National Monitoring Program and Modeling of BMSB

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Funding

USDA United States Department of Agriculture National Institute of Food and Agriculture

Specialty Crop Research Initiative

Collaborating Institutions

NC State University · PennState · OSU Oregon State · University of Maryland · University of Georgia · Washington State University · Northeastern IPM Center · Cornell University · Utah State University · Rutgers University · The Ohio State University · University of Kentucky · UC Davis · University of Minnesota · Virginia Tech · Berkeley · Michigan State University · UC Riverside

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(2) Assess suitability of landscapes for BMSB and predict risk of invasion to new regions

(3) Integrate data into outreach programs

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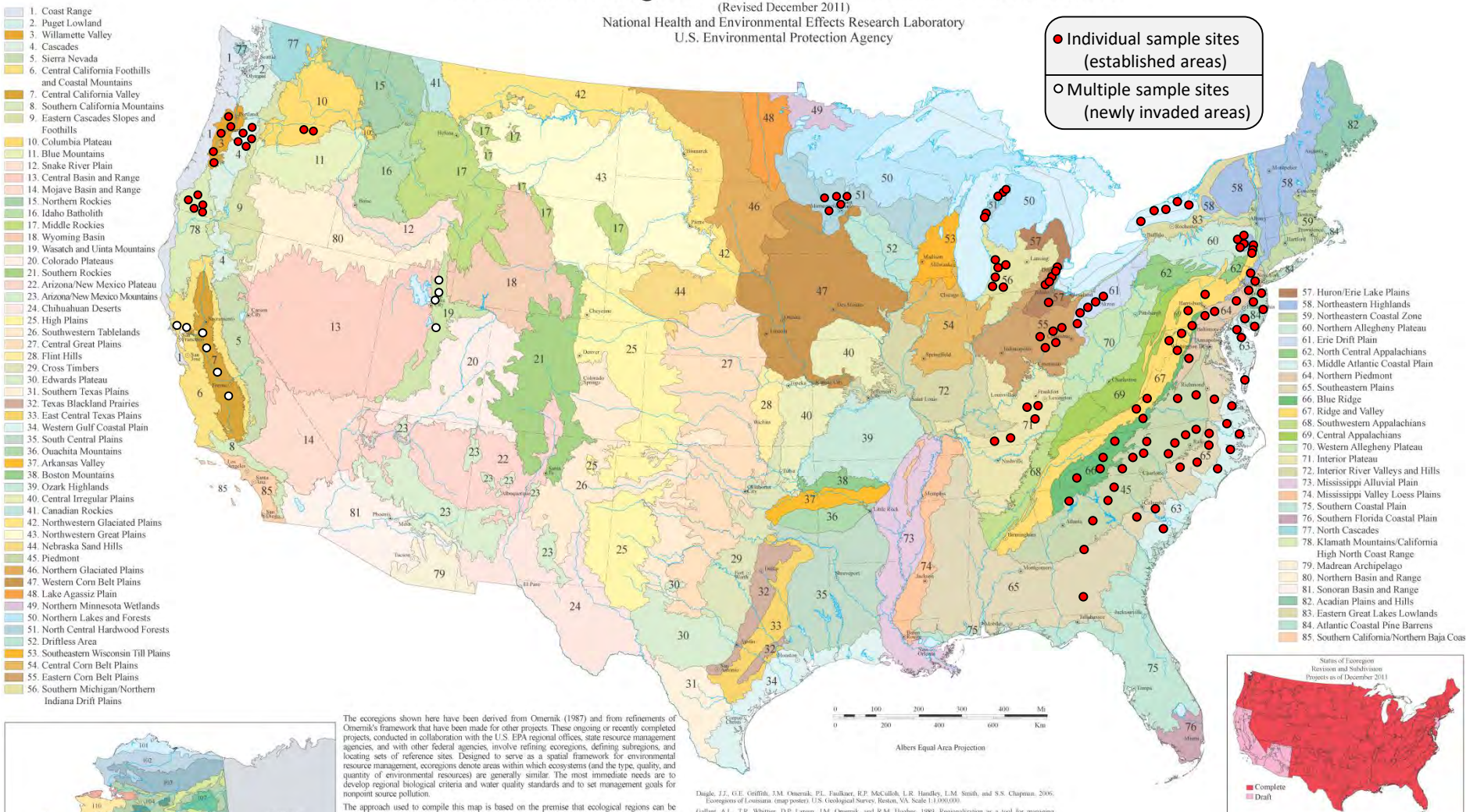
Level III Ecoregions of the Continental United States

(Revised December 2011)

National Health and Environmental Effects Research Laboratory

U.S. Environmental Protection Agency



The ecoregions shown here have been derived from Omernik (1987) and from refinements of Omernik's framework that have been made for other projects. These ongoing or recently completed projects, conducted in collaboration with the U.S. EPA regional offices, state resource management agencies, and with other federal agencies, involve refining ecoregions, defining subregions, and locating sets of reference sites. Designed to serve as a spatial framework for environmental resource management, ecoregions denote areas within which ecosystems (and the type, quality, and quantity of environmental resources) are generally similar. The most immediate needs are to develop regional biological criteria and water quality standards and to set management goals for nonpoint source pollution.

The approach used to compile this map is based on the premise that ecological regions can be identified through the analysis of the patterns and the composition of biotic and abiotic phenomena that affect or reflect differences in ecosystem quality and integrity (Wiken 1986; Omernik 1987, 1995). These phenomena include geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. The relative importance of each characteristic varies from one ecological region to another regardless of the hierarchical level. Because of possible confusion with other meanings of terms for different levels of ecological regions, a Roman numeral classification scheme has been adopted for this effort. Level I is the coarsest level, dividing North America into 15 ecological regions, whereas at Level II the continent is subdivided into 50 classes (CEC 1997). Level III is the hierarchical level shown on this map. For portions of the United States (see map inset) the ecoregions have been further subdivided to Level IV. The applications of the ecoregions are explained in reports and publications from the state and regional projects (e.g., Bryce et al., 1998, 2003; Chapman et al., 2001, 2006; Daigle et al., 2006; Gallant et al., 1989, 1995; Griffith et al., 1998, 2002, 2004; McGrath et al., 2002; Omernik et al., 2000, 2004; Thorson et al., 2003; and Woods et al., 1996, 2002, 2004). For additional information, contact James M. Omernik, U.S. EPA National Health and Environmental Effects Laboratory, 200 SW 35th Street, Corvallis, OR 97333; phone: (541) 754-4458, email: omernik.james@epa.gov.

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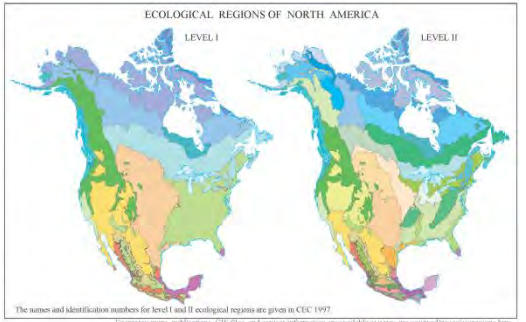
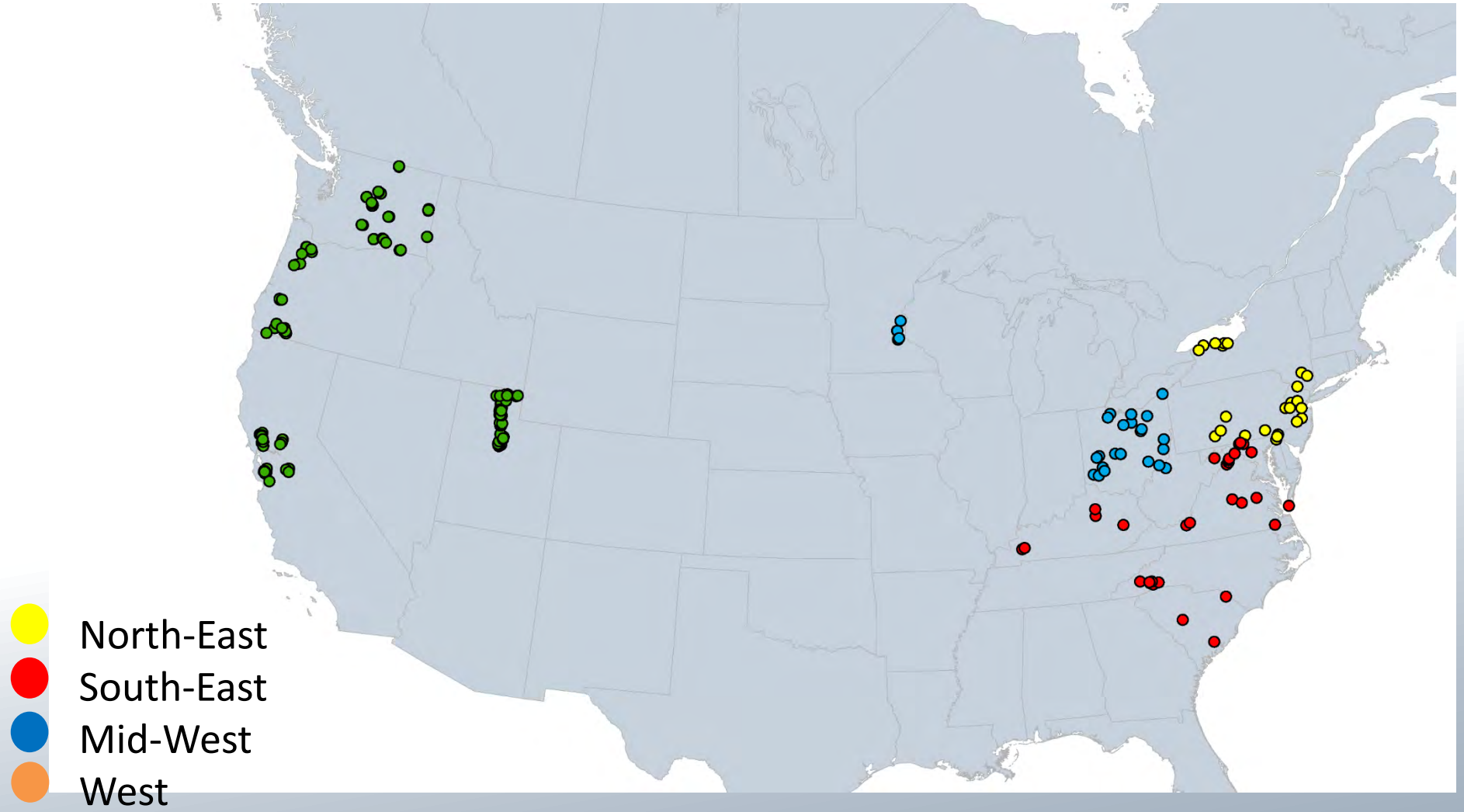


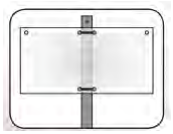
BMSB Monitoring Network Established

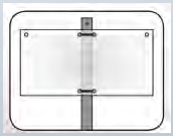


	BMSB sampling summary
States	15
Research groups	26
Sampling sites	268
Climatic Range	
Mean tp (ºC)	11.57 (5.07 - 18.26)
Minimum tp (ºC)	5.26 (-2.88 – 12.03)
Maximum tp (ºC)	17.87 (12.79 – 24.48)
Precipitation (mm)	705.50 (190.67 – 1841.45)
Elevational range (m)	541.63 (3-1845)
Land-use (in 5K buffer)	15 classes (82 crops)

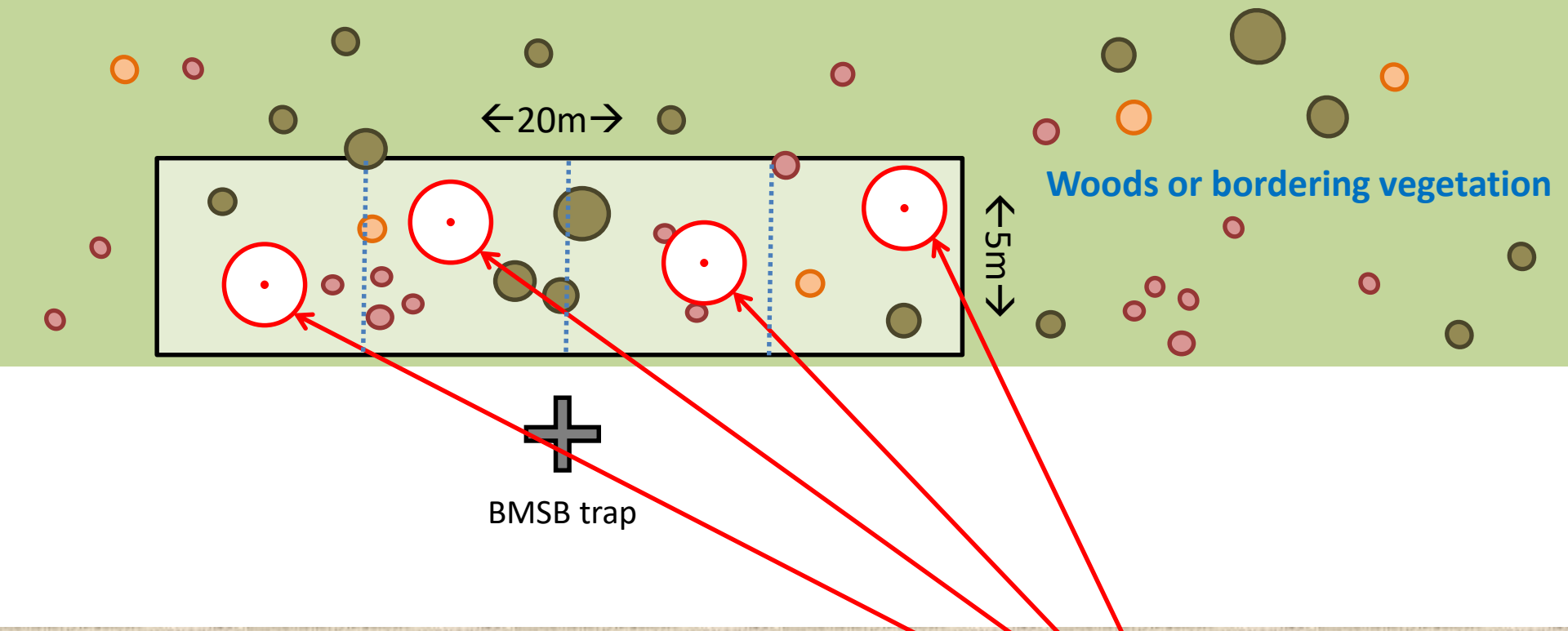
Weekly Use of Sticky Traps

Non-crop





Crop Field



TREE INVENTORY (list of dbh values)

pin oak: 30, 16, 12, 6, 6, 8, 18**

black cherry: 3,5,3,4,1,1,2,5*

tree of heaven: 7, 8 (all cm)

