

Factors Affecting the Spatial Patterns of Brown Marmorated Stink Bug, *Halyomorpha halys*, Populations in Peach Orchards

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Brown Marmorated Stink Bug (BMSB)



Halyomorpha halys



Allentown, PA (1996)



Major agricultural pest



Polyphagous¹



Shield-shaped body



White antennal segments



Black and white pattern on the abdomen

State	Bearing age acres
California	57,546
South Carolina	13,706
Georgia	9,602
New Jersey	5,791

1. Hoebeke, E. R. and M. E. Carter. Proc. of the Entomol. Soc. of Washington. 2003







Spatial Analysis

🏠 What is it?

🏠 Leads to focused management

🏠 Landscape

- 🏠 Mixed crop farm
- 🏠 Single crop
- 🏠 Forested areas, structures



What spatial patterns do BMSB populations exhibit?

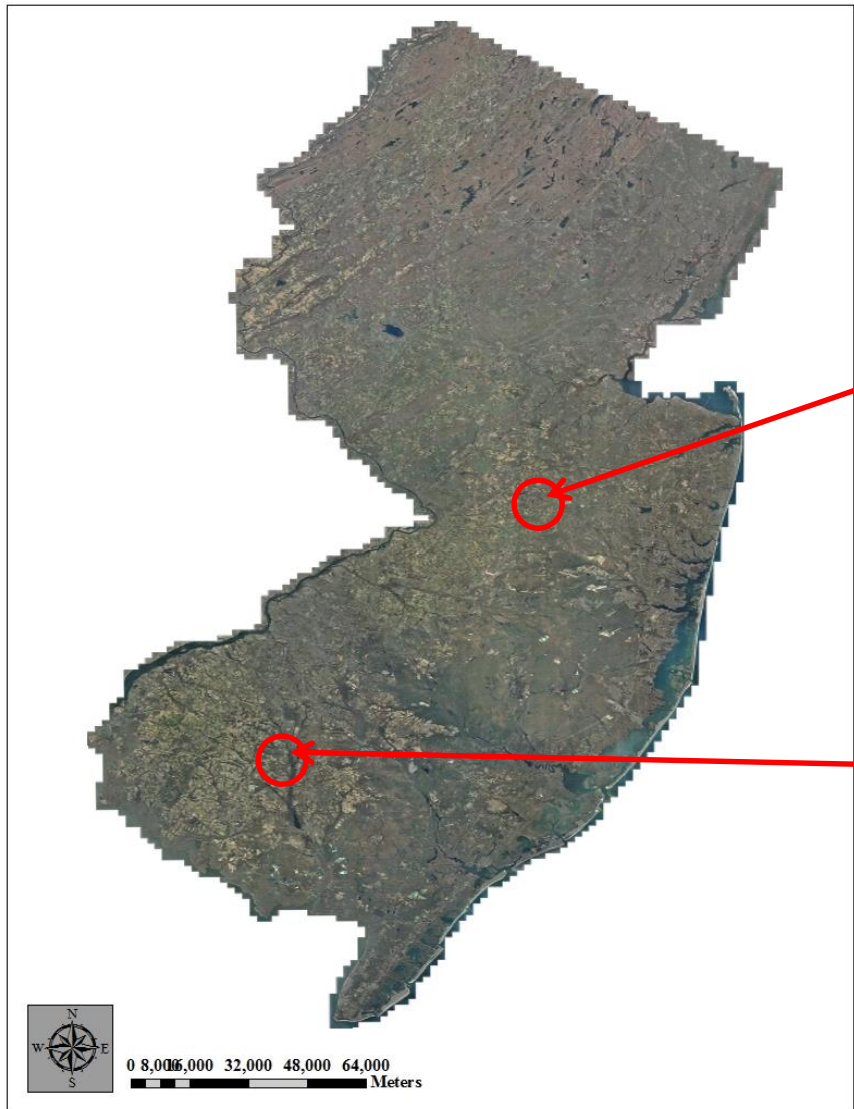


Hypotheses

 Populations are randomly distributed in the beginning of the growing season and clustered throughout the remainder.

 Clustering will be consistent across consecutive years at each location.

Study Sites



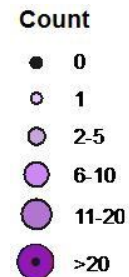
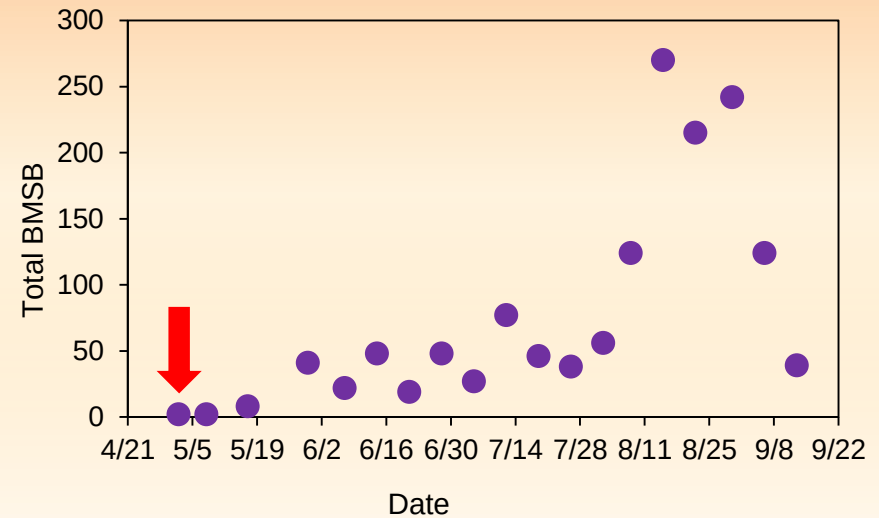
Data Collection

- 🐜 Sampling for BMSB
 - 🐜 Adults and nymphs
 - 🐜 1½ minutes visual survey
 - 🐜 5 beats per tree
- 🐜 Cream Ridge (2012)
- 🐜 Cream Ridge (2013)
- 🐜 RAREC (2013)



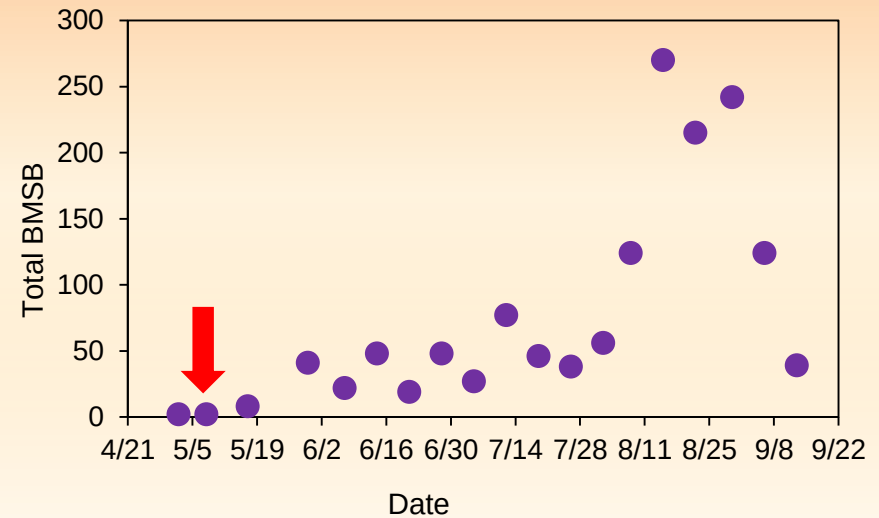
Cream Ridge

5/2/2012

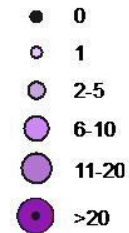


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5/8/2012

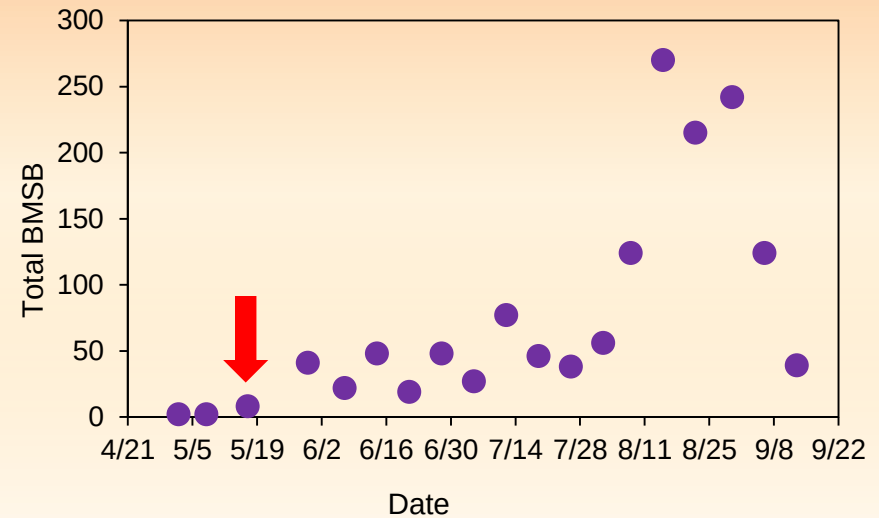


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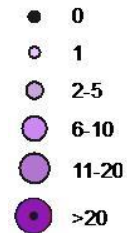


