The IPANE Project: An Introduction to New England's Early Detection Network

Leslie J. Mehrhoff, Chrisopher J. Mattrick, and John A. Silander

USDA - CSREES IP Meeting

Washington, DC **30 AUG 2005**

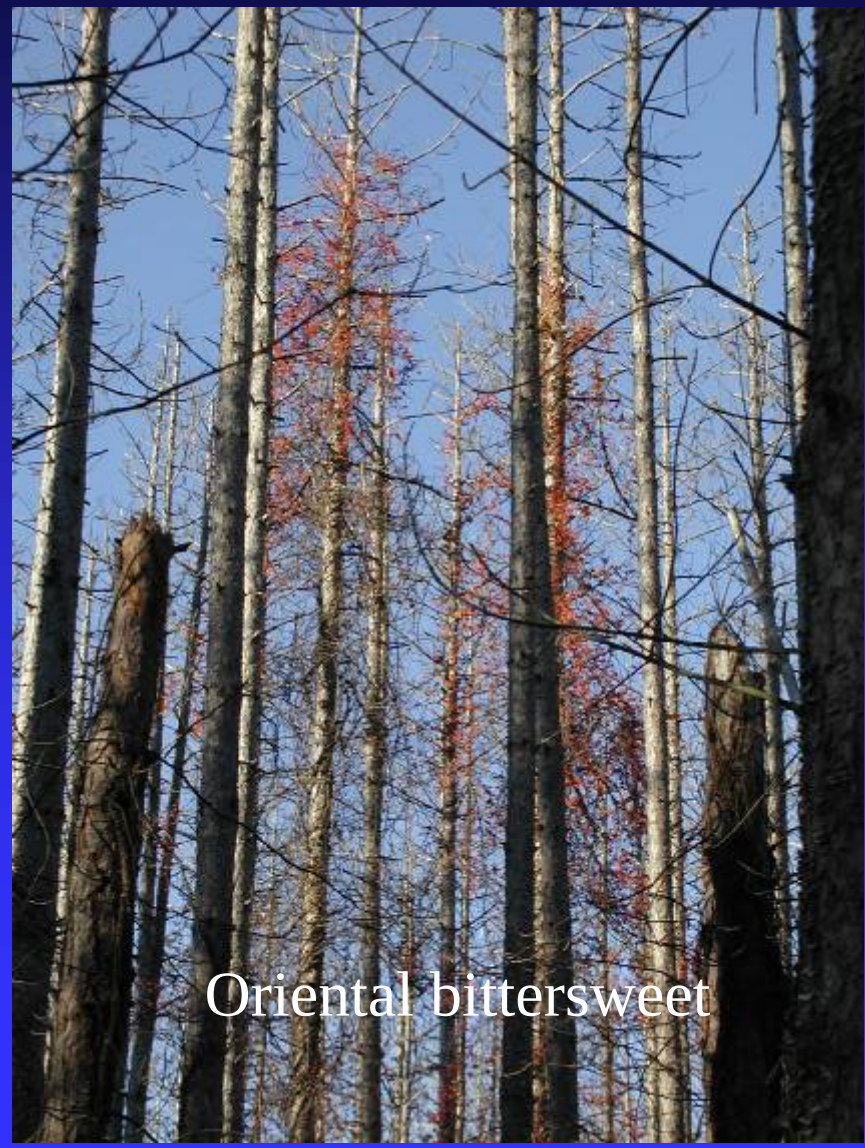
The Problems (late 1990s)

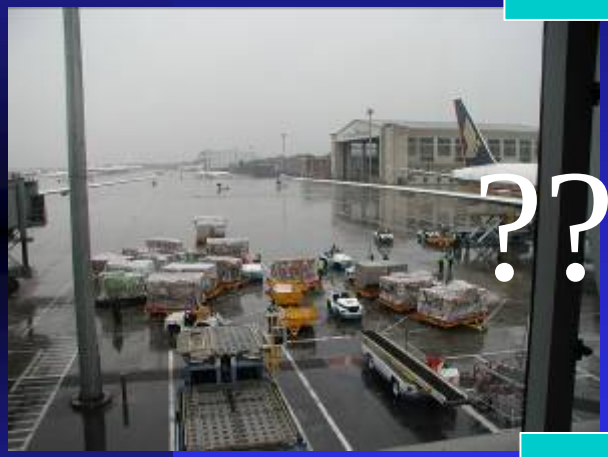
- Certain species of non-native plants were increasing across New England
- Potentially invasive plants were still being discovered in New England
- There was no established infrastructure to deal with these invasions

NEW ENGLAND – An invaded landscape


Japanese barberry


Japanese stilt-grass


Oriental bittersweet



??????

What's next?

The Problems on the ground…

- We need to know…
  - What invasive plants are already on the landscape
  - Where they are
  - How abundant they are
  - About their biology in order to control them
- We also need to find new incursions before…
  - They become well established and spread
  - The cost or environmental damage of their eradication is prohibitive

Pre-IPANE lack of infrastructure to deal with invasive plants in New England

- There were very few floristic botanists knowledgeable on the vascular flora of New England.
- No states had programs specifically for invasive plants.
- No paid staff solely devoted to invasive species work.
- How do you find and pull together a volunteer network across 6 states?
- How do you turn personal contacts into an extended invasive plant network?
- There were no established protocols for developing predictive models that could be implemented in New England.

1990s

- Desire to develop an atlas of invasive plants similar to breeding bird or butterfly atlases
- Silvio O. Conte National Fish & Wildlife Sanctuary Invasive Plant Control Initiative Strategic Plan (March 1999) discusses need for invasive plant infrastructure in New England
- Massachusetts Invasive Plant Advisory Group funds herbarium work on invasive plants

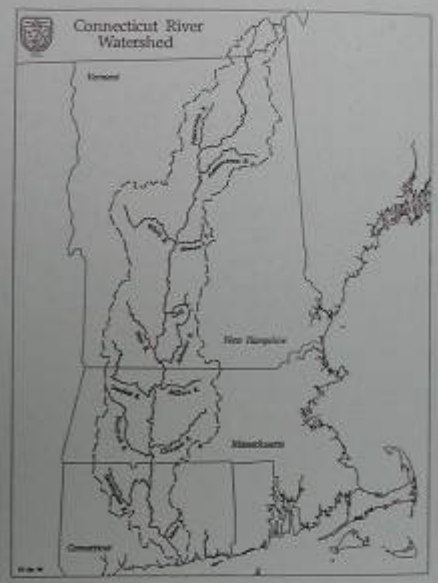
/ES Mahlstedt

THE CONNECTICUT RIVER WATERSHED/
LONG ISLAND SOUND

INVASIVE PLANT CONTROL INITIATIVE

STRATEGIC PLAN

Final
March, 1999



for the Invasive Plant Control Initiative Steering Committee, representing:
U.S. Fish &Wildlife Service, Silvio O. Conte National Fish & Wildlife Refuge
New England Wild Flower Society
Massachusetts Native Plant Advisory Committee
Vermont Agency of Natural Resources, Water Quality Division
Connecticut Department of Environmental Protection
New Hampshire Department of Environmental Services

funded by the National Fish and Wildlife Foundation

Report outlined existing concerns and need for a region-wide atlas of invasive plants and an infrastructure to deal with them.

2000

- Discussions between Silvio O. Conte and George Safford Torrey Herbarium (UCONN) on how to build a regional invasive plant network
- Partnership between Conte Refuge, UCONN, and New England Wild Flower Society Established
- **FICMENW EDRR** meeting

FICMNEW Early Warning and Rapid Response Workshop

June, 2000

- USGS Research Center, Ft. Collins, CO.
- Sponsored by USDA & USGS
- Broad Stakeholder Participation
- Five Working Groups
  - Early Detection
  - Rapid Assessment
  - Rapid Response
  - Outreach and Education
  - Operational Framework
- Proceedings (2-2001)
- Action Plan (Spring, 2001)

IPANE Team Development

- No pre-existing team
- Recognized the importance of having different expertise and organizational partners
- Blend existing knowledge, research, education, and outreach into effective region-wide program
- Existing personal networks used to create a 6-state regional network at all levels

2001

- Restructured USDA – CSREES – IFAFS grant based on comments received on 2000 attempt and new ideas from the FICMNEW EDRR meeting
- Increased NEWFS role and the importance of volunteer data gathers
- Used combined invasive plant network for endorsement
- Grant application submitted; project funded!

The IPANE Grant

An Early Detection
and
Rapid Assessment Network
for
New England

The IPANE Equation for EDRR

Early Detection +

Rapid Reporting +

Reliable data + appropriate predictive models

Good science =

Effective Strategic Response

The IPANE Early Detection Vision

If IAS get here, we can’t let them become established!

IPANE Project Participants

- University of Connecticut
  - Ecology & Evolutionary Biology
  - Homer Babbidge Library
  - Center for Cartographic Analysis
- Silvio O. Conte National Fish and Wildlife Refuge, US F&WS
- New England Wild Flower Society

Project Steering Committee

- Les Mehrhoff, UCONN, Project Director & CoPI
- John Silander, UCONN, PI
- Cynthia Boettner, USFWS, NIPGro Coordinator
- Beth Goettel, USFWS
- Chris Mattrick, NEWFS, Part-time Volunteer Coordinator
- Bill Brumback, NEWFS

Interested Stakeholders

- Land Managers
- Conservationists
- Government Agencies
- Regulators & Legislators
- Academia
- Green Industries
- Public

Advisory Committee

- David Boufford, Harvard University Herbaria
- Chris Dionigi, National Invasive Species Council
- Ann Gibbs, Maine State Horticulturist
- Bill Gregg, USGS
- John Kartesz, BONAP
- Dick Mack, Washington State University
- Scott Peterson, USDA Plants Database
- Barry Rice, TNC Wildland Weeds Program
- Annie Simpson, USGS NBII
- Tom Stohlgren, USGS NIISS
- Al Tasker, USDA APHIS
- Randy Westbrooks, USGS
- Tom Bewick, USDA CSREES (*ex officio*)

Federal Partners…

- U. S. Fish and Wildlife Service
- U. S. Department of Agriculture
  - U. S. Forest Service
  - PLANTS database
- U. S. Geological Survey
  - Biological Research Division
  - National Biodiversity Info Infrastructure
  - National Institute for Invasive Species Science
- National Park Service
- FICMNEW

Some Other Partners…

- New England Wild Flower Society
- TNC – Wildland Invasive Species Team
- The Flora of North America Project
- Biota of North America Project
- Northeast Aquatic Nuisance Species Panel
- Global Invasive Species Information Network
- Connecticut Invasive Plants Council
- Massachusetts Nursery and Landscape Association
- Federated Garden Clubs of New England
- Appalachian Mountain Club
- Massachusetts Audubon Society
- Friends of Acadia

IPANE Goals

- New England Early Detection Network
- Gather current & historic distributional data
- Make information available
- Conduct & encourage scientific research
- Develop predictive models using project data
- Increase public awareness about invasive plants
- Train volunteer spotters & citizen scientists
- Develop exportable protocols
- “Interoperability”

IPANE Project Components

- **Regional Early Detection Network**
- Atlas of invasive or potentially invasive plants in New England
- Interactive website
- Herbarium search and data capture
- Volunteer training & data gathering
- Research and predictive modeling
- Outreach (NIPGro)

Data Warehouse

IN

- Herbarium records
- Current field data
- Current research
- Invasive species information

OUT

- Species Catalog
- Records databases
- Maps
- Invasive species information

IPANE Databases

- Herbarium specimen database
- Current Field Data
- People database
  - Trained field volunteers
  - NIPGro members
  - Rapid Assessment contact people
  - State agency contacts

Volunteer Network – primary data gathers

- 530 in 3 years – 25 per state per year
  (original goal: 450/3 years, going for 600)
- Volunteer coordinator
- Staff-run introductory, “getting started”, and advanced training sessions
- Block-busting weekends
- Terrestrial and Aquatic species
- On-line reporting forms and volunteer list serve
- Verification and Quality Control mechanisms in place

The Invasive Plant Atlas of New England Website

- http:// ipane.org
- Spontaneous reporting mechanism
- Catalog of species – 114 and growing
- Maps & databases for tracked species
- Project information
- Noxious weed information
- Volunteer support information
- Much more!

Invasive Plant Atlas of New England

IPANE

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.

:: Invasive Alerts ::

:: Early Detection

:: IPANE Species

:: Data & Maps

USDA

New England Wild Flower Society

University of Connecticut

::Site Map
::Contact Us
::Report a Sighting

Citation Information:
Mehrhoff, L. J., J. A. Silander, Jr., S. A. Leicht, E. S. Mosher and N. M. Tabak. 2003.
IPANE: Invasive Plant Atlas of New England. Department of Ecology & Evolutionary Biology, University of Connecticut, Storrs, CT, USA.
URL: http://www.ipane.org

Spontaneous & Unsolicited Reports

- “Report sighting” button on website
- Ability to attach digital images
- Verification levels
  - IPANE staff
  - Regional herbaria
  - BONAP distribution
  - FNA authors
- Initiate Rapid Assessment process if necessary
- Respond to submitter

Invasive Plant Atlas of New England

Report Sightings


:: Species List (Scientific Names)


:: Species List (Common Names)


:: Table by States and Life Forms


:: Report a Sighting

Use this form to alert us to sightings of invasive species and activate our early detection network, or to ask questions of our experts. This is a communication tool: reports are not entered into our database from this form (a complete field form is necessary for inclusion in the database). Please attach a digital photograph if possible.

