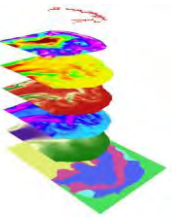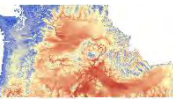# Objective 1: Landscape Ecology BMSB SAP meeting 2019
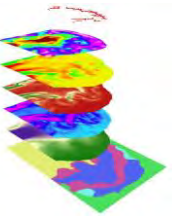
Dave W. Crowder & Javier G. Illan

Questions/Main aims

- Can we effectively predict the risk of invasion and population dynamics of BMSB using ecological modelling?

- What are the most important environmental factors driving BMSB expansion and population dynamics?
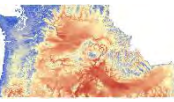
Questions/Main aims

- Can we effectively predict the risk of invasion and population dynamics of BMSB using ecological modelling?

- What are the most important environmental factors driving BMSB expansion and population dynamics?

• Our nation-wide BMSB monitoring scheme represent a very rare and ideal dataset to tackle these questions

• Novel study: SDMs are rarely applied to non-natural systems or agricultural insect pests

Monitoring Network System

Monitoring Network System

2017

- 15 States

Mid-West

South-East

North-East

West

Monitoring Network System

2018

• 15 States

- 🟡 Mid-West
- 🔵 South-East
- 🔴 North-East
- 🟢 West

Monitoring Network System

North-East
West

States

Monitoring Results

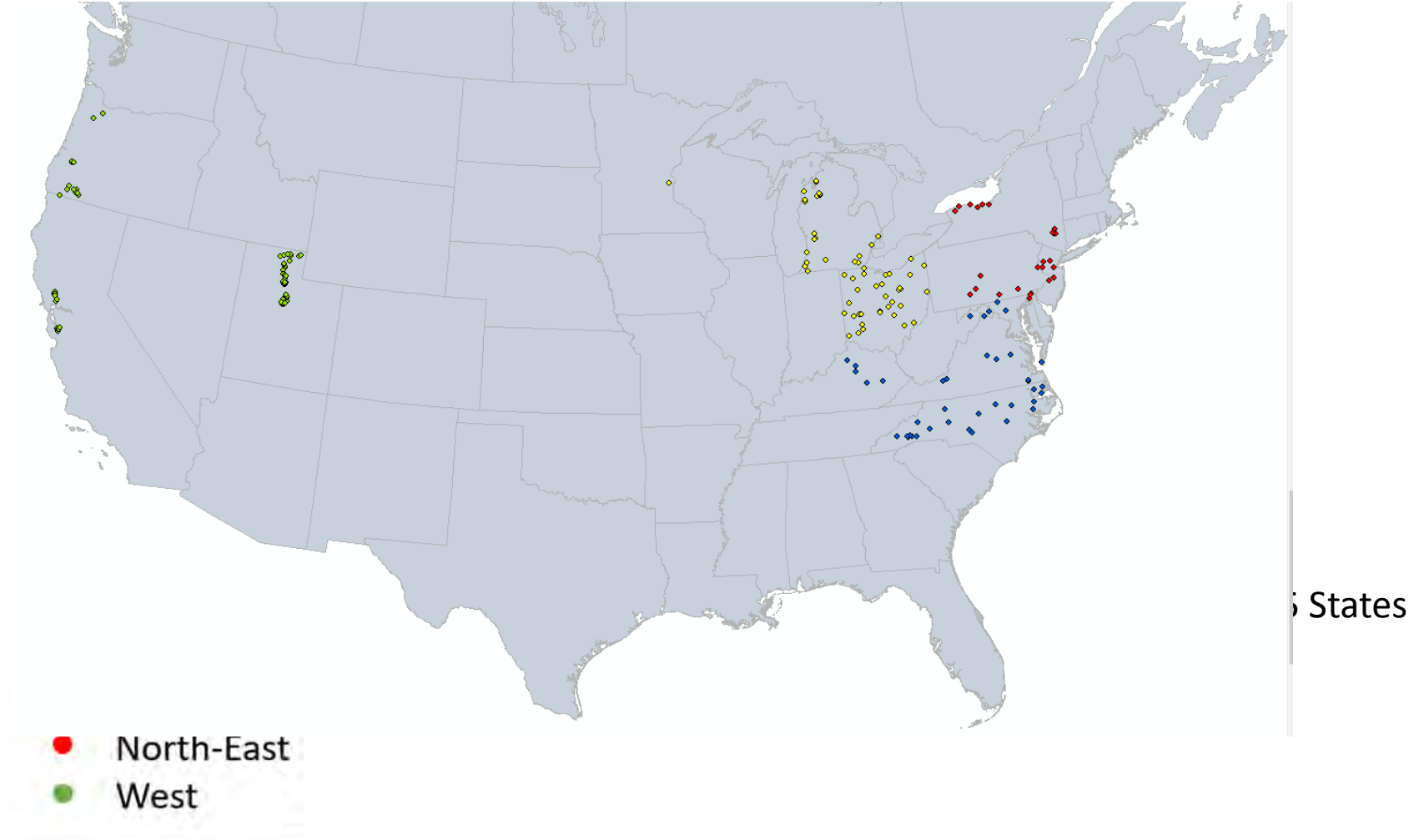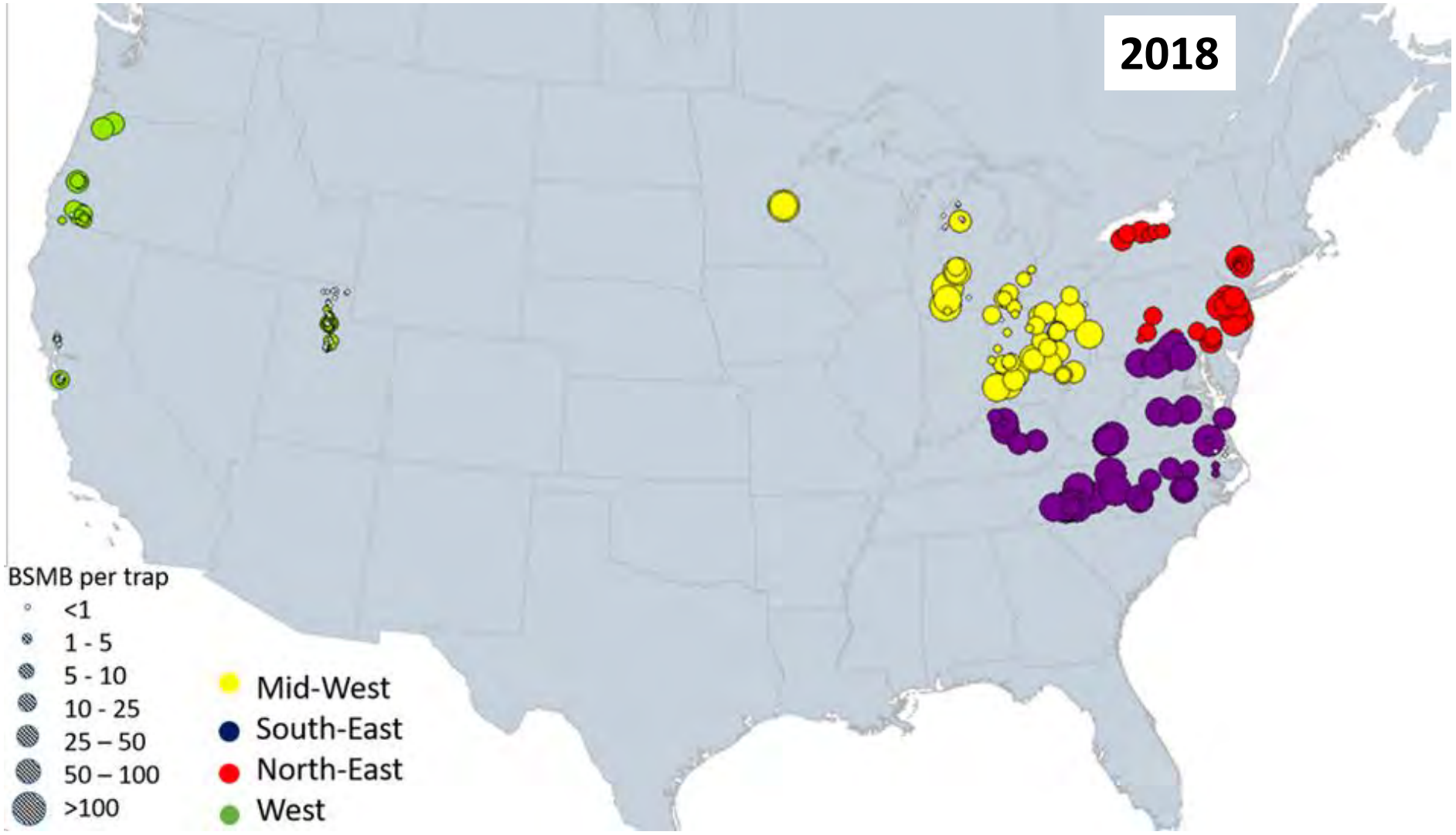|	2017	2018*
States	15	15
Research groups	26	26
Sampling sites	276	223
BMSB individuals trapped	24476	14605
BMSB/trap by region (#sites):		
MidWest	25.6 (37)	28.4 (62)
NorthEast	56.5 ** (29)	30.3 (30)
SouthEast	60.9 (65)	71.6 (42)
West	10.2 (145)	16.4 ** (89)
Utah	3.7 (54)	2.7 (58)
West (without UT)	14.0 (91)	17.2 (31)
Mean tp (ºC)	11.57 (5.07 - 18.26)	(under development)
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 (within 5K buffer)	15 land-use classes (+82 crop types)	