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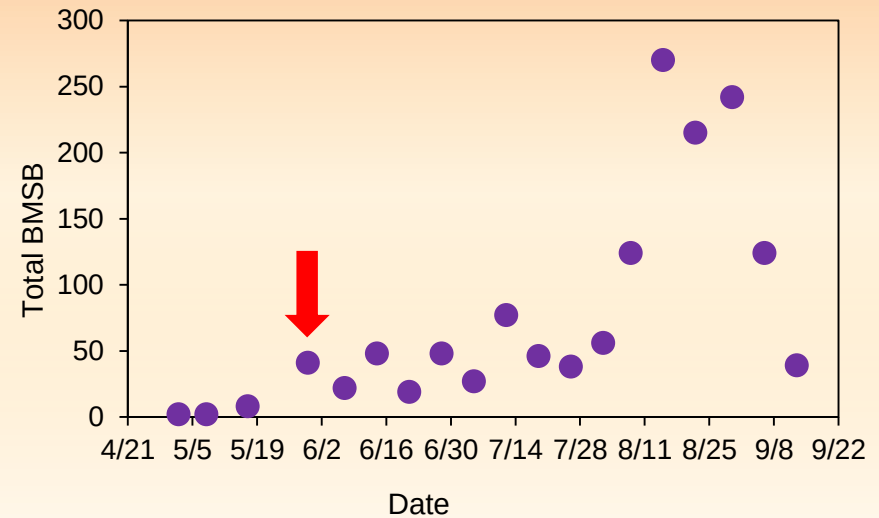


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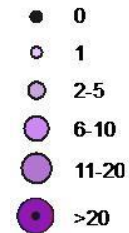


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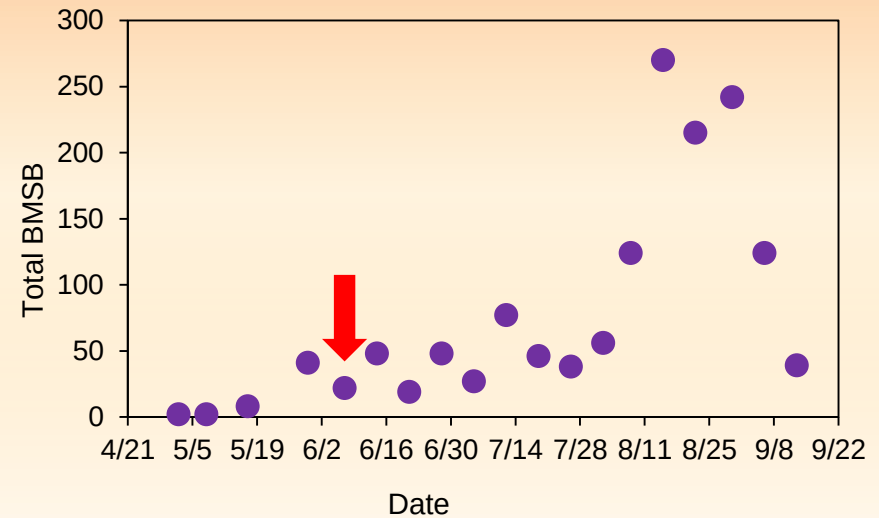


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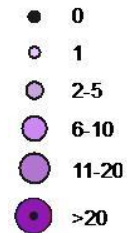


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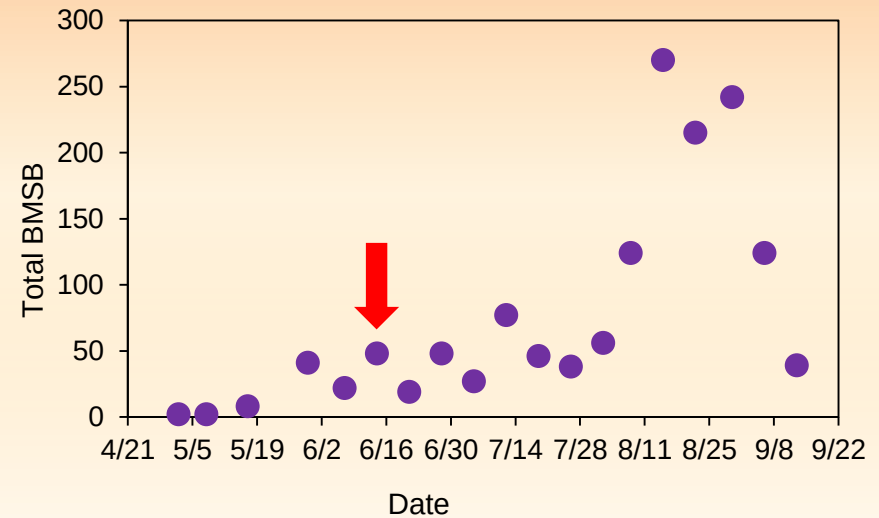


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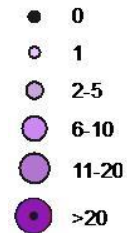


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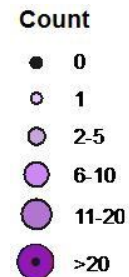
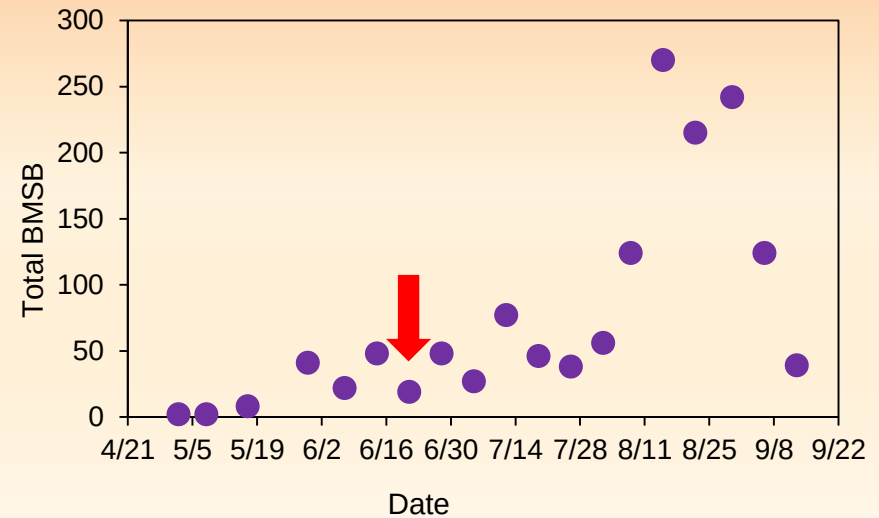


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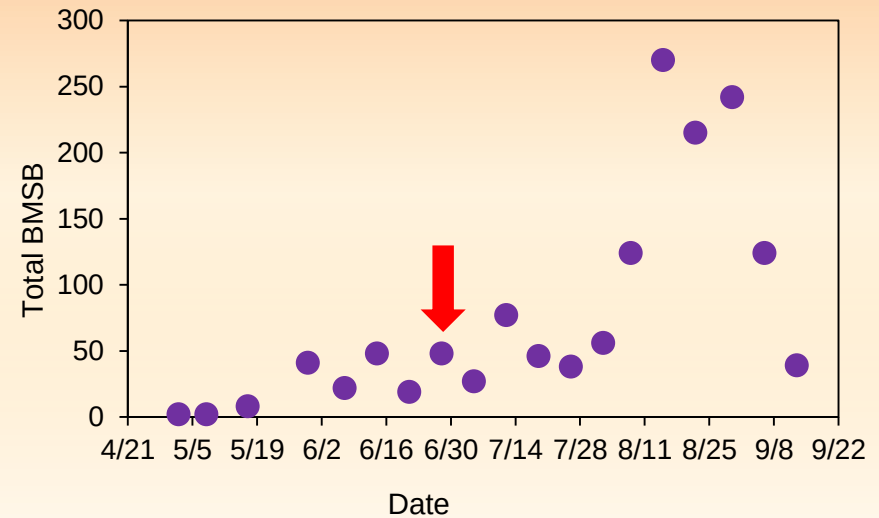
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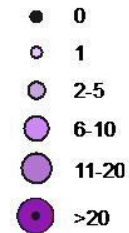


