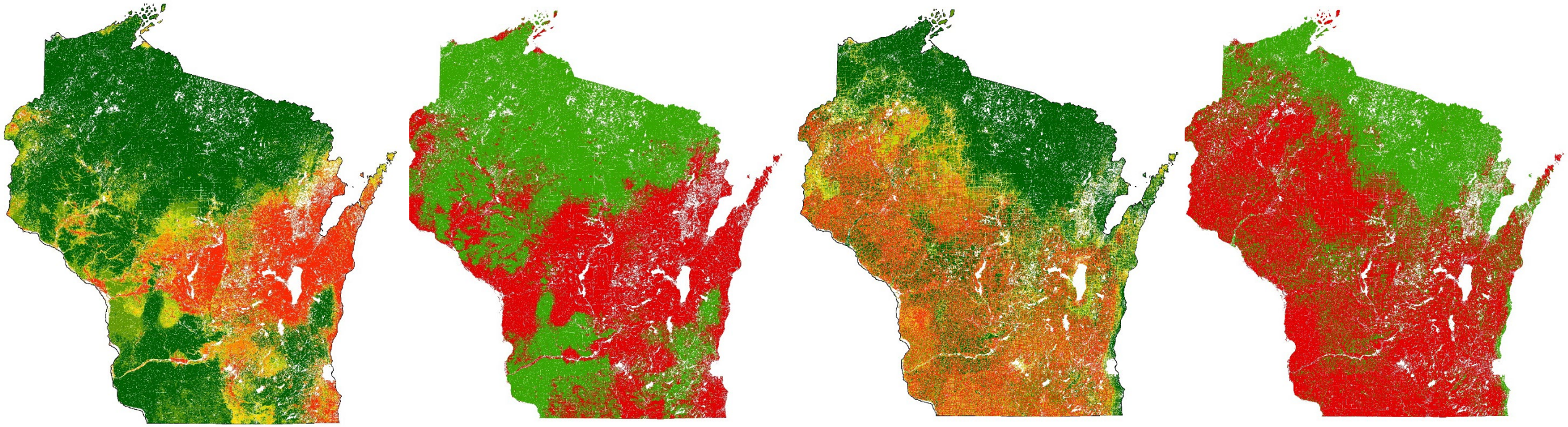
Using Citizen Science Observations to Validate 21 Habitat Suitability Models in Wisconsin



THE UNIVERSITY of WISCONSIN MADISON

Mark Renz & **Niels Jorgensen**

University of Wisconsin-Madison

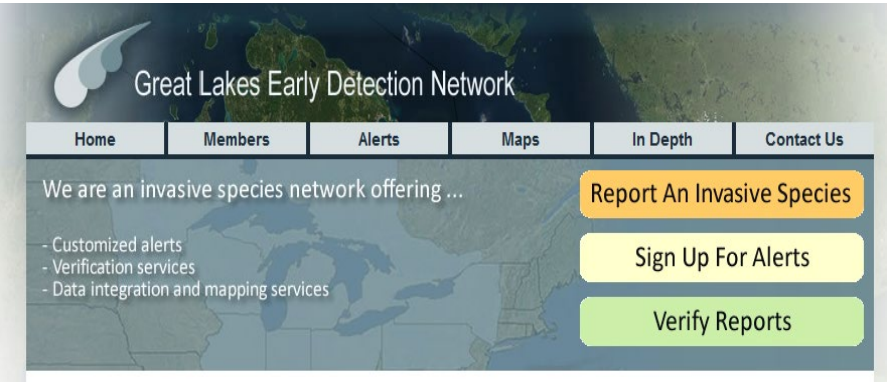
UW Extension
University of Wisconsin–Extension

Wouldn't be possible without the development of previous resources and networks

EDDMapS

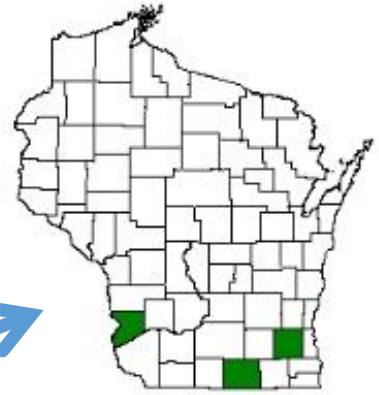
Early Detection & Distribution Mapping System

WISCONSIN FIRST DETECTOR NETWORK

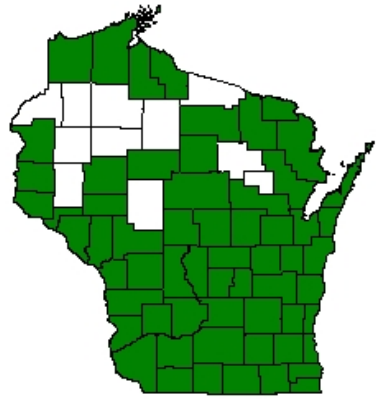


EDDMapS Midwest

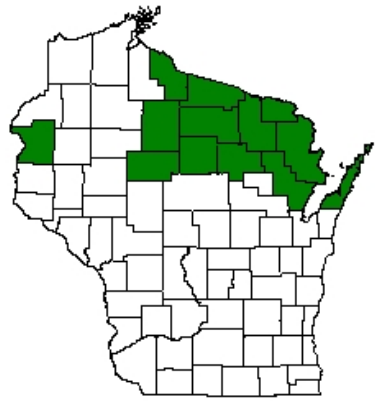
Wisconsin has a large number of regulated invasive species



- Over 145 invasive plants are regulated
  - 68 are prohibited = **must control**

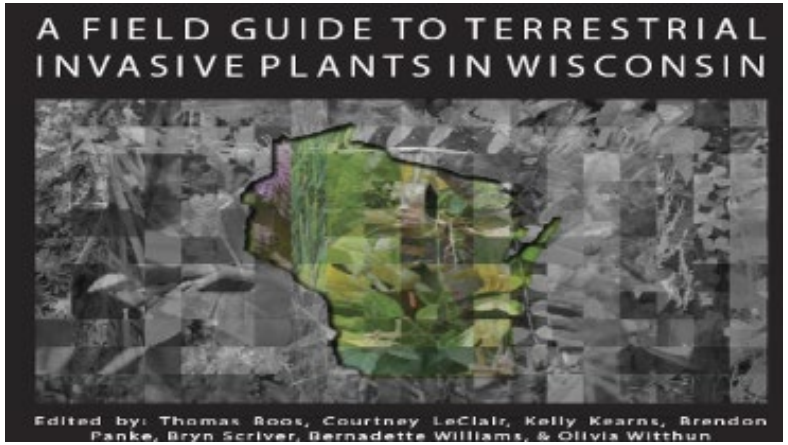


  - 63 are restricted
    - recommend control
    - can’t move propagules to un-infested areas
  - 14 are split listed
    - prohibited where uncommon/absent
    - restricted where common