We require your name, a note to our staff, and either a e-mail address or a phone number.
** indicates a required field

Your Name **	
Your E-mail **	
Your Phone **	
Do you want to send a copy of this message to yourself?	○ Yes ◉ No
Your note to our staff **	
We can also accept pictures as further documentation. They must be either a (**.gif**, **.jpeg**, or **.png**).	Browse...

Send message | Reset

IPANE Catalog

- Scientific and common names
- Diagnostic & incursion photographs
- Descriptive text
- Historical information
- Similar species
- Hard copy references and hot links
- Management links

Invasive Plant Atlas of New England

Catalog of Species Search




Select at least one species.

Select species from the list
Acer ginnala
Acer platanoides
Acer pseudoplatanus
Aegopodium podagraria

Submit | Reset

Select at least one common name.

Select common names from the list
Reed sweetgrass
Amur honeysuckle
Amur maple
Amur peppervine

Submit | Reset

Search by Keyword(s)

Search by Keyword

SEARCH TIPS: To conduct a search on a partial word, use an asterisk *. *Example*: To search for words beginning with *lepid*, enter *lepid** in the text box.

You may also use *AND* or *OR* or *NOT*. *Example: Polygonum OR Lepidium.*

Browse the Catalog of Species

Browse by Species

Browse by Life Form

Select a life form

Submit

Metadata Model

IPANE
Invasive Plant Atlas of New England

NAVIGATION MENU

- Home
- Early Detection
- Catalog of Species
- Data & Maps
- Project Information
- Volunteers
- Related Links
- Noxious Weeds
- Discuss Invasives
- NE Plant Summit

Senecio jacobaea
(Tansy ragwort , stinking willie)

COMMON NAME

Tansy ragwort, stinking willie

FULL SCIENTIFIC NAME

Senecio jacobaea L.

FAMILY NAME COMMON

Aster family

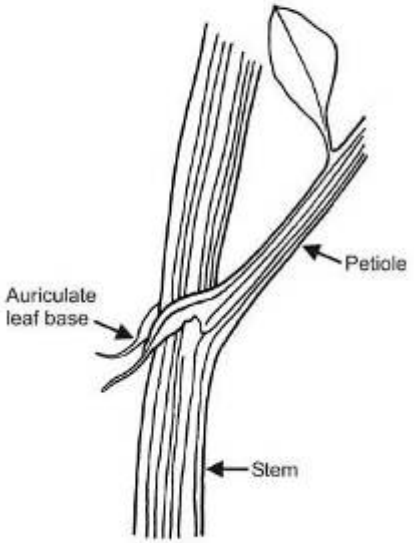
FAMILY SCIENTIFIC NAME

Asteraceae

IMAGES



C. impatiens, *C. parviflora* and *C. pensylvanica* all look very similar. The most important distinguishing characteristic is the sagittate-auriculate leaf bases of *C. impatiens*. These can be seen with the naked eye, but is more clearly visualized with a hand lens. See detail in illustration below.

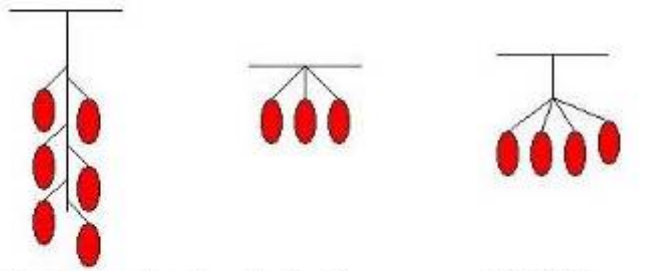


Detail of the sagittate-auriculate leaf base

Cardamine impatiens

Berberis spp.

Character	*Berberis thunbergii*	*Berberis ×ottawensis*	*Berberis vulgaris*
Branch spines	1 (can have up to 3)	varies	3 (can be 1)
Inflorescence*	sessile umbel	Subumbellate-raceme	Raceme
Leaf margin	Entire	Most often entire**	Serrate
Berry consistency	Dry	Dry	Juicy



Berberis vulgaris Berberis thunbergii Berberis ×ottawensis

Incursion photos –
Informative,
Hard to challenge

IPANE Website Databases

- HERBARIUM SPECIMEN RECORDS

  Records from 20+ herbaria when we finish

  Geographic perspective

    35,000 geo-reference points

  Historic perspective

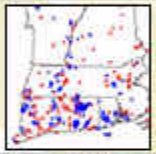
    Earliest records from 1840s

  Predictive modeling applications

Invasive Plant Atlas of New England

Data and Maps


:: Data


:: Maps


:: Search By Place

Select one species from the list below:

Show scientific names:

- Acer ginnala
- Acer platanoides
- Acer pseudo-platanus
- Aegopodium podagraria
- Ailanthus altissima
- Aira caryophyllea

Search by place

Select a data source: Herbarium specimens

Select a data output format: Formatted display as table

Submit Reset

Invasive Plant Atlas of New England

Data and Maps

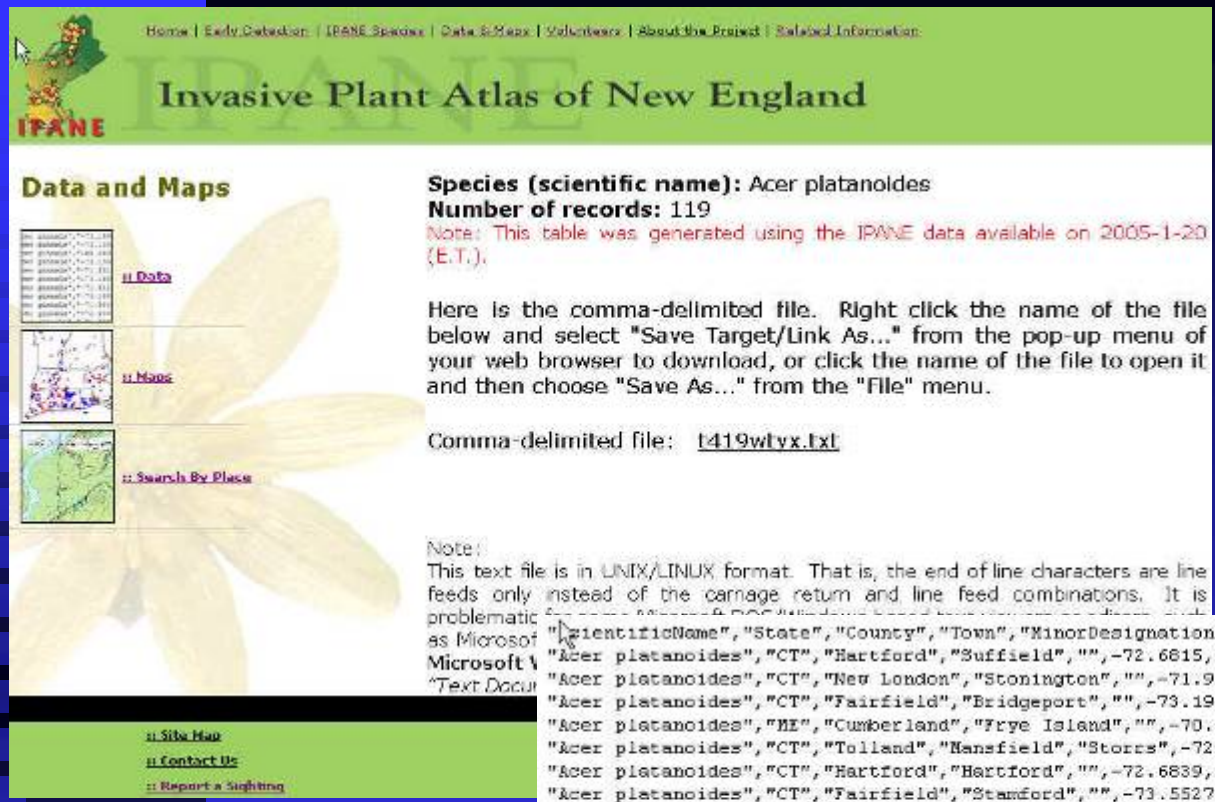

:: Data


:: Maps


:: Search By Place

Species (scientific name): Acer platanoides
Number of records: 119
Note: This table was generated using the IPANE data available on 2005-1-20 (E.T.).

ScientificName	State	County	Town	MinorDesignation	GeographyL
Acer platanoides	CT	Hartford	Suffield		-72.6815
Acer platanoides	CT	New London	Stonington		-71.9072
Acer platanoides	CT	Fairfield	Bridgeport		-73.1962
Acer platanoides	ME	Cumberland	Frye Island		-70.311
Acer platanoides	CT	Tolland	Mansfield	Storrs	-72.25
Acer platanoides	CT	Hartford	Hartford		-72.6839
Acer platanoides	CT	Fairfield	Stamford		-73.5527
Acer platanoides	CT	New Haven	North Haven		-72.859




```
"ScientificName","State","County","Town","MinorDesignation","GeographyLongitude","GeographyLatitude","Locality","
"Acer platanoides","CT","Hartford","Suffield","",-72.6815,42.0002,"Alcorn's Hartford","6/8/1960","","","","","Jes
"Acer platanoides","CT","New London","Stonington","",-71.9072,41.3651,"Morgan's Field","5/11/1978","","","","","E
"Acer platanoides","CT","Fairfield","Bridgeport","",-73.1962,41.1863,"","5/1/1895","","","","","Edwin Hubert Eame
"Acer platanoides","ME","Cumberland","Frye Island","",-70.311,43.505,"Route 32, West Willington Tolland, Willingt
"Acer platanoides","CT","Tolland","Mansfield","Storrs",-72.25,41.8083,"Road to vinyard","3/5/1911","","","","","A
"Acer platanoides","CT","Hartford","Hartford","",-72.6839,41.7657,"railroad right-of-way","7/16/1977","","","","","
"Acer platanoides","CT","Fairfield","Stamford","",-73.5527,41.0967,"Bartlett Arboretum","4/21/1981","","","","","
"Acer platanoides","CT","New Haven","North Haven","",-72.859,41.3818,"338 Quinnipiac Ave., in yard","8/3/1993",""
"Acer platanoides","CT","Hartford","Hartford","",-72.6839,41.7657,"48 Oxford St., at edge of yard","7/26/1990",""
"Acer platanoides","CT","Hartford","Suffield","",-72.6815,42.0002,"","6/30/1960","","","","","Jesse F. Smith","",
"Acer platanoides","CT","Fairfield","Stamford","",-73.5527,41.0967,"UConn branch campus","10/23/1979","","","","",""
"Acer platanoides","CT","New Haven","Southbury","",-73.2347,41.4735,"","8/6/1980","","","","","river shore","Harry E
"Acer platanoides","CT","Hartford","Suffield","",-72.6815,42.0002,"435 No. Main St.","9/13/1960","","","","","Lawn",
"Acer platanoides","CT","Fairfield","Fairfield","",-73.2724,41.1757,"Jennings Woods","5/7/1940","","","","","Edwi
"Acer platanoides","CT","Fairfield","Stratford","",-73.1302,41.2043,"Seaside Park","8/24/1893","","","","","C. E.
"Acer platanoides","CT","New London","Montville","Haughton Mountain",-72.1097,41.4461,"Rts. 32  163 at S end of H
"Acer platanoides","CT","Fairfield","Stamford","",-73.5527,41.0967,"Bartlett Arboretum","10/24/1979","","","","",
"Acer platanoides","CT","Tolland","Mansfield","Storrs",-72.25,41.8083,"","5/31/1920","","","","","George Safford
"Acer platanoides","CT","Fairfield","Redding","",-73.3933,41.3044,"Greenbush Rd.","7/23/1988","","","","roadside"
"Acer platanoides","CT","Tolland","Mansfield","Storrs",-72.25,41.8083,"North Eagleville Rd.","4/16/1968","","","","
"Acer platanoides","CT","Fairfield","Fairfield","",-73.2724,41.1757,"","6/7/1940","","","","","Edwin Hubert Eames
"Acer platanoides","CT","Tolland","Mansfield","Storrs",-72.25,41.8083,"","1/1/1800","","","","","Dorothy B. Alin"
"Acer platanoides","MA","Norfolk","Brookline","",-71.1424,42.3231,"","6/30/1901","","","","","F. F. Forbes","",O.
"Acer platanoides","MA","Franklin","Deerfield","South Deerfield",-72.6083,42.4772,"","8/3/1972","","","","","Step
"Acer platanoides","NH","Strafford","Milton","",-71.0138,43.4526,"","10/29/1968","","","","","woods","Albion R. Hodg
"Acer platanoides","CT","New London","Old Lyme","",-72.3036,41.3172,"Duck River Cemetery","6/12/1997","","","","",
"Acer platanoides","MA","Middlesex","Medford","",-71.1087,42.4225,"Tufts University","6/2/1976","","","","","unspeci
"Acer platanoides","MA","Middlesex","Medford","",-71.1087,42.4225,"Tufts University","6/2/1976","","","","","Szep
"Acer platanoides","CT","New Haven","New Haven","",-72.9241,41.3101,"","6/23/1999","","","","","utility right-of-way
"Acer platanoides","CT","Fairfield","Norwalk","",-73.4202,41.0939,"Sheffield Island, Stewart B. McKinney NWR","6/
"Acer platanoides","CT","Fairfield","Fairfield","",-73.2724,41.1757,"I-95 at Exit 22, Benson Road Fairfield Co.,
```

IPANE Website Databases

- CURRENT FIELD RECORDS

  Ecological & site specific data

  Population size and status information

  Modeling & pathways applications

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 10/09/02

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 (please circle - decimal degrees, minute, sec) 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
Forests	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)

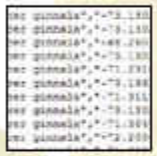
Canopy Closure	0-25%	26-50%	51-75%	76-100%	

IPANE Maps

- New maps generated as new data are added
- Herbarium records & current reports
- State, county, town, & site occurrence
- Maintained by USGS - NBII
- ?? Automated

Invasive Plant Atlas of New England

Data and Maps


:: Data


:: Maps


:: Search By Place

Select one species:

Show scientific names:

- Acer ginnala
- Acer platanoides
- Acer pseudo-platanus
- Aegopodium podagraria
- Ailanthus altissima
- Aira caryophyllea

Search by place

Select your study area:

- (•) The whole New England area
- ( ) One or more states
- ( ) One or more counties
- ( ) One or more towns (county sub-divisions)

Submit Reset

ant Atlas of New England

Select a map type (see map examples):

- (•) Existence of species
- ( ) Specimen/observation location map
- ( ) Choropleth map for specimen counts
- ( ) Choropleth map for specimen density

Select mapping data source(s):

- (•) Herbarium specimens
- ( ) Field records
- ( ) Both (only available for specimen/observation location map

Submit Reset

Classes, legends, and labels:

Below are the classes and their colors and labels, which are automatically generated by the system, based on the map type, and the mapping data. You can modify the colors and class lables, but not the classification rules.