*more in than out: include

**more out than in: exclude

TREE SUMMARY (from data, left)

pin oak: 6 stems, BA=1127.8 cm^2

black cherry: 8 stems, BA=47.9

tree of heaven: 2 stems, BA=88.7

BA = total basal area ($\Sigma\pi r^2$)

from these can be calculated:

%density= 37.5%, 50%, 12.5%

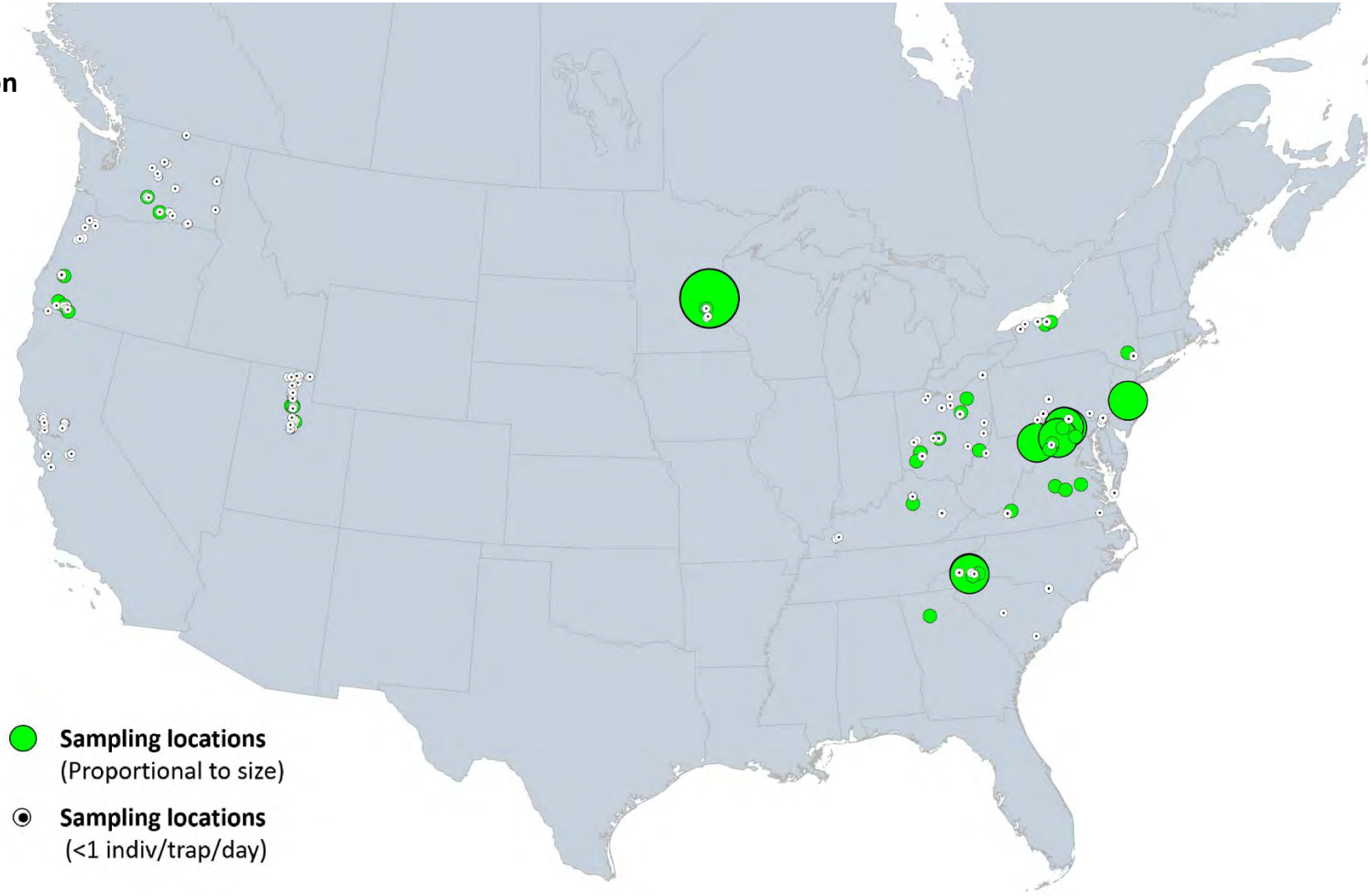
% basal area= 89.2%, 3.8%, 7.0%

IV = imprtc. value = 63.3%, 16.9%, 9.8%

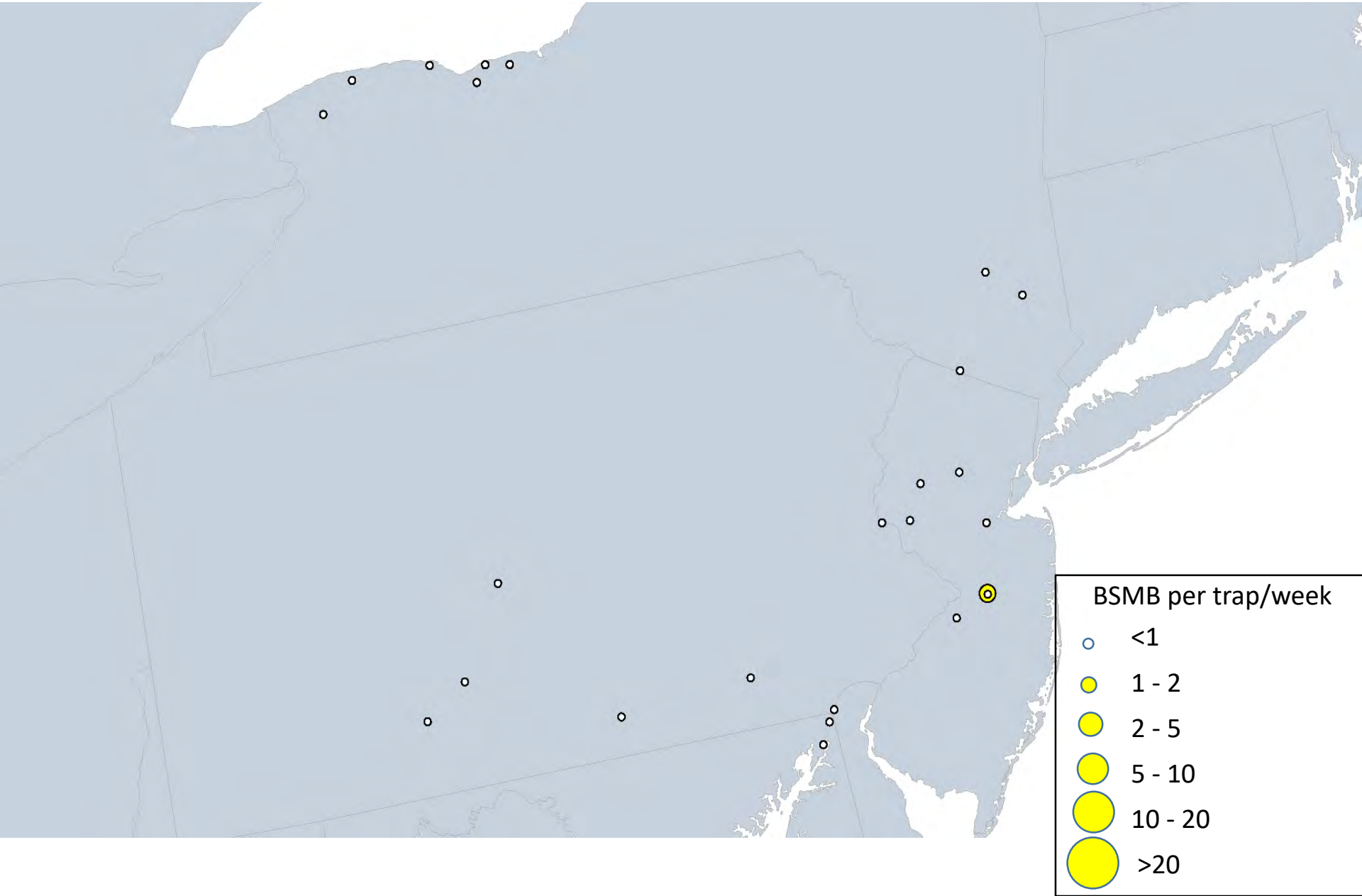
GROUND COVERAGE (4 circles with observer at center point looking out 1m)
Looking down at 4 points within 5x20m plot (one in each of the four 5x5m subplots shown): estimate coverage % within 1m radius, including bare ground, leaf litter, downed wood, etc. Provide means of 4 points to nearest 5%.
Example: 30% leaf litter, 25% bare ground, 25% Japanese honeysuckle, 10% grass, 5% vetch, 5% other woody shrubs.

Data Overview

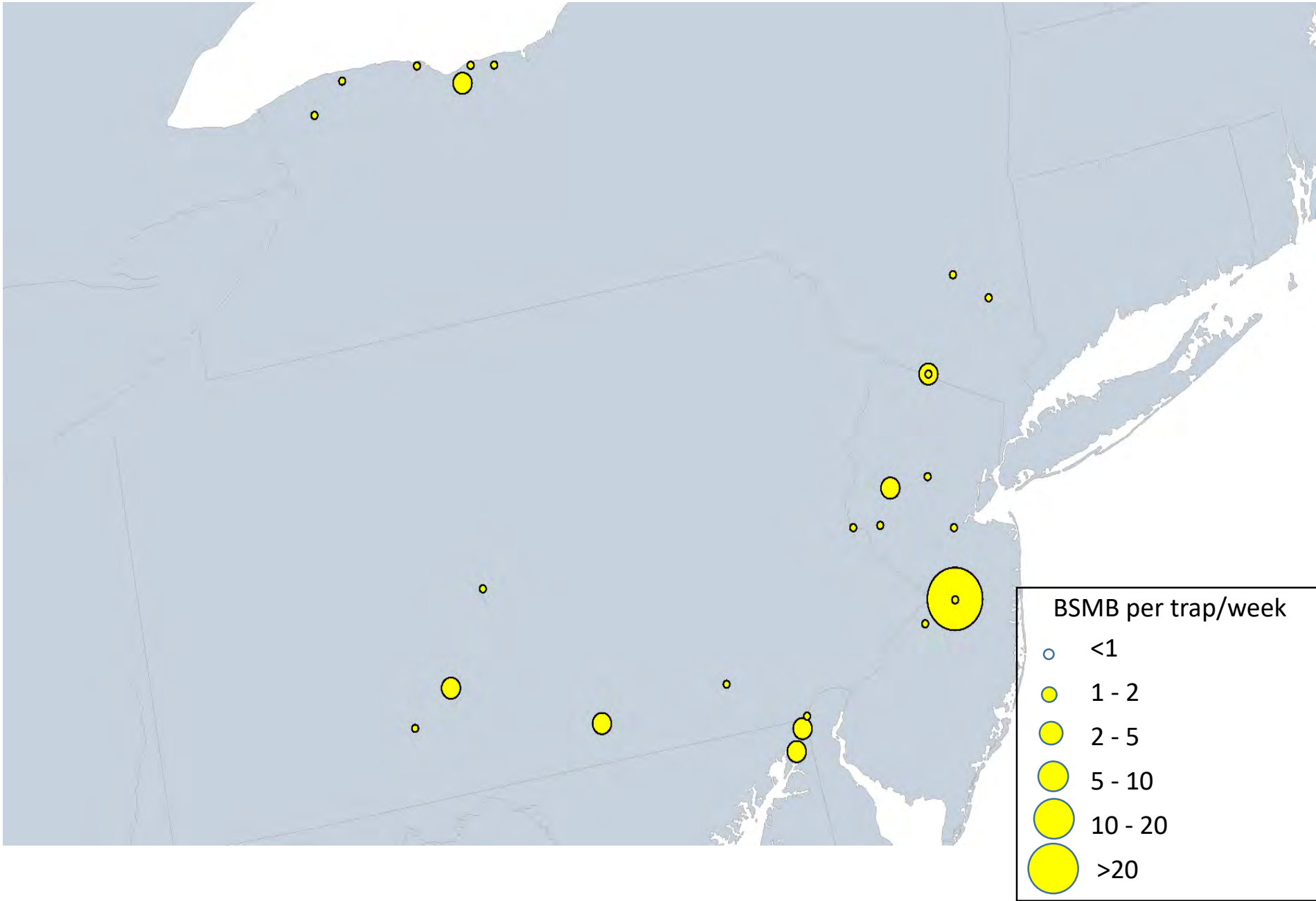
Total population Size (annual)