Note: Waiting for three states
*** Statistically significant*

2017

BSMB per trap
- ○ <1
- ∘ 1 - 5
- ● 5 - 10
- ● 10 - 25
- ● 25 – 50
- ● 50 – 100
- ● >100

- ● Mid-West
- ● South-East
- ● North-East
- ● West
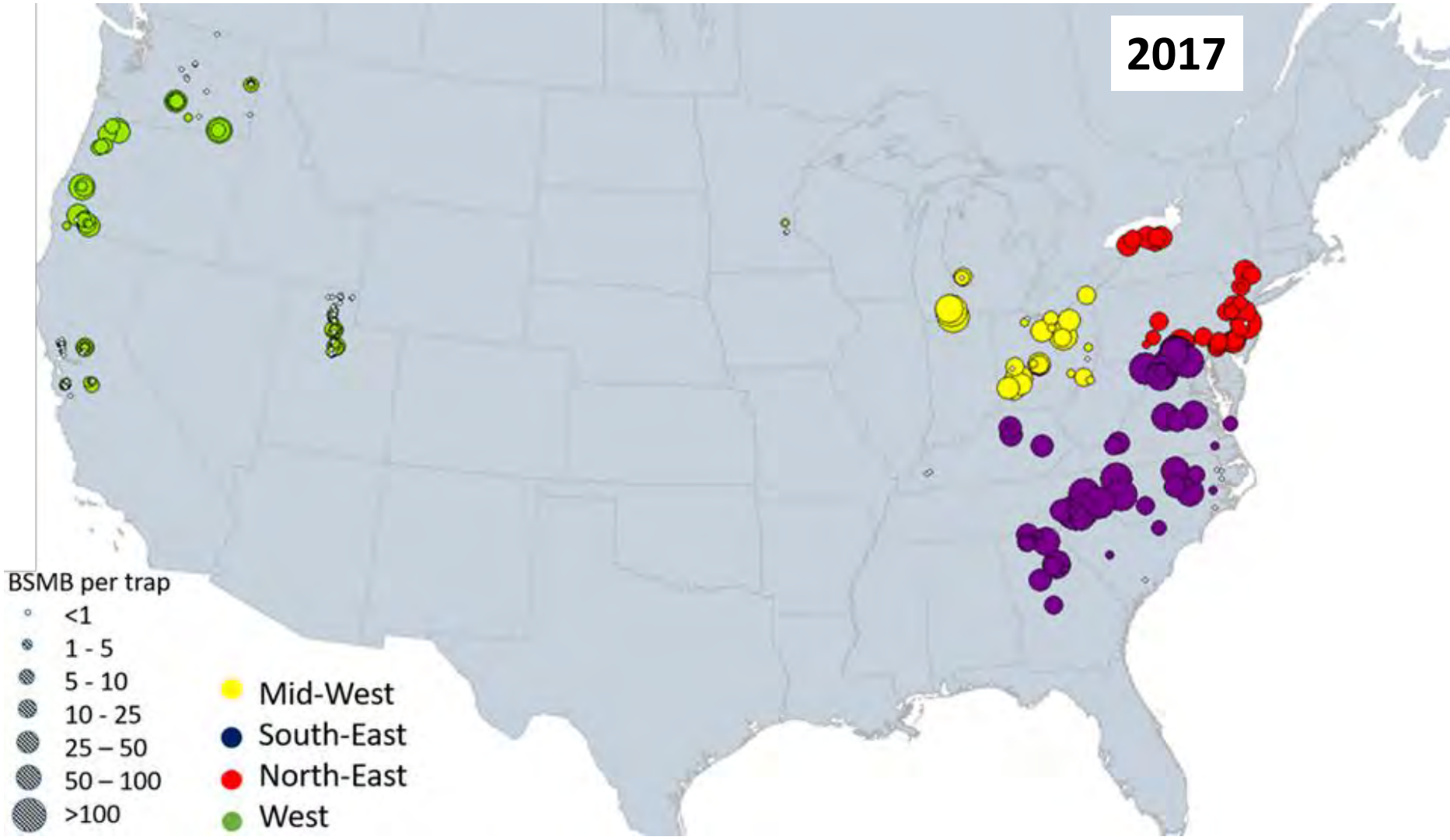
2018