Symbol for both berbarium specimens and field records:
Symbol: Dot Size: 5 x 5 pixels

Number of classes: 2

	Symbol Color	Fill Color	Classification	Class Label
1		#ff0000	10	Herbarium specimens
2		#0000ff	20	Field records

Map title and legend title: Show

Submit Reset

nt Atlas of New England

Select your study areas:

09001 Fairfield, Connecticut
09003 Hartford, Connecticut
09005 Litchfield, Connecticut
09007 Middlesex, Connecticut
09009 New Haven, Connecticut
09011 New London, Connecticut
09013 Tolland, Connecticut
09015 Windham, Connecticut
23001 Androscoggin, Maine
23003 Aroostook, Maine
23005 Cumberland, Maine
23007 Franklin, Maine
23009 Hancock, Maine
23011 Kennebec, Maine
23013 Knox, Maine
23015 Lincoln, Maine

Select the geographical units of interest:

- (•) Counties
- ( ) Towns (county sub-divisions)

Submit Reset

Invasive Plant Atlas of New England

Data and Maps


:: Data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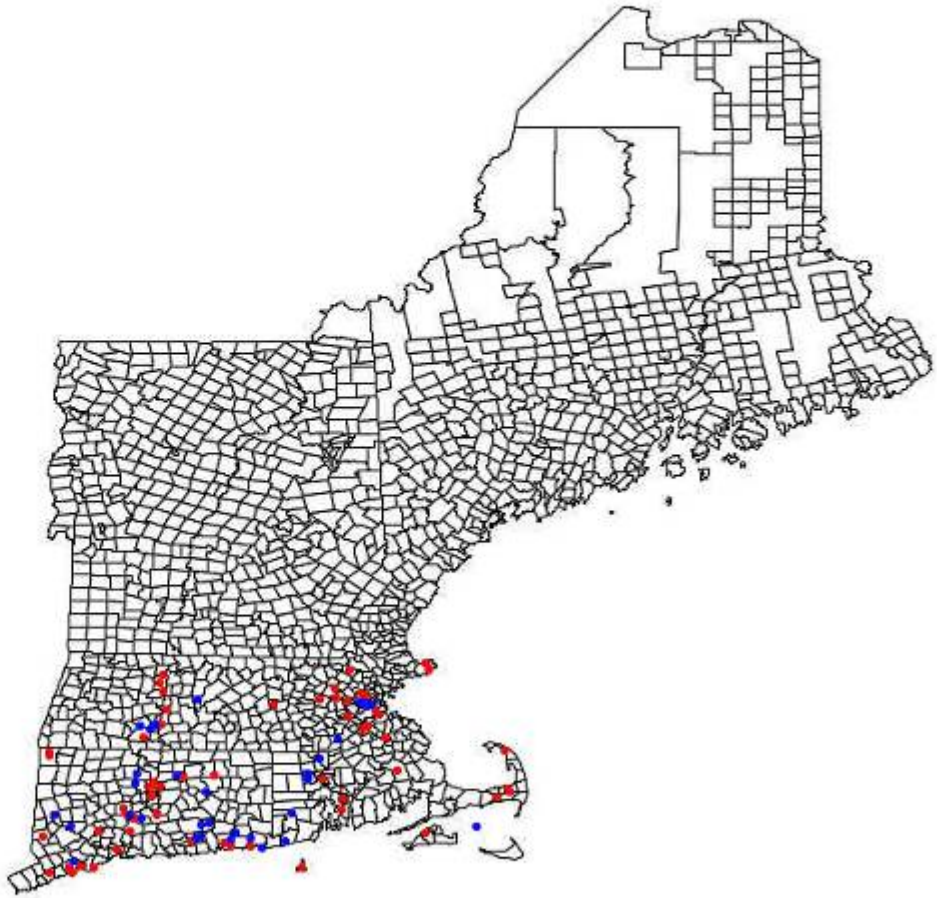
:: Search By Place

Distribution of Ailanthus altissima



This map was generated using the IPANE data available on 2005-1-20 (E.T.). Prepared by the IPANE project.

Occurrence

- Herbarium specimens
- Field records

IPANE Early Detection Information

- List of “Early Detection Species”
- Table of species’ status in all 6 states
- Table of species’ status in all 67 counties
- Regularly updated
- Early detection protocols
- How to report a possible new incursion
- “Weeds To Watch For”

New England Wild Flower Society

Invasive Plant Atlas of New England

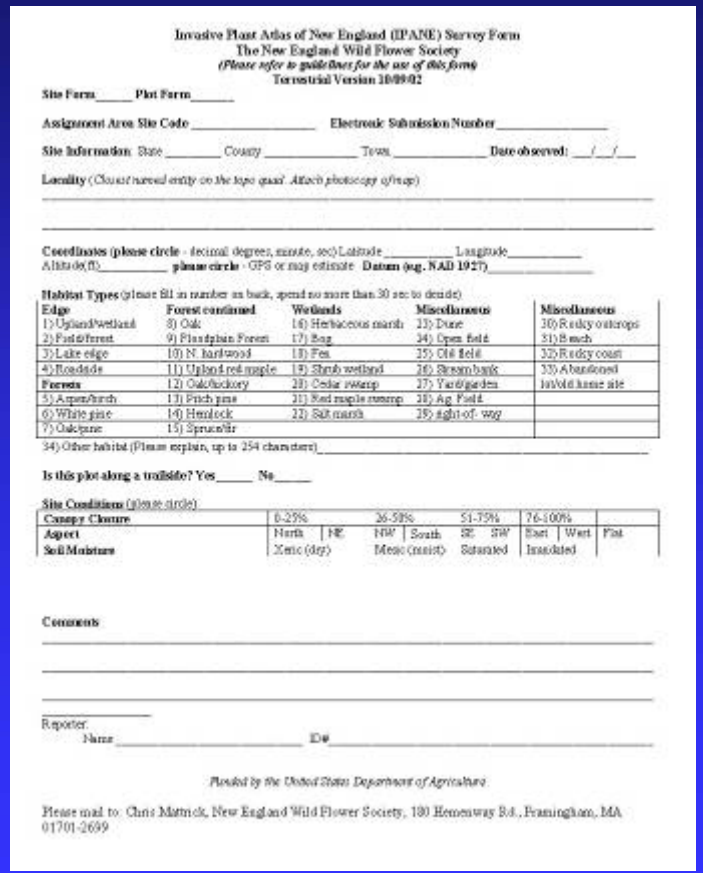
A Citizen Science Volunteer Network

New England Wild Flower Society Primary Roles

- Recruiting and training volunteers. Develop and provide training materials and opportunities for volunteers
- Coordinating volunteer data collection in the field
- Ensuring data are properly entered and uploaded to database and website
- Quality control data collection and data submission
- Verify data via submitted specimens and images

The Problem: Lack of scientifically collected Data

- Solution 1: Develop a survey form and methodology to gather the appropriate information
- Must be easy to use and understand.



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 10/09/02

Site Form_____ **Plot Form**_____

Assignment Area Site Code _____ **Electronic Submission Number**_____

Site Information State _____ County _____ Town _____ **Date observed:** __/__/__

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

_____

_____

Coordinates (please circle - decimal degrees, minute, sec) Latitude _____ Longitude_____
Altitude(ft)_____ **please circle** - GPS or map estimate **Datum (eg. 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
Forests	12) Oak/hickory	20) Cedar swamp	27) Yard/garden	Individual home site
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	NW	South	SE SW	East West	Flat
Soil Moisture	Xeric (dry)		Mesic (moist)		Saturated	Inundated	

Comments

_____

_____

_____

Reporter:
Name _____ ID# _____

Funded by the United States Department of Agriculture

Please mail to: Chris Mattrick, New England Wild Flower Society, 180 Hemenway Rd., Framingham, MA 01701-2699

- Solution 2: Recruit a volunteer corps able and willing to collect needed data.
- Volunteer recruitment from a variety of sources: garden clubs, land trusts, conservation organizations, newspaper advertising

Each Volunteer receives

- A training manual
- A field guide to the identification of 50 invasives species
- Training on survey methods and species identification.
- Survey methods include both plot sampling and opportunistic sampling
- An assignment area – USGS topographic quad with identified natural areas to survey
- Office and field support from Atlas staff

Volunteer Training – six introductory trainings offered each year – one in each New England state.

Advanced Trainings on Special Topics and Difficult Groups

Graminoids

Aquatics

Unusual herbs

Getting Started Programs and Blockbusting Weekends

- Getting started - field programs designed to help newly trained volunteers get started on their survey assignments
- Blockbusting – similar to bio blitzes, these weekend long events target under-surveyed regions and bring groups of volunteers together to go out and collect data on invasives found. Highly successful with five to six quads being completed at each location

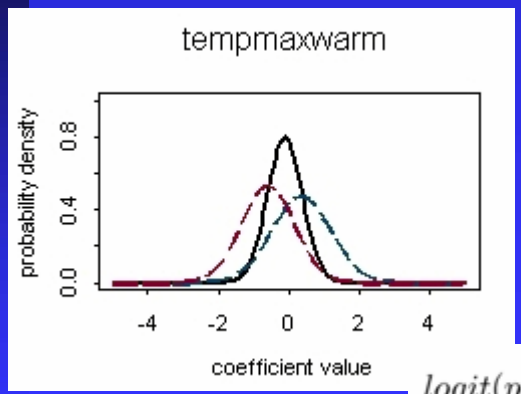
Volunteers & Accomplishments

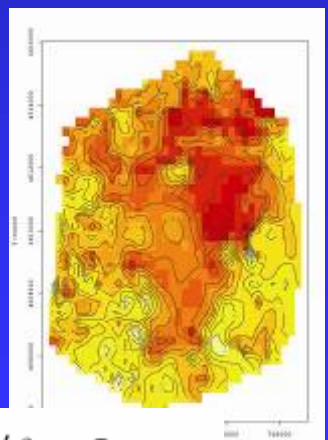
- 585 trained volunteers
- 700+ volunteers in our database
- Data gathering on 302 USGS quads
- Almost 7,000 individual species observations
- Over 3,000 data collection forms submitted
- Over 50 IPANE presentations and recruitment programs given throughout the region

- Twenty-eight introductory training programs presented to volunteers
- Offered nine advanced trainings on Early Detection species
- Targeting group volunteer activities in under-served regions – through blockbusting weekends
- Offering Getting Started programs
- Involving IPANE volunteers in management and control activities

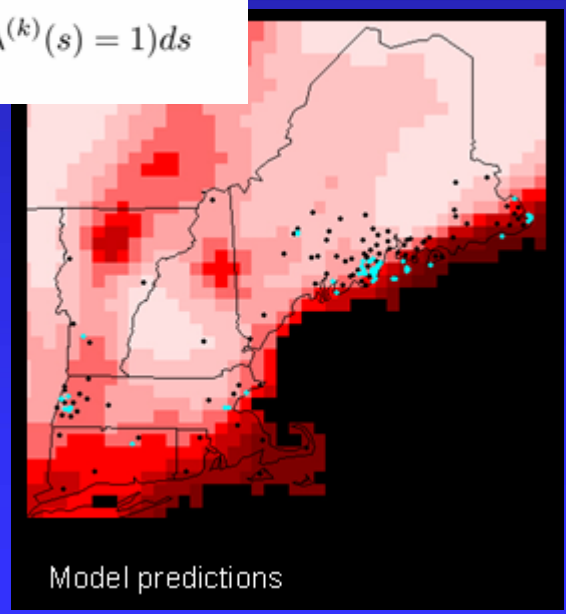
Predictive Modeling of Invasive and Potentially Invasive Species in New England

$$p_i^{(k)} = 1/|A_i| \int_{celli} \lambda^{(k)}(s)ds = 1/|A_i| \int_{celli} 1(\lambda^{(k)}(s) = 1)ds$$