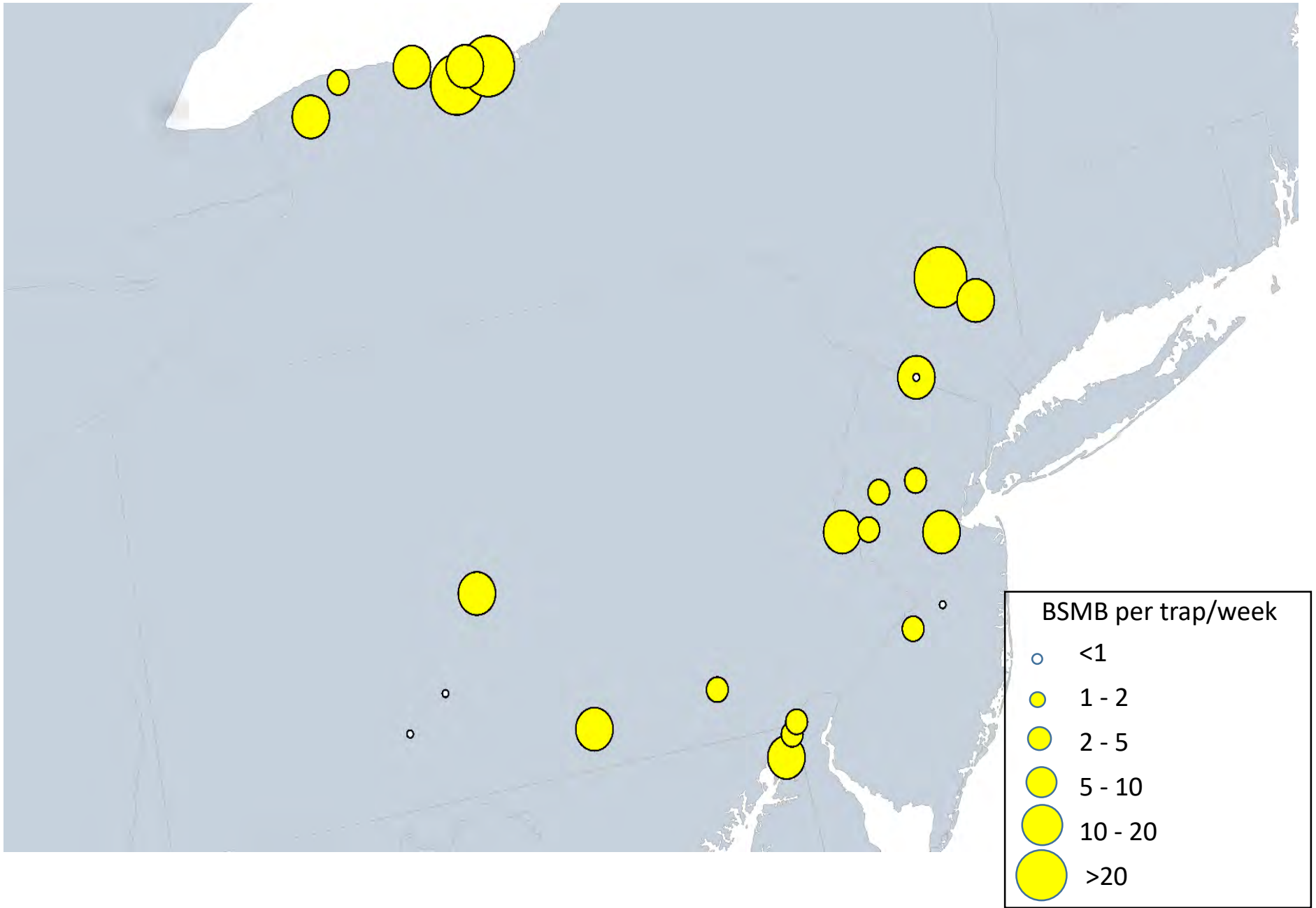
Mid-Atlantic Region (March to May)



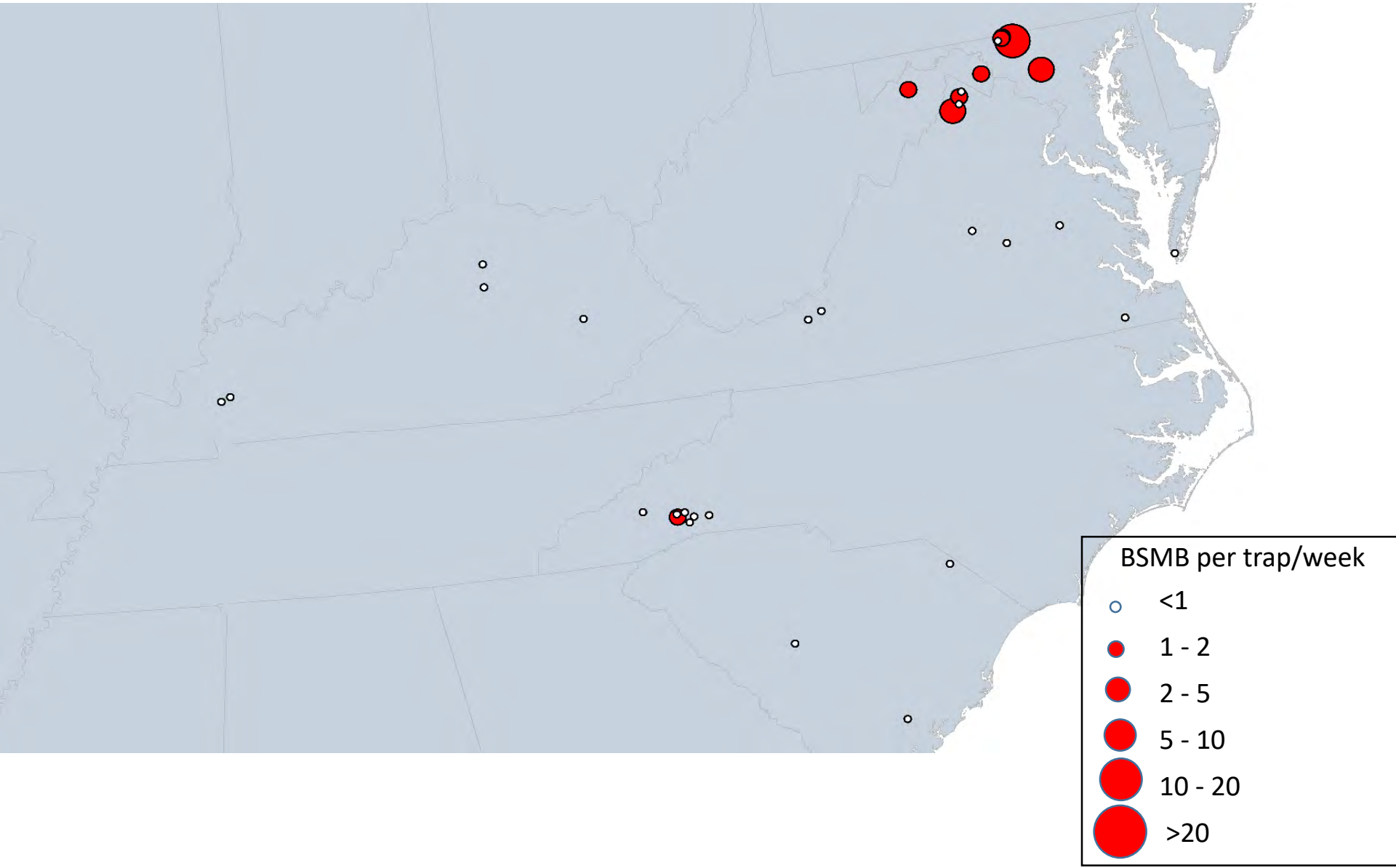
Mid-Atlantic Region (June to Aug)



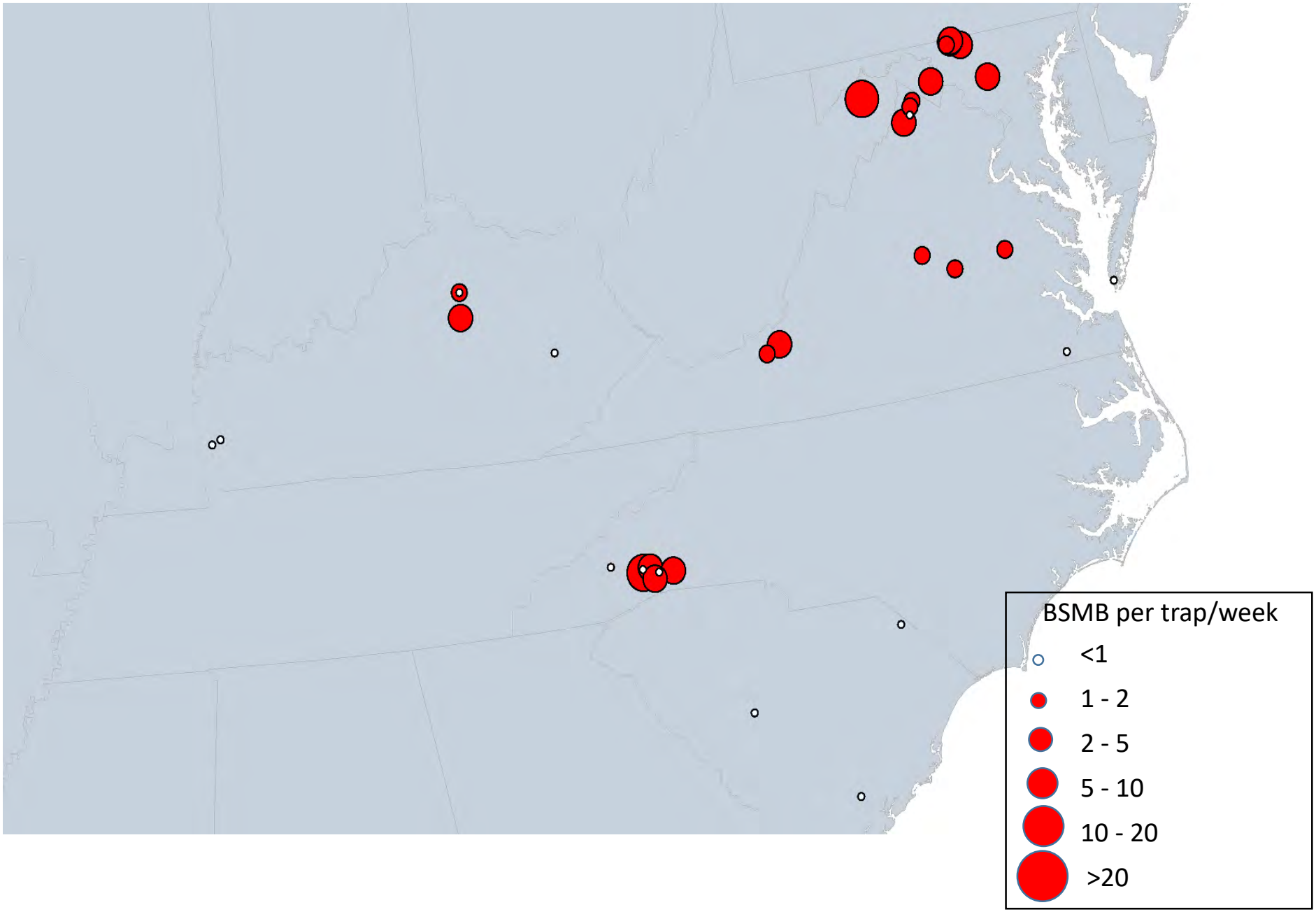
Mid-Atlantic Region (Sep to Nov)



Southeast (March to May)



Southeast (June to Aug)