BSMB per trap
○ <1
● 1 - 5
● 5 - 10
● 10 - 25
● 25 – 50
● 50 – 100
● >100

● Mid-West
● South-East
● North-East
● West

Modeling approach:

- Invasion Risk (occurrence models): **MAXENT**

- Population Dynamics (abundance models): **Boosted regression trees** implemented in "gbm" R package.

Predictors

a) **Climatic** (PRISM)

- Maximum temp summer

- Minimum temp winter

- Precipitation

- Vapor pressure deficit
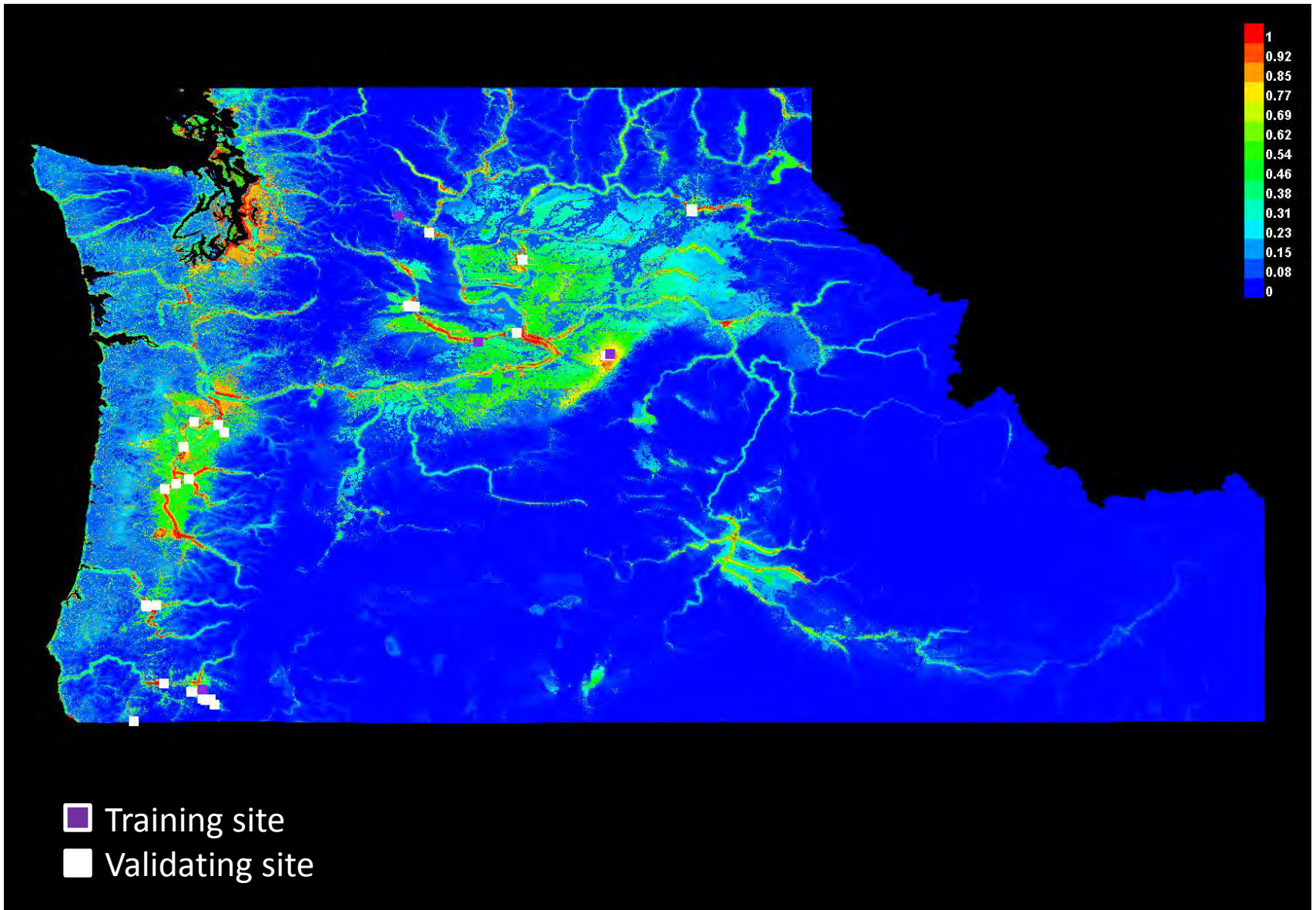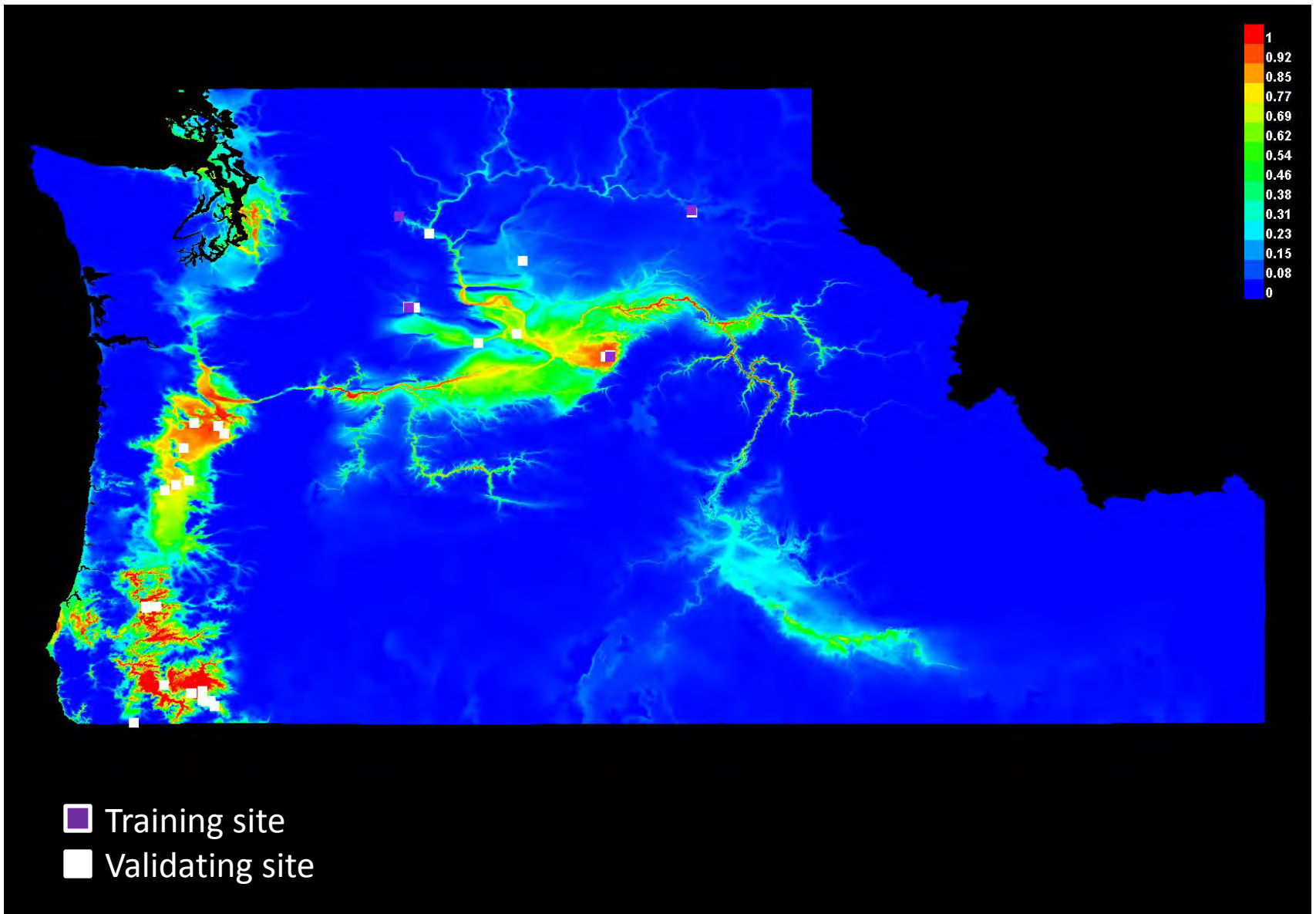
- Photoperiod