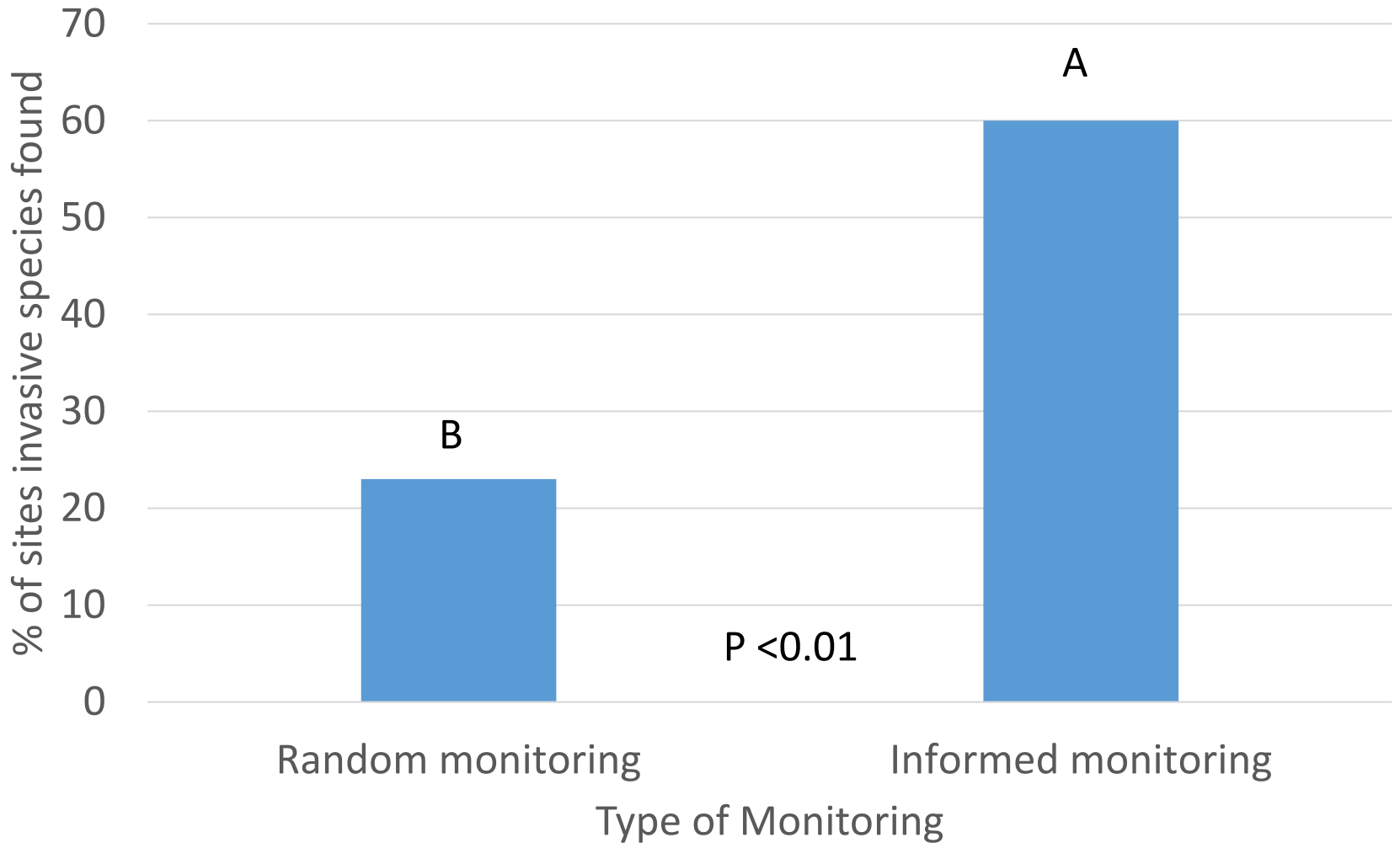
Large # of regulated plants challenge land managers ability to identify and monitor for

- Resources have been made to help with ID
- Land managers want tools to help prioritize monitoring efforts



Habitat suitability models can help improve monitoring efforts

- Using a model to inform monitoring for 1 invasive species **<u>can improve success rate</u>**
  - Crall et al. 2013



Funded to create 21 habitat suitability models for WI regulated plants

- Ensemble modeling approach using 5 models
  - boosted regression tree (BRT), generalized linear model (GLM), multivariate adaptive regression splines (MARS), maximum entropy (MaxEnt), random forests (RF)
- Observations
  - Existing databases (Great Lakes Early Detection Network, EDDMapS, WI DNR)
  - Citizen scientists (data verified)
- Used common environmental, topographic, and climactic conditions available for geo-referenced locations.

Utilized Iterative Approach

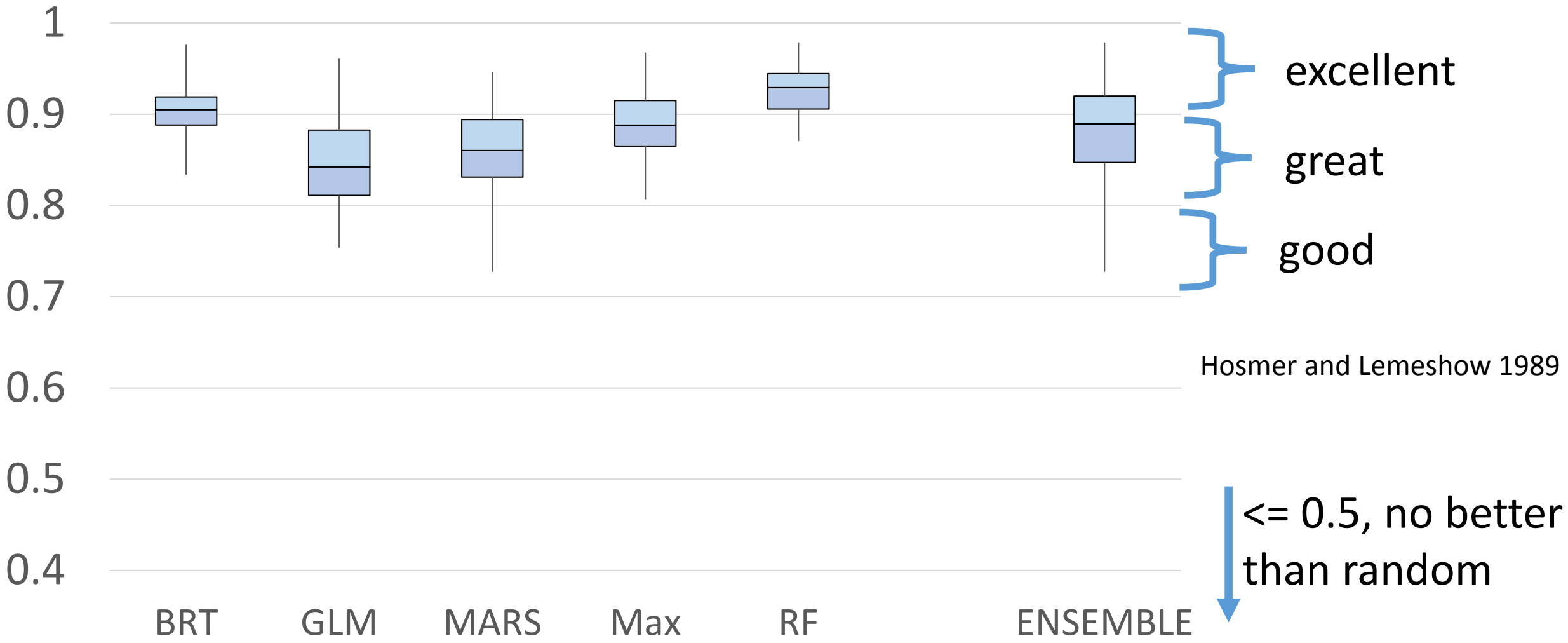
How well did the iterative approach work?