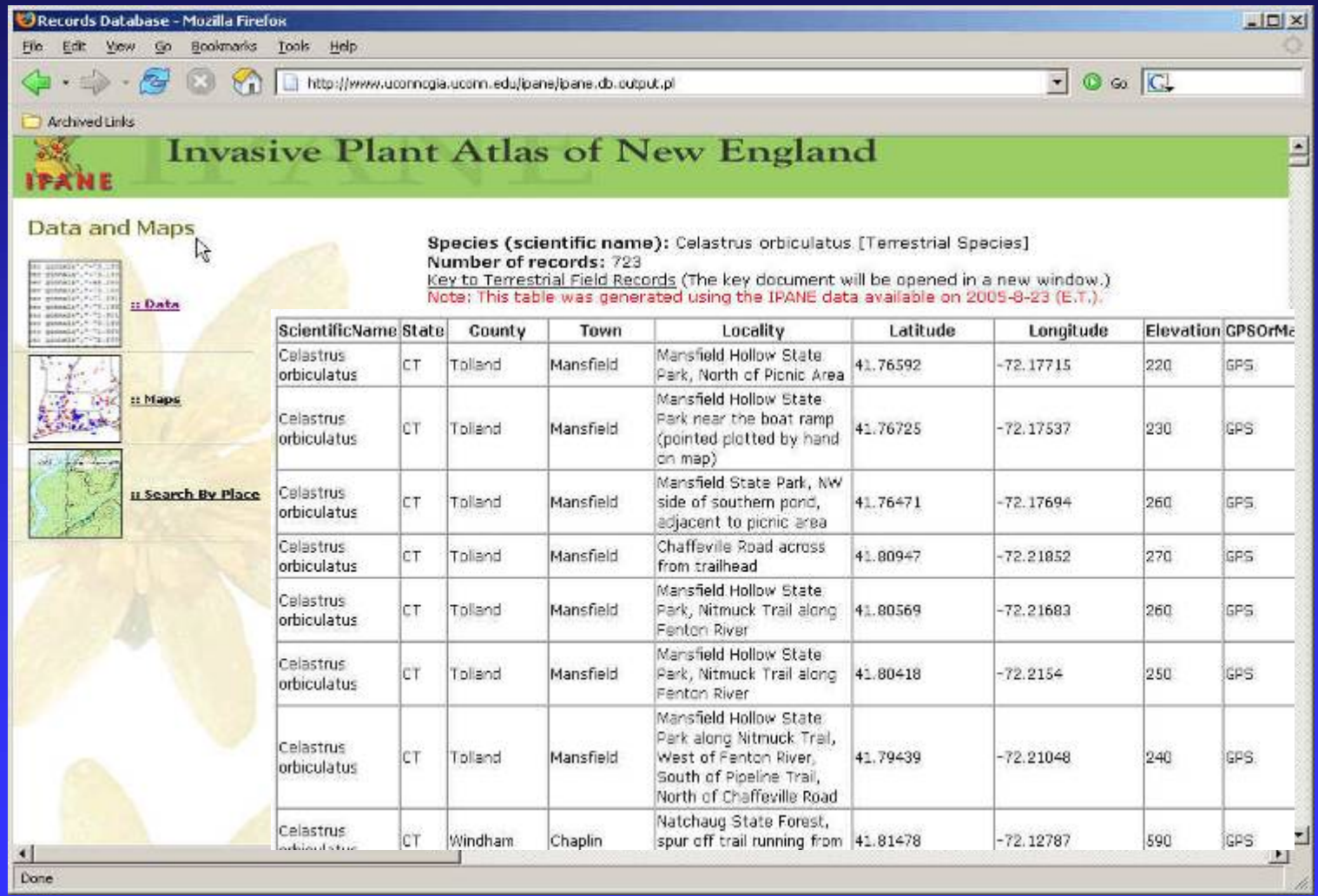
$$logit(p_i^{(k)}) = w_i'\beta_k + \Psi_k + \rho_i$$



Model development challenges

- What are necessary and sufficient data to develop predictive models?
- What is the appropriate spatial scale for the model predictions?
- What models to use?
- How to evaluate model predictions?
- How to use model predictions in early detection management?

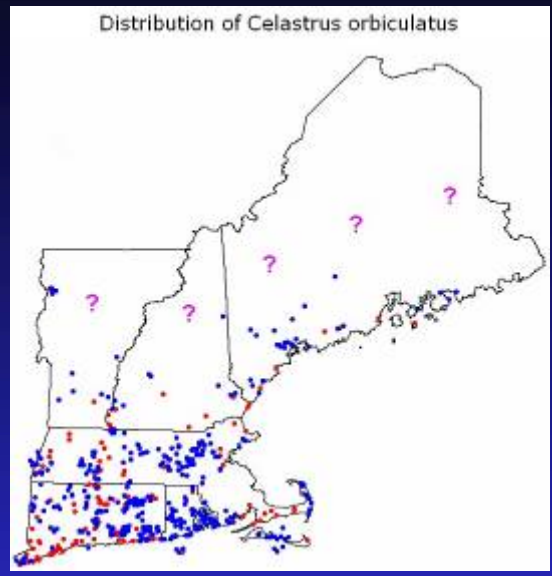
The data from IPANE database

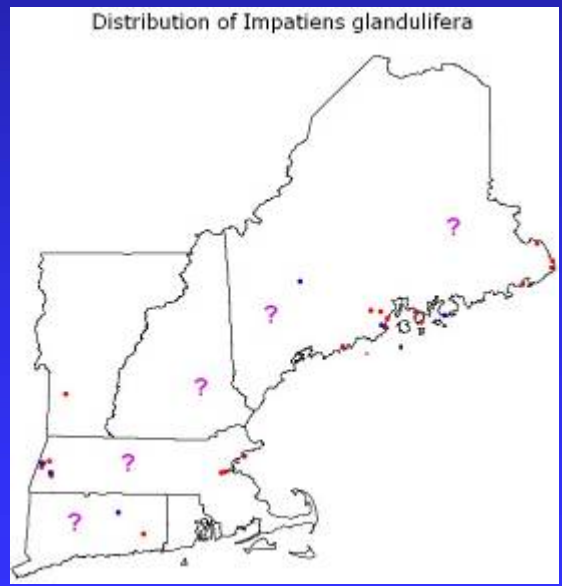


ScientificName	State	County	Town	Locality	Latitude	Longitude	Elevation	GPSOrMa
Celastrus orbiculatus	CT	Tolland	Mansfield	Mansfield Hollow State Park, North of Picnic Area	41.76592	-72.17715	220	GPS
Celastrus orbiculatus	CT	Tolland	Mansfield	Mansfield Hollow State Park near the boat ramp (pointed plotted by hand on map)	41.76725	-72.17537	230	GPS
Celastrus orbiculatus	CT	Tolland	Mansfield	Mansfield State Park, NW side of southern pond, adjacent to picnic area	41.76471	-72.17694	260	GPS
Celastrus orbiculatus	CT	Tolland	Mansfield	Chaffeville Road across from trailhead	41.80947	-72.21852	270	GPS
Celastrus orbiculatus	CT	Tolland	Mansfield	Mansfield Hollow State Park, Nitmuck Trail along Fenton River	41.80569	-72.21683	260	GPS
Celastrus orbiculatus	CT	Tolland	Mansfield	Mansfield Hollow State Park, Nitmuck Trail along Fenton River	41.80418	-72.2154	250	GPS
Celastrus orbiculatus	CT	Tolland	Mansfield	Mansfield Hollow State Park along Nitmuck Trail, West of Fenton River, South of Pipeline Trail, North of Chaffeville Road	41.79439	-72.21048	240	GPS
Celastrus orbiculatus	CT	Windham	Chaplin	Natchaug State Forest, spur off trail running from	41.81478	-72.12787	590	GPS

Data sufficiency?

- Current and historical data on the distribution of invasive species may not be sufficient for good predictive models of potential distributions.
- Should native ranges or other distributions be used as well?
- What to do with presence only data? How to generate absence data?



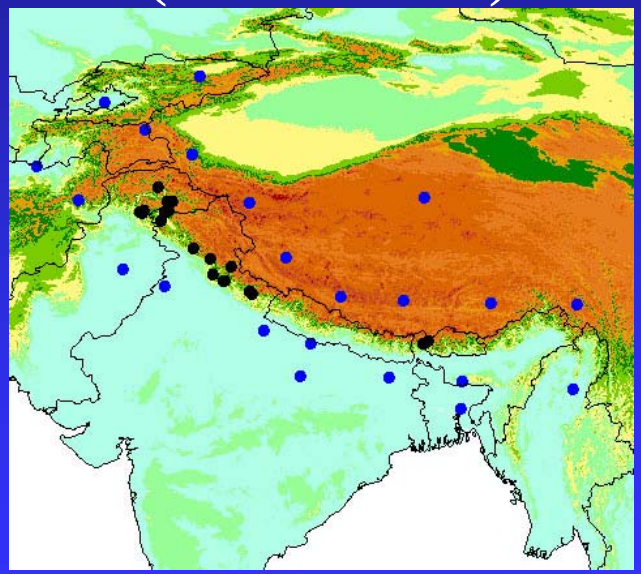


Presence and absence data

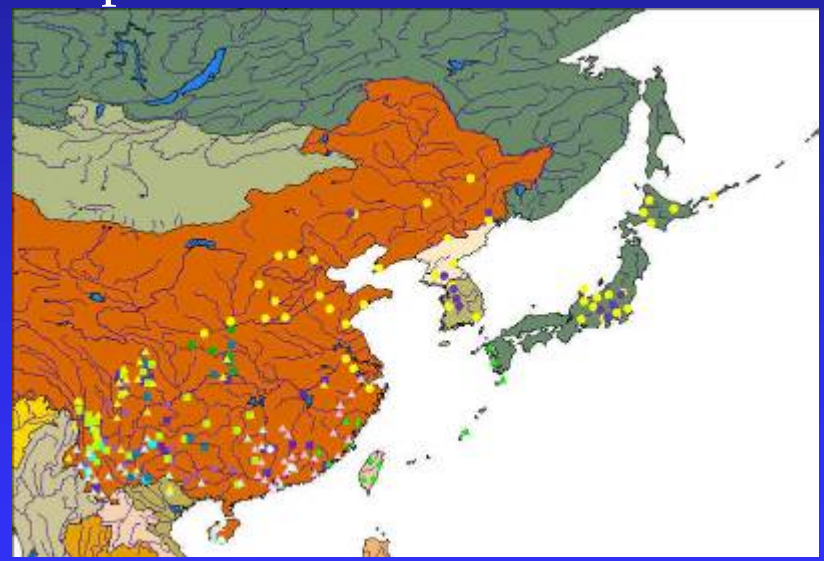
- The field record surveys were developed to generate both presence and absence data.
- But absences do not necessarily mean that the species cannot occur there now or in the future.
- Herbarium data provide presence only information.
- Presence of conspecifics in herbarium datasets may provide data on informed absences for the species of interest; ecological knowledge may also provide insight into informed absences.

Native Range Distributions

Impatiens glandulifera distribution in South Asia (black circles)



Celastrus orbiculatus distribution in East Asia (yellow circles) with conspecifics

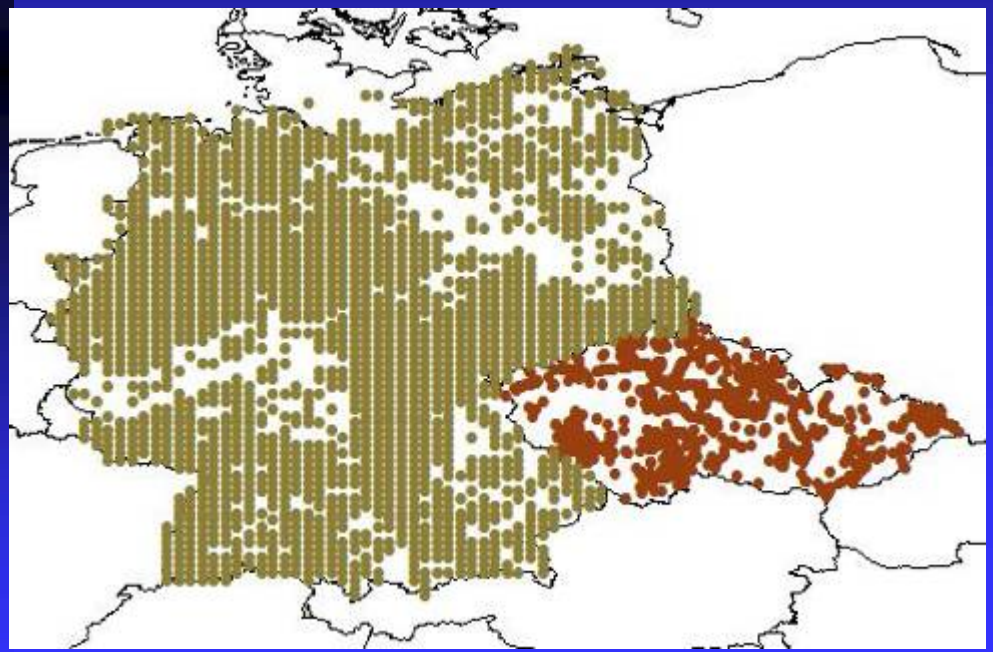


The challenge is obtaining reliable occurrence (presence) data for native ranges. And what about absence data?