Predictors

b) **Landscape**

- Cropscape (land-cover)

- Distance to water

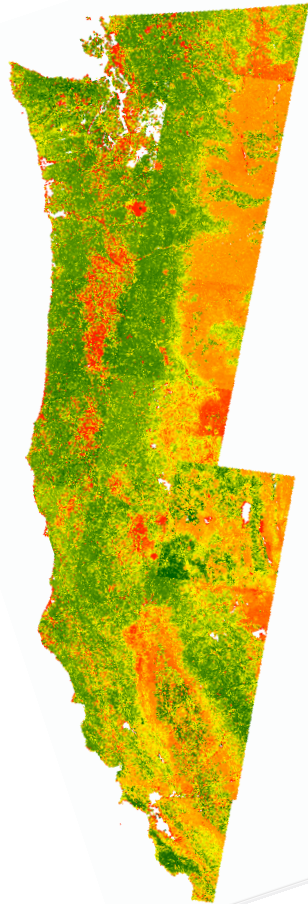- Distance to urban areas

- DEM (Elevation)

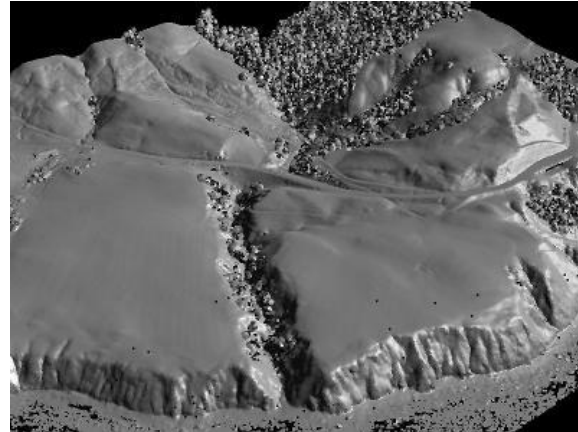BMSB risk of invasion (Landscape) 2017/2018 in the PNW

Training site
Validating site

BMSB risk of invasion (Climate) 2017/2018 in the PNW

Further research…

LIDAR

NDVI

**Heterospecifis / conspecifics
Facilitation vs competition**