Common Name	Scientific Name	inc	Total
Garlic mustard	*Allaria petiolata*	44%	3,520
Japanese barberry	*Berberis thunbergii*	13%	474
Oriental bittersweet	***Celastrus orbiculatus***	**4%**	**223**
Spotted knapweed	*Centaurea stoebe*	37%	6,899
European marsh thistle	***Cirsium palustre***	**59%**	**1,369**
Teasels	*Dipsacus spp.*	3%	1,541
Autumn olive	*Elaeagnus umbellata*	59%	156
Leafy spurge	*Euphorbia esula*	106%	698
Knotweeds	***Fallopia spp.***	**17%**	**1,069**
Bush honeysuckles	*Lonicera spp.*	27%	3,943

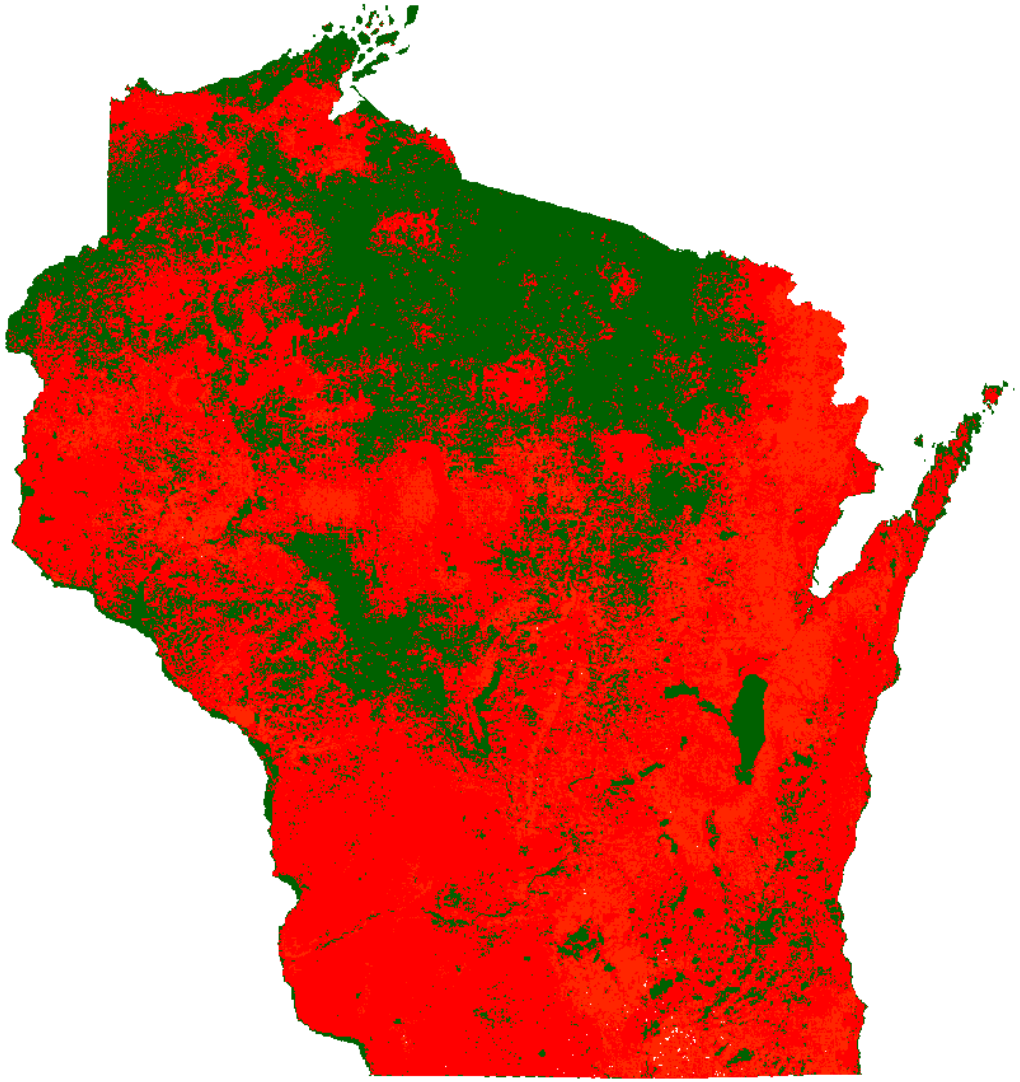
14,314 more points (37% increase)

Common Name	Scientific Name	inc	Total
Purple loosestrife	*Lythrum salicaria*	17%	1,642
Wild parsnip	*Pastinaca sativa*	18%	8,139
Canada thistle	*Cirsium arvense*	-	4,250
Phragmites	***Phragmites australis***	**1%**	**5,529**
Common buckthorn	*Rhamnus cathartica*	63%	1,673
Glossy buckthorn	*Rhamnus frangula*	12%	753
Wild chervil		-	613
Crown vetch	*Securigera varia*	36%	988
Tansy	*Tanacetum vulgare*	148%	10,778
Hedgeparsleys	***Torilis spp.***	**12%**	**509**
Garden valerian	*Valeriana officinalis*	5%	506

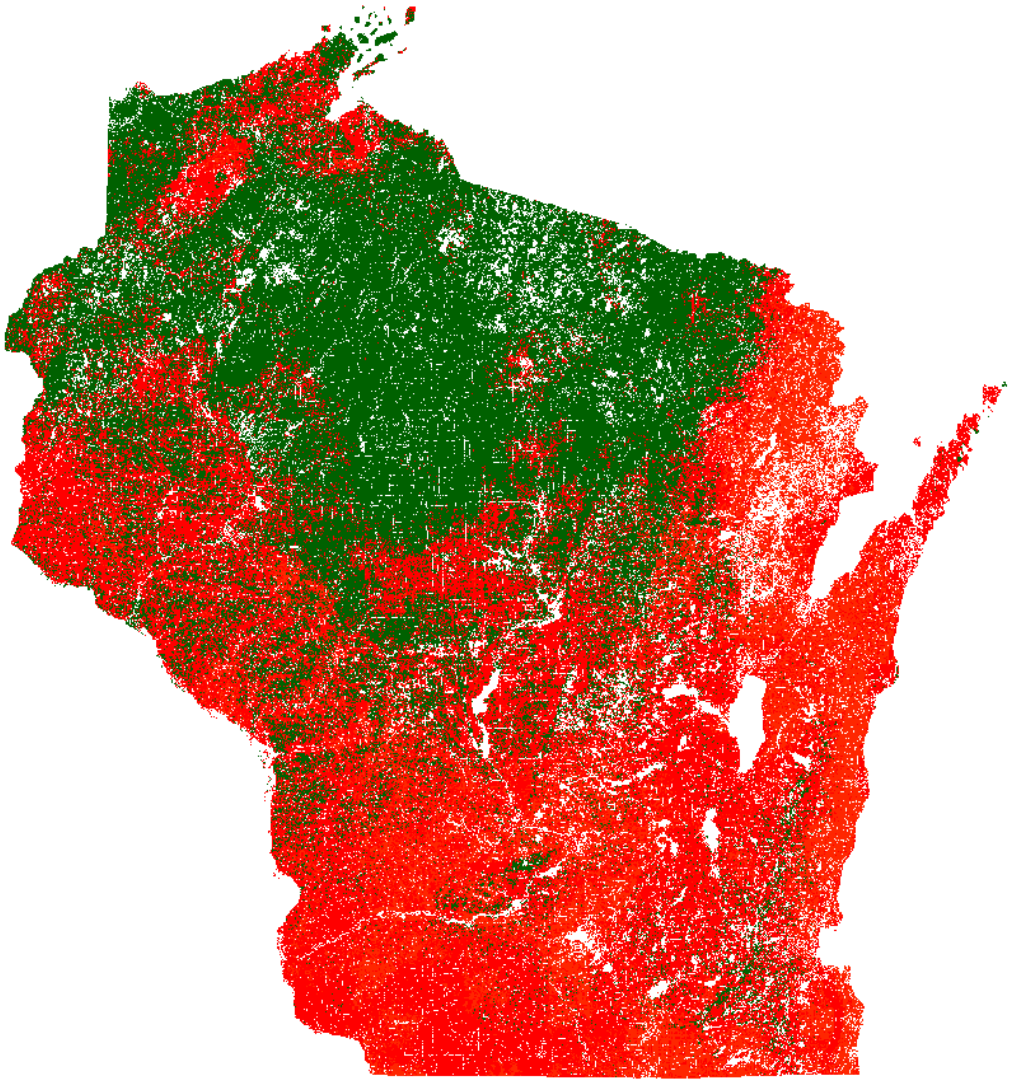
Did the iterative process improve models?
AUC values