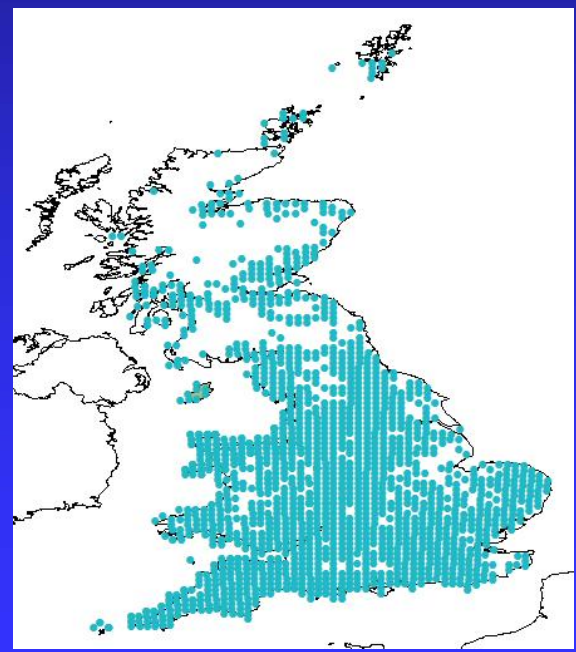
Invasive Species Distributions Elsewhere

Impatiens glandulifera occurrences in Europe

Germany and Czech Republic



Great Britain



Presence and informed absence data

What spatial scale to model?

- What explanatory data are available?
  - Climate data available globally at coarse to finer spatial resolution (10, 5, 2.5 and 0.5 min.).
  - Other data (LULC, soils, wetlands, human disturbances, etc.) may only be available at the local or landscape scales.
- Use areal or point based modeling?

Which models to use?

- Stochastic (statistical) models:
  - Classical multiple regression models (GLM).
  - Other models, e.g. GAM, PCA, CCA, etc.
  - Bayesian (hierarchical) regression models.
- Algorithmic or rule-based models:
  - Niche-based or climate-envelope models (e.g. GARP, BIOCLIM, DOMAIN, ENFA, etc.

……..

- How many explanatory variables to include?
- What about trade-offs between dataset size and computational limitations?

Examples from the modeling to date

- GLM logistic regression models using New England data
  - Climate explanatory variables only
  - Climate plus other explanatory variables
- GARP models
- Bayesian regression models (simple to hierarchical).
  - Areal and point-based models
  - Regional and local landscape models

GLM predictions (plus uncertainty) for the distribution of *Berberis thunbergii* using climate data and New England presence/absence data only

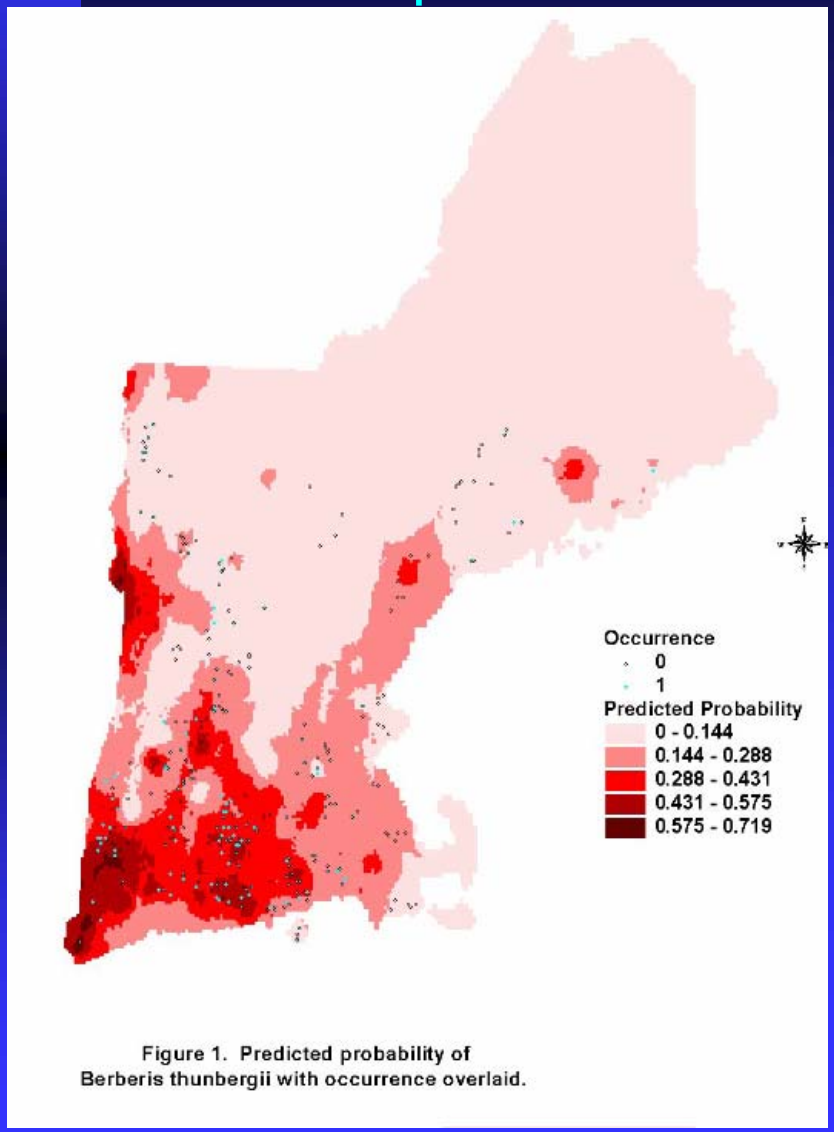


Figure 1. Predicted probability of Berberis thunbergii with occurrence overlaid.

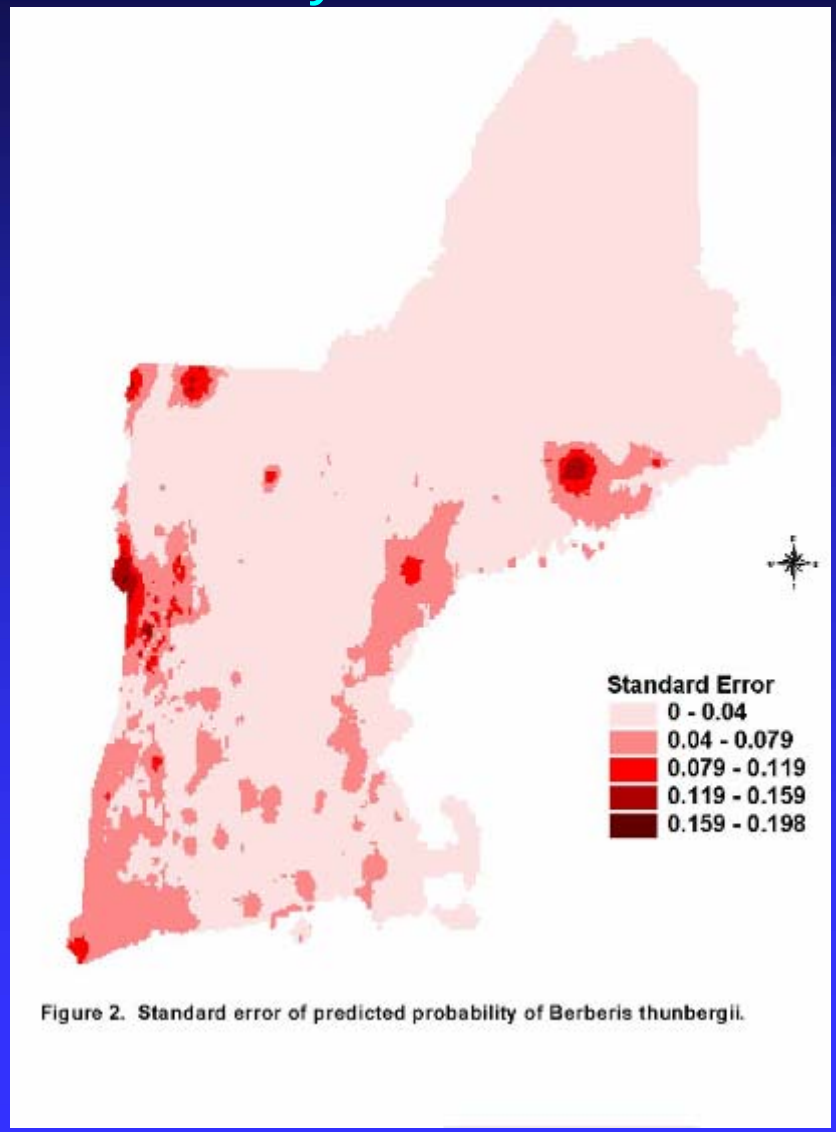


Figure 2. Standard error of predicted probability of Berberis thunbergii.

GLM model predictions for *Berberis thunbergii* using climate **plus** land-use land-cover (LULC) variables

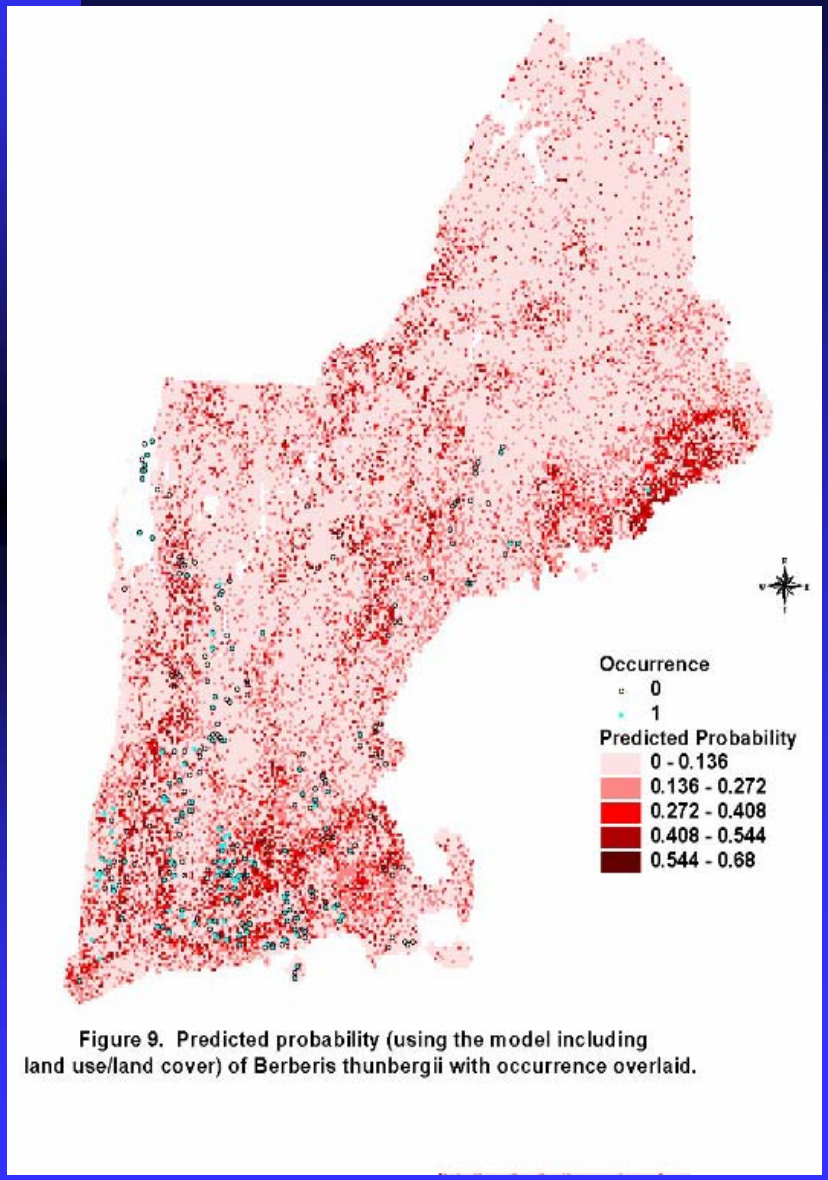


Figure 9. Predicted probability (using the model including land use/land cover) of Berberis thunbergii with occurrence overlaid.

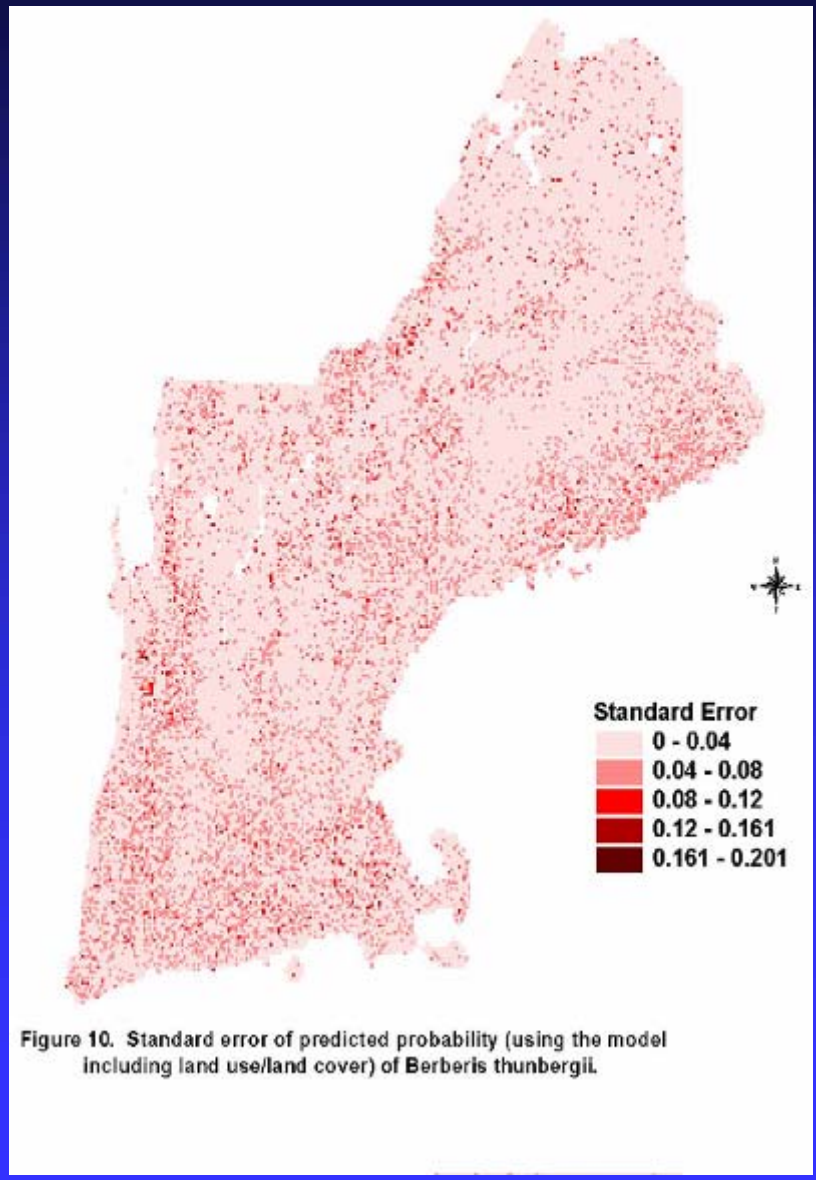


Figure 10. Standard error of predicted probability (using the model including land use/land cover) of Berberis thunbergii.

