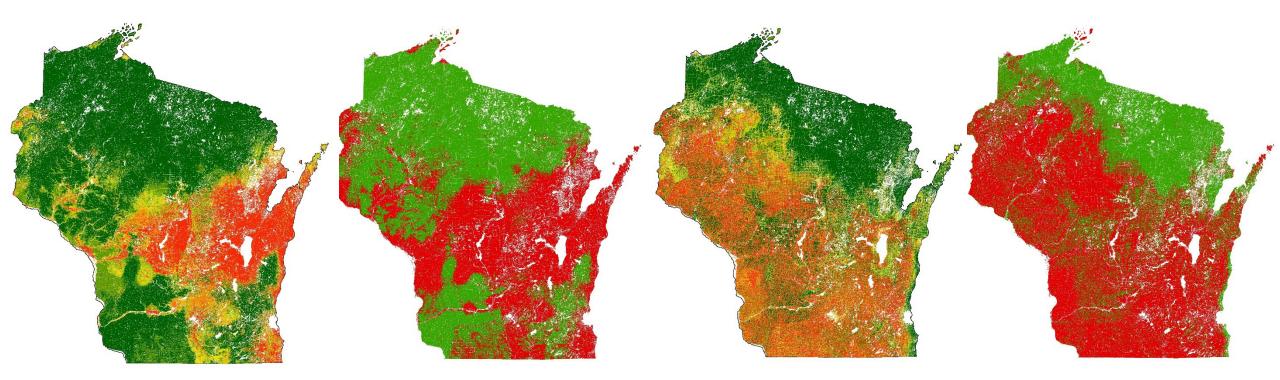
## Using Citizen Science Observations to Validate 21 Habitat Suitability Models in Wisconsin

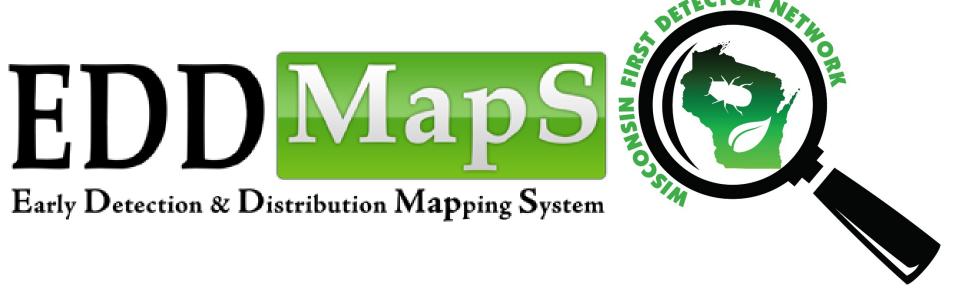




Mark Renz & **Niels Jorgensen**University of Wisconsin-Madison



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





























# 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

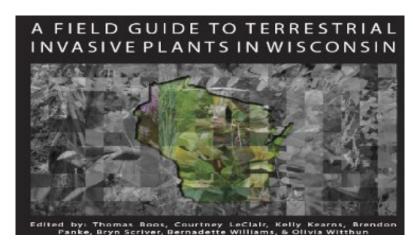






### Large # of regulated plants challenge land managers ability to identify and monitor for

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





Brendon Pankeand Mark Ren

and aggressively spiral beyond their in trus in range, disrupting-exceptemen. He drange-more of Inter-tive March in Workshoot in the area of the area

#### Japanese knotweed

(Polygonum cuspidatum)

peremial, growing up to 10 tall, reddiff, arching bambool lot et ke are smooth and stout, and they can p after plant diestock each year. The br of the stam above each joint is swotk and surrounded by a membranous st (or sea).