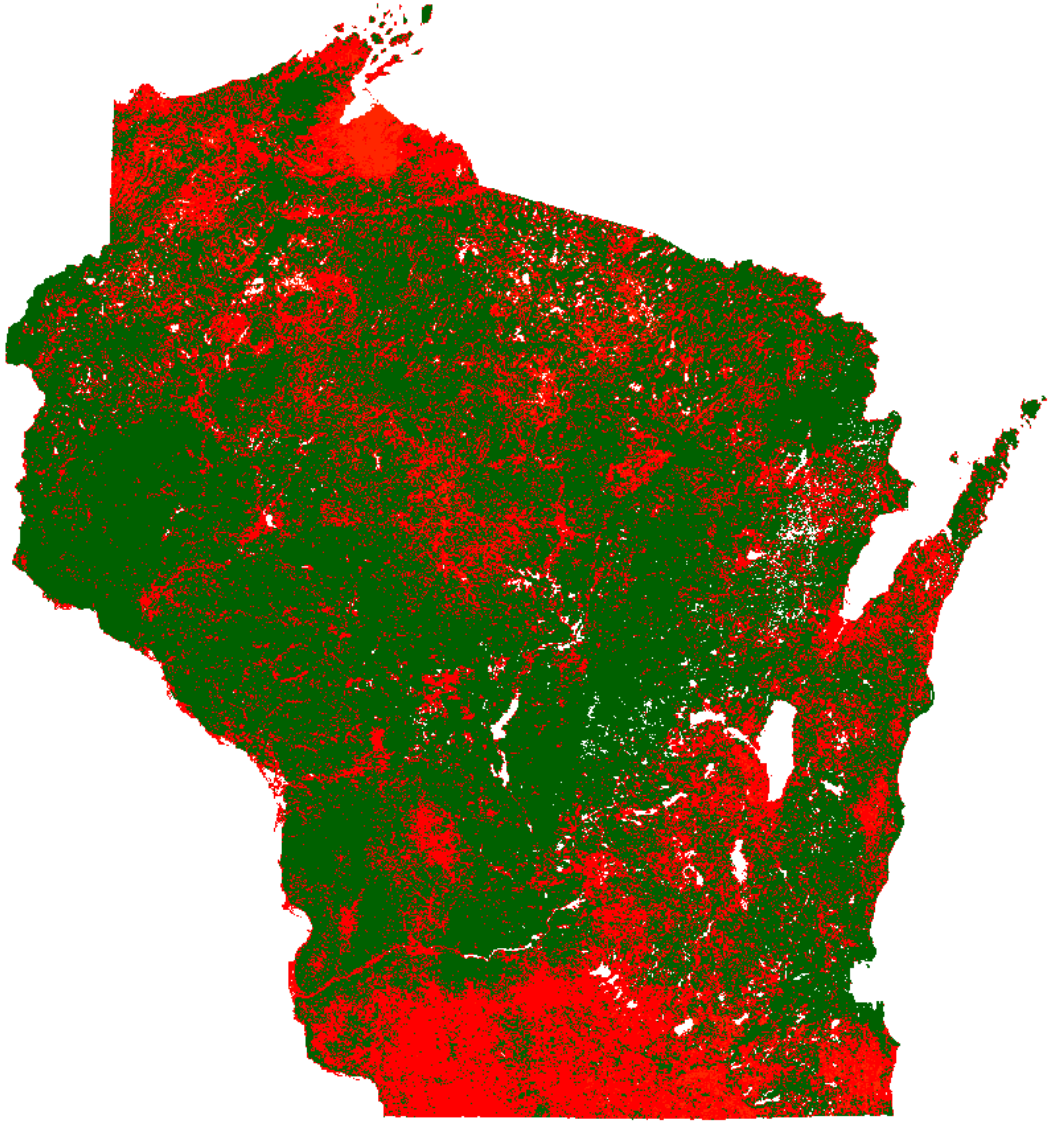
Leafy Spurge model (2015)



Leafy spurge model (2016)



Purple loosestrife model (2015)