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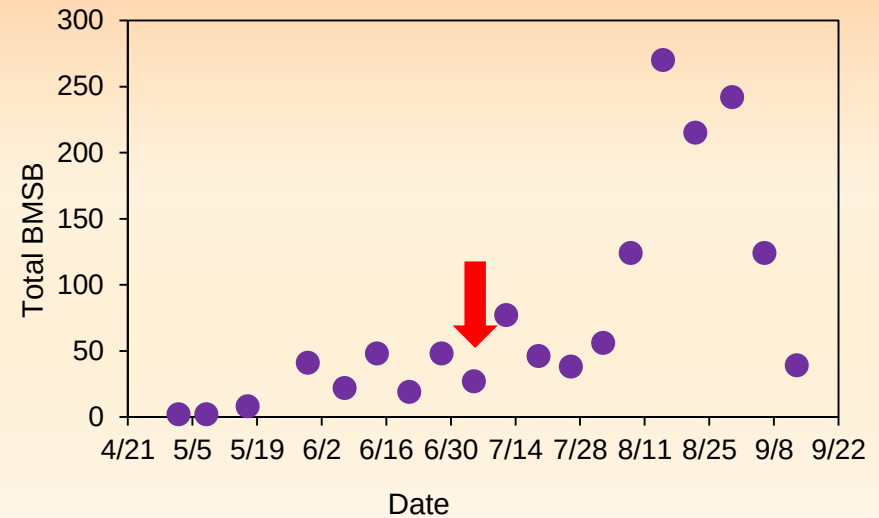


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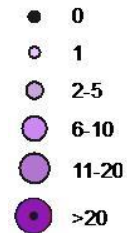


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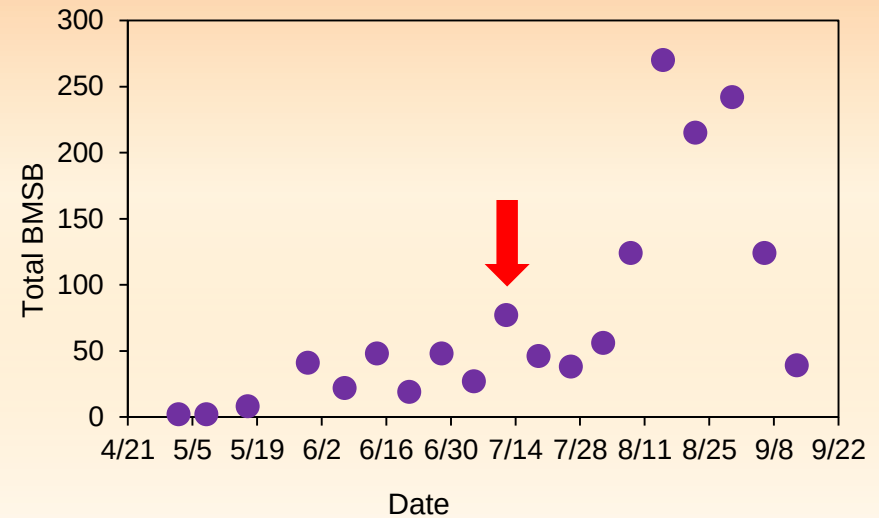


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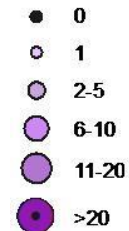


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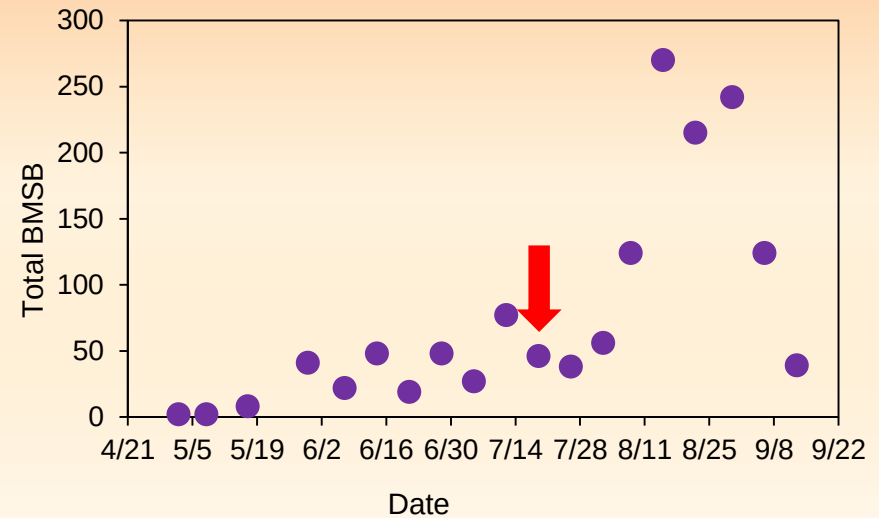


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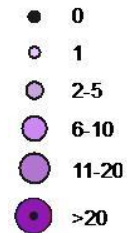


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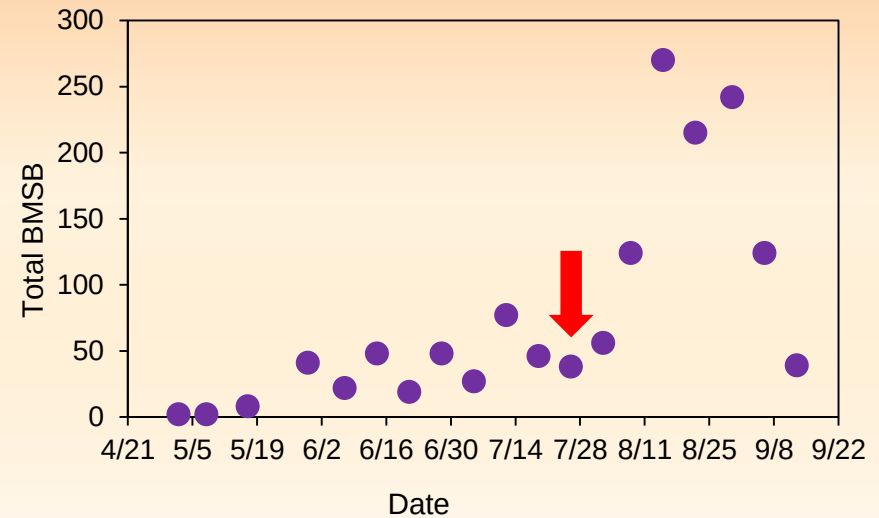


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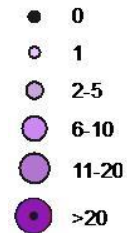


Cream Ridge

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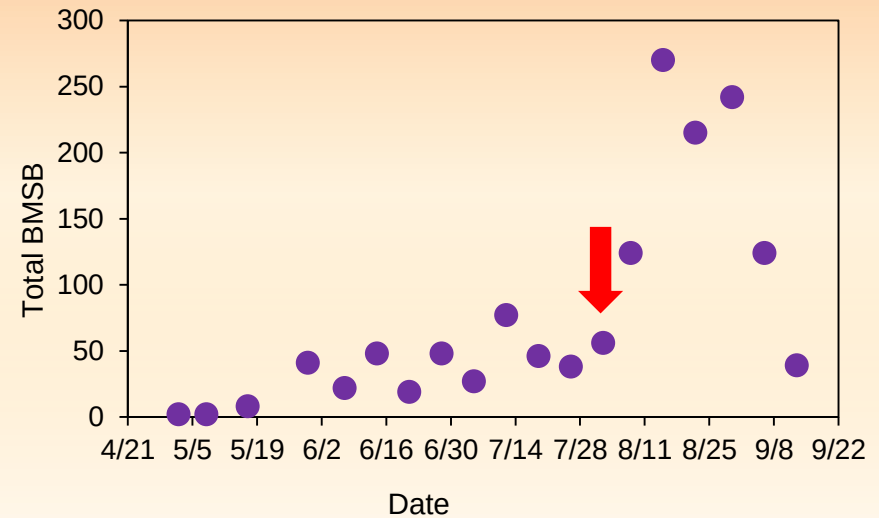


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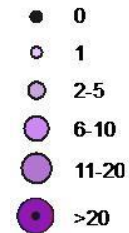