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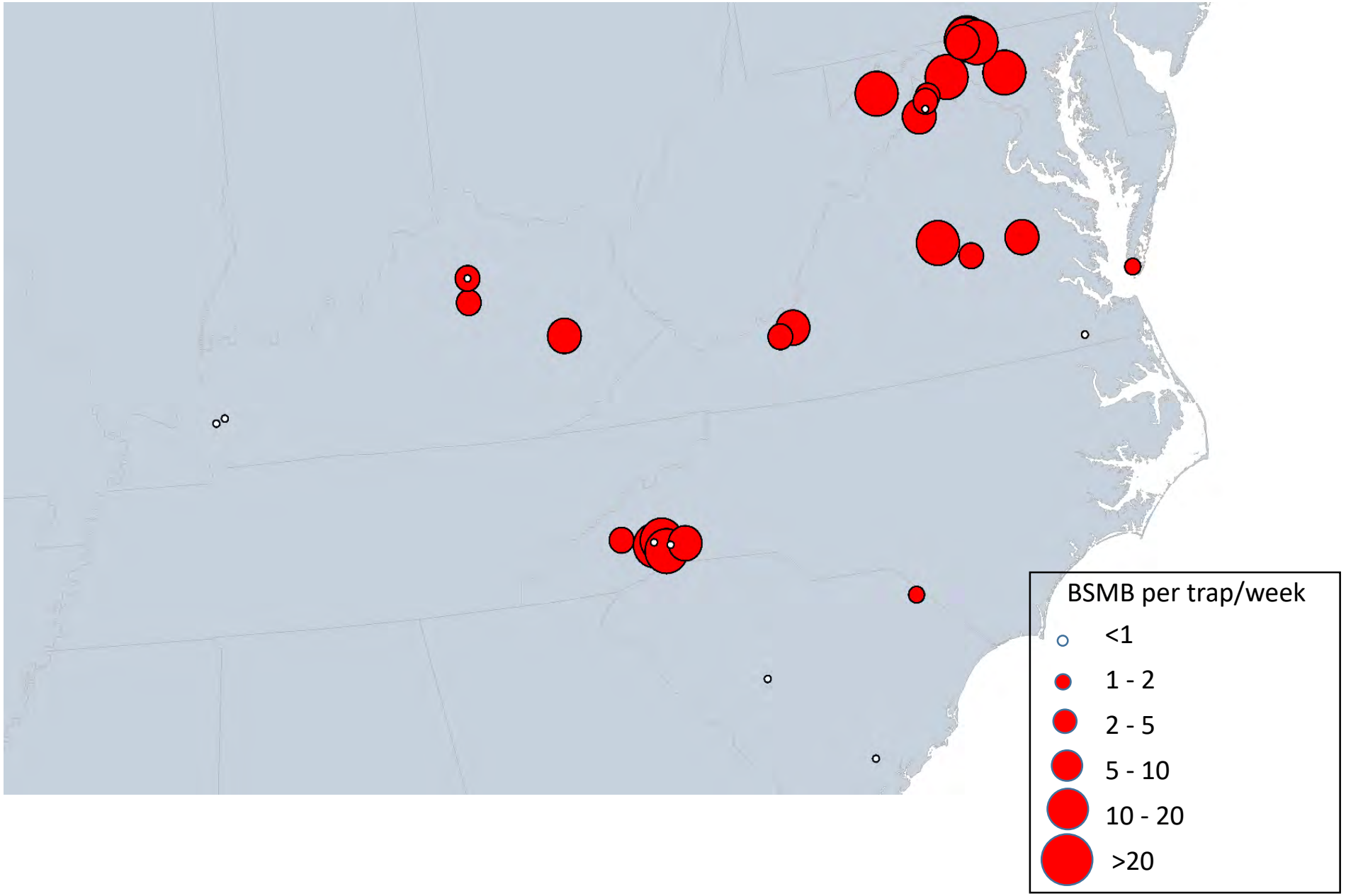
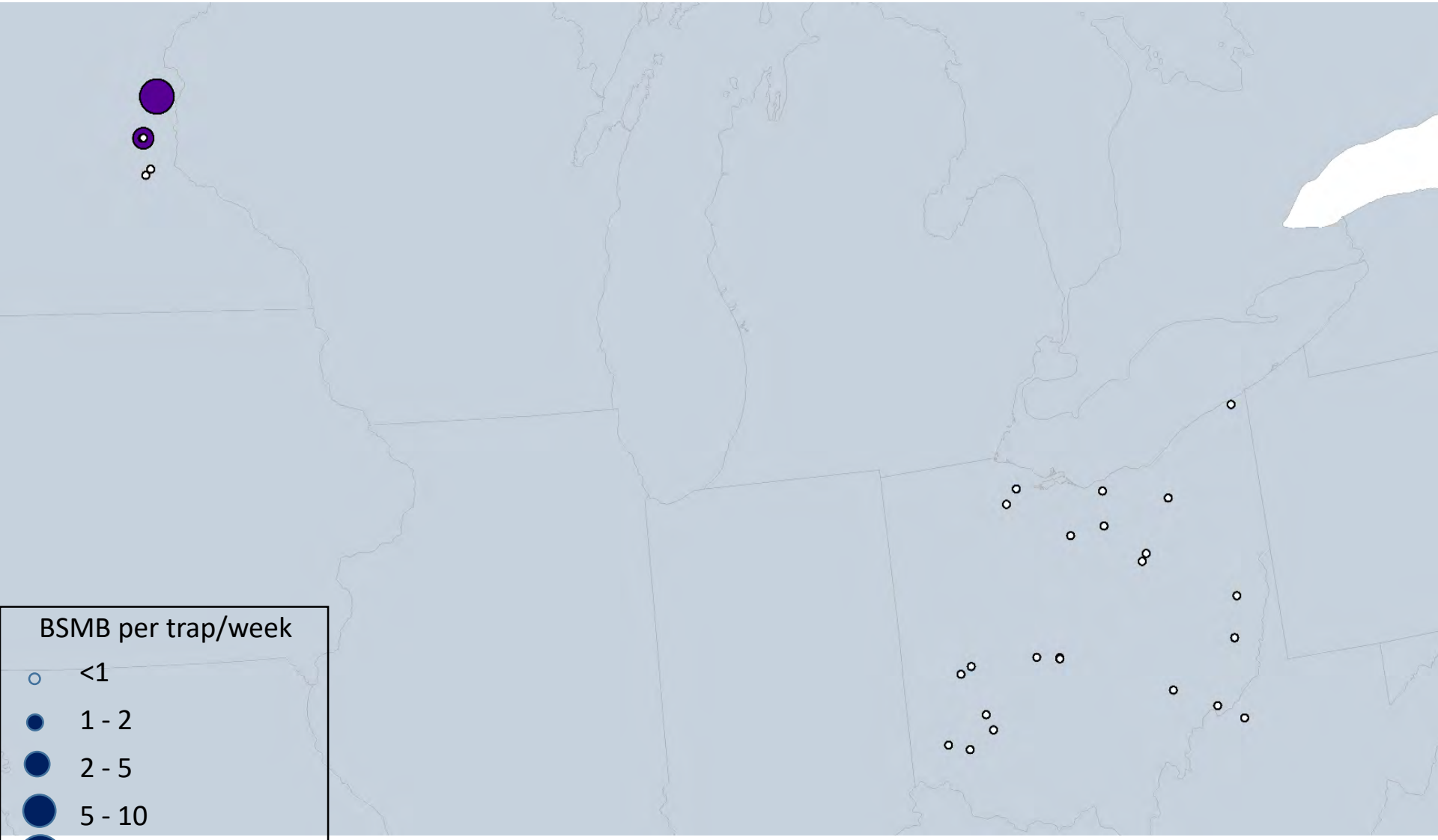


Great Lakes (March to May)



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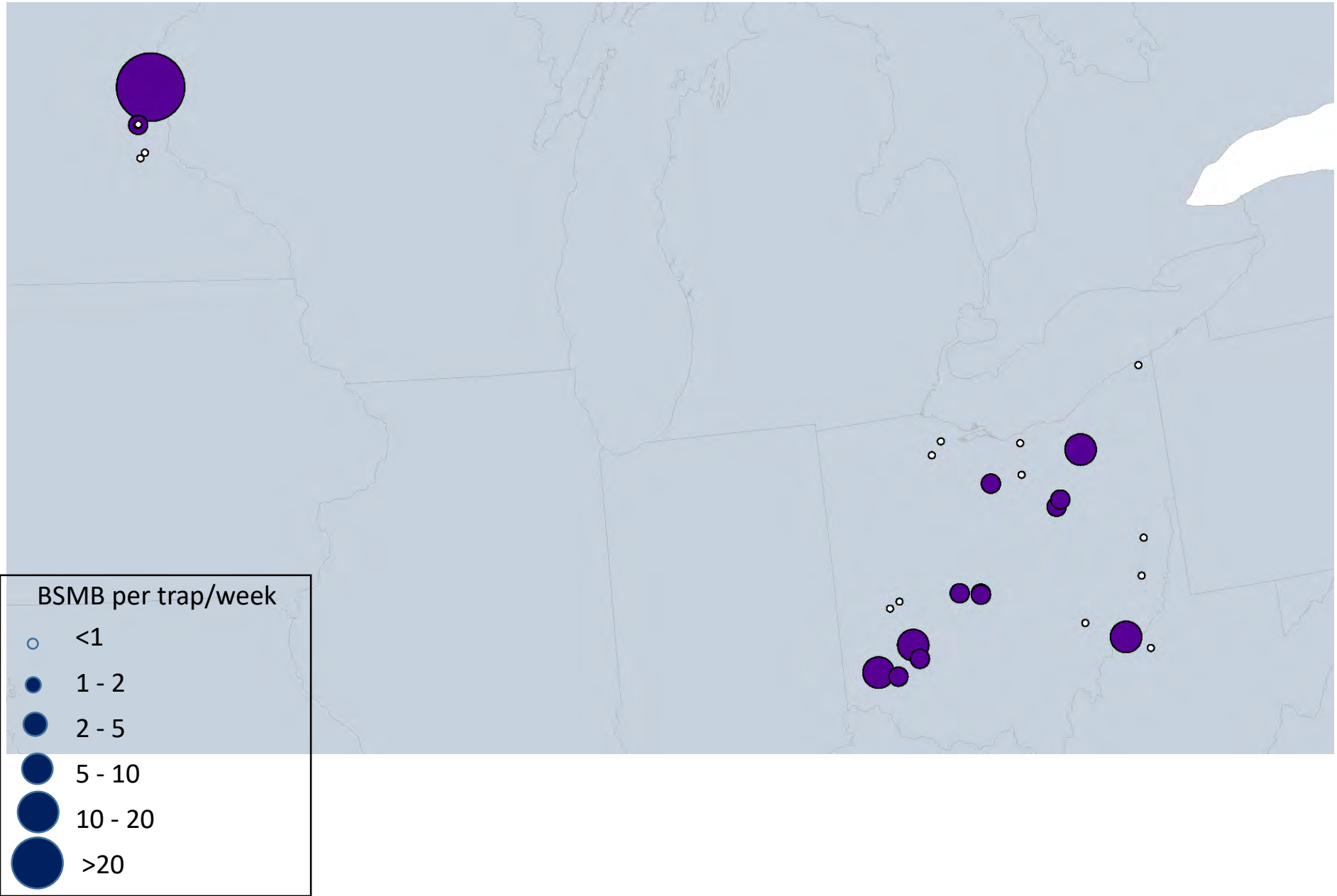

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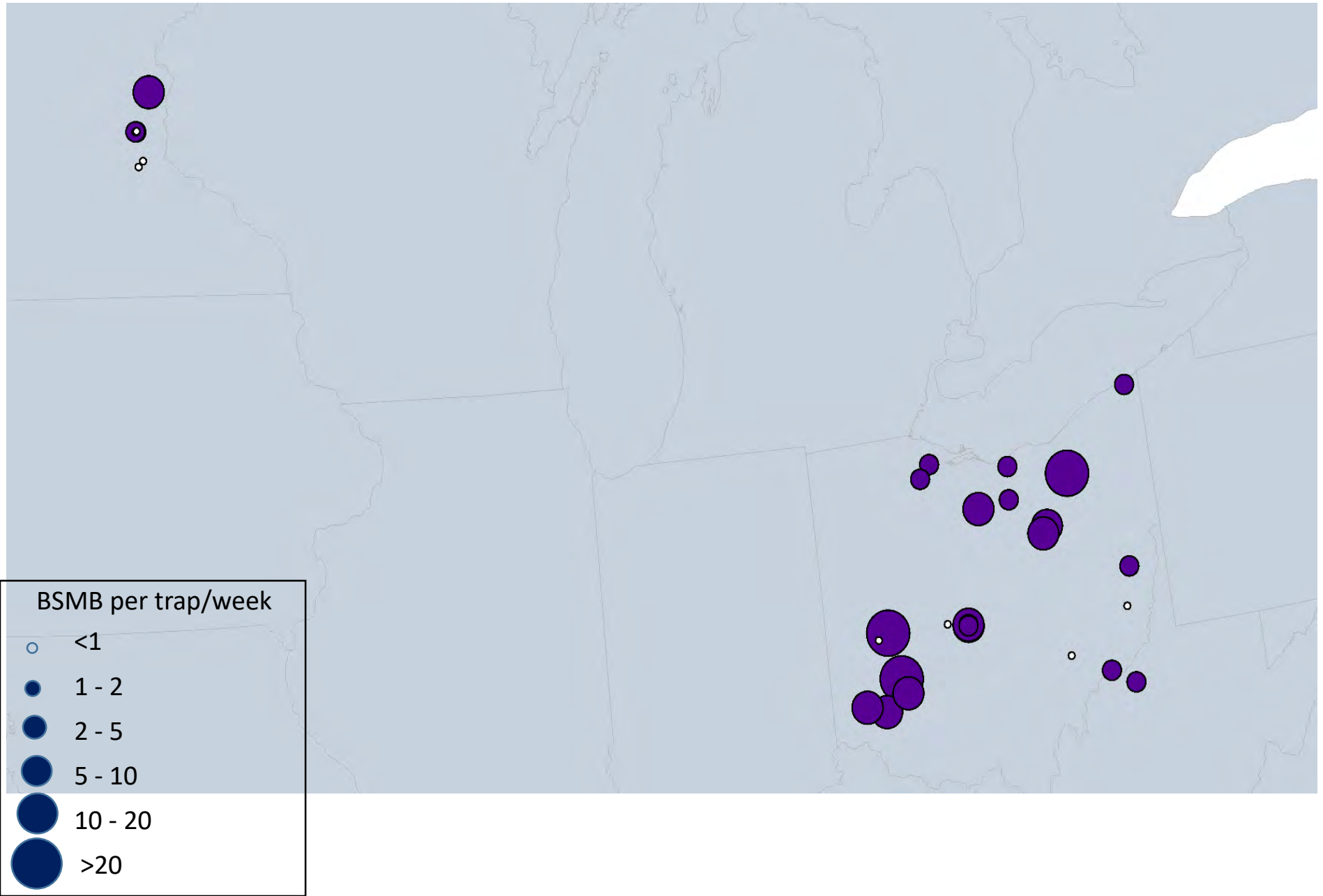
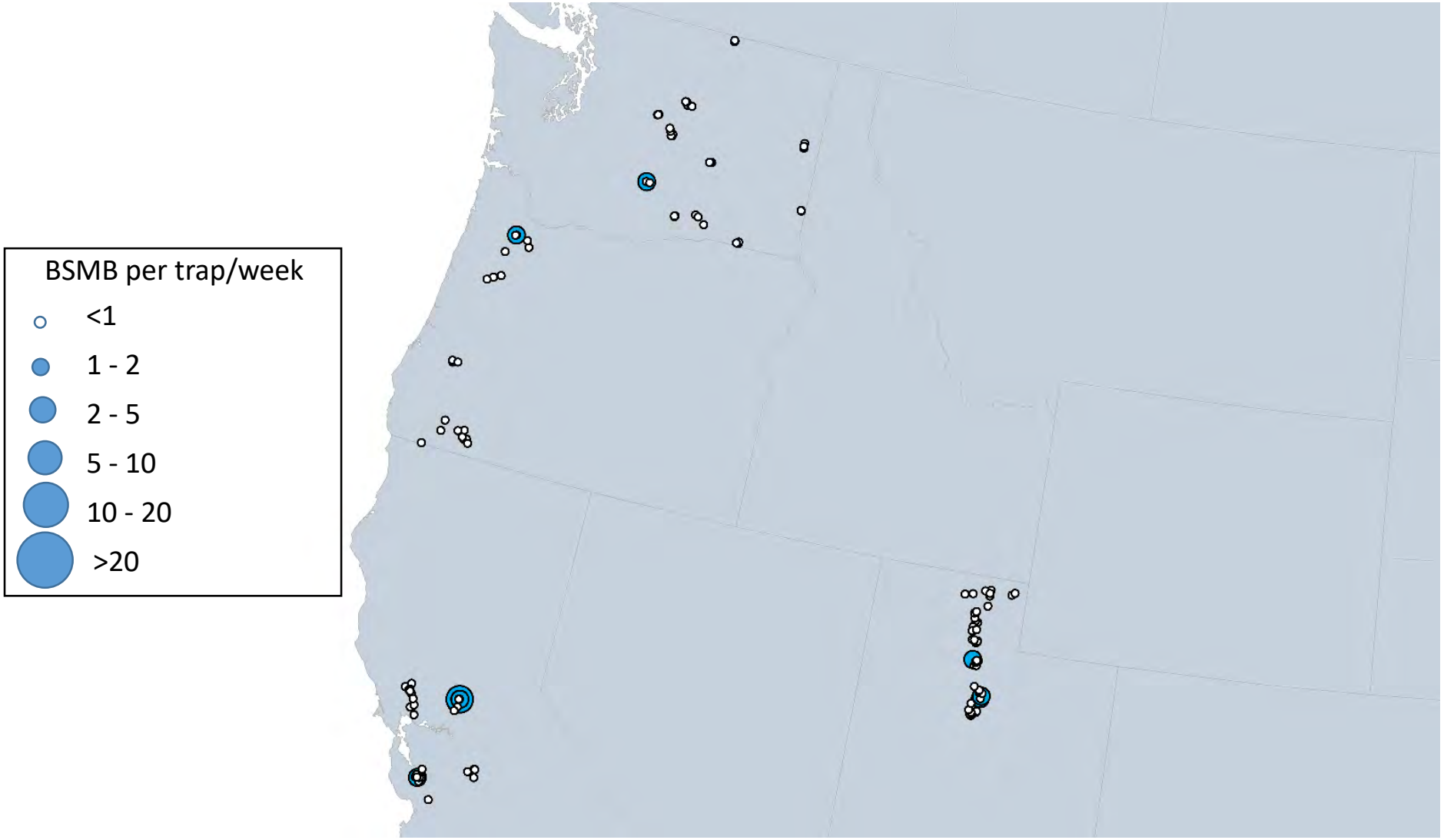