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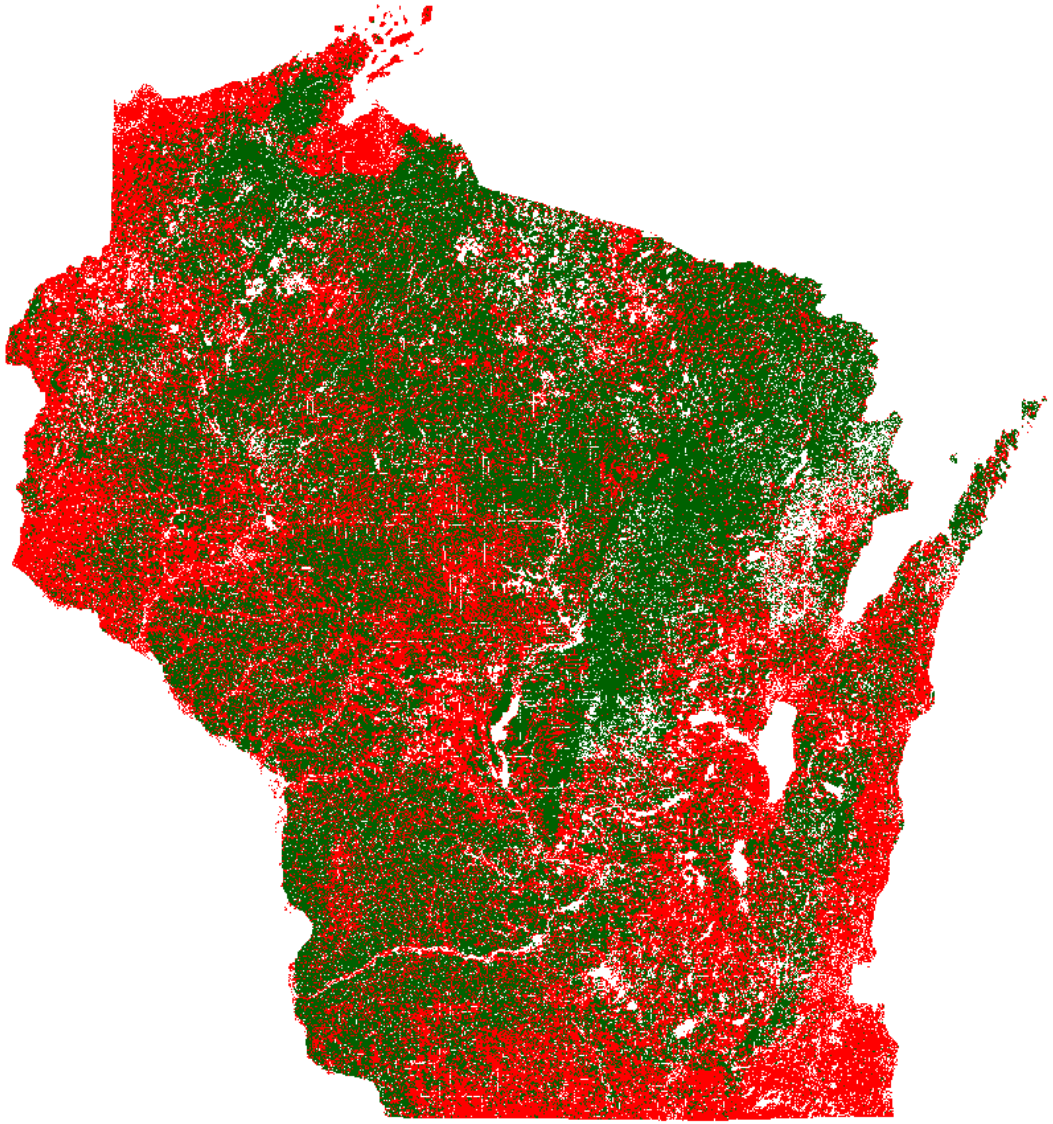


We wanted to field validate, but how?

- Past experiences we used experts and staff
  - Only focused on two species, had a grant to help fund students
- How to collect data on 20+ species in one summer across Wisconsin?

Wisconsin First Detector Network (WIFDN)

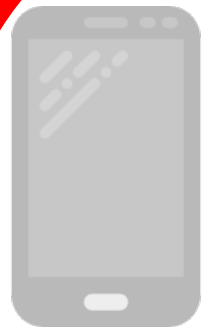
ESTABLISHED 2013

A statewide citizen science network for invasive species detection and education

http://fyi.uwex.edu/wifdn

WIFDN Impacts 2014-2017

9620
reported volunteer hours



7272
invasive species reports

9286
miles driven to volunteer activities

443
baseball diamonds surveyed for *Cerceris* wasps

1004
insects collected, **75** EAB from 2014-2015

http://fyi.uwex.edu/wifdn

Objectives:

- Field validate 21 habitat suitability models for invasive species

  1. Across all species

  2. Within each species

Methods for field validation

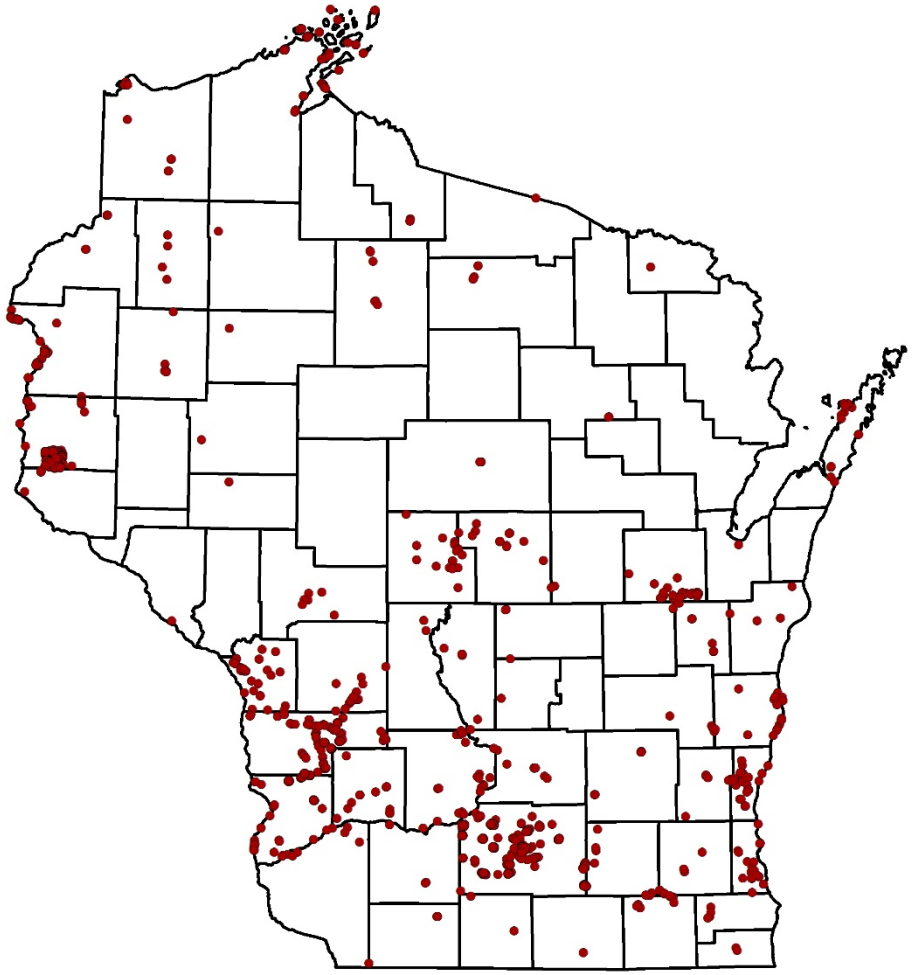
- Independent dataset from citizen scientists in summer 2017
  - Submitted via the Great Lakes Early Detection App