Legal dassification in Wisconsi Restricted

setricted was: Alternate, egg-shaped to almost riangular, 4-6"long, 3-4"wide. Dark green on upper surface and pale gree in lower surface.

are rumerous, highly branched, tiny, creamy white or greenish and found where the leaf attaches to the stem (xxils), near the tips of stems

Prui is and seeds: Small, winged, triangula fruits carry very small, shiny seeds. Roots: Flants ariding from seed have a taprootup to 6 deep. Stout rhizomes

loots Partsarding from sea chave a taprootup to dideep. Stoutrhizomes can reach diffor more from parent plantsandigive rise to new stalks Plants arising from seed and thizome also have florous roots.

Similar species Gantkinotweed (P. w. sichaliterine) is also invasive, but grows up to 13 'tall with larger leaves The two species are known to hybridize. Boological threat:

 Invades uplandand lowbind sites that are disturbed and undisturbed.
 Poses a dignificant threat to riparian.

areas, where it can rapidly spread.

It tolerakes shade, high temperatures, high sainity, and drought.

It can be transported to new skeras a cortaminant in fill ditt or on equipment.

contraminant infill dift or on equipment. During floods, it spread downstream by shoot fragments, rhizomes or coasionally by seeds. Exappes from neglected gardens and discarded outlings are common routure of depends from urbanareas.

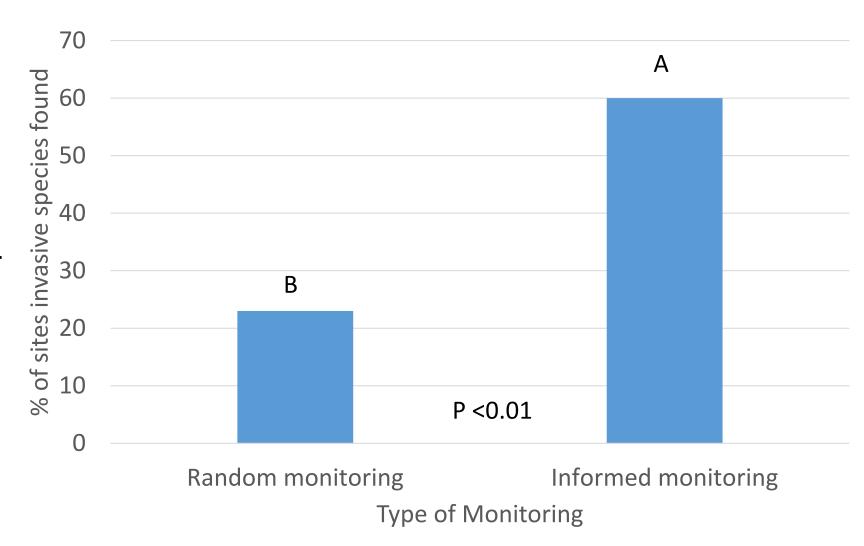
Michoulam herborted for not produce

 Although reported to not produce viable seed several studies have shown that populations of knotwed in the United States camproduce viable seed that readily germinate and survive in field conditions.



## Habitat suitability models can help improve monitoring efforts

- Using a model to inform monitoring for 1 invasive species <u>can improve</u> <u>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**