West (March to May)



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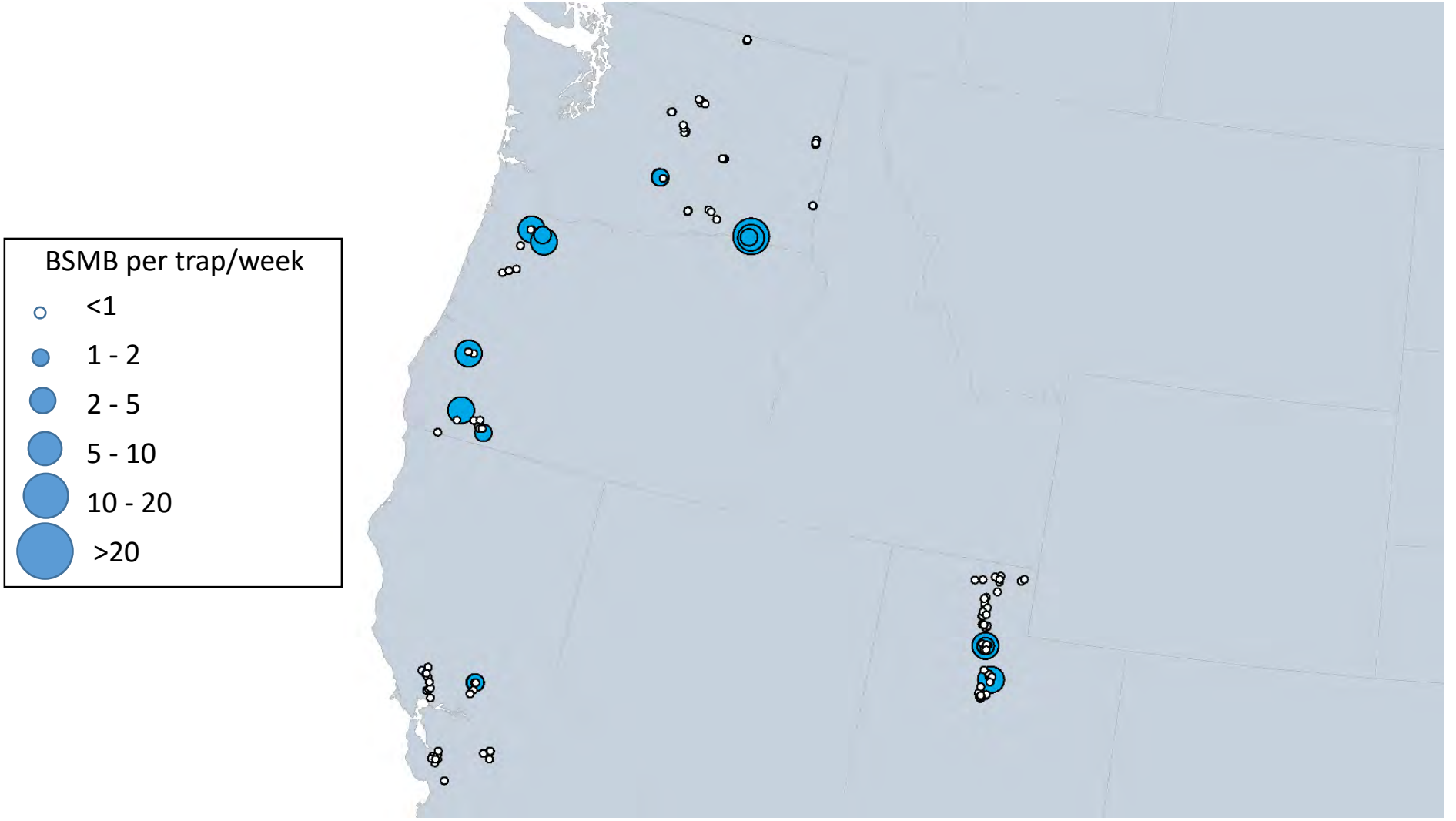

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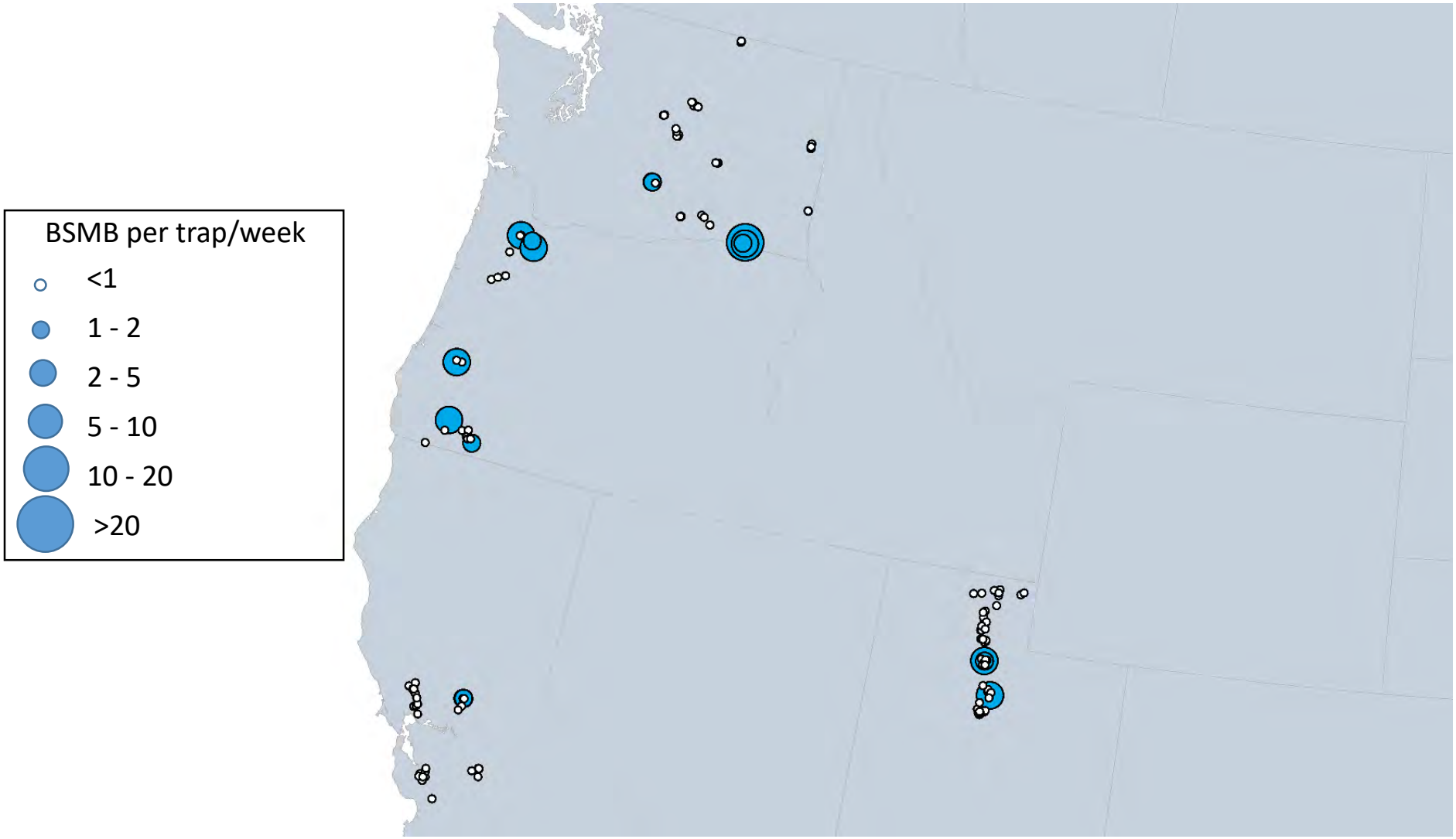