Only assessing type 1 error

EDDMapS
Early Detection & Distribution Mapping System

Reports

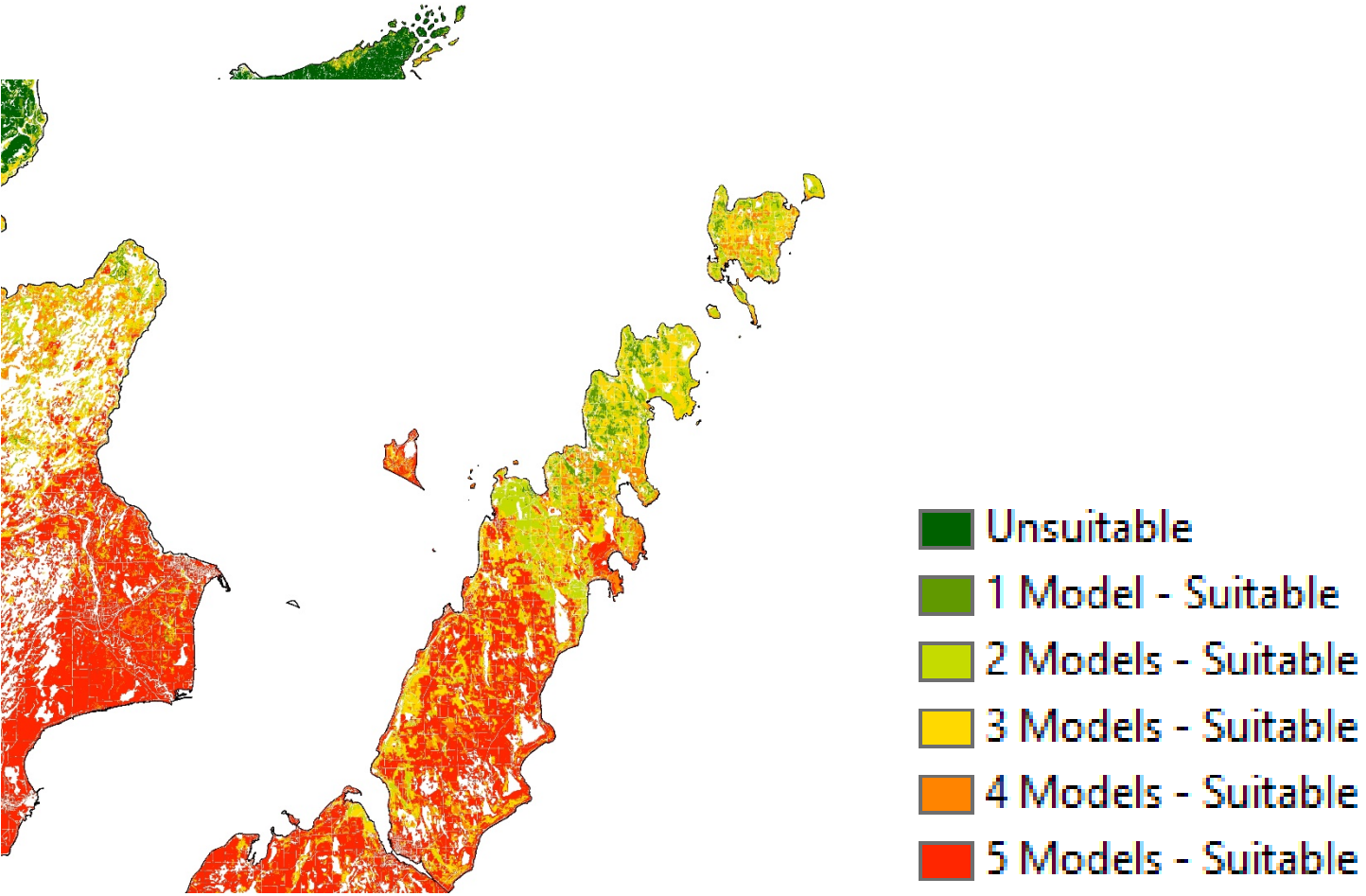
- 3,916 reports
  - 89% of Wisconsin counties reported at least one
  - 2,937 were used
    - Excluded if in novel areas or within road networks
- Calculated the % correct/incorrect classification for each species
  - Compared ensemble for
    - All species
      - Early detection species
      - Widespread species
    - Each species



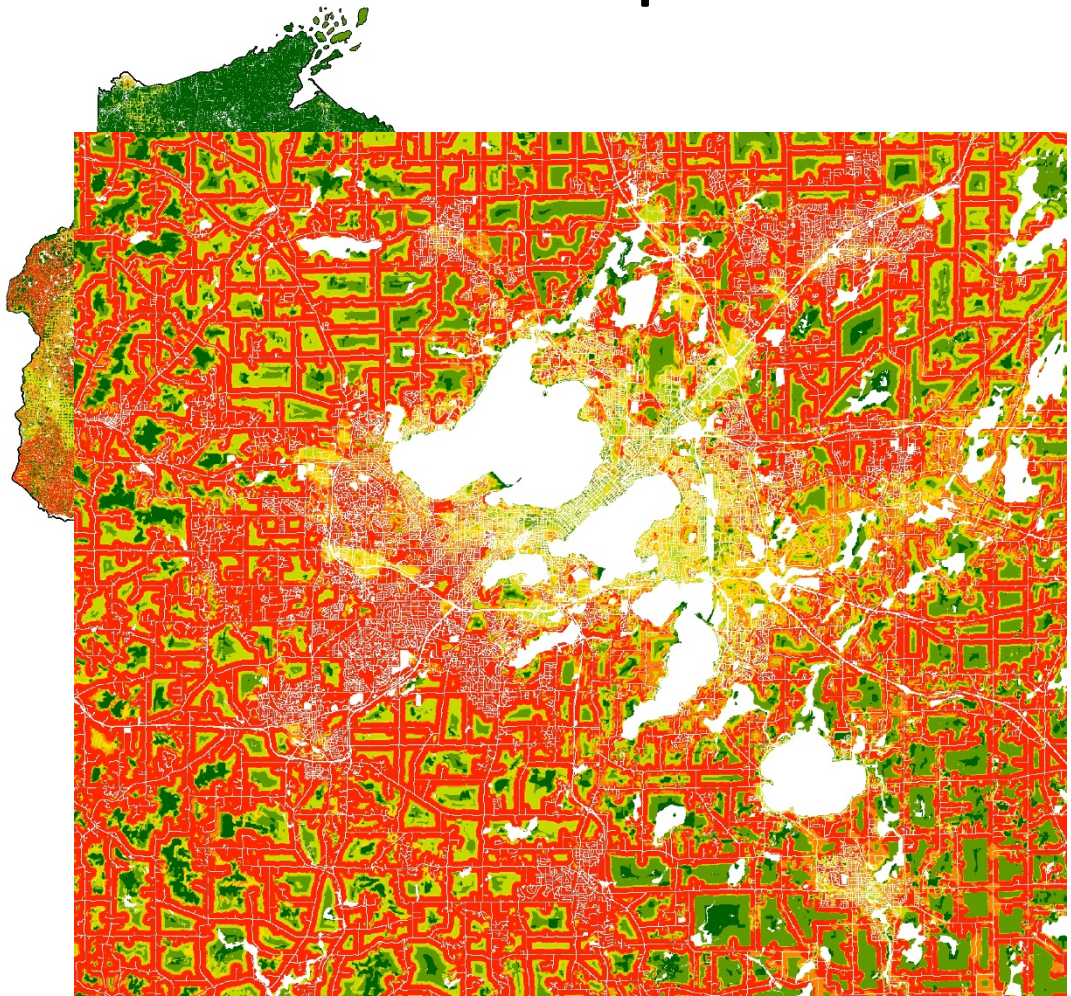
What Habitat Suitability Models look like