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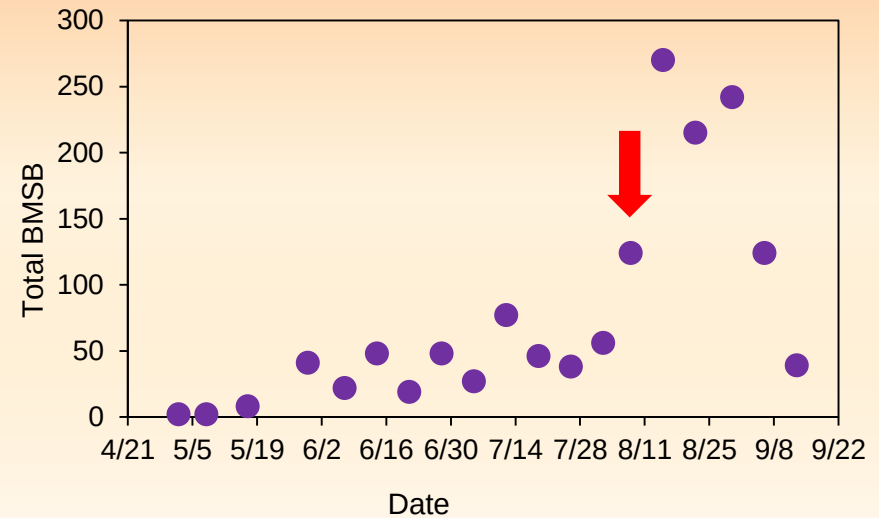


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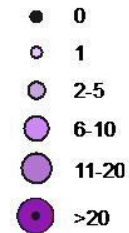


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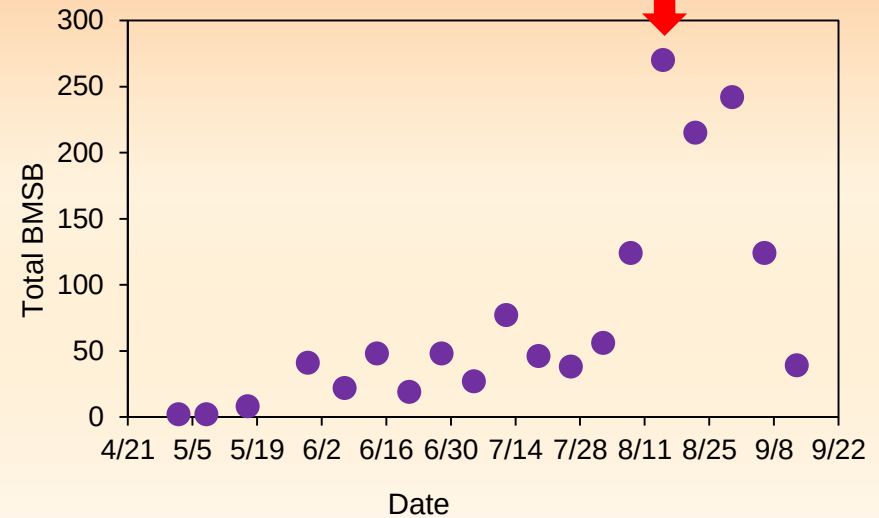


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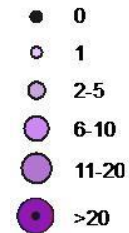


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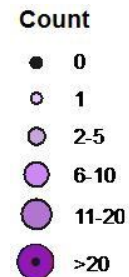
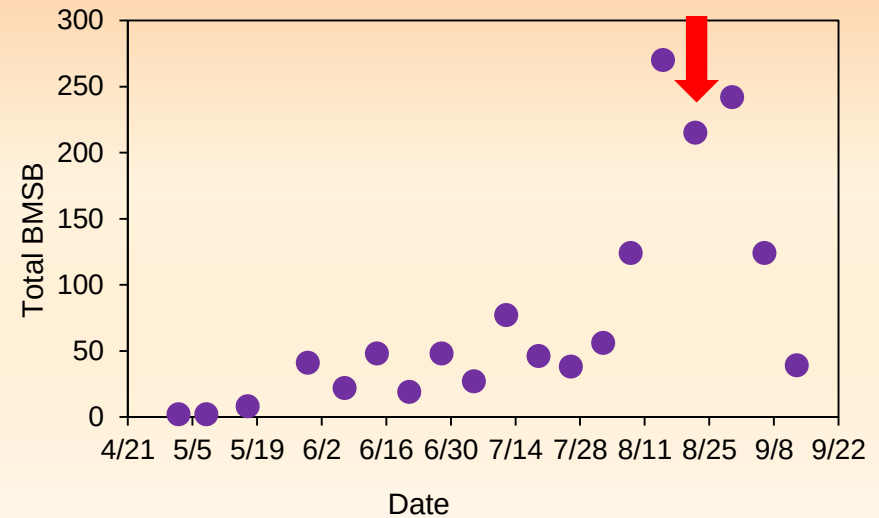


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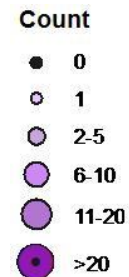
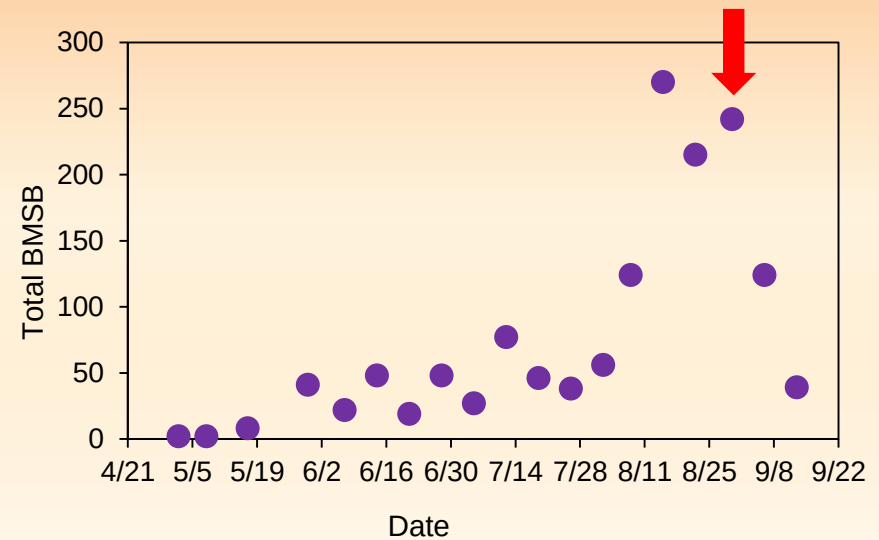
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8/22/2012



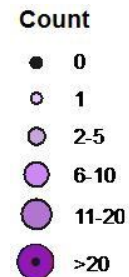
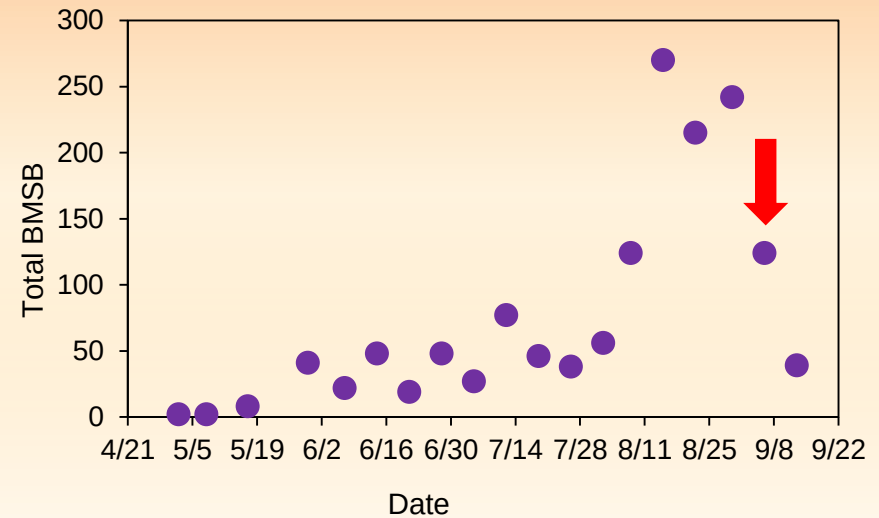
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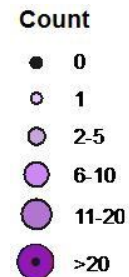
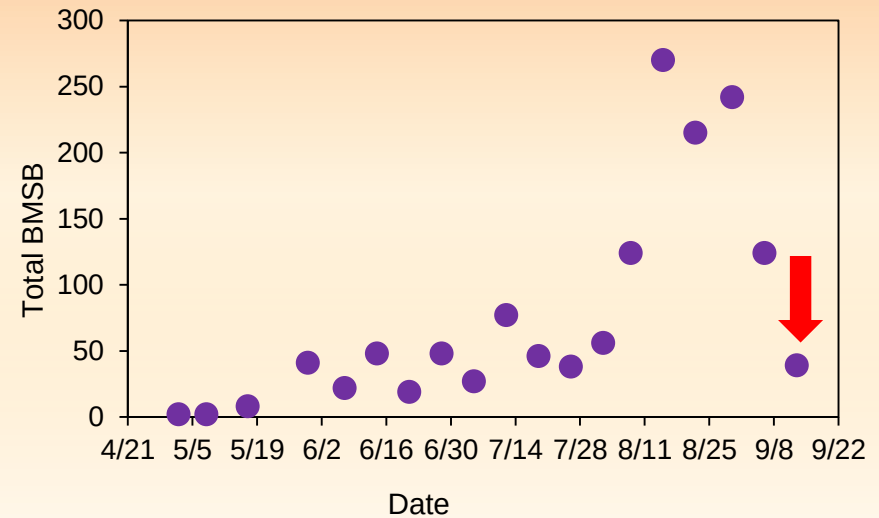
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9/6/2012



