq.org).

New England Wild Flower Society. Conservation and Research Plans. 2000-2004. Available for New England's 110 rarest plant species. Can be obtained from NEWFS or online at <http://www.newfs.org/protect/>

Newcomb, Lawrence. Newcomb's Wildflower Guide. 1977. Many of the plants will be in Newcomb's, but double check a more complete flora such as Gleason and Cronquist for similar species and their ranges. Newcomb doesn't have it all.

Sorrie, Bruce A. and Paul Somers. The Vascular Plants of Massachusetts: A County Checklist. Massachusetts Division of Fisheries and Wildlife, Massachusetts Natural Heritage and Endangered Species Program. 1999. A long time coming, but worth the wait. Provides county distribution, native status, nomenclature and common name.

Seymour, Frank C. The Flora of New England. 2<sup>nd</sup> Edition. 1989. No illustrations, but useful information on flowering times and species range.

Tucker, Gordon C. The Vascular Flora of Southeastern Connecticut. 1995. A checklist of species with habitat descriptions and listings of herbarium records.

Voss, Edward G. Michigan Flora: Vol I: Gymnosperms and Monocots. 1972. Keys are a great help with the sedges; however, does not include coastal species.

### **Places to visit:**

The Garden in the Woods: We grow many rare plants. Come to our Rare Plant Garden to see what they look like before you go into the field.

Gray Herbarium, Harvard Herbaria, 22 Divinity Ave. Cambridge, MA. On a rainy day, check out the dried specimens to help identify the living plants. Call first for hours and protocols: 617-495-2365.



Peabody/Essex Museum Herbarium, East India Square, Salem, MA. Essex County flora. Call Jane Winchell, Natural History Department, 978-745-1876. You can purchase a copy of the Flora of Essex County through the herbarium.

Pringle Herbarium, Botany Department, University of Vermont, Burlington VT. Contact David Barrington for information 802-656-3221.

G. S. Torrey Herbarium, University of Connecticut, Storrs, CT. Contact Les Mehrhoff for information 860-486-1889.

University of Maine Herbarium, Orono, ME. Contact Christopher Campbell: 207-581-4394.

### **Websites:**

Arthur Haines. <http://www.arthurhaines.com/> The current home of Flora Novae Angliae. A comprehensive list of New England flora and some keys; a good source for up-to-date taxonomy!

Center for Plant Conservation. <http://www.centerforplantconservation.org>. Provides plant profiles for selected rare plants, with photos, descriptions, and distribution maps.

Connecticut Botanical Society <http://www.ct-botanical-society.org/> Provides photos of many species.

Flora of North America <http://www.fna.org/FNA/> Provides species descriptions, keys, and distribution maps.

Google <http://www.google.com> Typing in the scientific name often yields many useful links and images.

MassGIS <http://www.mass.gov/mgis/mapping.htm>

Missouri Botanical Garden. <http://www.mobot.org/>. Search engine for taxonomic information on plants and over 50,000 plant images.

The Nature Conservancy, Invasive Species Initiative. <http://tncweeds.ucdavis.edu/esadocs.html> Information on invasive species and their impacts.

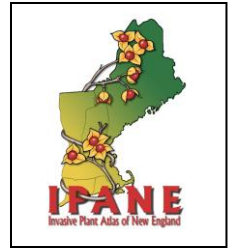
NatureServe. <http://www.natureserve.org/> Provides information on species ecology, range, habitat, and lists additional references.

New England Wild Flower Society. <http://www.newfs.org/> Provides links to Natural Heritage program websites, electronic versions of field forms, conservation plans, and more!

PLANTS Database <http://plants.usda.gov/> A good source for images.

Topozone <http://www.topozone.com/> Enter GPS points to create and print topographic maps.

# Alternatives to using invasive plants in landscapes



Many plants have similar growth forms, leaf shape, fall color, and flowering habits as non-native invasive species. These alternatives can serve as a substitute for the continued addition of problematic species to landscapes and yards. Several organizations have created lists of invasive species and similar alternatives; a few are listed below.

New England Wildflower Society: Alternatives-Beautiful native and non-invasive landscaping options

<http://www.newfs.org/protect/invasive-plants/alternatives-to-invasives-in-the-landscape>

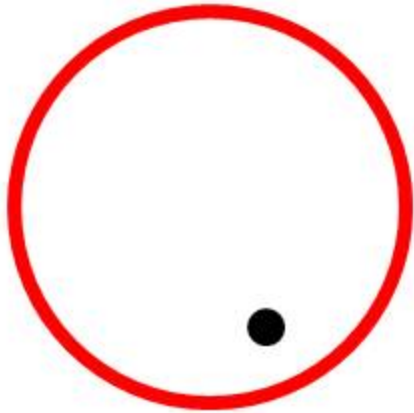
A list of invasive and potentially invasive plants and native substitutes with both scientific and common names.

Alternatives for Invasive Ornamental Plant Species- A guide by Tim Abbey, CT Agriculture Experiment Station

<http://www.hort.uconn.edu/CIPWG/>

This color booklet (available online as a .pdf) lists some of the most problematic invasive species and suggests several similarly appearing native or non-invasive plants. Includes short species descriptions, growing characteristics, and color photographs.

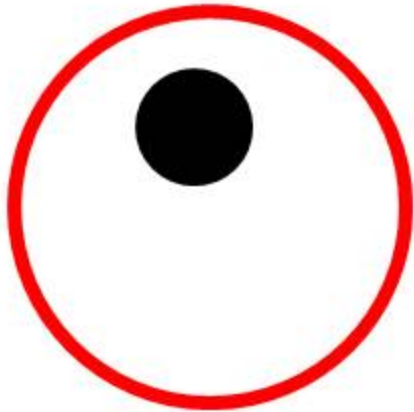
## Diagram of distribution classifications.



1. Single Plant



2. Evenly Sparse



3. Single Patch



4. Multiple Patches



5. Dense Throughout