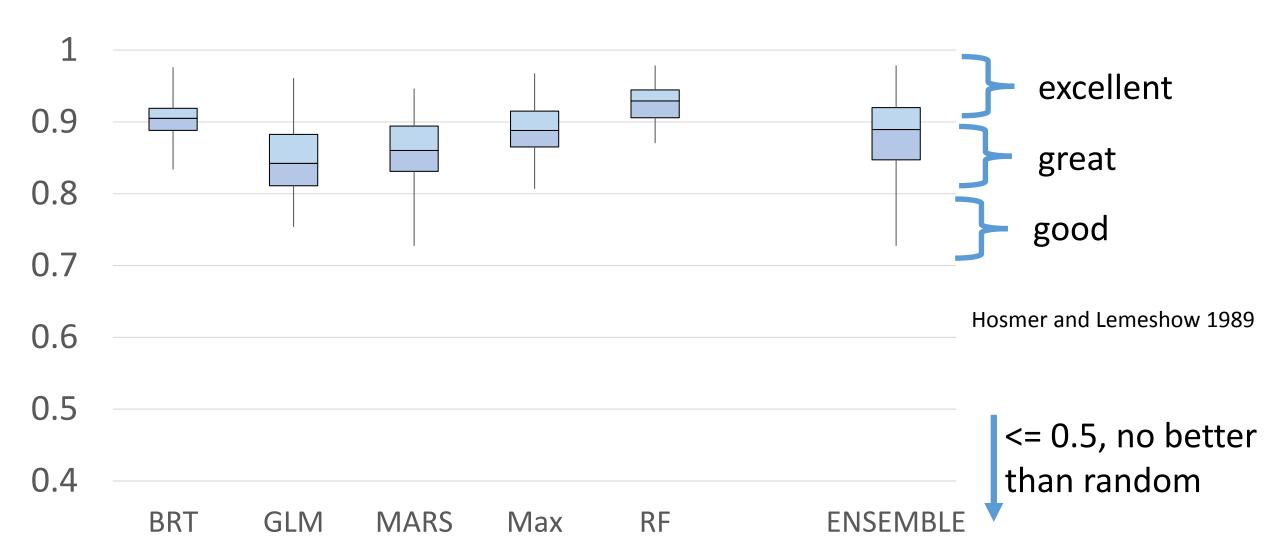
#### How well did the iterative approach work?

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

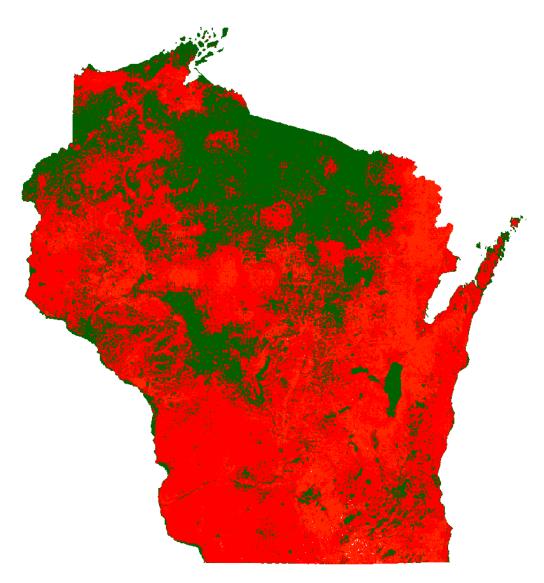
14,314 more points (37% increase)

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



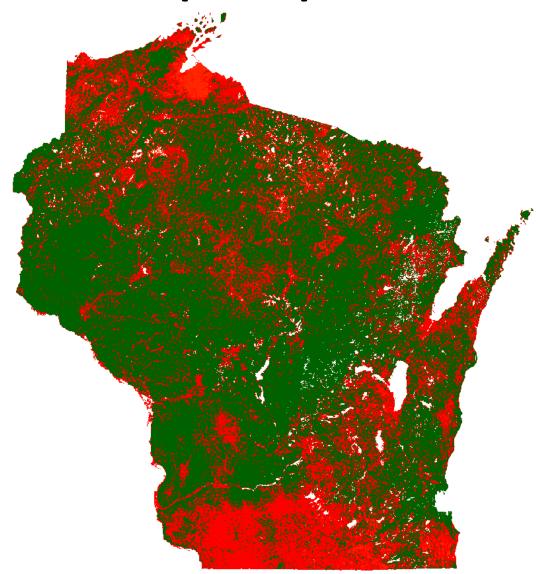
## Leafy Spurge model (2015)