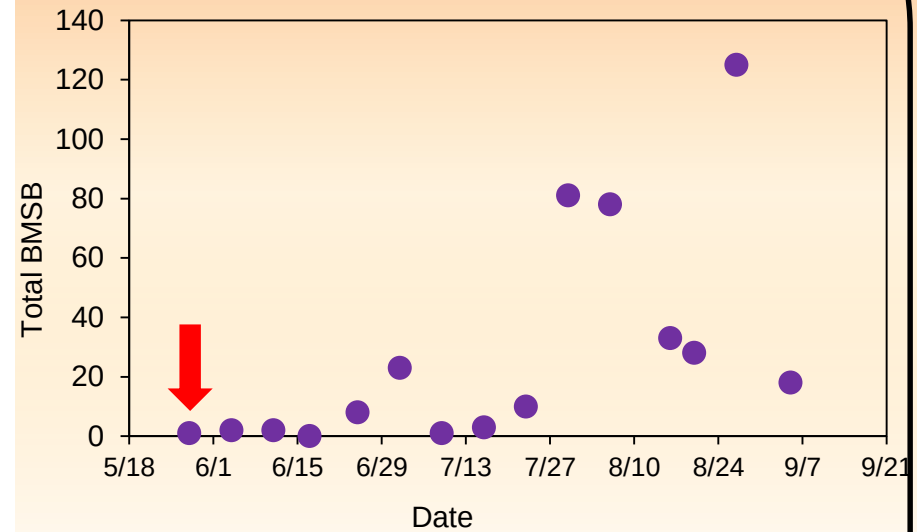
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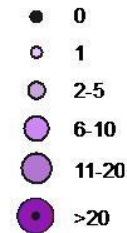


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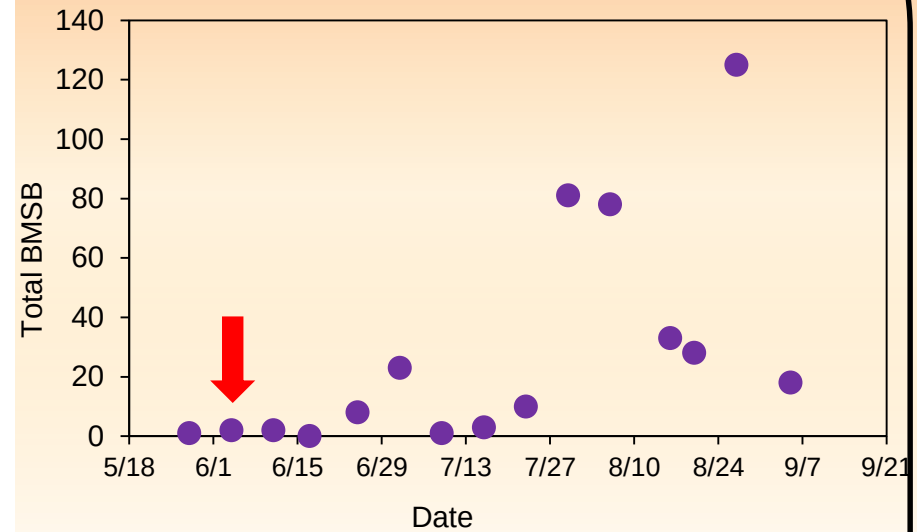


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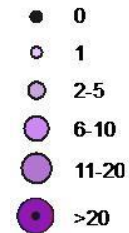


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6/4/2013

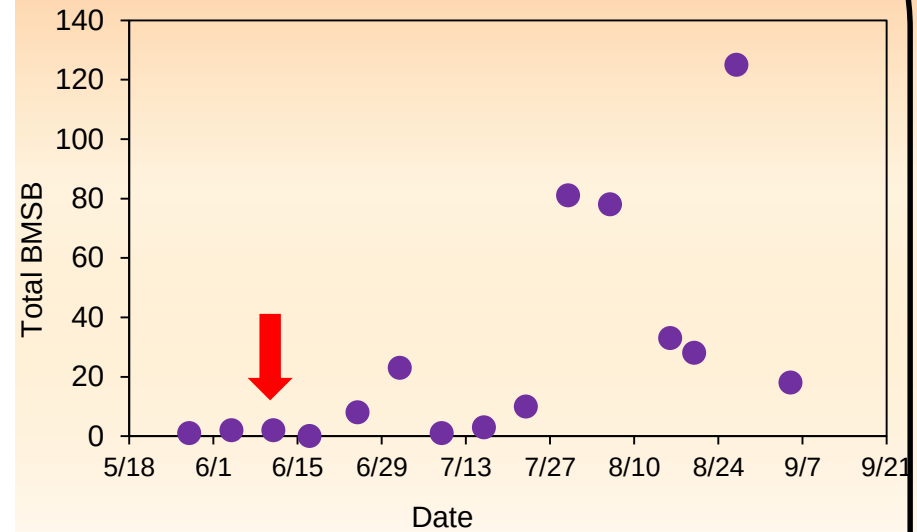


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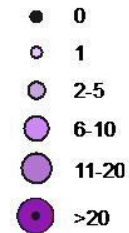


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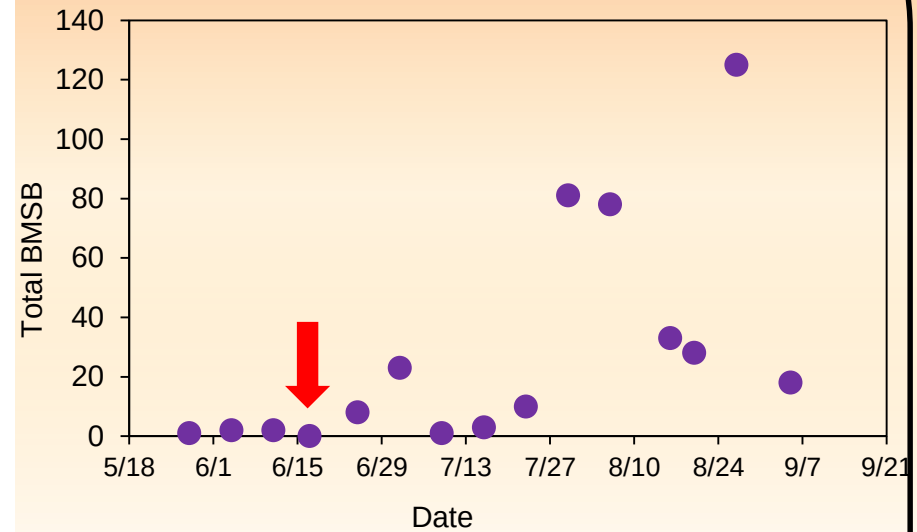


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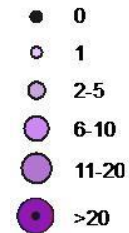


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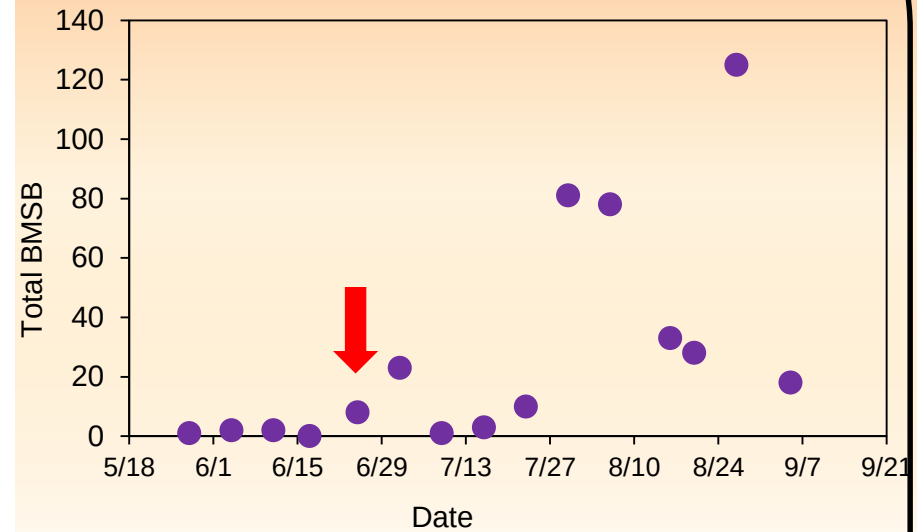