Models run at 30 m resolution

Phragmites

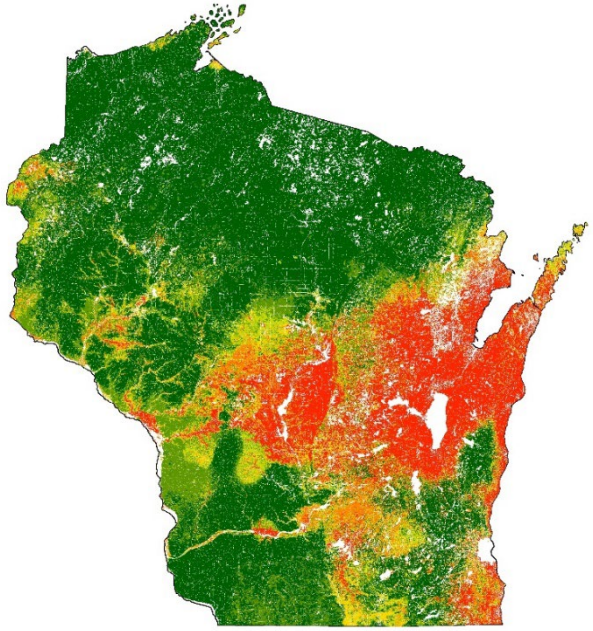


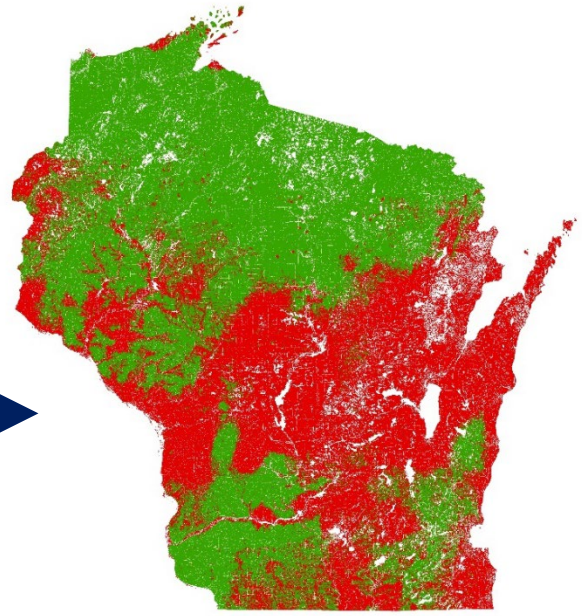
Wild Parsnip



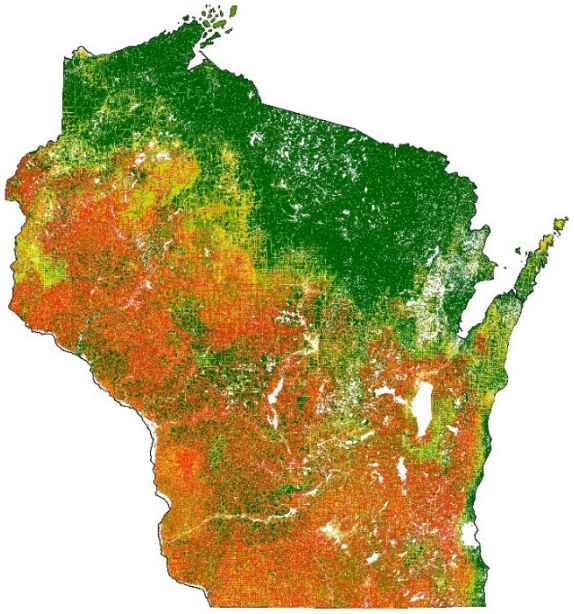
Converting Models into Binary maps (Ensemble)

