Models of Regional Invasive Species using Merged Datasets

Catherine Jarnevich

Created January 2008

The Good ol' Days: 40+ databases, inconsistent data, no sharing

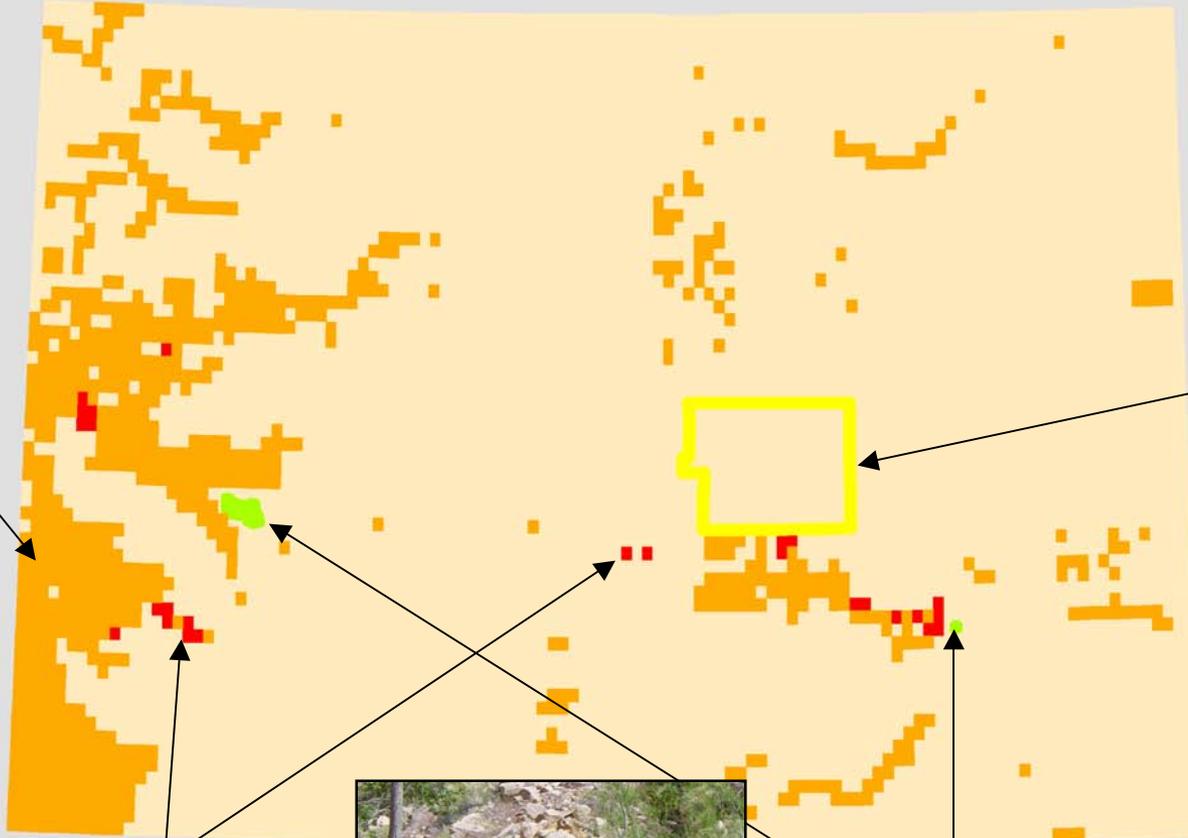## Gathering existing data from all sources: Colorado example

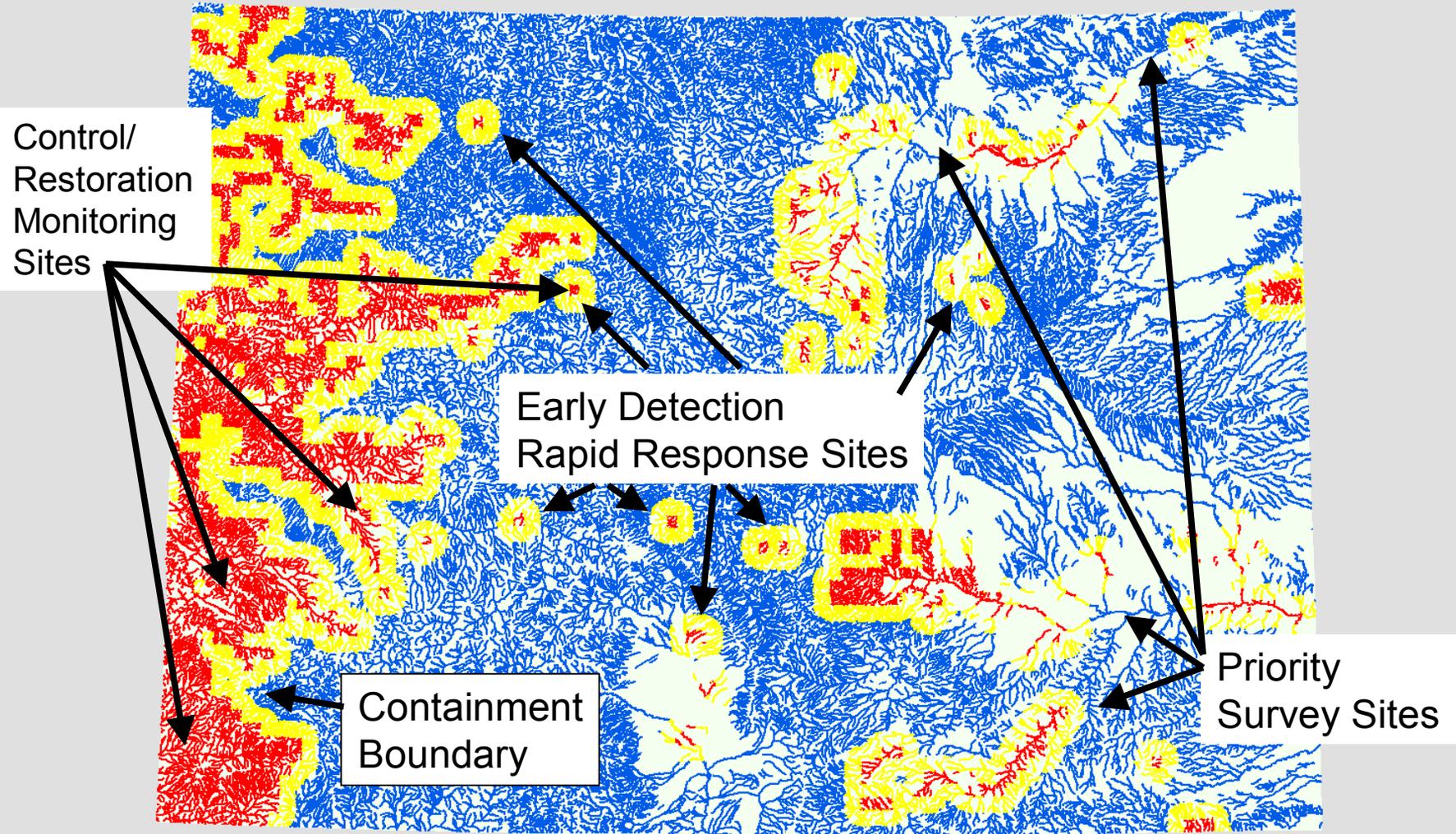Where is it?

Quarter-Quads reporting Tamarisk

County reporting Tamarisk missed by Quarter-Quads

Weed mapping or vegetation survey plots reported Tamarisk missed by Quarter-Quads

National Parks reporting Tamarisk missed by Quarter-Quads

Crosier, C.S. and T.J. Stohlgren. 2004. Improving biodiversity knowledge through dataset synergy: a case study of non-native vascular plants in Colorado. *Weed Technology* 18: 1441-1444.