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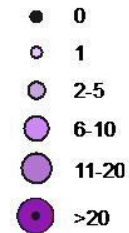


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6/25/2013

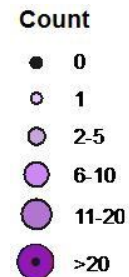
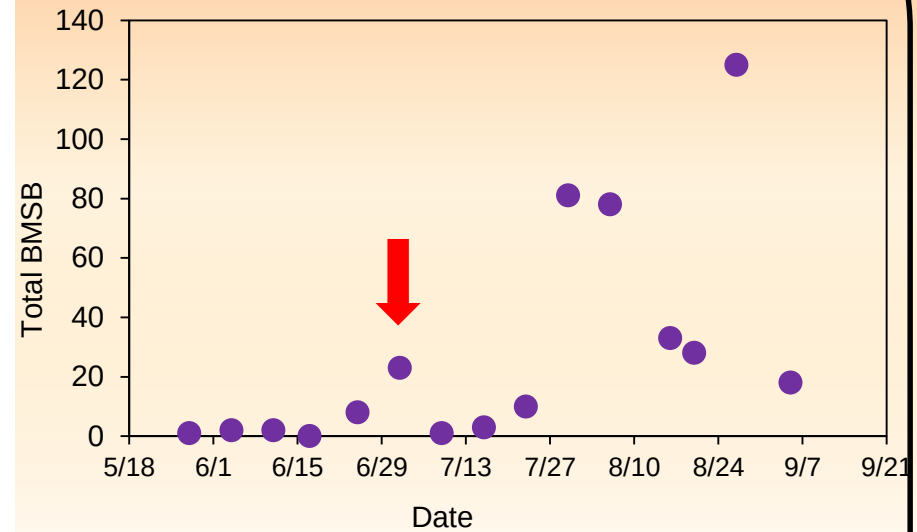


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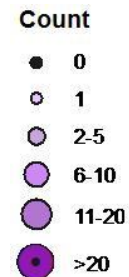
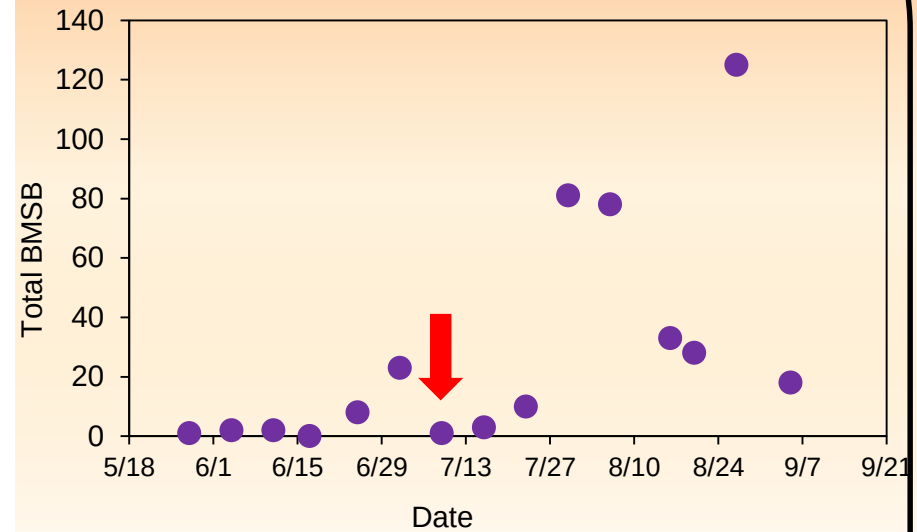
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7/2/2013



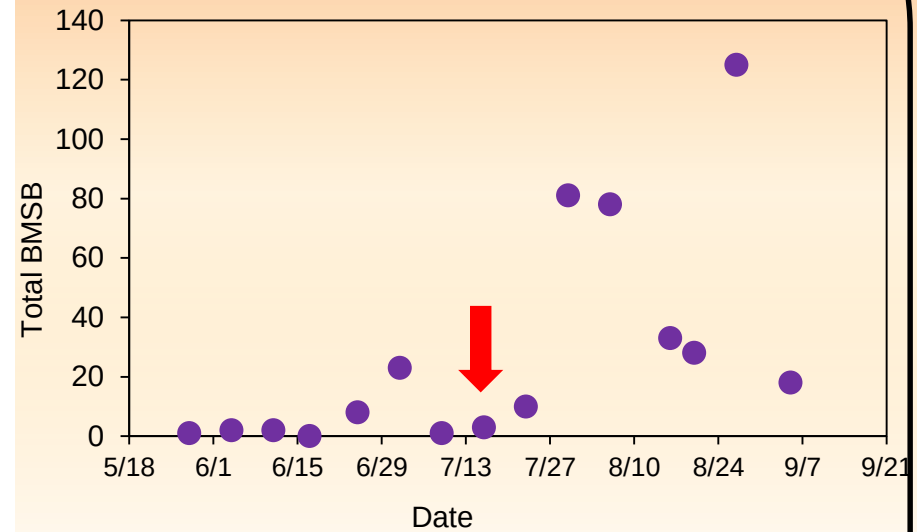
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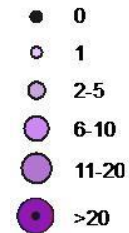


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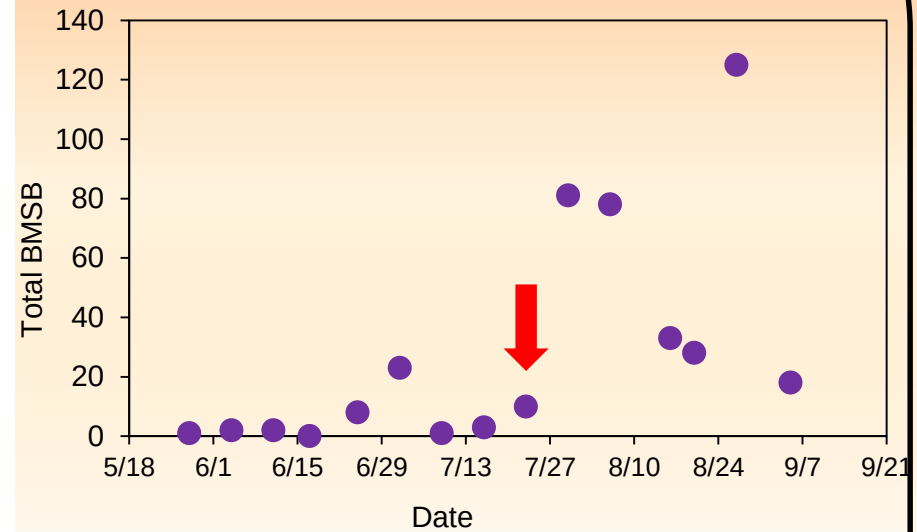


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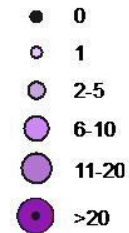