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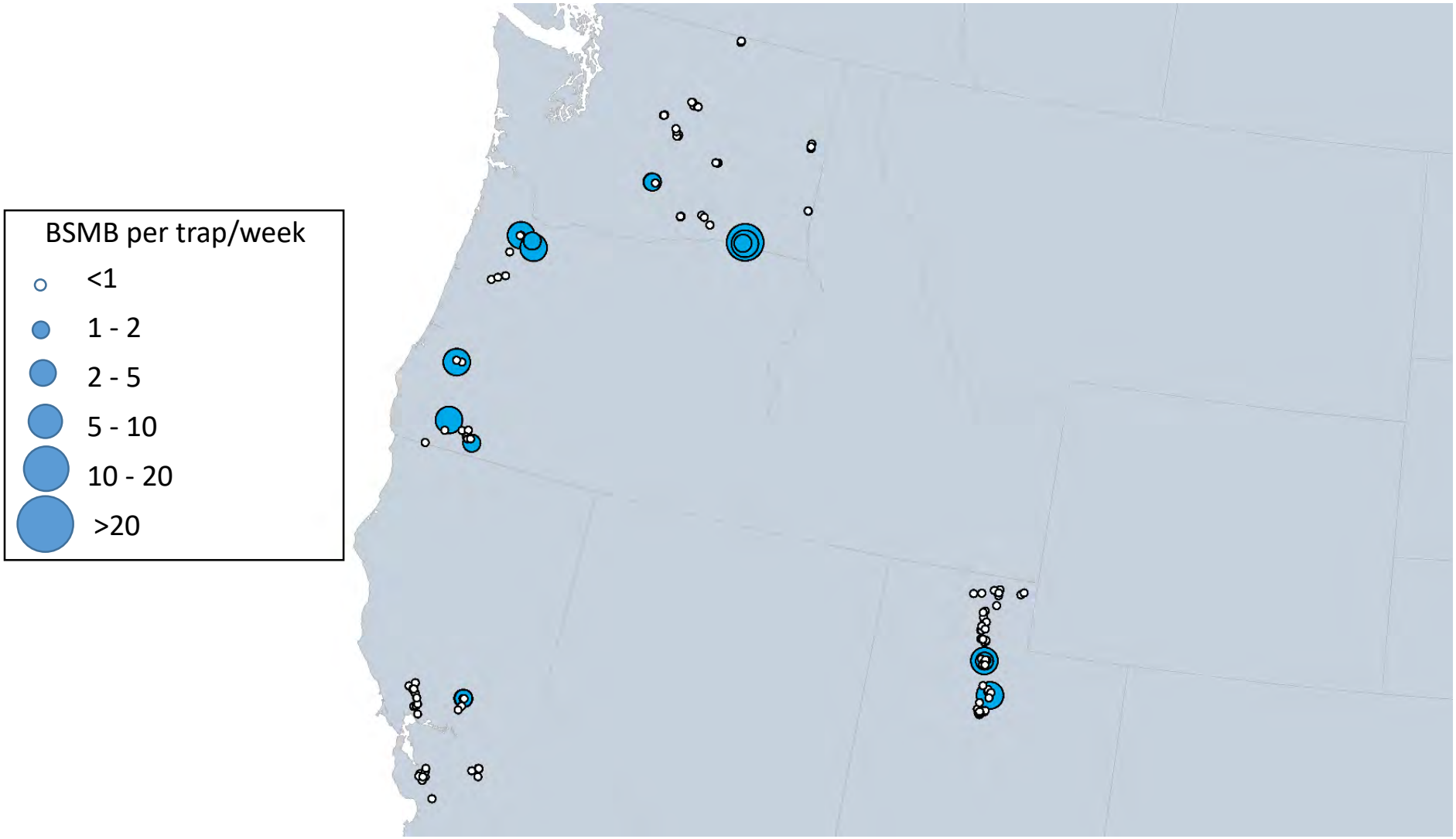
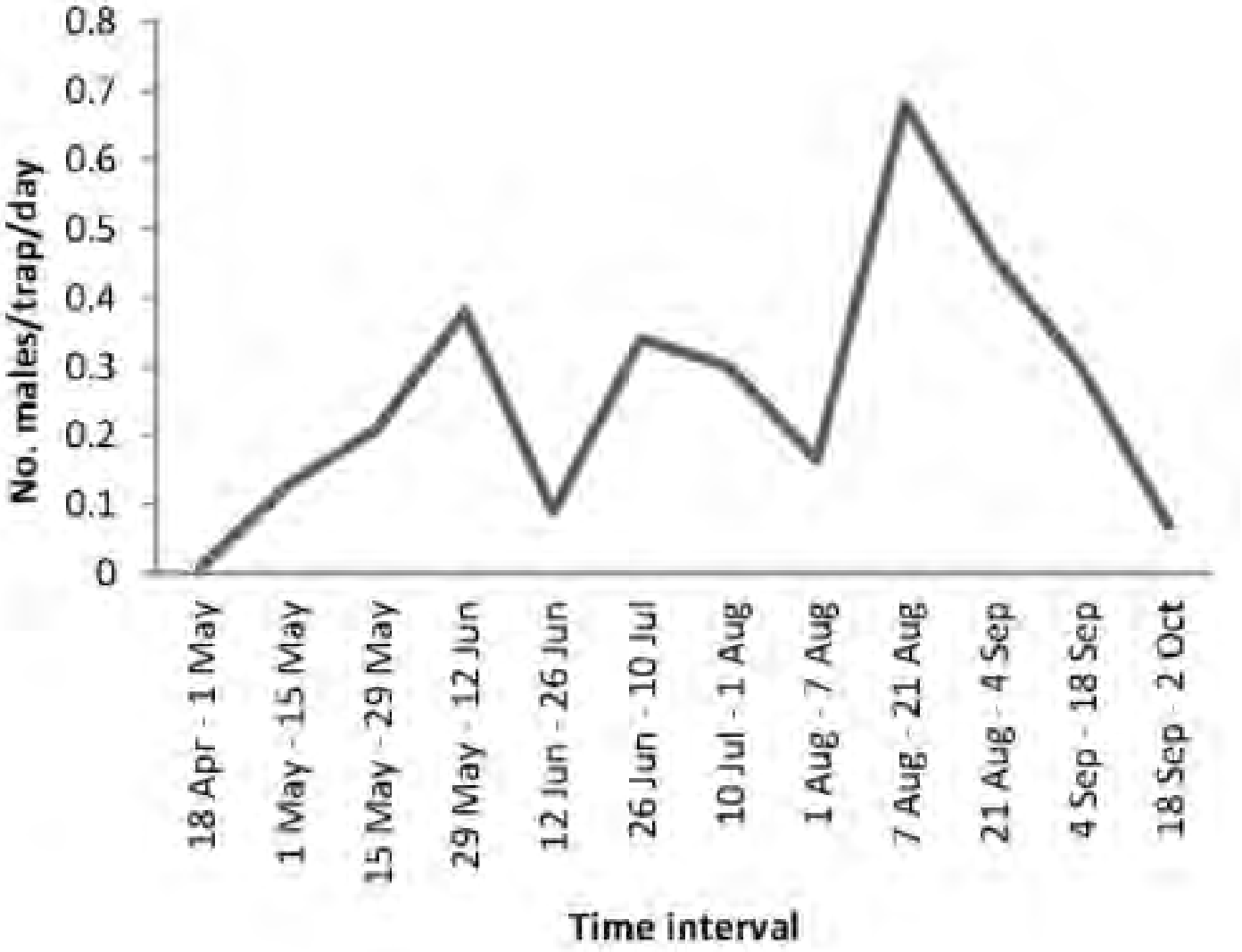
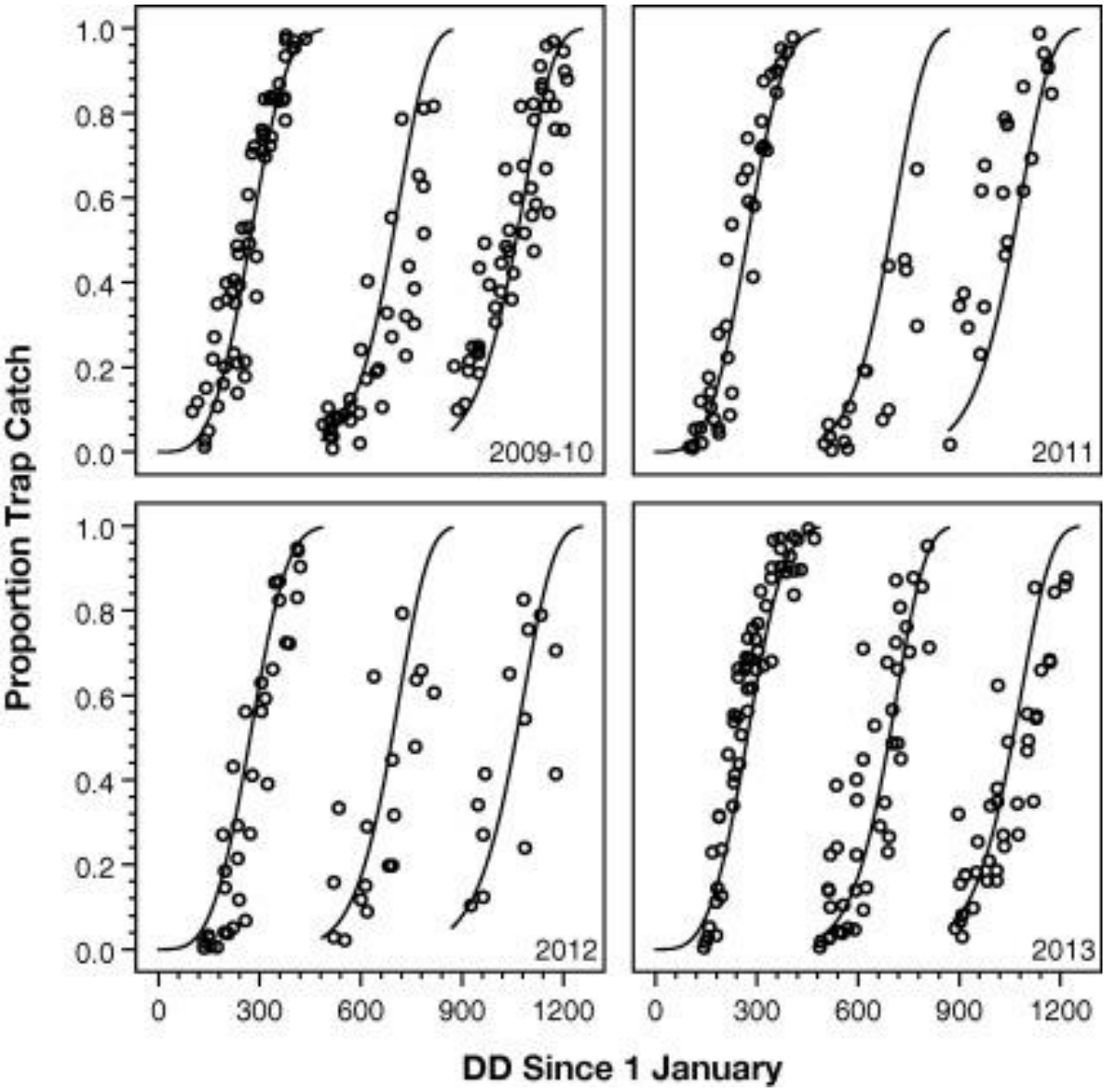


Understand Seasonal Population Dynamics



Develop Phenology Models



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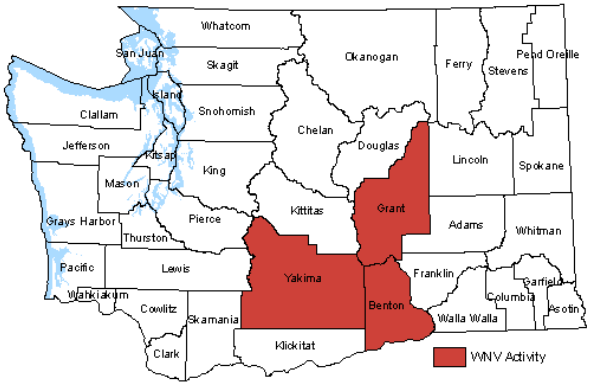


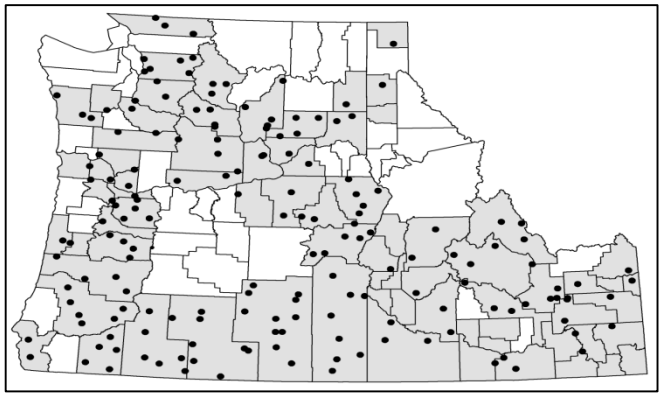
% WNV Positive

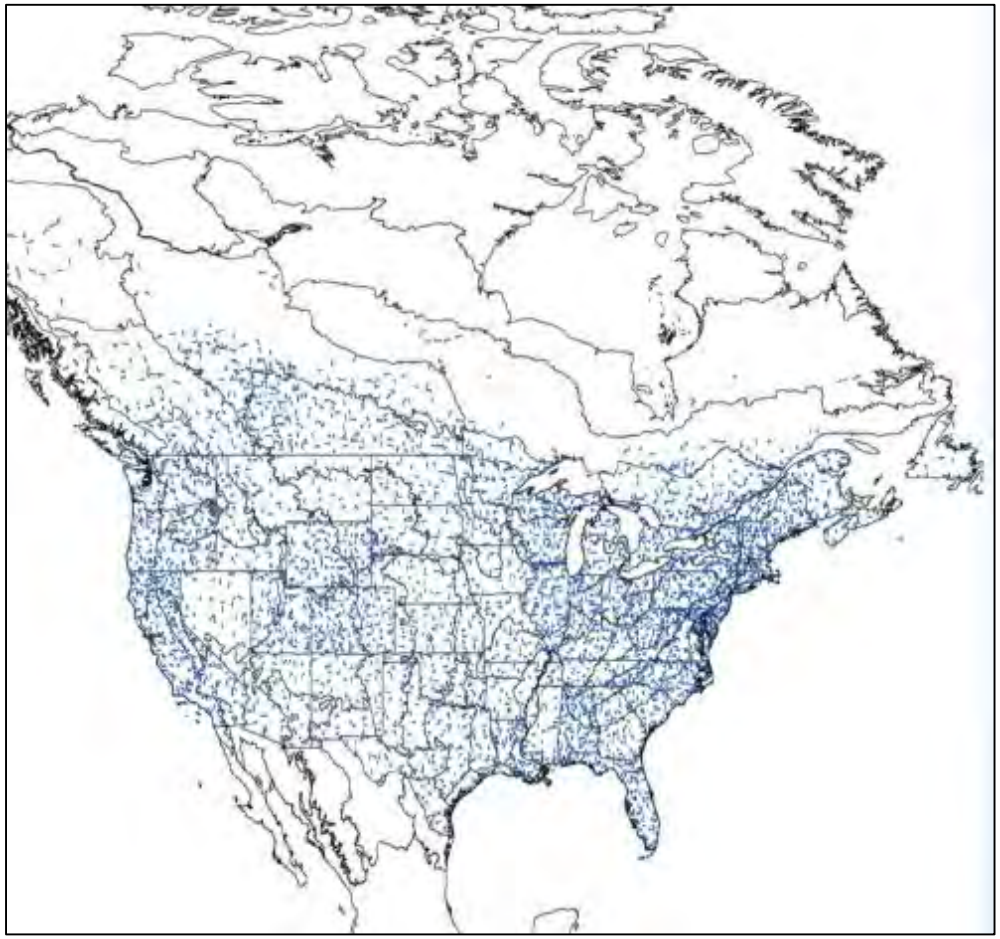
- 0.0
- 0.1 - 25.0
- 25.1 - 50.0
- 50.1 - 75.1
- 75.1 - 99.9
- 100.0

Crowder et al. 2013

BREEDING BIRD SURVEY

www.pwrc.usgs.gov/bbs/





Crowder et al. 2013

Table 1. Results from a multiple regression model on effects of land-use and climate on mosquito and bird abundance and community composition.

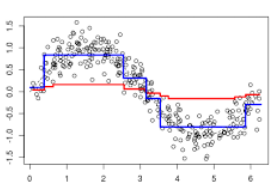
	Explanatory Variable									
	Temperature		Precipitation		Vegetable / forage		Orchard		Natural	
Response	Slope	*P*	Slope	*P*	Slope	*P*	Slope	*P*	Slope	*P*
Mosquito abundance	0.028	0.91	0.24	0.30	0.17	0.12	0.51	<0.0001	0.088	0.39
American robin abundance	0.039	0.45	0.10	0.41	-0.17	0.26	0.22	0.053	-0.063	0.69
House sparrow abundance	0.011	0.89	-1.02	0.38	-0.11	0.42	0.30	0.0036	-0.12	0.40

Crowder et al. 2013

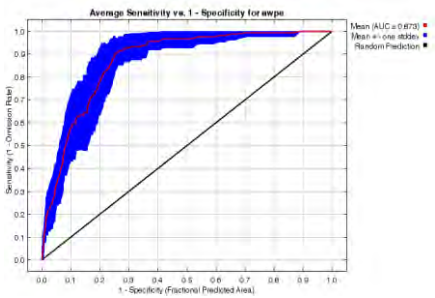
Modeling algorithms:

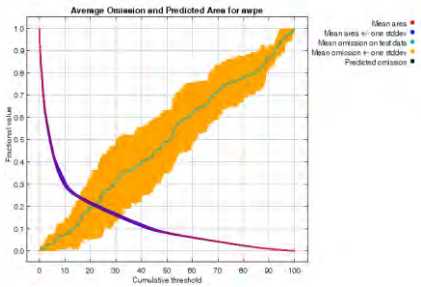
- Response variable: recorded BMSB occurrence and abundance nationwide (Established vs invasive populations).
- Machine learning techniques:

- **Abundance models: Boosted regression trees** implemented in *gbm* (generalized boosted models) R package.