Preliminary Model of Potential Spread in 10 Years

Control/
Restoration
Monitoring
Sites

Early Detection
Rapid Response Sites

Containment
Boundary

Priority
Survey Sites

Legend

— Expected Spread Within Next 10 Years — Absense Locations

— Present Distribution

Data & Models

- **Lots of points in small area (<=county size)**

- **Few points over large area (>=state size)**

- **Presence AND absence locations any size**

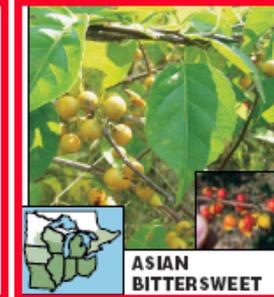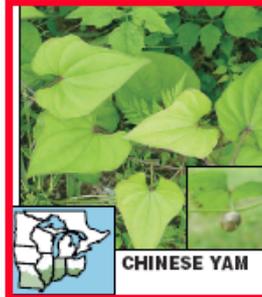   **Type of model depends on type of species data and resolution**
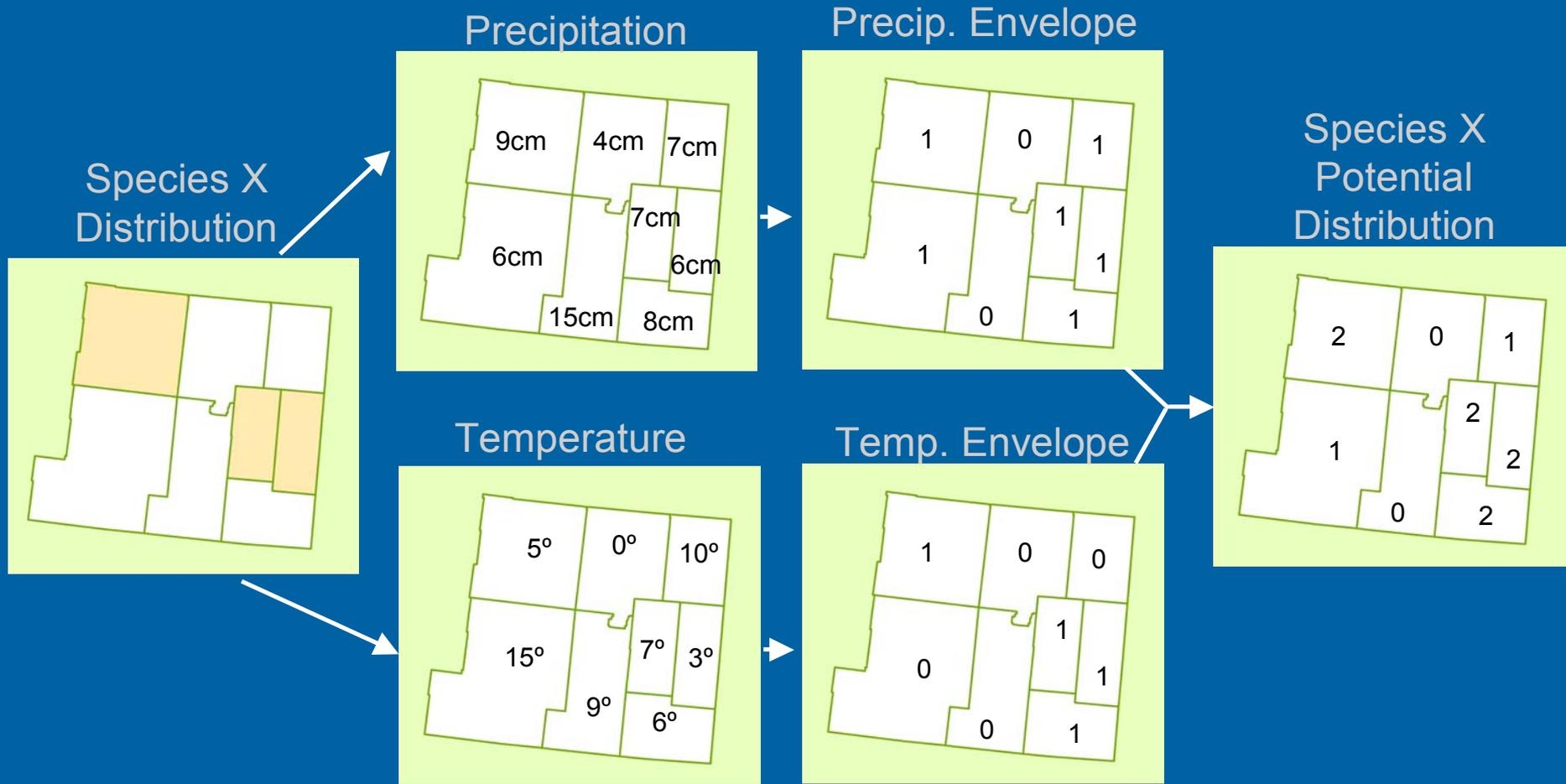
≋ USGS

Regional Species of Concern

KEEP A LOOKOUT for *New* **INVASIVE PLANTS** in the Midwest!

MIPN.org — Midwest Invasive Plant Network

These species could be spreading in your area; *early detection and eradication* can prevent an invasion.

Current Midwest general distribution, including southern Ontario: ☐ Not Known ☐ Isolated ☐ Locally Abundant ☐ Widespread

BLACK SWALLOW-WORT · PALE SWALLOW-WORT · JAPANESE HOPS · KUDZU · MILE-A-MINUTE WEED · CHINESE YAM · ASIAN BITTERSWEET · TREE OF HEAVEN · JAPANESE KNOTWEED · JAPANESE STILT GRASS · SPOTTED KNAPWEED · CUT-LEAVED TEASEL · GIANT HOGWEED · JAPANESE HEDGE PARSLEY · LEAFY SPURGE · FLOWERING RUSH

USGS
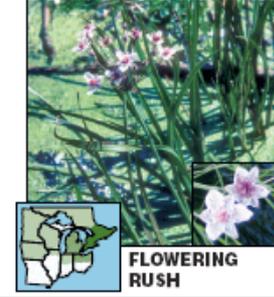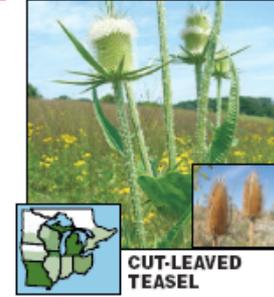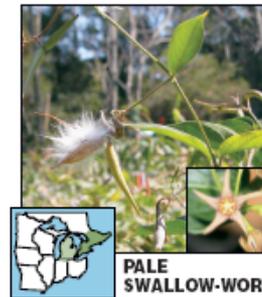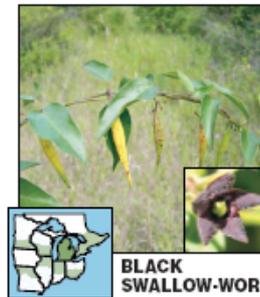
Environmental Envelope

Species X Distribution

Precipitation

9cm	4cm	7cm
6cm	7cm	6cm
	15cm	8cm

Precip. Envelope

1	0	1
1	1	1
	0	1

Temperature

5°	0°	10°
15°	7°	3°
	9°	6°

Temp. Envelope

1	0	0
0	1	1
	0	1

Species X Potential Distribution

2	0	1
1	2	2
	0	2

USGS

Ancillary data layers

- **Elevation**
- **Average annual temperature**
  - **Minimum, Mean, Maximum, Range**
- **Average annual precipitation**
  - **Mean, Frequency**
- **Average annual solar radiation**
  - **Minimum, maximum**
- **Average annual growing degree days**