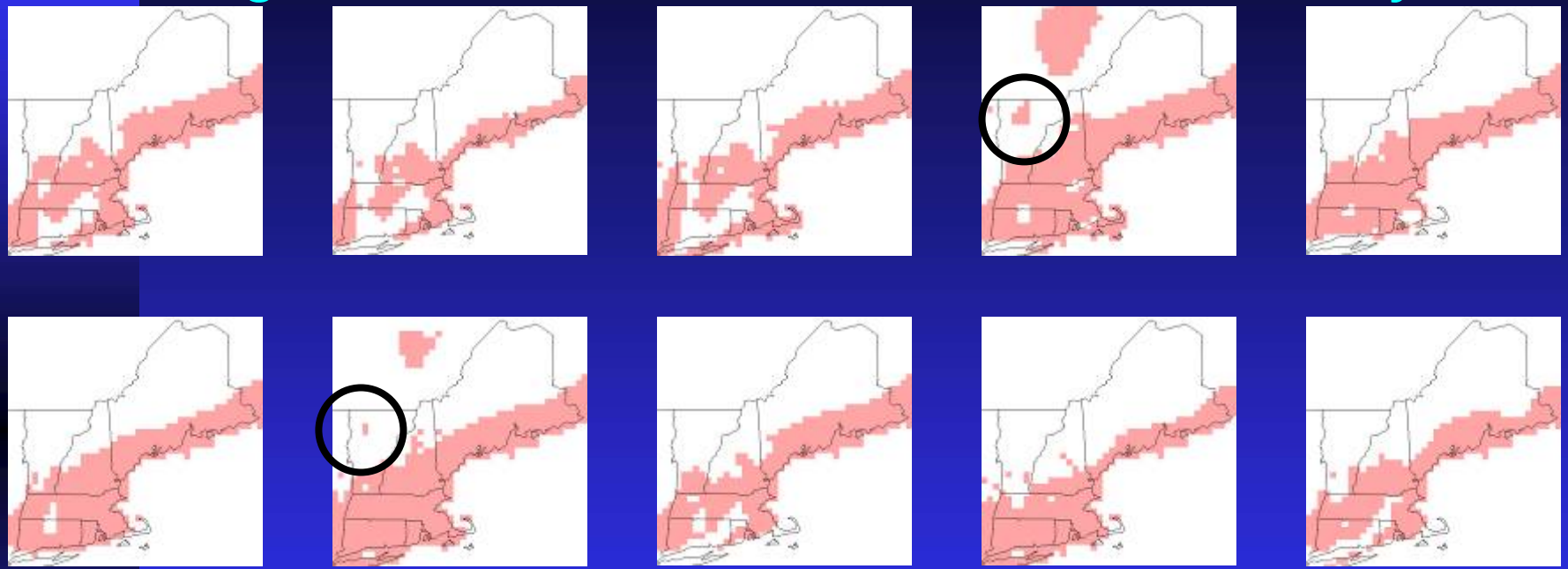
GLM models

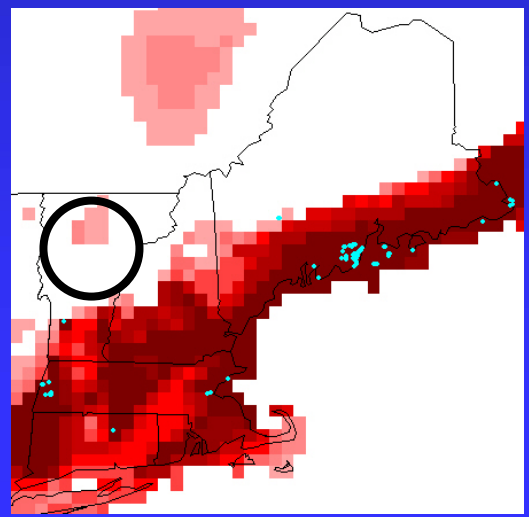
- Patterns of predictions using climate variables with simple linear models are encouraging.
- Response variables require presence and absence data.
- Models include uncertainty in predictions.
- Patterns are more difficult to discern when LULC variables are included at small spatial scales (1 km^2).

Algorithmic modeling approach: examples using GARP [Genetic Algorithm for Rule-set Prediction]

- Species occurrences define climate model envelopes.
- Absences are generated at random from parts of the environmental envelop where the species was not observed.
- Predictions are generated by algorithmic iteration that do not necessarily converge on unique solutions.

GARP models for *Impatiens glandulifera* using New England occurrences and climate data only

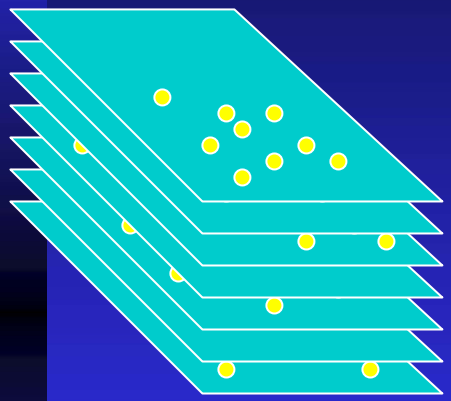




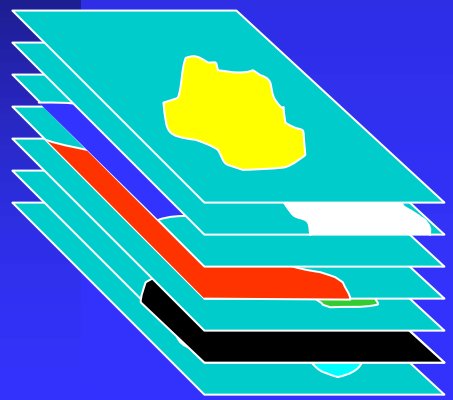
Summary GARP predictions for New England with known occurrence points

Predictions for one locality may be projected onto a second location

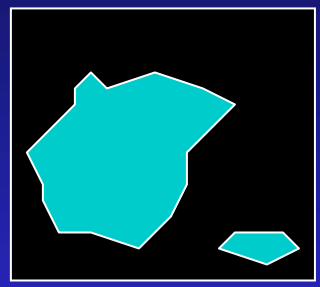
Native range locality data



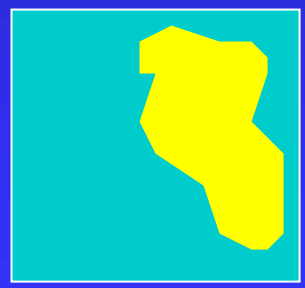
Ecological data



GARP



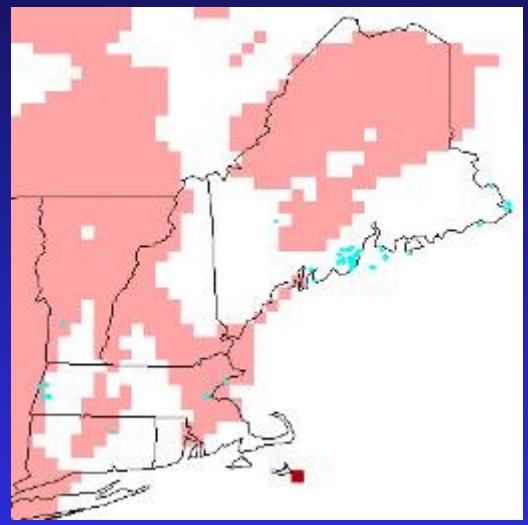
Native distributional prediction



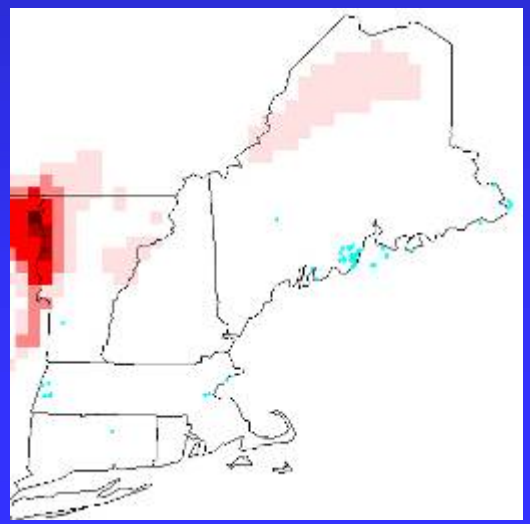
Invasive species projection

Comparisons of GARP model predictions using different occurrence data sources

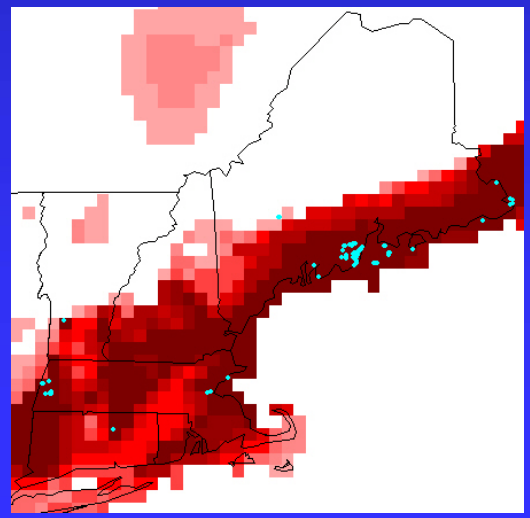
Projections from Germany



Projections from Britain



Projections from the Himalayas

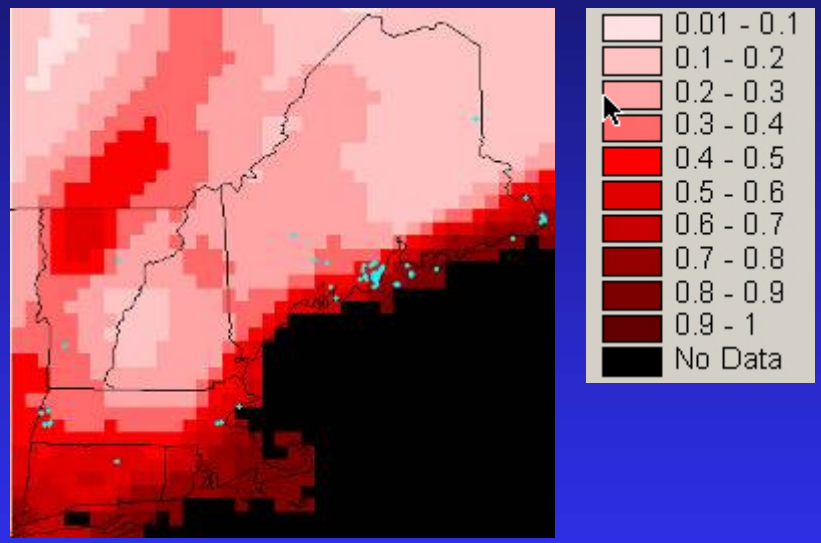


Predictions using New England data only

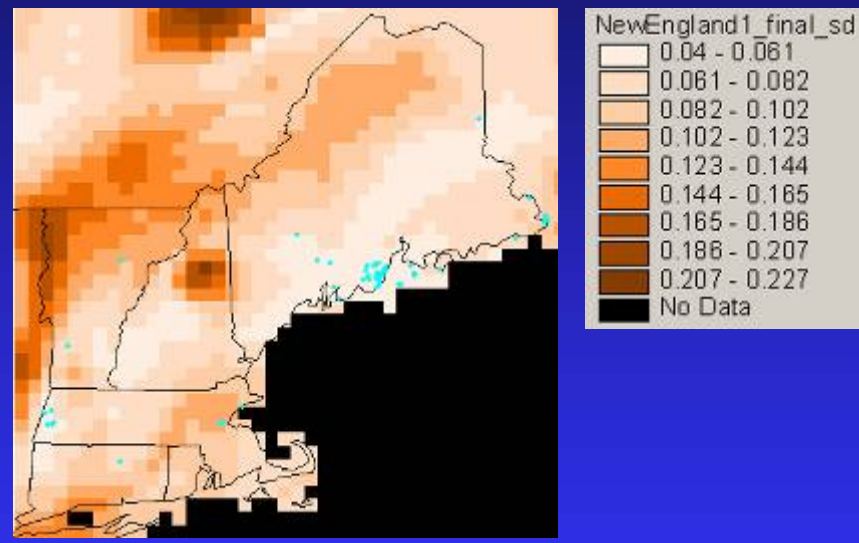
GARP Summary

- Common, easily used method.
- Results can be quite variable.
- No associated uncertainty in predictions.
- Absence data are generated in an *ad hoc* manner.
- No way to compare models in a statistical sense.
- Not easy to incorporate other variables, change scales, or include explicit spatial effects.