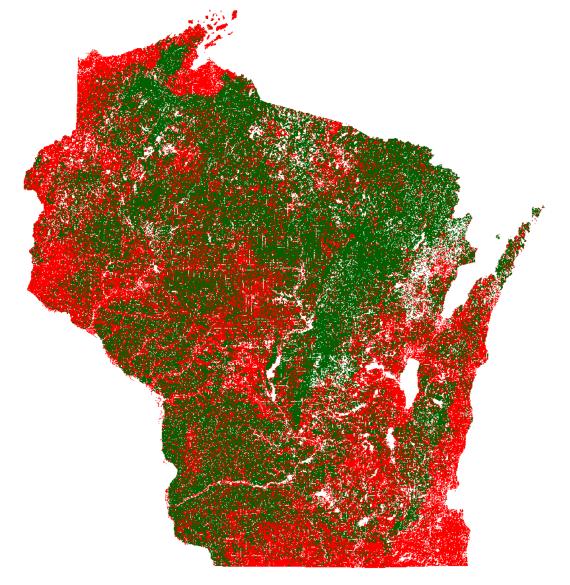
## Leafy spurge model (2016)



### Purple loosestrife model (2015)



### Purple loosestrife model (2016)



#### 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

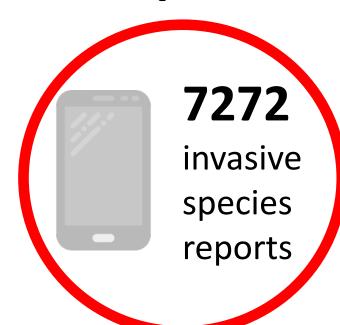
A statewide citizen science network for invasive species detection and education