Cardaria draba (white top)

a) 1930
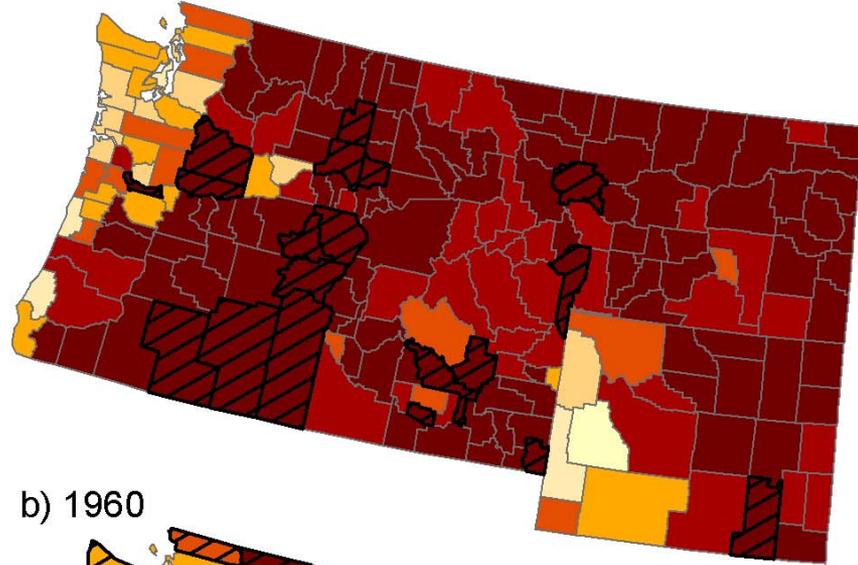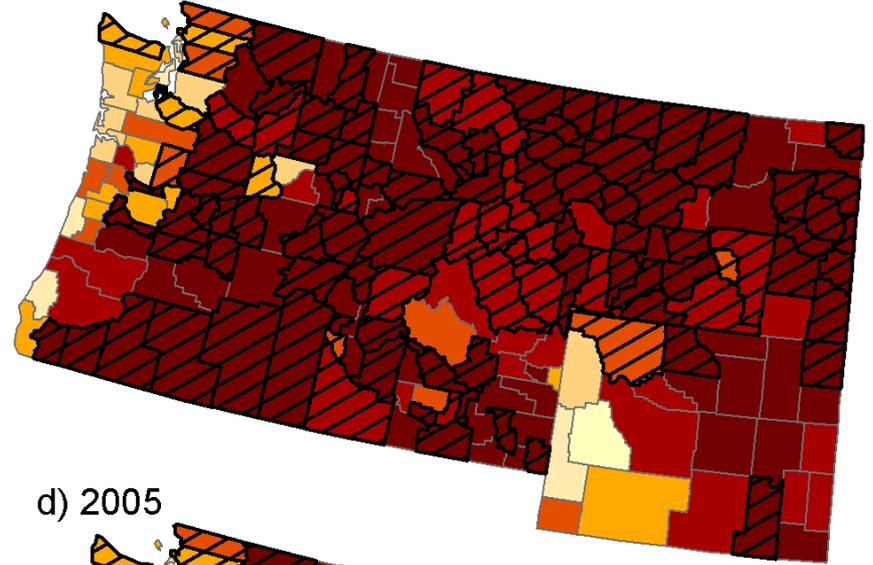
b) 1960

c) 1990
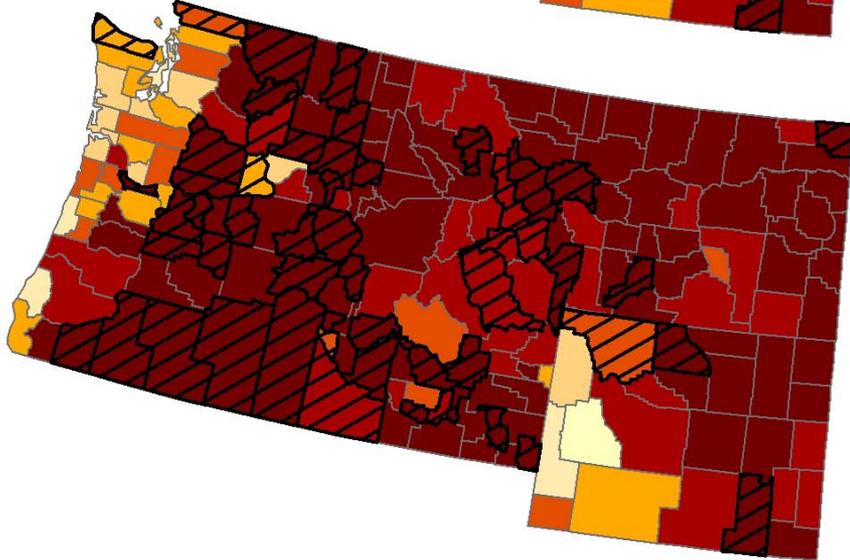
d) 2005
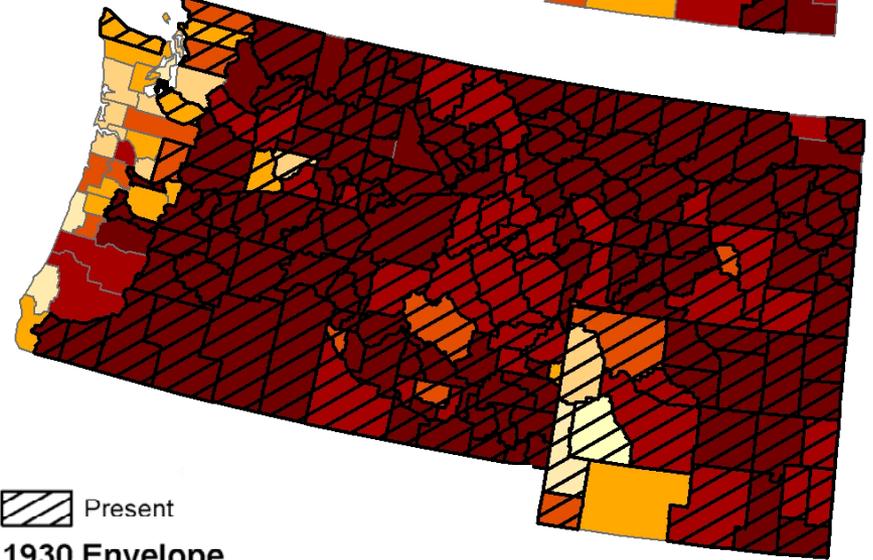
Present

1930 Envelope

4	6	8	10
5	7	9	

Microstegium vimineum
(Japanese stilt grass)