Simple Bayesian Regression Models; examples for *Impatiens glandulifera*



Probability of occurrence of Impatiens in a grid cell in New England, using New England data only.

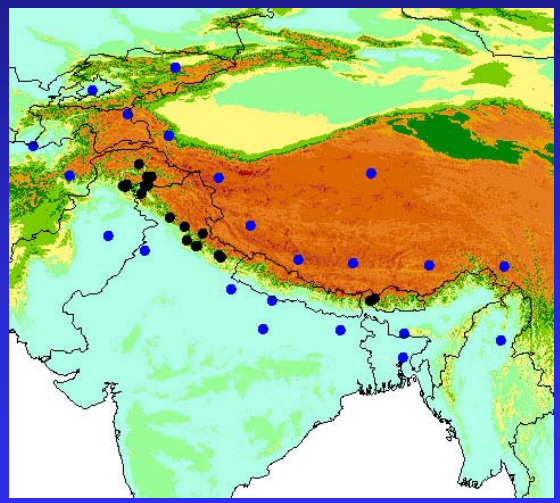


Uncertainty in predictions: Standard deviation in probability of occurrence.

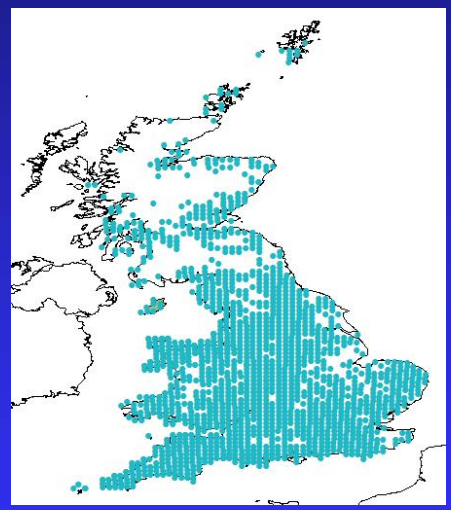
Bayesian models

- Regressions models may be developed using a Bayesian paradigm.
- Prior information may be formally included in the modeling.
- Model complexity may be incorporated hierarchically through linked sub-models.
- Bayesian models are fully stochastic.

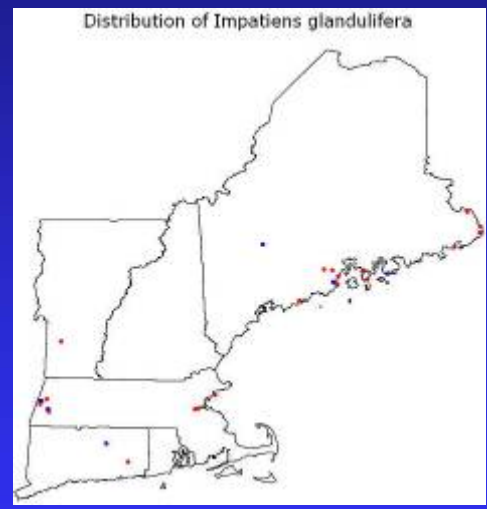
Distribution information for *Impatiens glandulifera* in its native range and as an invasive in the U.K. and New England



Native range

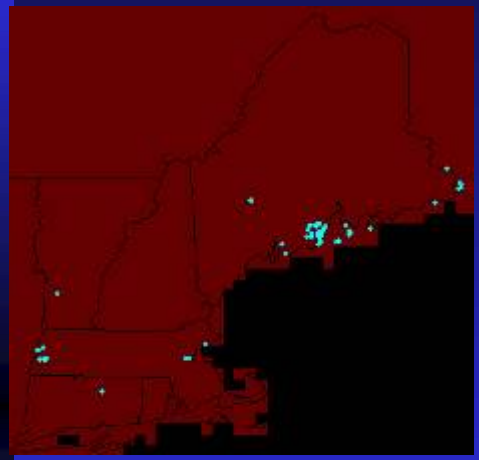


U.K.

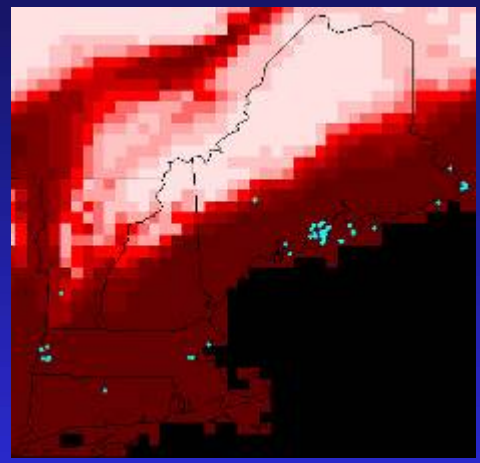


New England

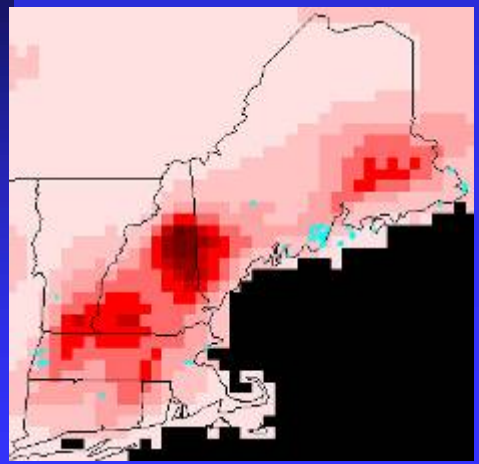
Bayesian Regression Model Results for *Impatiens gladulifera* using climate data



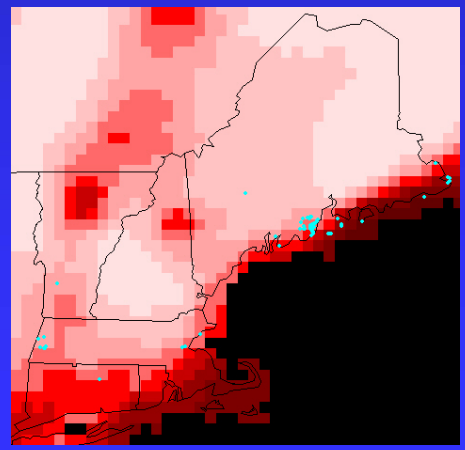
Projection from Himalayas on to New England



Projections from UK on to New England

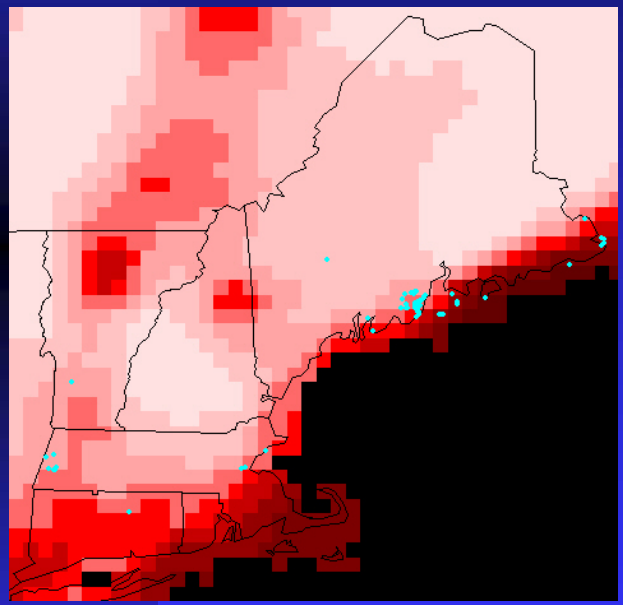


Projections from Germany on to New England



Predictions using New England presence/absence data only

Bayesian two level models – incorporating spatial effects.



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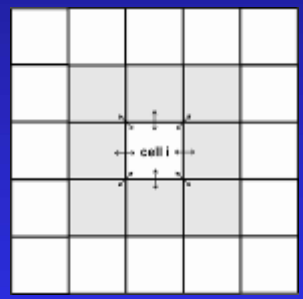

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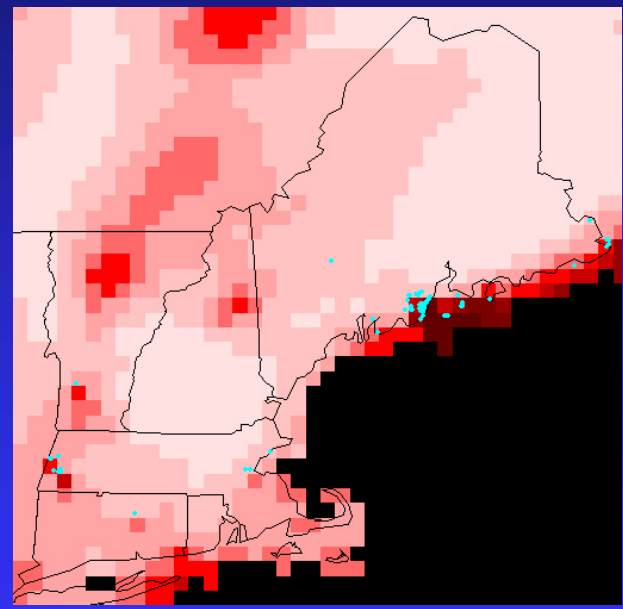
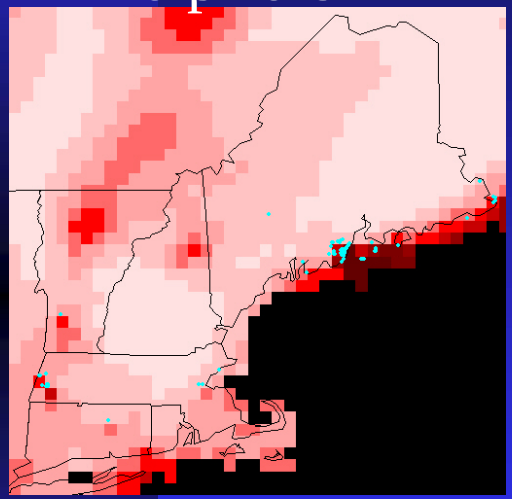
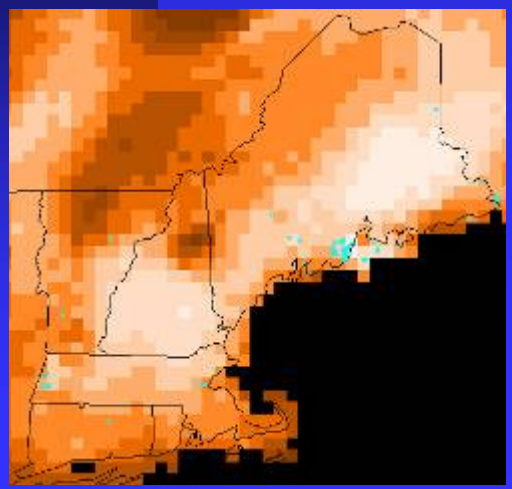


The notion that neighboring cells are similar

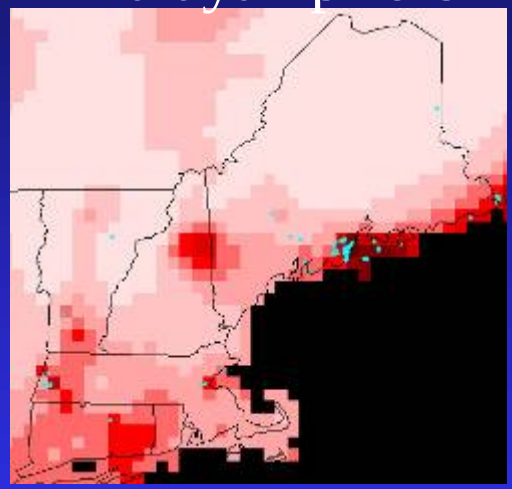
Bayesian 3+ level models – incorporating space **plus** *prior* information

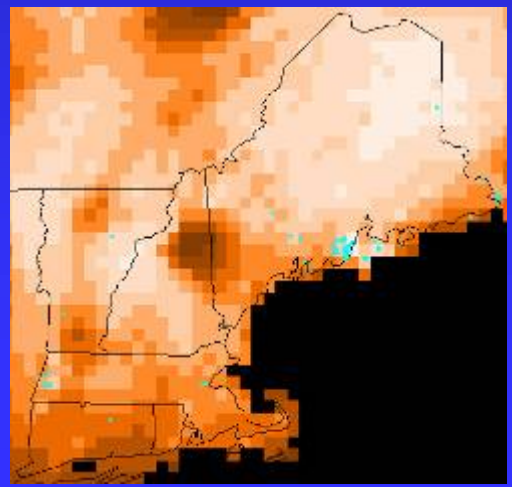
No priors



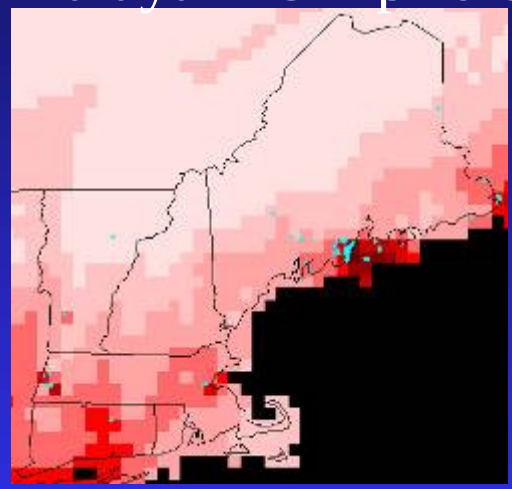


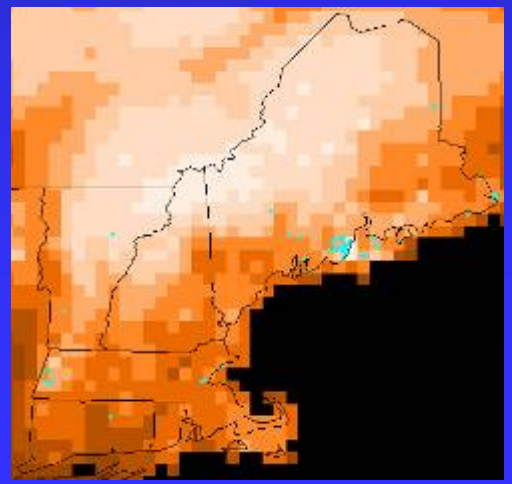
Himalayan priors





Himalayan>UK priors





Summary of Bayesian Regional models

- Can build more complexity and incorporate more information formally into models.
- Can incorporate informed absences and prior information along with known presence data.
- Stochastic models with uncertainty are produced.
- Results can be variable, but less so than GARP.
- Model predictions can be compared statistically.
- Bayesian methods that incorporate these components are just now being developed by statisticians.