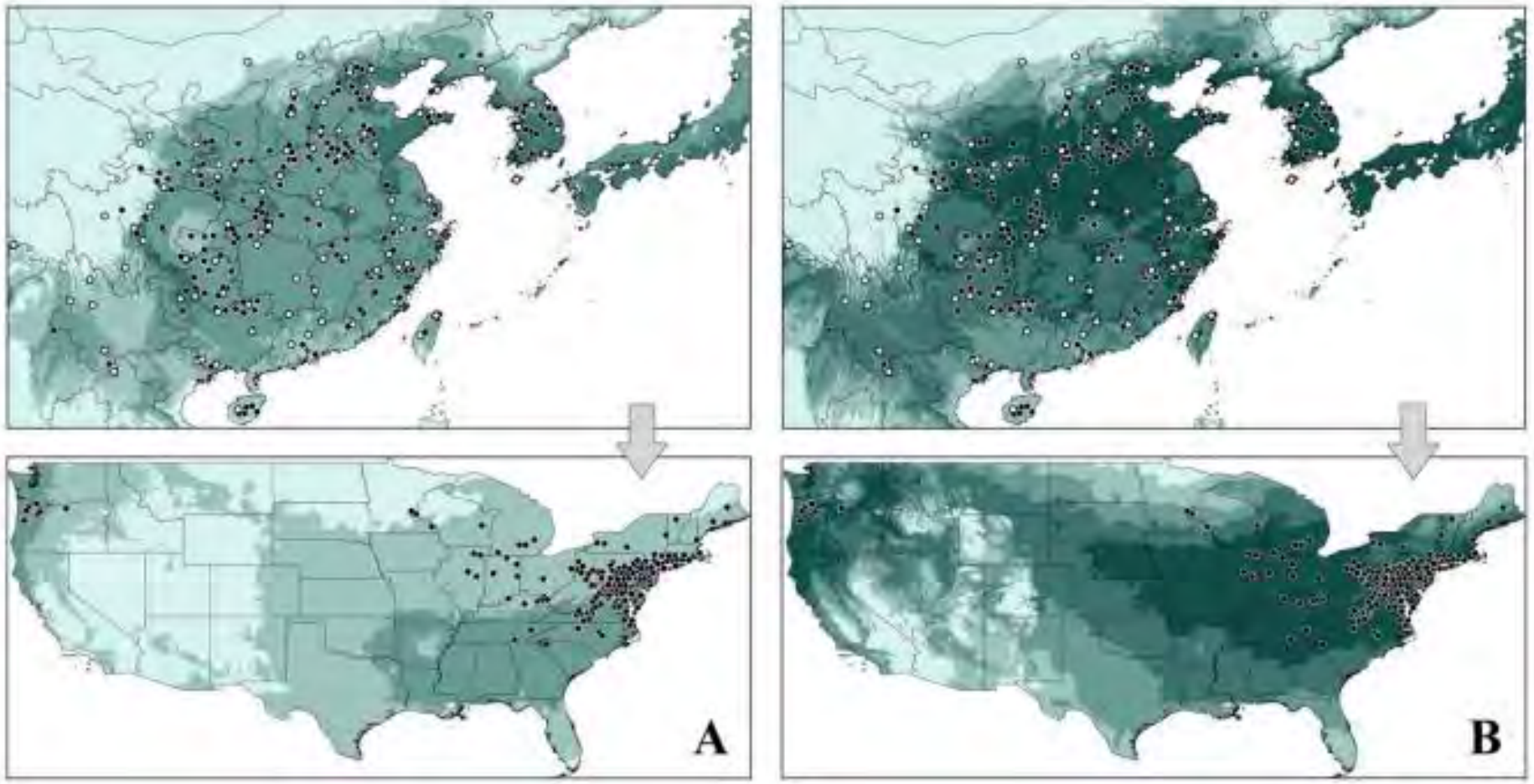
- **Occurrence models**: Maximum Entropy Modeling (**MAXENT**)



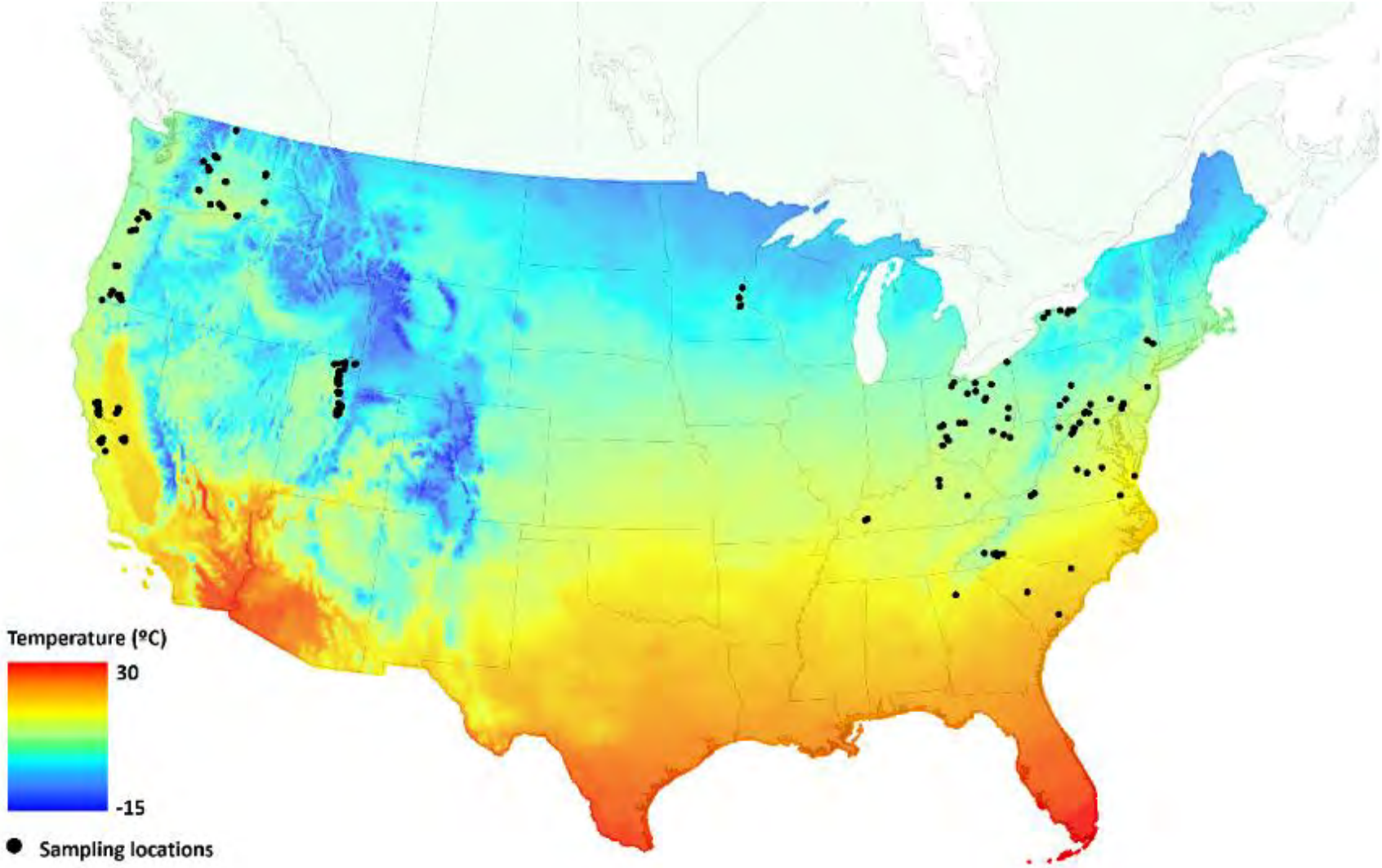


MAXENT

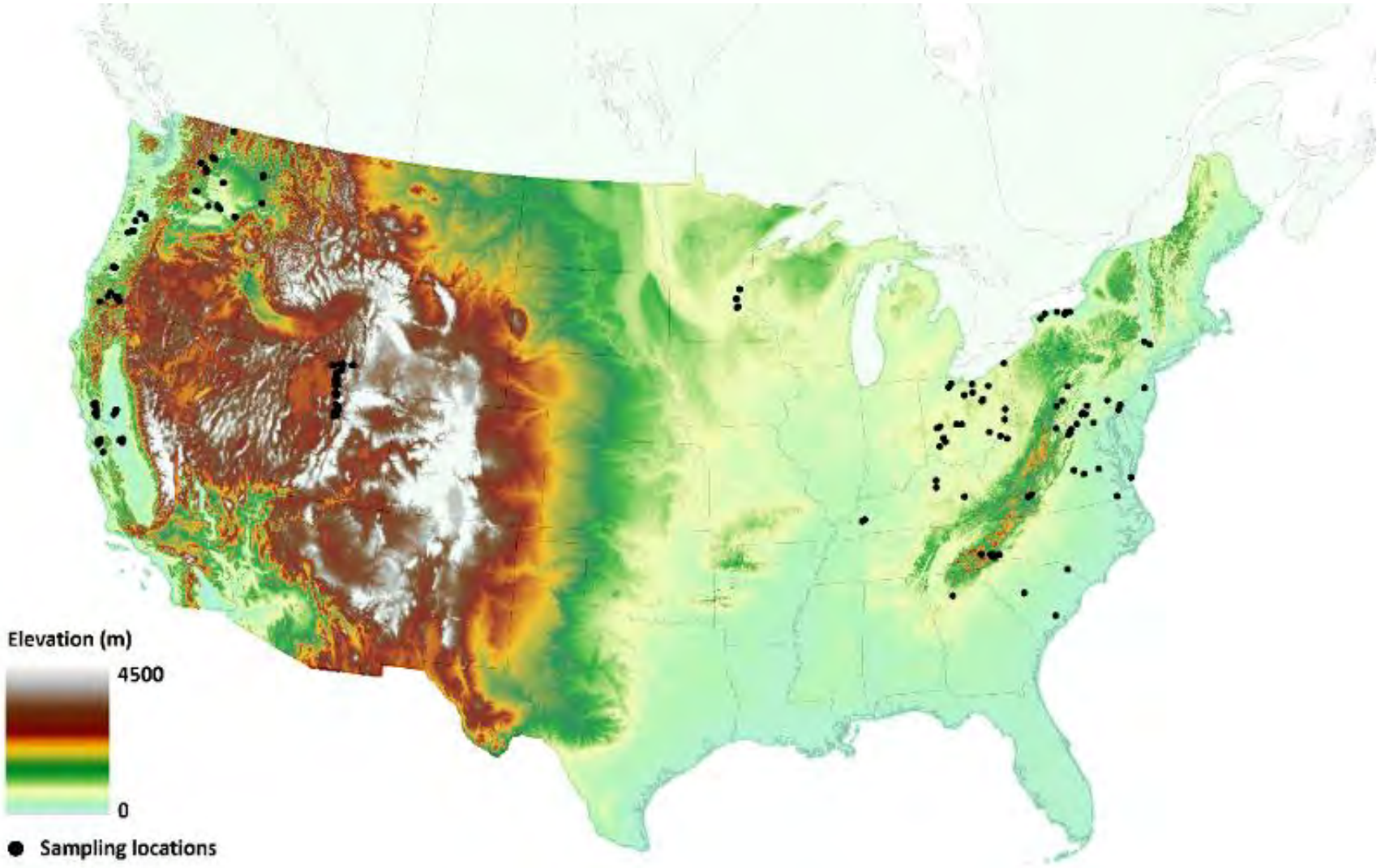
MaxEnt (Zhu et al. 2012)