Envelope

0 - 2	
3 - 4	
5 - 6	
7 - 8	
9 - 10	

☐ Present by 2005
☐ Present by 2007

0   240   480   960 Kilometers
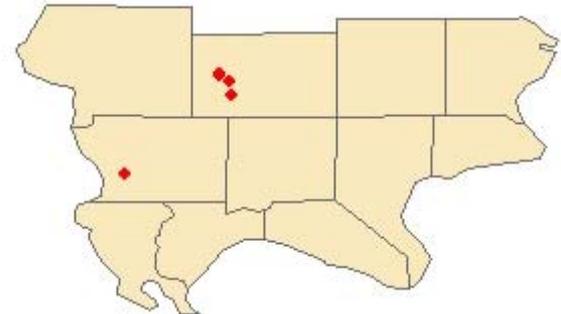
N
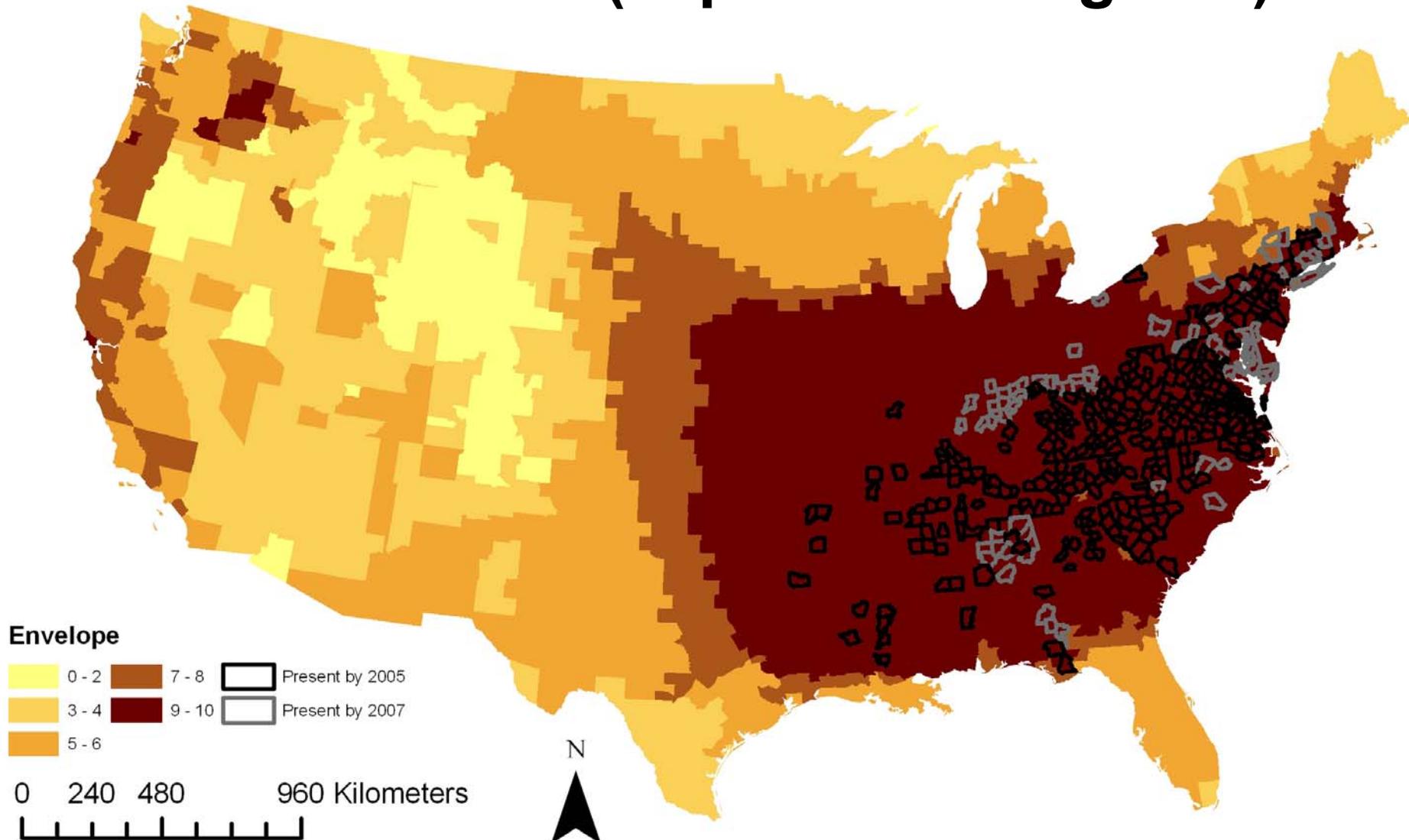
Introduced 1919

Species distribution model
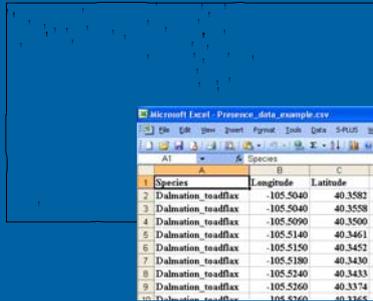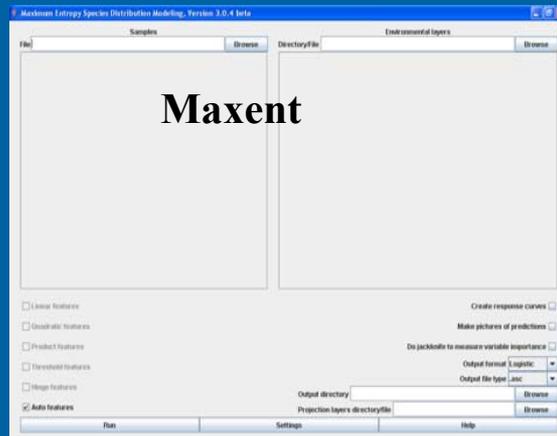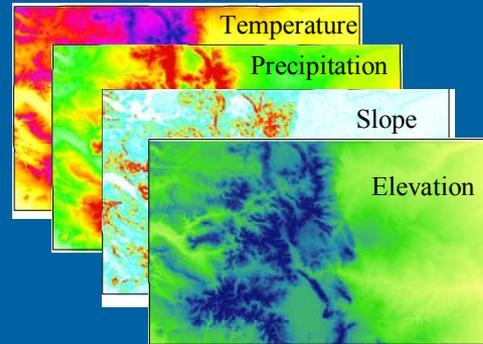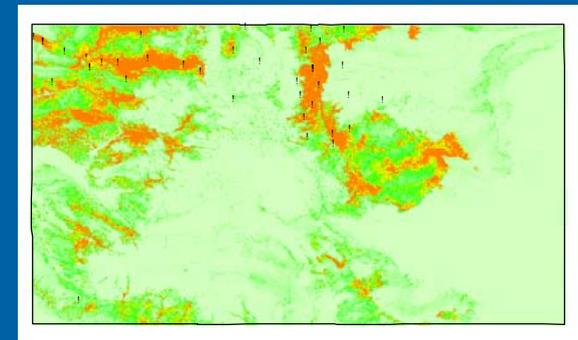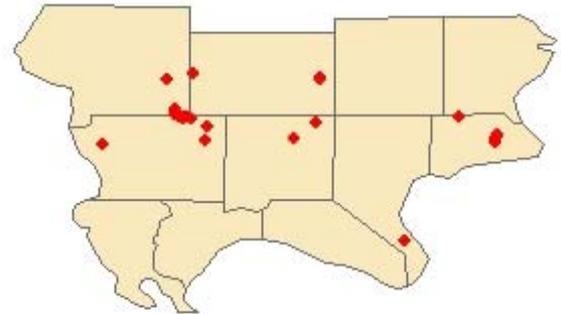
Southern Illinois data
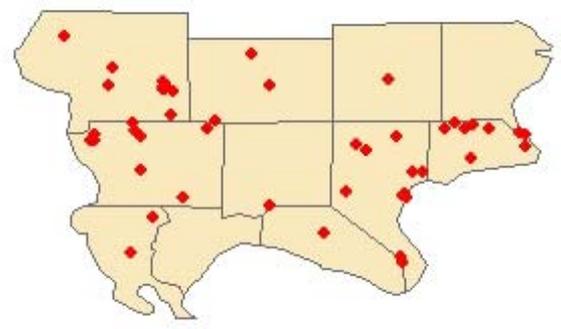
Chinese yam