Bayesian modeling at the landscape-level – incorporating climate and LULC variables.

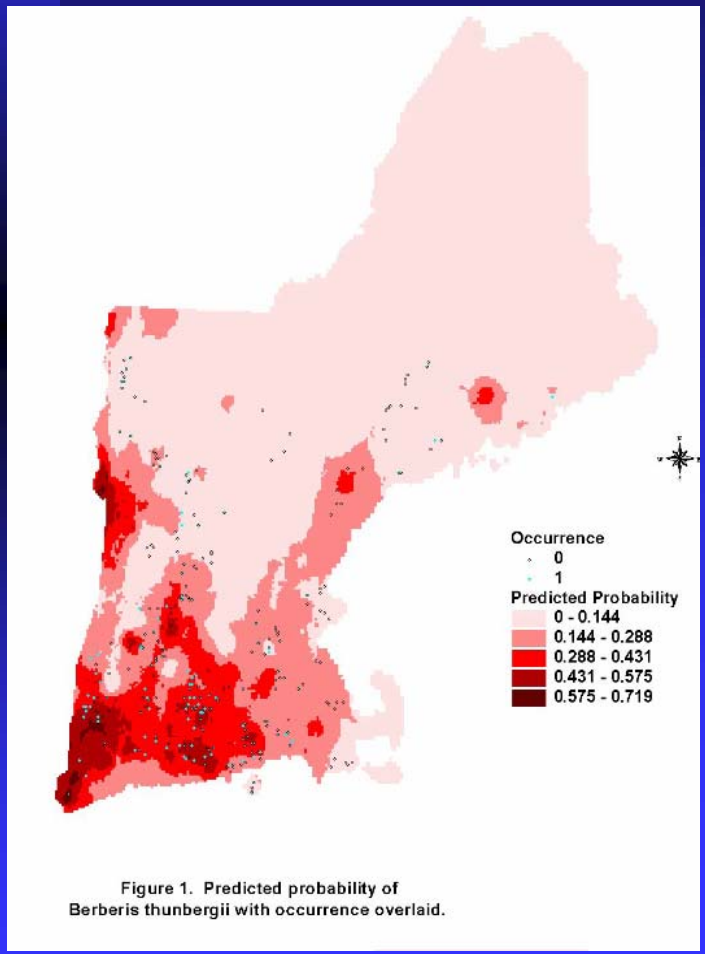


Figure 1. Predicted probability of Berberis thunbergii with occurrence overlaid.

vs.

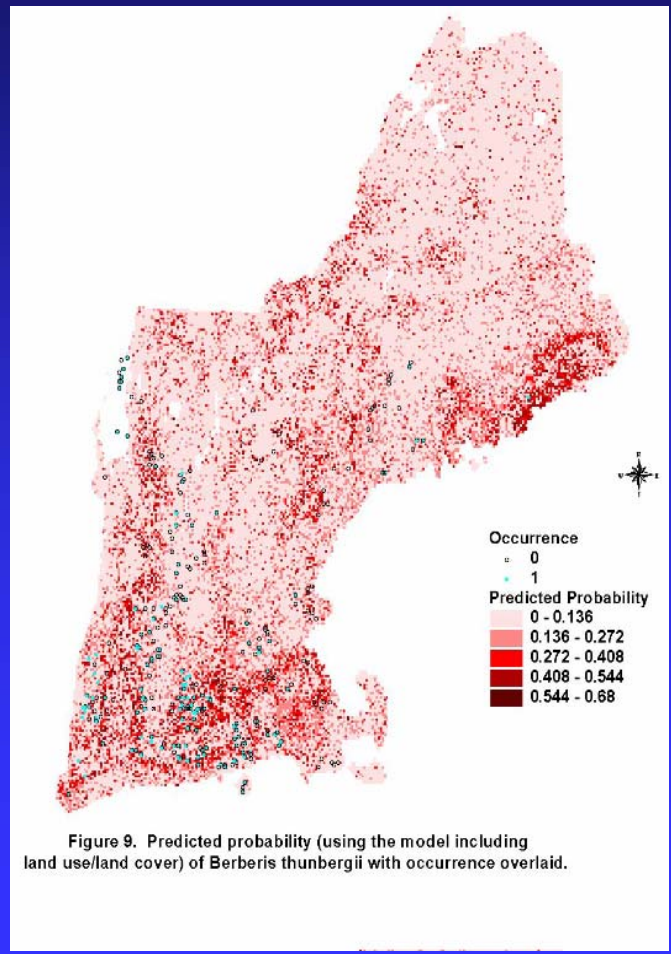
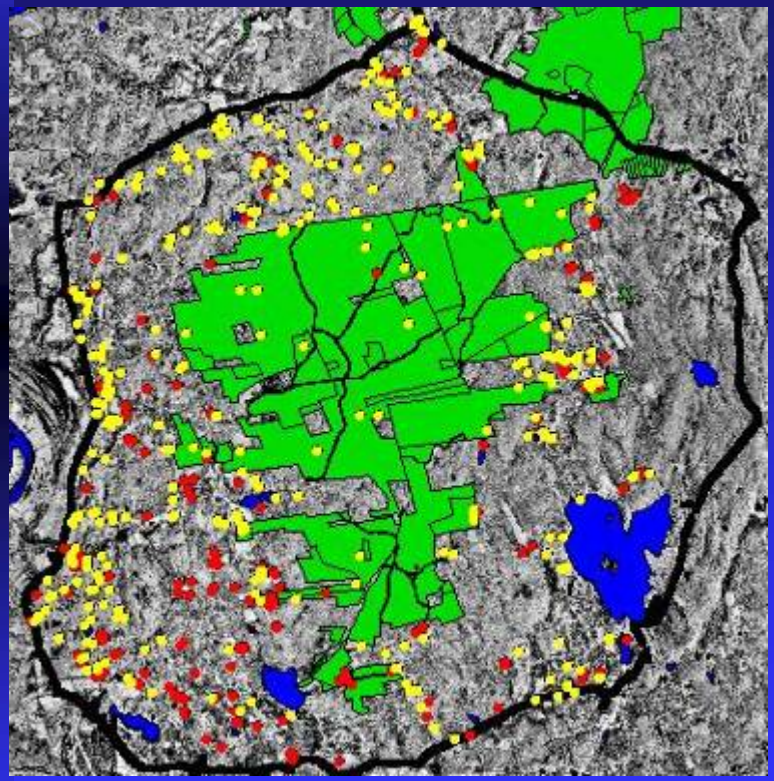


Figure 9. Predicted probability (using the model including land use/land cover) of Berberis thunbergii with occurrence overlaid.

Examples for *Berberis thunbergii*

- Predictions for a small landscape (~95 km^2) in central CT.
- focus LULC traits; climate shows little spatial variation at this scale.
- Use point-based (versus areal) occurrence information plus spatial explanatory data.

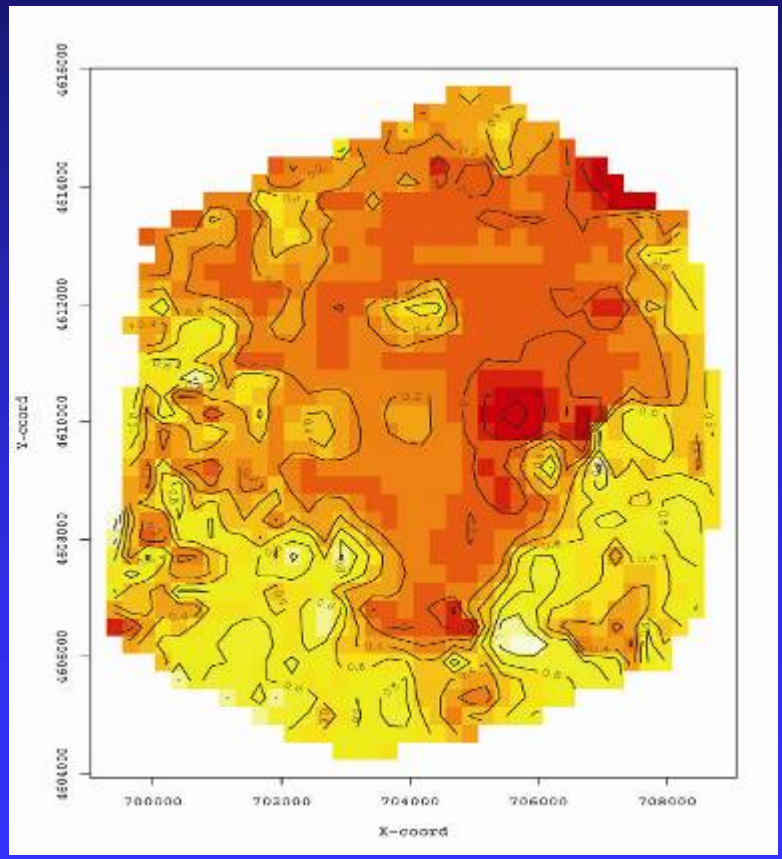
Point-level Bayesian landscape model predictions for *Berberis Thunbergii*



Forest blocks = green

Presence= red; absence= yellow

Displayed on a geo-rectified aerial photo.



Spatially interpolated predictions for occurrence; high probability = yellow, low = orange.

Modeling summary

- Modeling to date is novel and promising, especially the Bayesian hierarchical models.
- At the regional scale models provide predictions on more and less likely landscape locations to search for new incursions, and the level of certainty in these predictions.
- Early landscape-level model predictions are encouraging, but still in development.
- Unanticipated collaboration with statisticians have lead to novel modeling approaches and new insights on predicted species distribution patterns.
- Yet to validate model predictions.
- Yet to evaluate and test these in the field using volunteers.

Project Summary and Perspectives

- Maintaining collaboration
- Project time line
- Benefits from an integrated, trans-disciplinary project
- Challenges overcome
- Remaining challenges
- Accomplishments
- The future

Maintaining the Collaboration

- Steering committee meetings
- Website is critical for education and maintaining volunteer network
- Summits
- Email contact
- Presentations
- Continued networking and support-building

Project Time Line

- September 2001 – 2002
  - Project officially started
  - Assembled steering committee, convened advisory board, developed website and field forms
  - First field season – held training sessions; had volunteers gathering and submitting data
  - Herbarium record capture

Project Time Line

- 2nd year (2002-2003)
  - Additional data capture, volunteer training, field data gathering
  - 1st New England Invasive Plant Summit
- 3rd year (2003-2004)
  - Additional data capture, volunteer training, field data gathering
  - Advisory board meeting

Project Time Line

- 4th year (2004-2005)
  - Additional data capture, volunteer training, field data gathering
  - Produce prototype predictive models
  - 2nd New England Invasive Plant Summit
  - 2-year continuation funding obtained

Expected & Unexpected Benefits Associated with Integrating Research, Education, and Outreach

- Integration of different components is necessary
- Single focus will not answer all problems
- The synergism of a multidisciplinary approach
- Project has won acclaim from broad audiences outside New England

What Challenges Were Overcome

- Created a network of scientists, conservationists, volunteers, and general public
- Gathered accurate and reliable information
- Solved cartography and presentation problems
- Developed user-friendly and critically acknowledged website
- Using data to develop predictive models

Challenges Still to Overcome

- Institutionalization project, continued funding at reliable levels; hard to make future plans
- IT support
- Full time positions for staff
  - Project director
  - Volunteer coordinator

Project Accomplishments and Impacts

- Volunteer network of almost 600
- Databased most of New England Herbarium records
- Current field figures
  - Over 3000 field forms submitted
  - Almost 7000 species observations
- Developed popular and effective website
- Supported and trained undergraduate and graduate students – spin-off projects

On the Horizon….

- Additions to IPANE list and re-classification for some currently listed species
- Pocket PC data entry and submission capability & early detection tool
- Predictive models on the IPANE website
- Local ED networks with public participation
- Town, county, and state-based search capabilities
- Going global – Asian “exchange” data

IPANE - Part of a National Vision

- Interoperability
- Regional approach
- Uniform data standards
- National data base
- Shared information
- Ecological forecasting
  - Predictive modeling
  - Risk assessment