http://fyi.uwex.edu/wifdn

#### **WIFDN Impacts 2014-2017**



9620 reported volunteer hours





**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

**Great Lakes Early** 

Detection Network

#### Methods for field validation

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





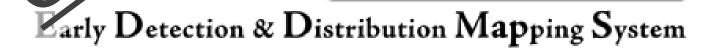


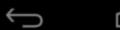








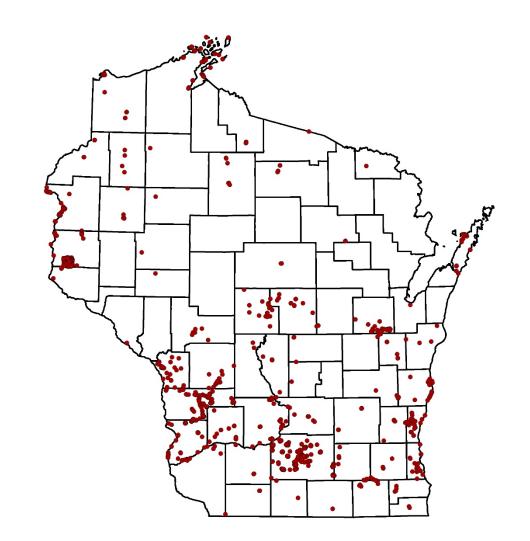






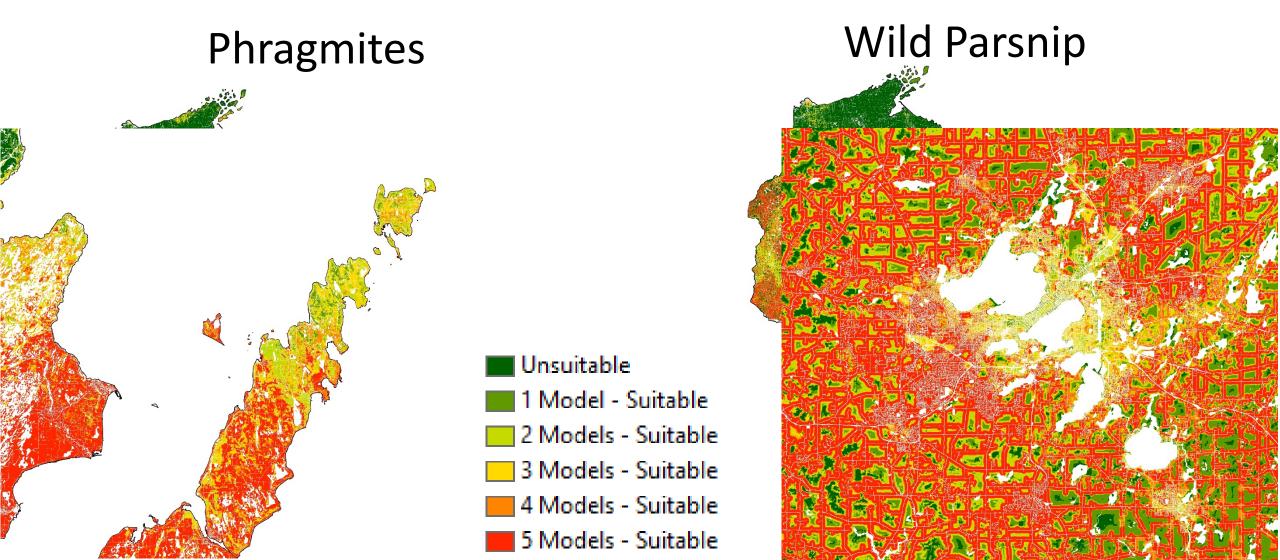
#### Reports

- 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

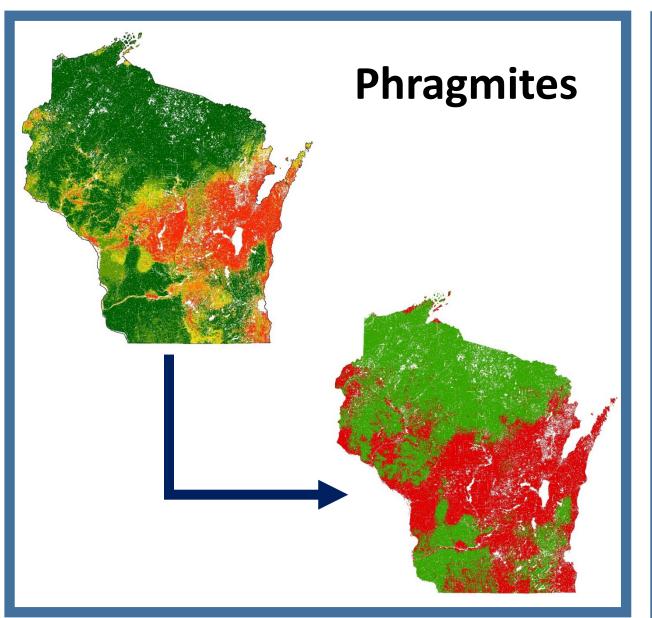


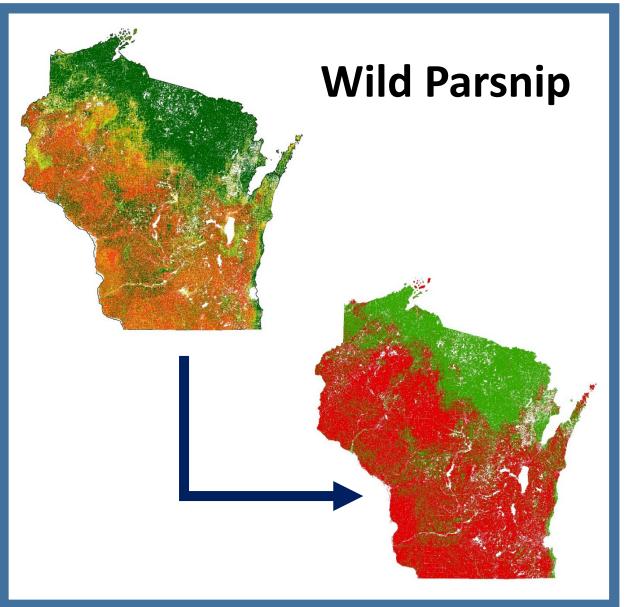
#### What Habitat Suitability Models look like