Japanese hops

Japanese hedge parsley

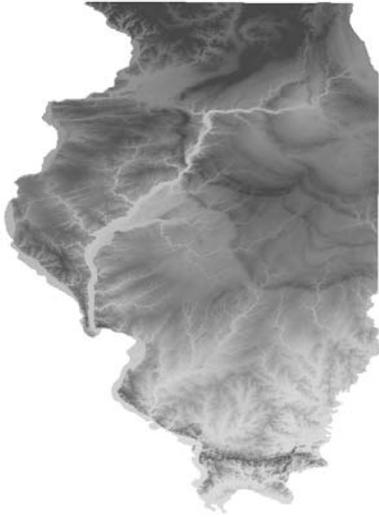Tree of heaven

Asian bittersweet

Mile a minute weed

Predictor layers

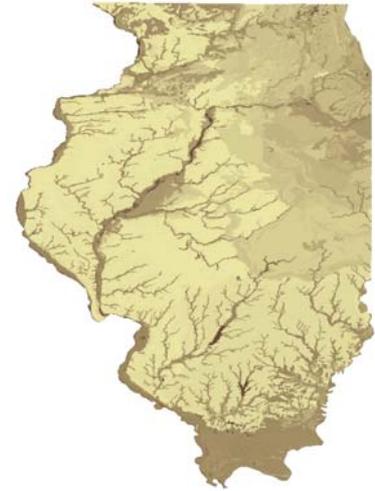Elevation   Solar radiation   Vegetation type   Soil type
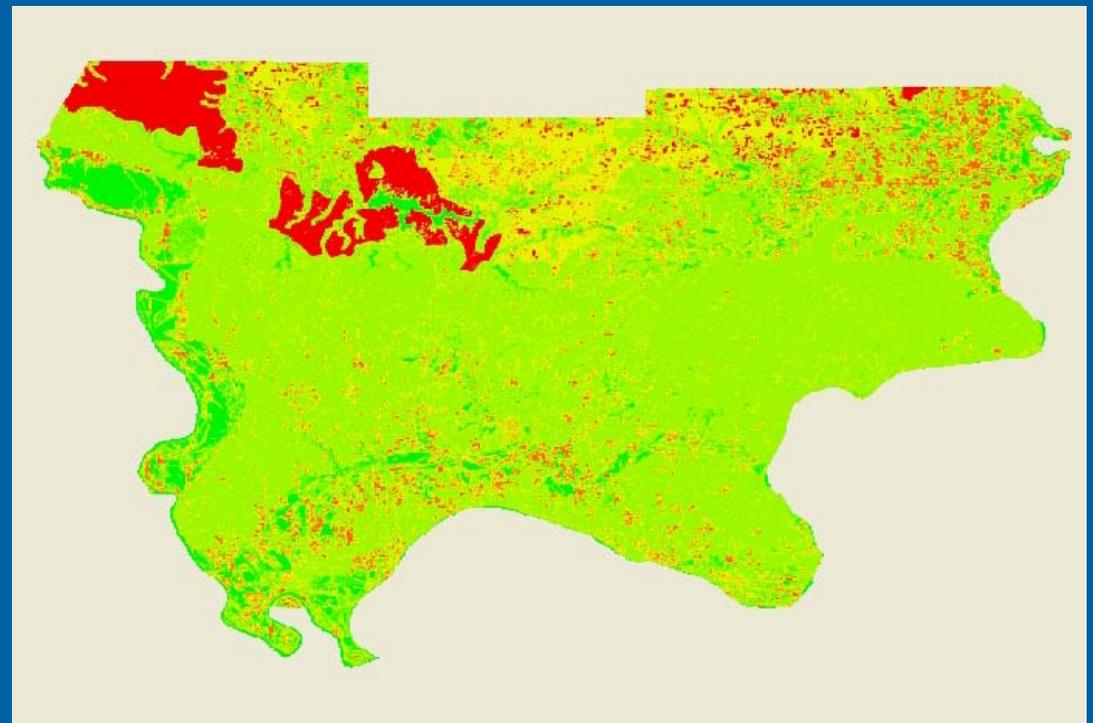
Aspect
(northness)
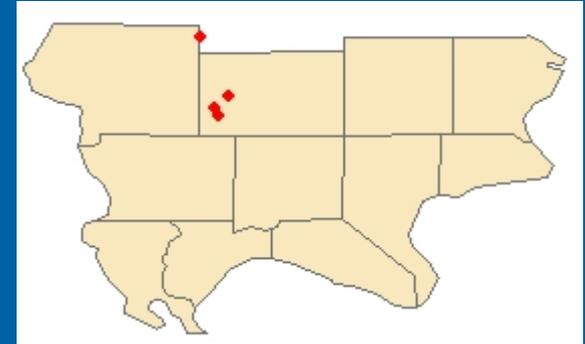
Slope

From the Illinois Natural
Resources Geospatial
Data Clearinghouse
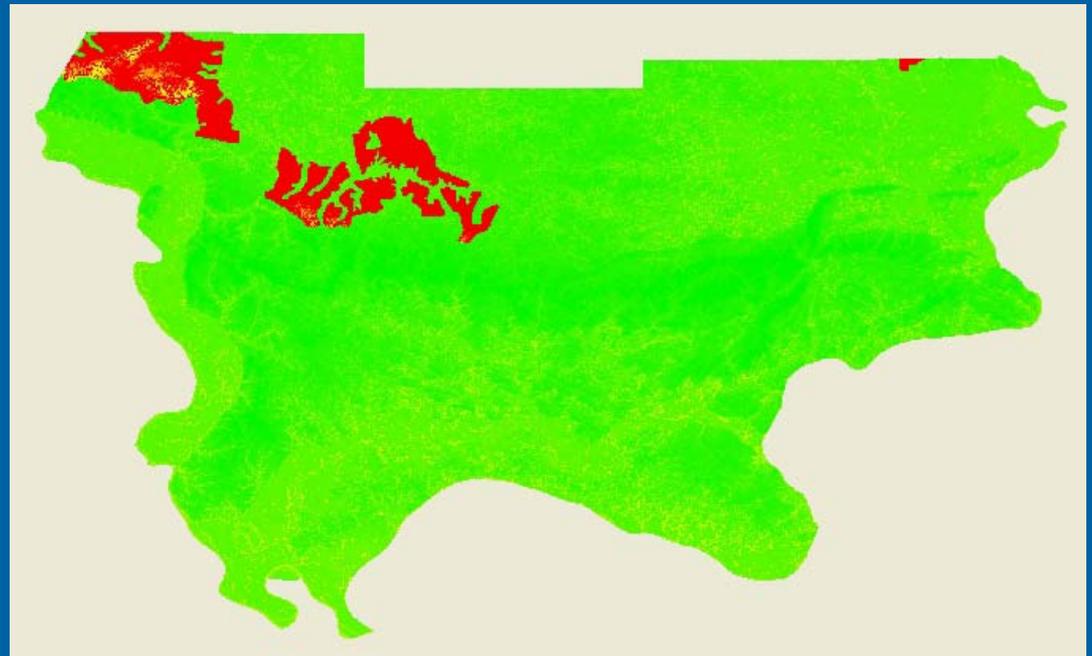(http://www.isgs.uiuc.edu
/nsdihome)

USGS

Tree of heaven (*Ailanthus altissima*)

- **Most important predicators:**
  1. **Soil association**
  2. **Vegetation type**
  3. **Slope**