Model predictors: Climate

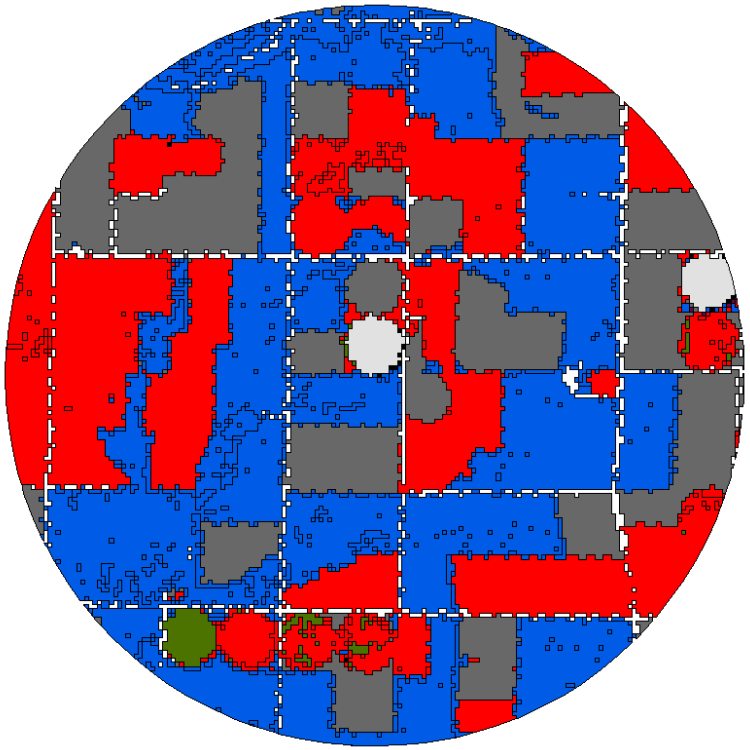


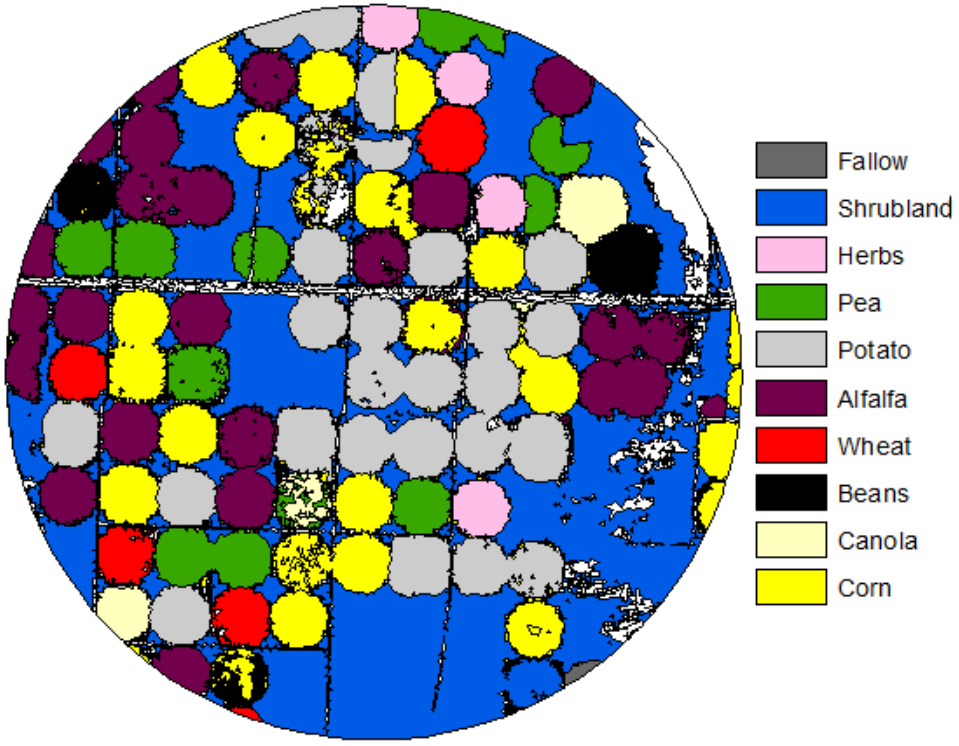
Model predictors: Elevation



Model Predictors - Landscapes

- USDA Cropland Datalayers
- Categorized land use within 5 km of each surveyed field





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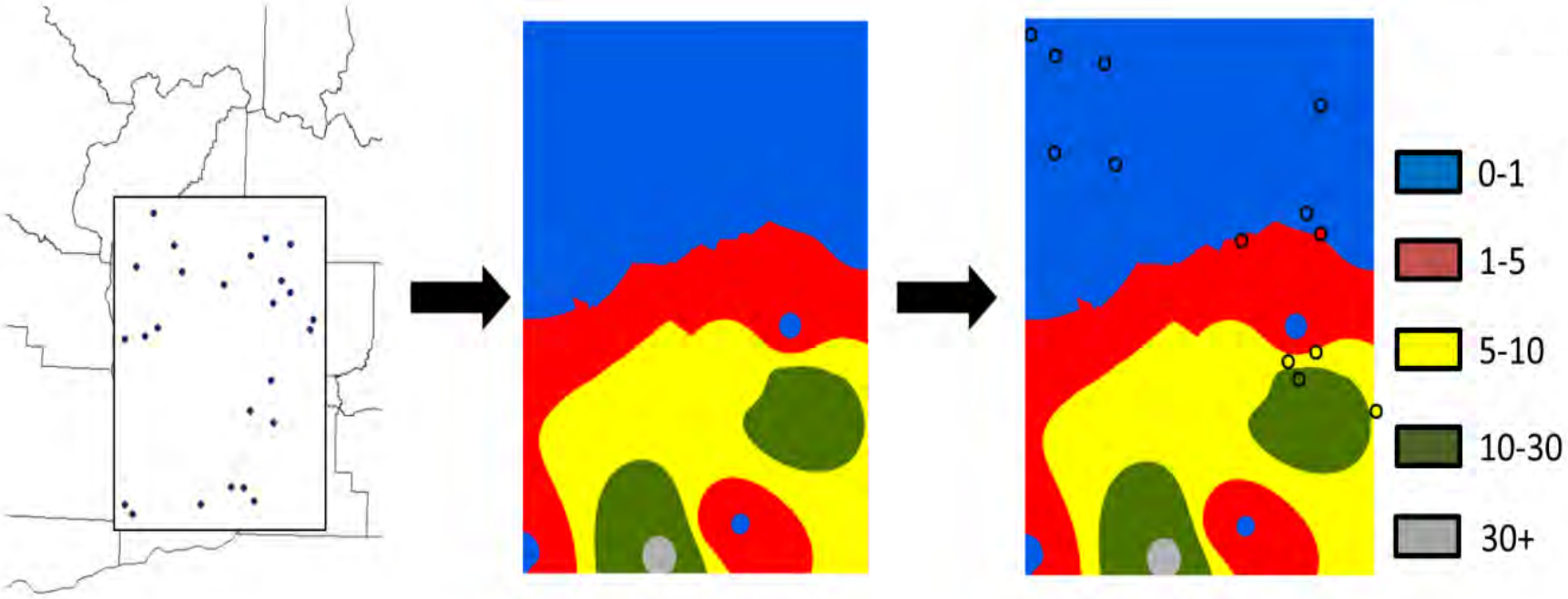
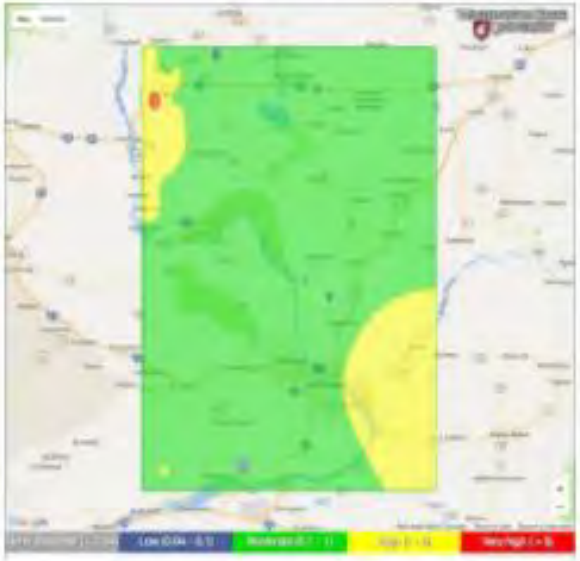
(3) Integrate data into outreach programs

Interpolation and Weekly Output?

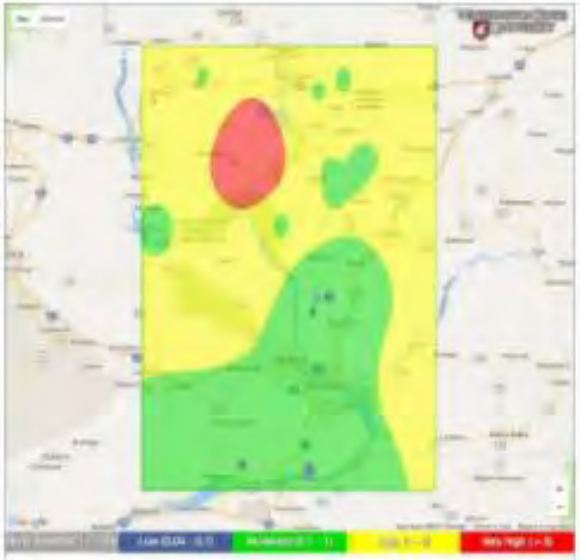


33. Week of Aug 13th to Aug 19th

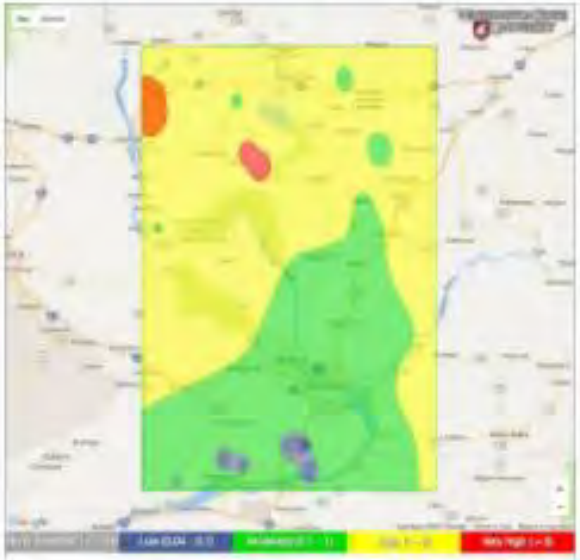
32. Week of Aug 6th to Aug 12th

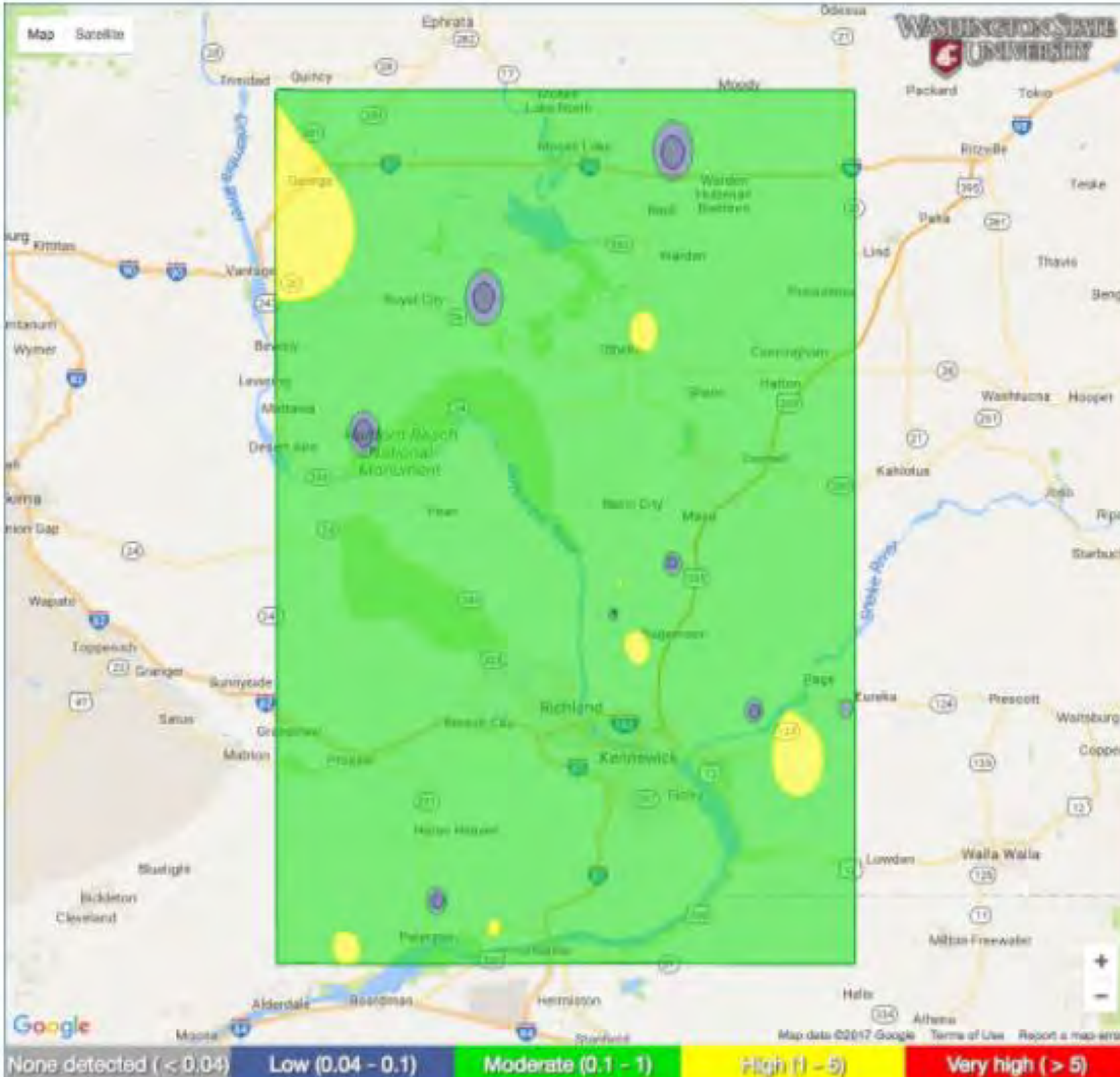


31. Week of Jul 30th to Aug 5th



30. Week of Jul 23rd to Jul 29th




Map
Satellite
Washington State University
Ephrata
Quincy
Trinidad
Moody
Packard
Tokio
Ritzville
Kittitas
Vantage
Warden
Royal City
Othello
Cunningham
Hatton
Lind
Washtucna
Hooper
Kahlotus
Connell
Basin City
Mesa
Wymer
Wapato
Toppenish
Granger
Sunnyside
Grandview
Mabton
Prosser
Benton City
Richland
Kennewick
Finley
Eureka
Prescott
Waitsburg
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Lowden
Milton-Freewater
Paterson
Bluelight
Bickleton
Cleveland
Alderdale
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Hermiston
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Report a map error
None detected (< 0.04)
Low (0.04 - 0.1)
Moderate (0.1 - 1)
High (1 - 5)
Very high (> 5)

2018 Goals

(1) Repeat/expand monitoring from 2017

(2) Develop better system for reporting data, and determine how we want to use data

(3) Work with different research groups to establish questions for analyses (may differ region to region)

(4) Analyze data from 2017

Acknowledgements

Jim Walgenbach
Tracy Leskey
Don Weber
Angel Acebes

All the research teams (faculty, students, postdocs, Technicians) who collected data and participated in the objective


Questions?