Models run at 30 m resolution



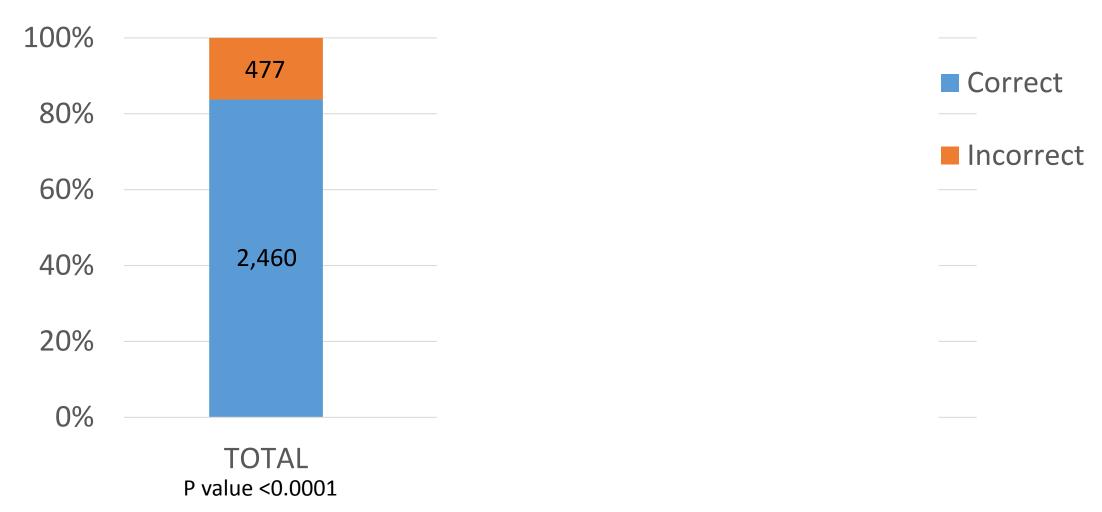
#### Converting Models into Binary maps (Ensemble)





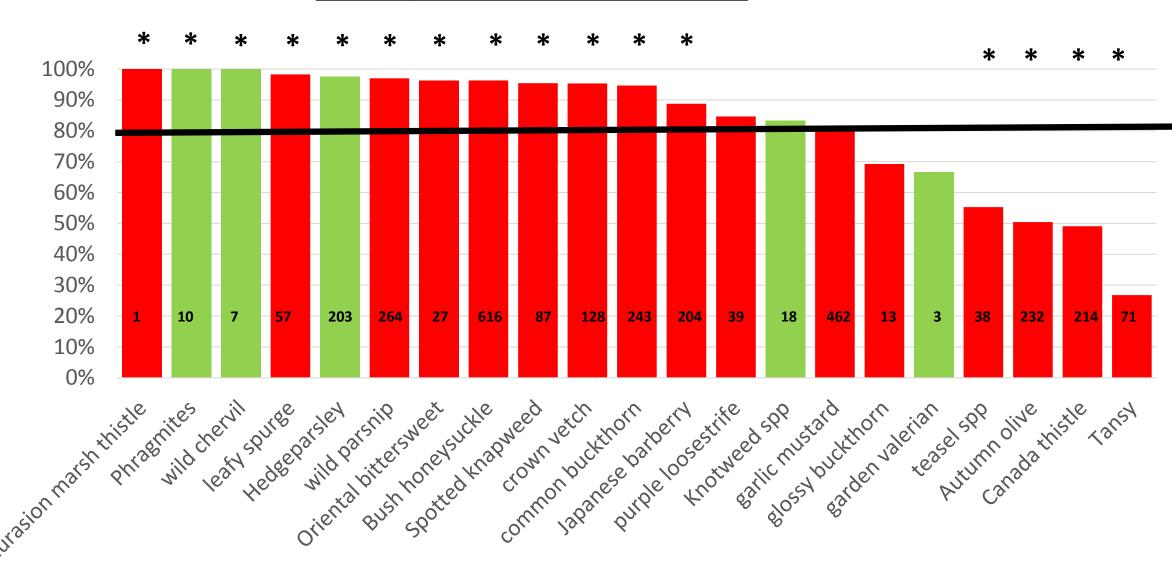
### Percent of observations that were classified correct/incorrect as suitable habitat

Ensemble (at least one model correct)



#### Percent correctly classified by species (ensemble)

\* Chi square or Fisher's exact test



#### 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





### Funding