USGS

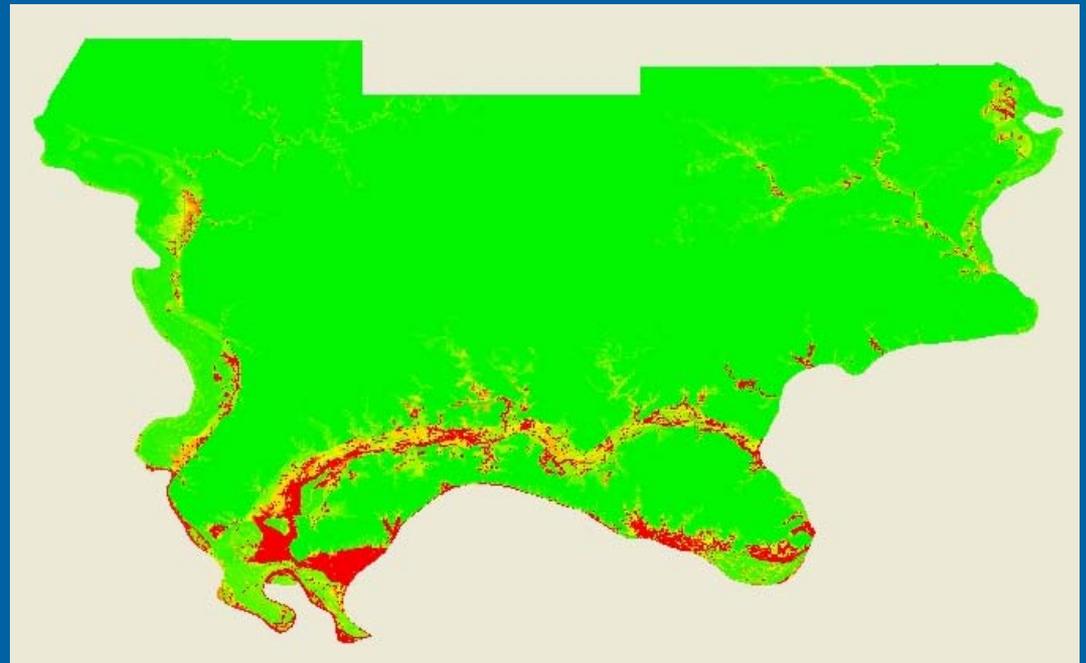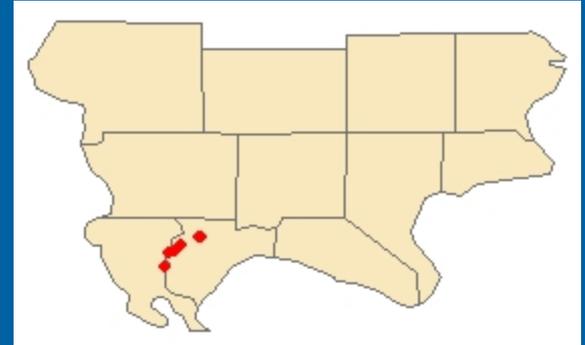# Japanses hedge parsley (*Torilis japonica*)

- **Most important predicators:**
    1. *Soil association
    2. Elevation
    3. Vegetation type

USGS
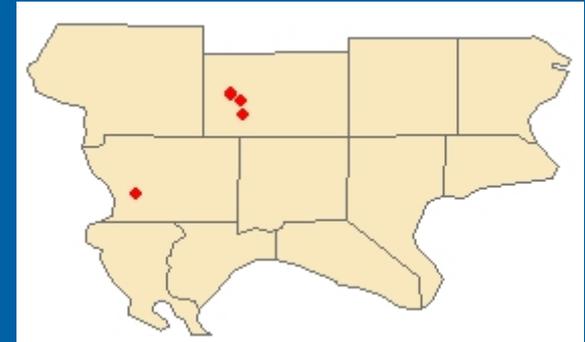
Japanese hops (*Humulus japonicus*)
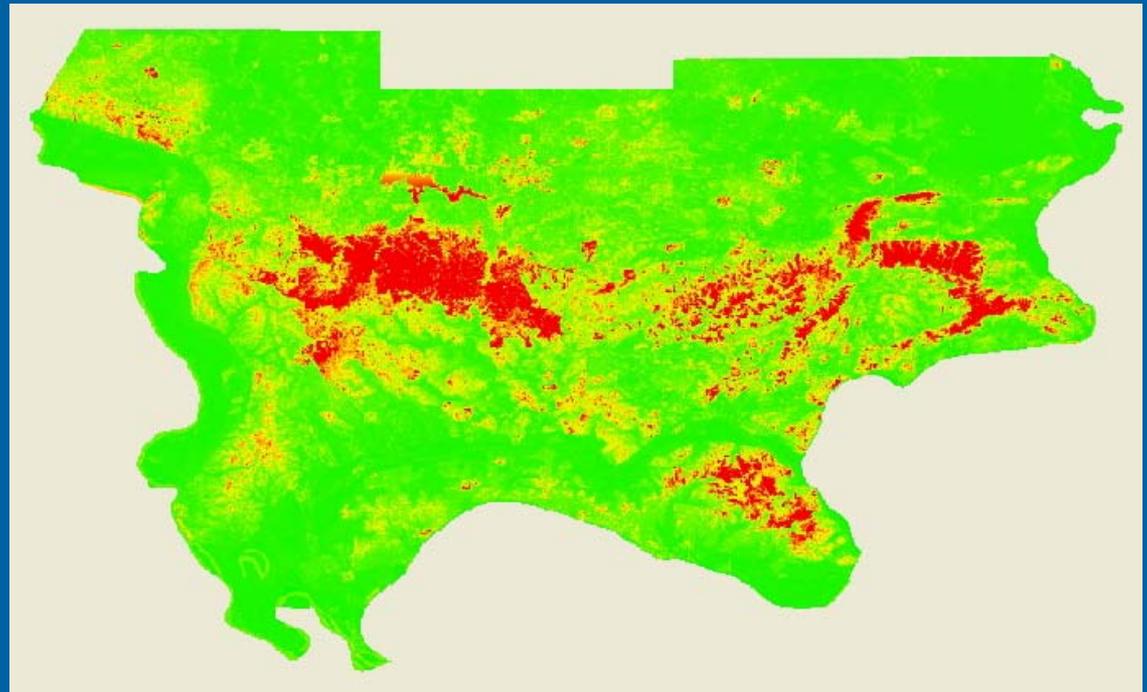
- **Most important predicators:**
  1. **Elevation**
  2. **Soil association**
  3. **Vegetation type**

USGS

Asian bittersweet (*Celastrus orbiculatus*)