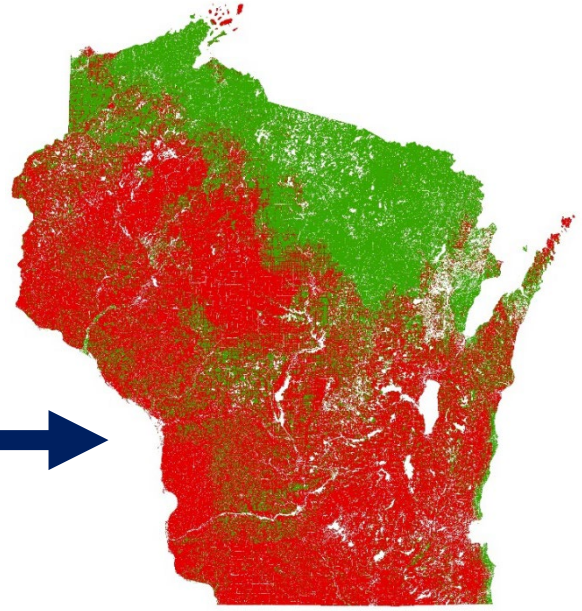
Phragmites





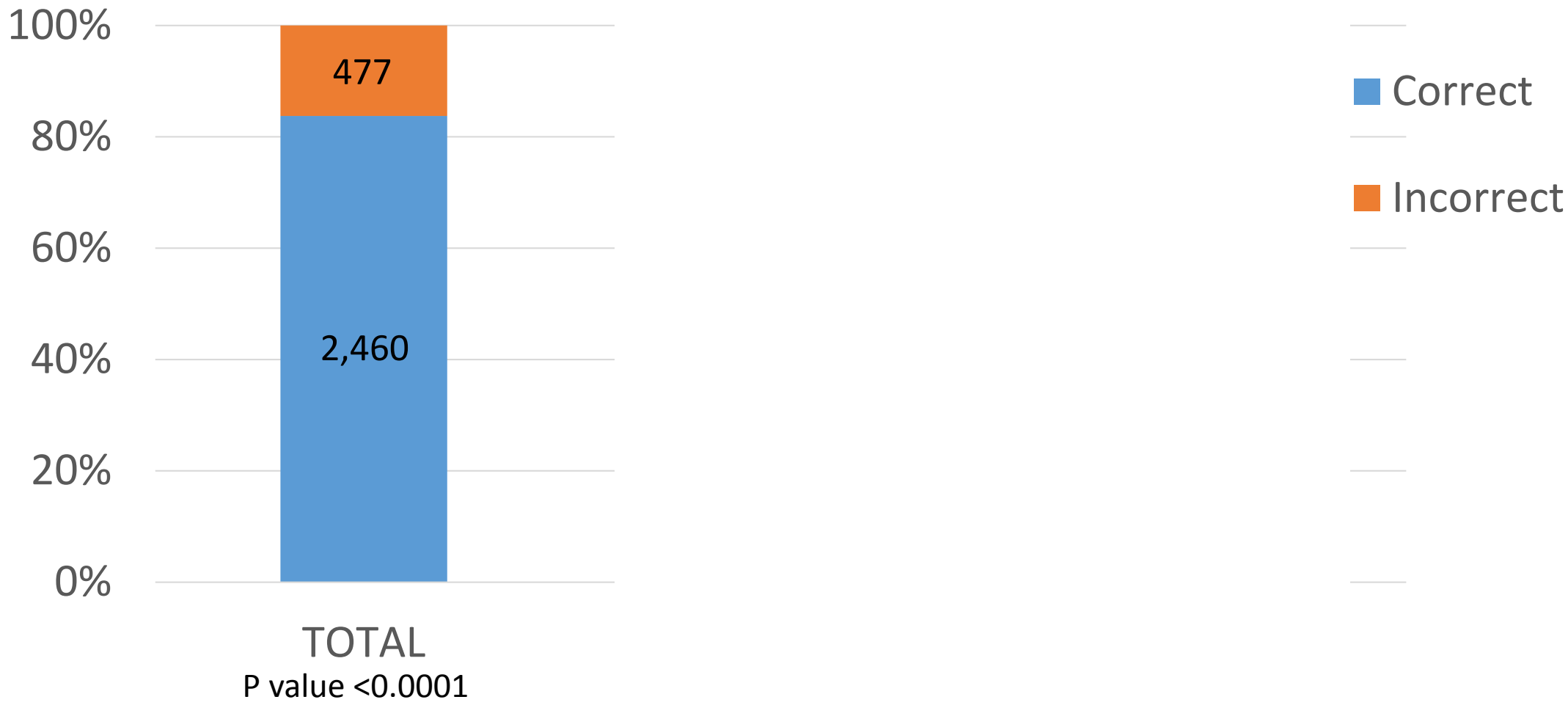
Wild Parsnip



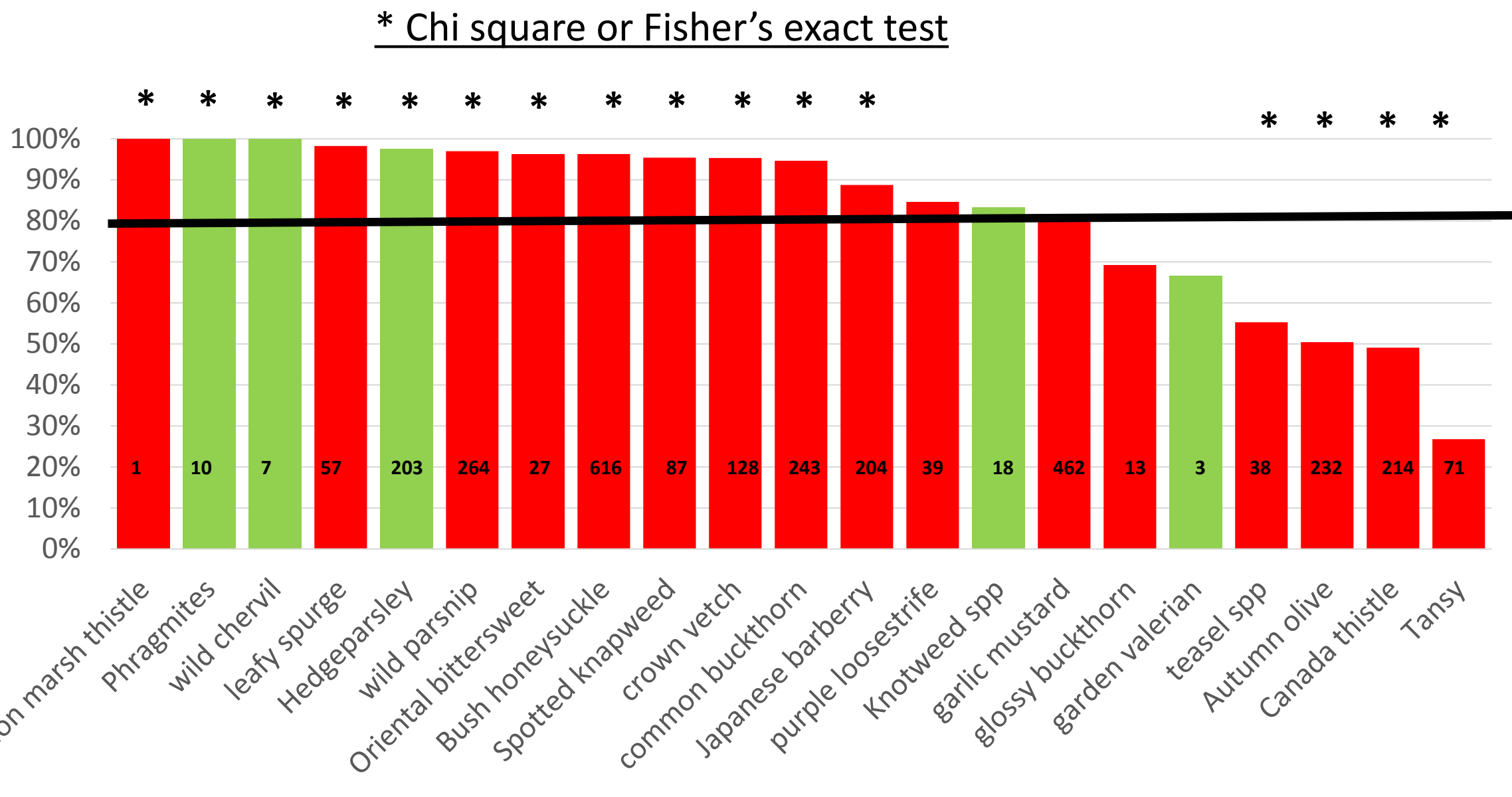


Percent of observations that were classified correct/incorrect as suitable habitat

Ensemble (*at least one model correct)*



Percent correctly classified by species (ensemble)



Summary

- Correctly classified invasive plant locations > 80%
  - Early detection > 95%
- Individual species
  - 12 species were correct > 80%
  - 5 species were similar to 80% expected correct
  - 4 species were worse than 80%
- Future efforts will include 2018 data in analysis

Summary

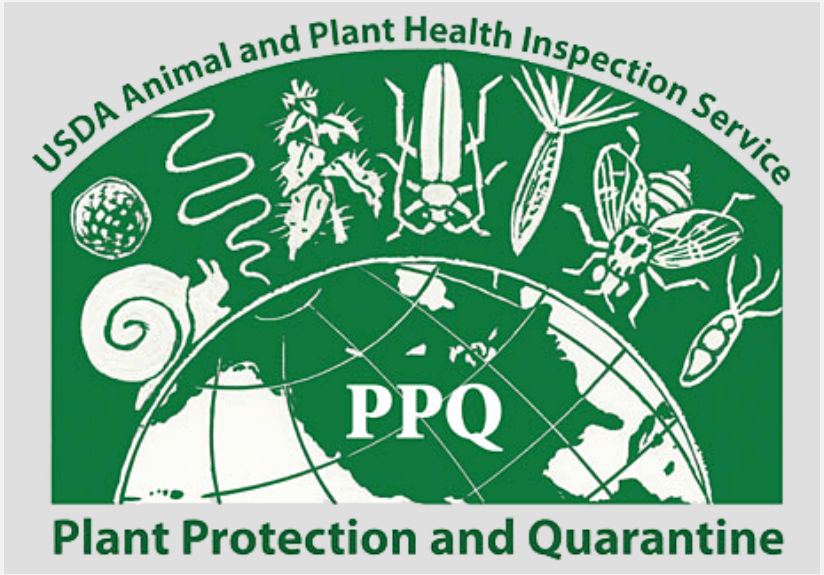
- Citizen Scientists can help!
- WIFDN has been a great partnership to improving our understanding of invasive plant presence and suitable habitats in Wisconsin

UW Extension
University of Wisconsin-Extension

Funding


USDA


FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE


USDA Animal and Plant Health Inspection Service
PPQ
Plant Protection and Quarantine