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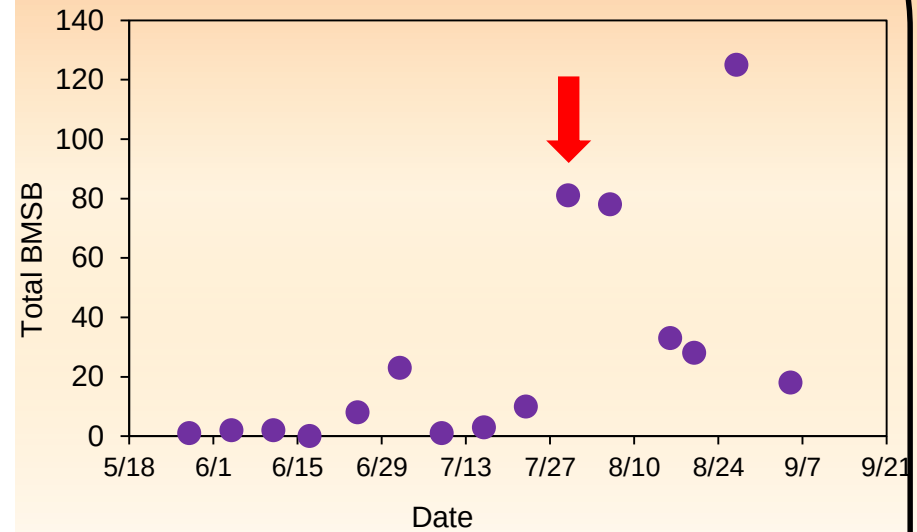
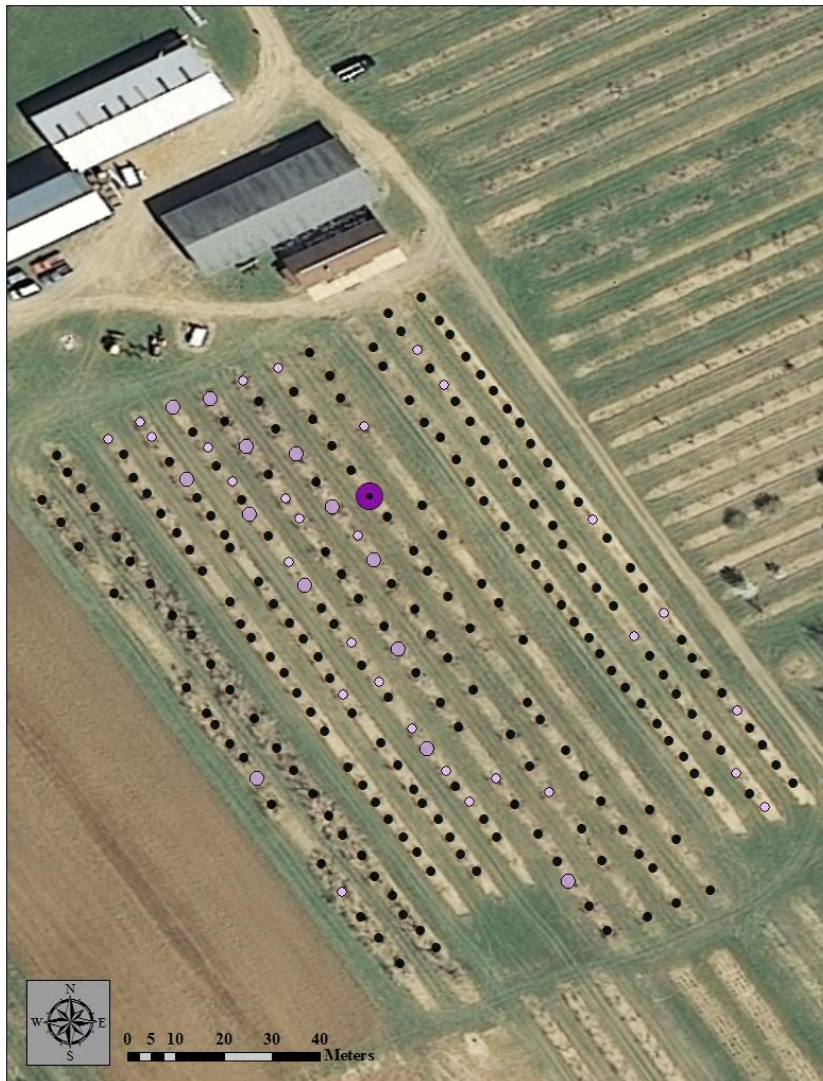


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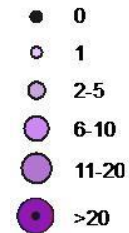


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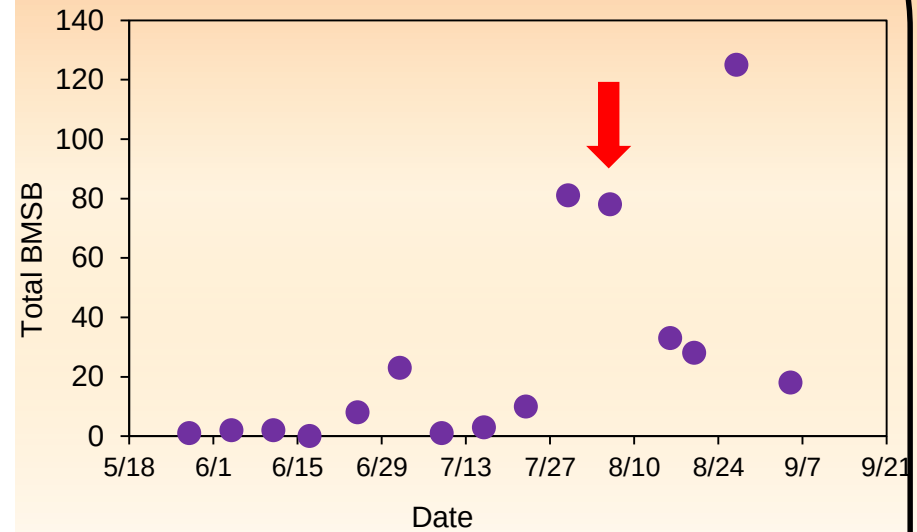


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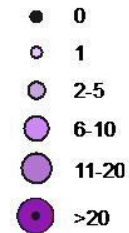


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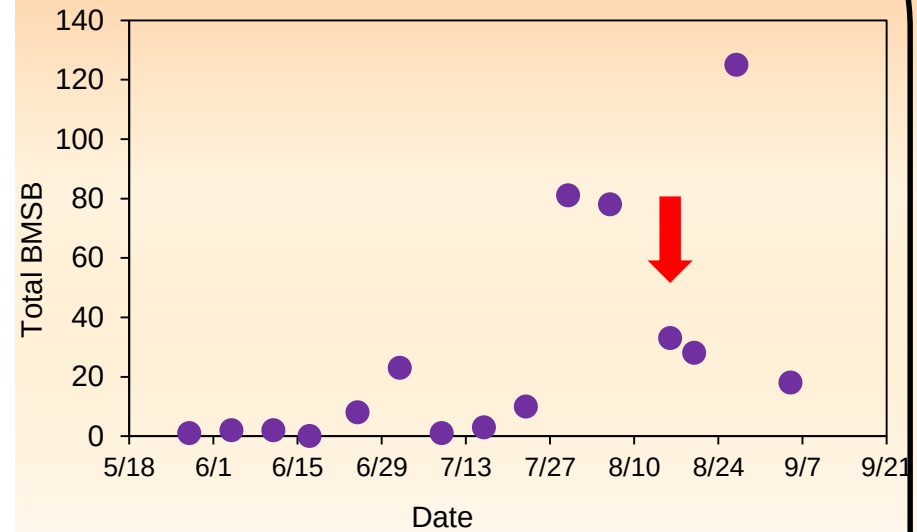


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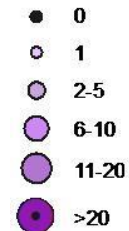


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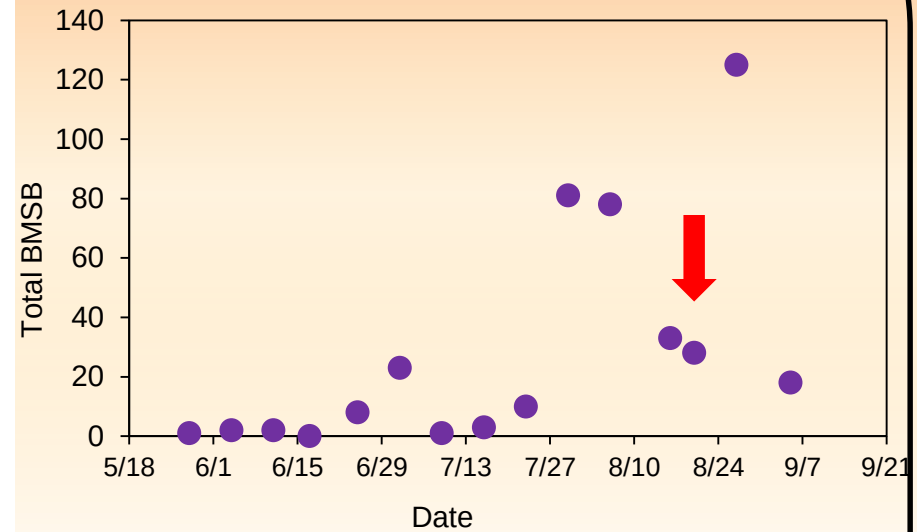


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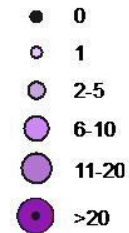