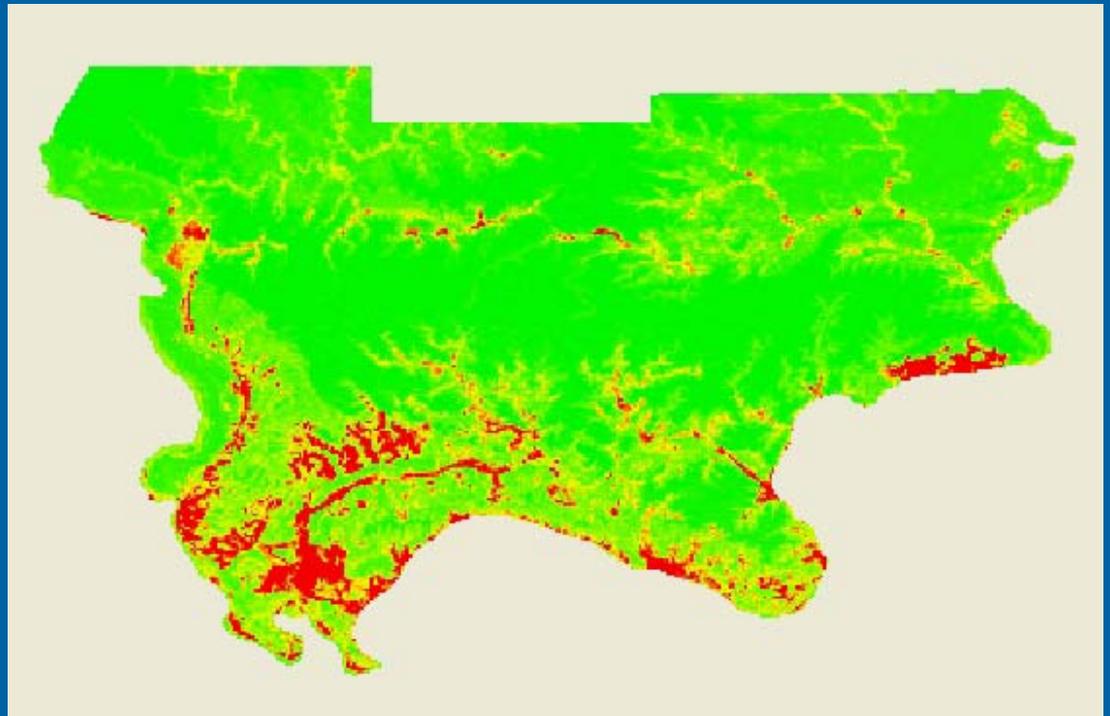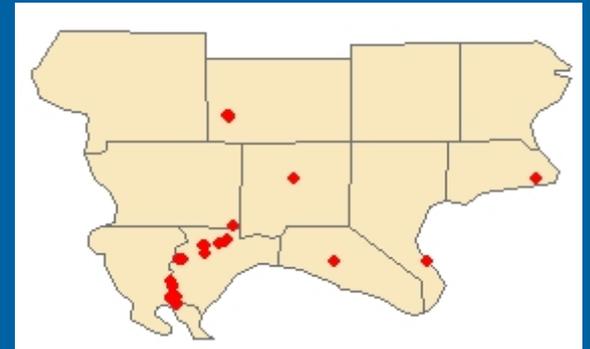- **Most important predicators:**
  1. **Elevation**
  2. **Vegetation type**
  3. **Soil association**

Mile a minute weed (*Microstegium vimineum*)
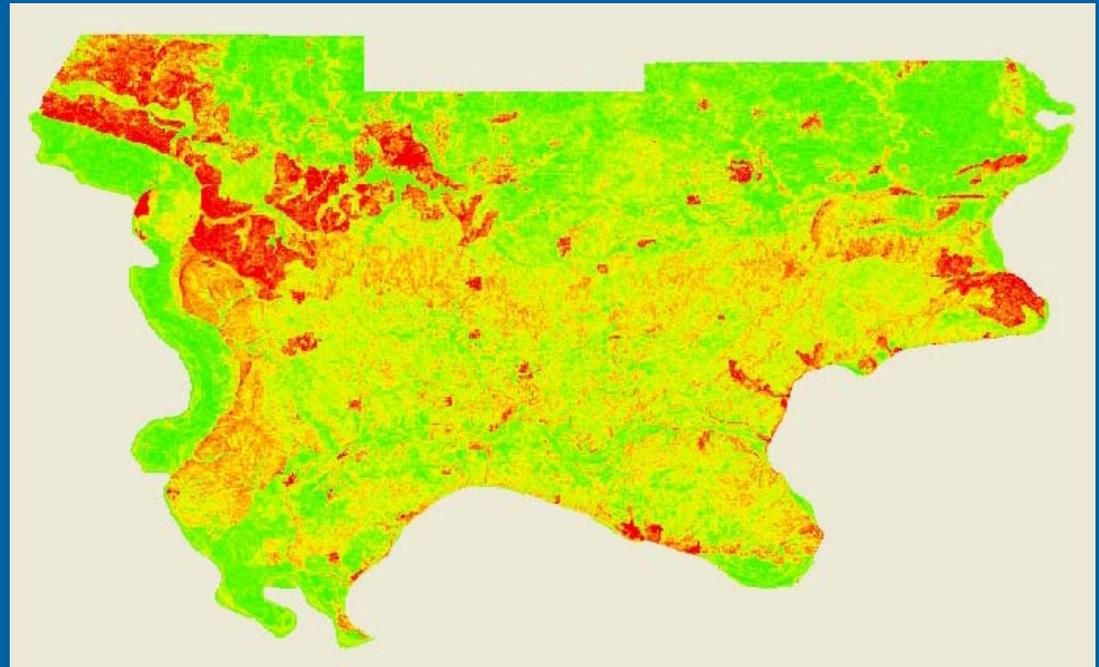

- **Most important predicators:**
  1. Soil association
  2. Elevation
  3. Vegetation type

≋ USGS

Chinese yam (*Dioscorea oppositifolia*)
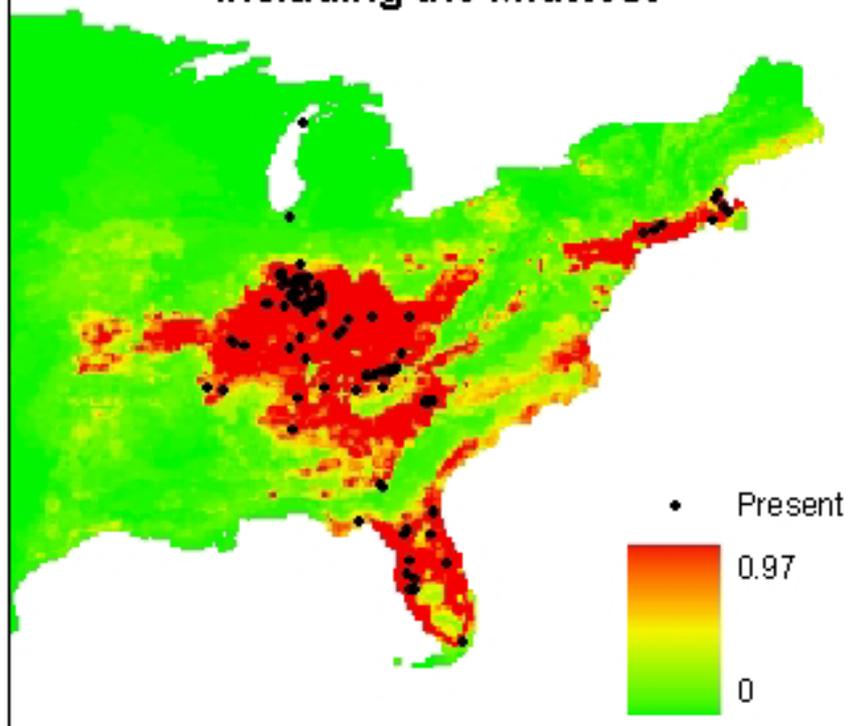

- **Most important predicators:**
  1. **Vegetation type**
  2. **Soil association**
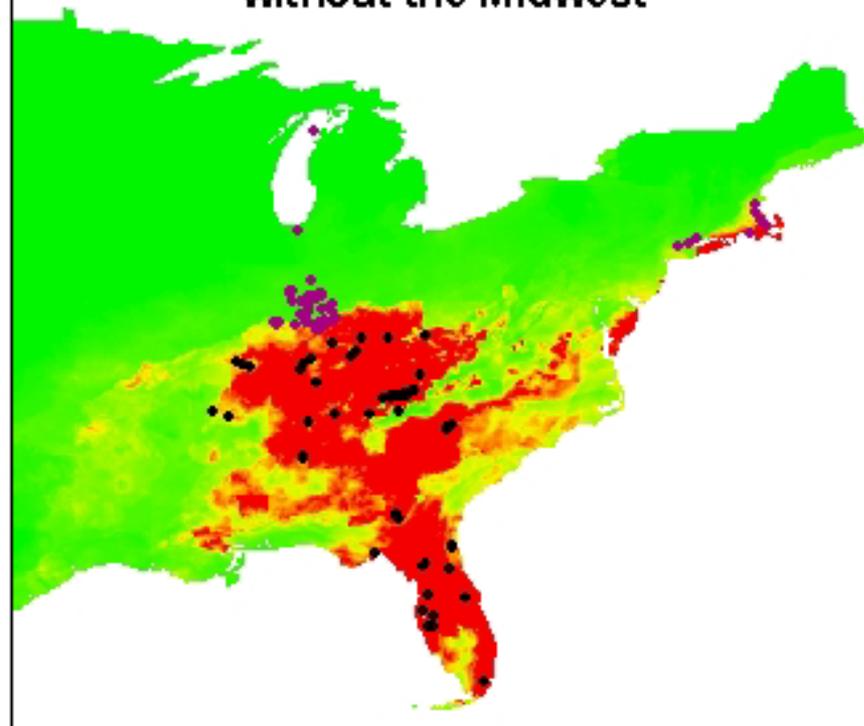 3. **Slope**

≋USGS

Need data from entire range

Kudzu distribution in the Eastern United States
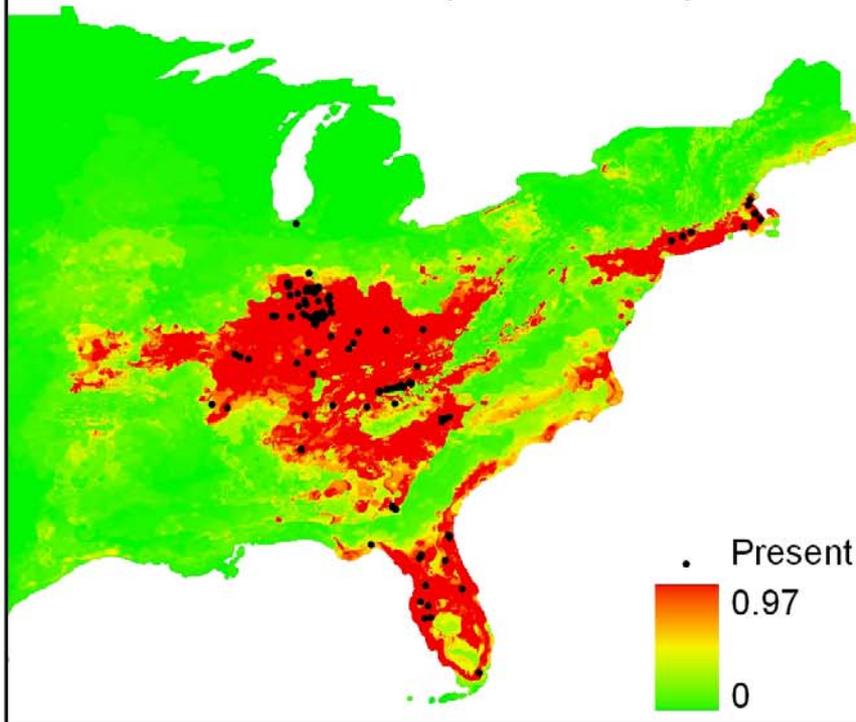
Distribution based on data including the Midwest

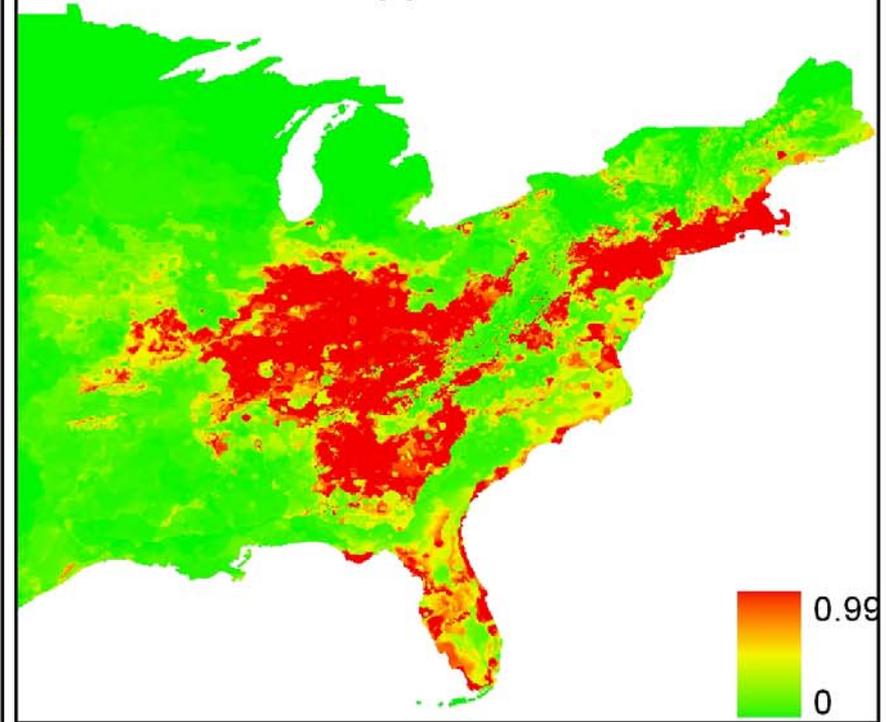Distribution based on data without the Midwest

- Present

0.97

0

Requires merged dataset

USGS

Kudzu distribution in the Eastern United States

Distribution based on 30 year average climate data (1971 - 2000)

- Present
- 0.97
- 0

Distribution based on 112 year climate trend applied to 2035

- 0.99
- 0

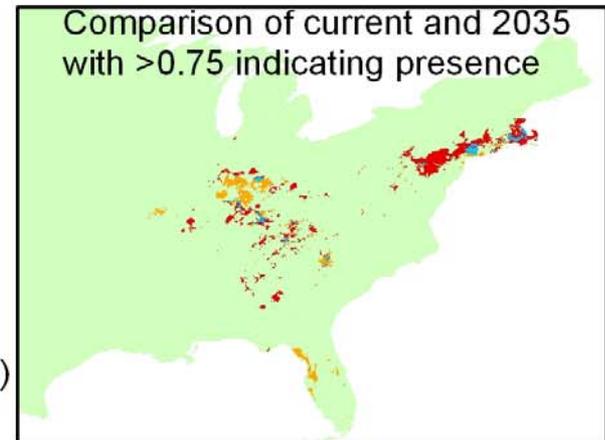Model created with MaxEnt (Phillips et al 2006)
Most important variables:
  Annual Precipitation
  Precipitation of Driest Quarter

Comparison of current and 2035 with >0.75 indicating presence

Current versus 2035
- Unsuitable
- Increasing (suitable 2035)
- Decreasing (suitable current)
- Stable (suitable both)

Conclusions

- **Merged datasets needed**

- **Models aid management**
    - **Watch lists**
    - **Priority survey locations**
    - **Control locations**
    - **Future trends**

≋ USGS