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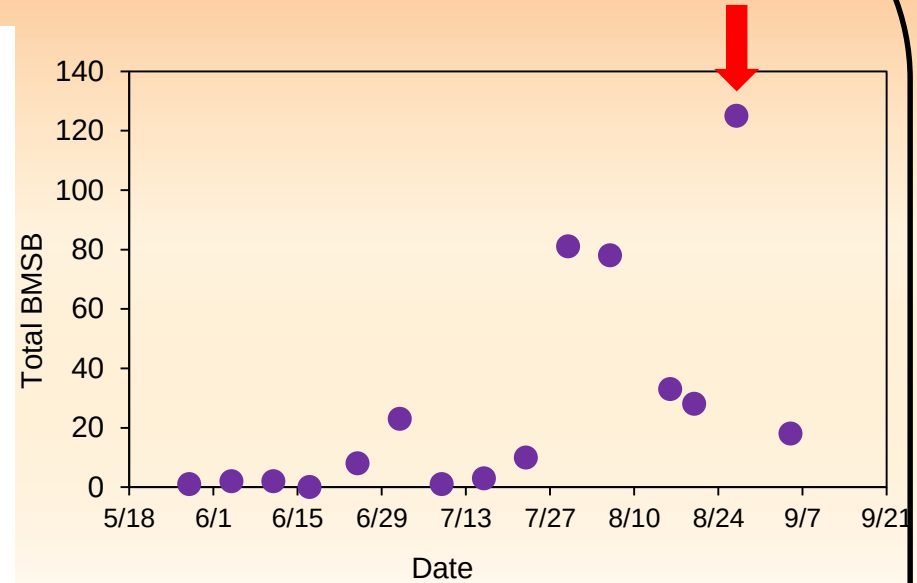


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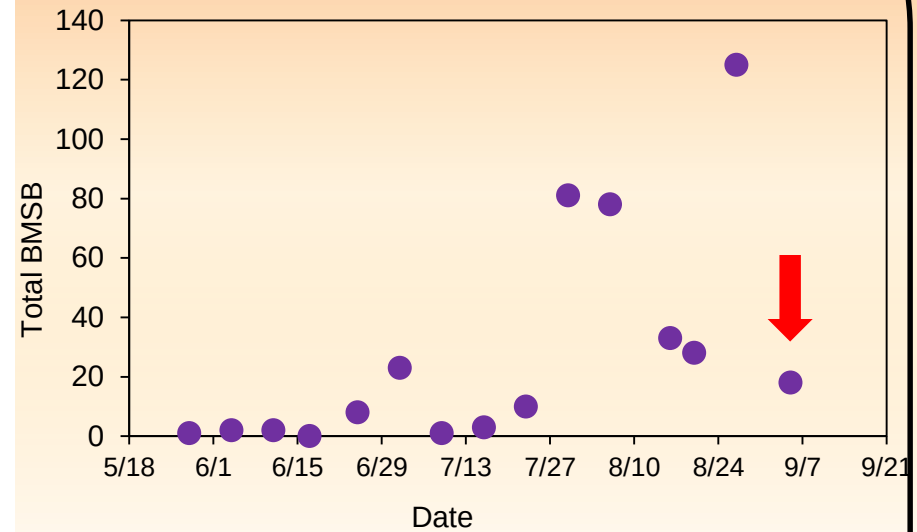
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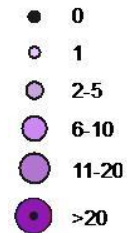


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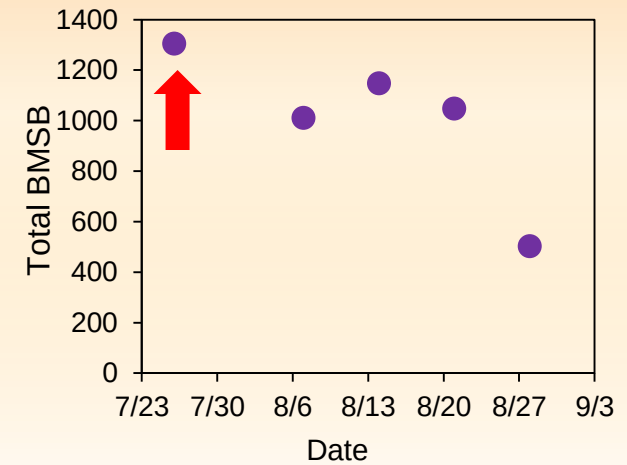
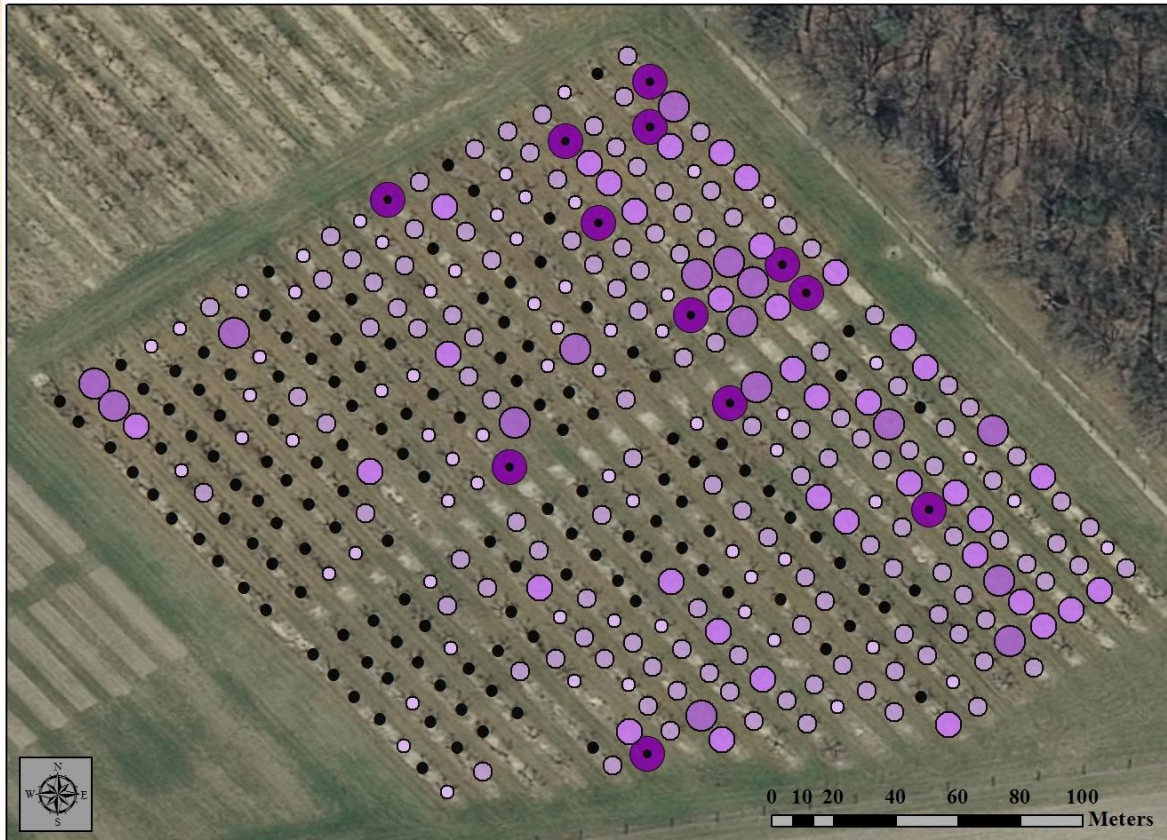


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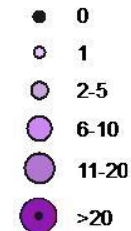


RAREC

7/26/2013

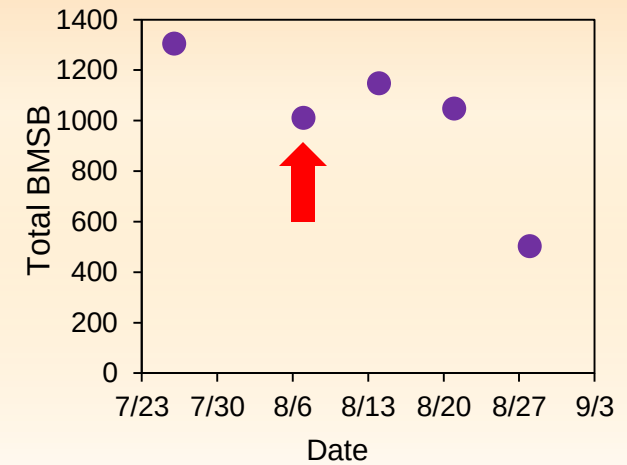
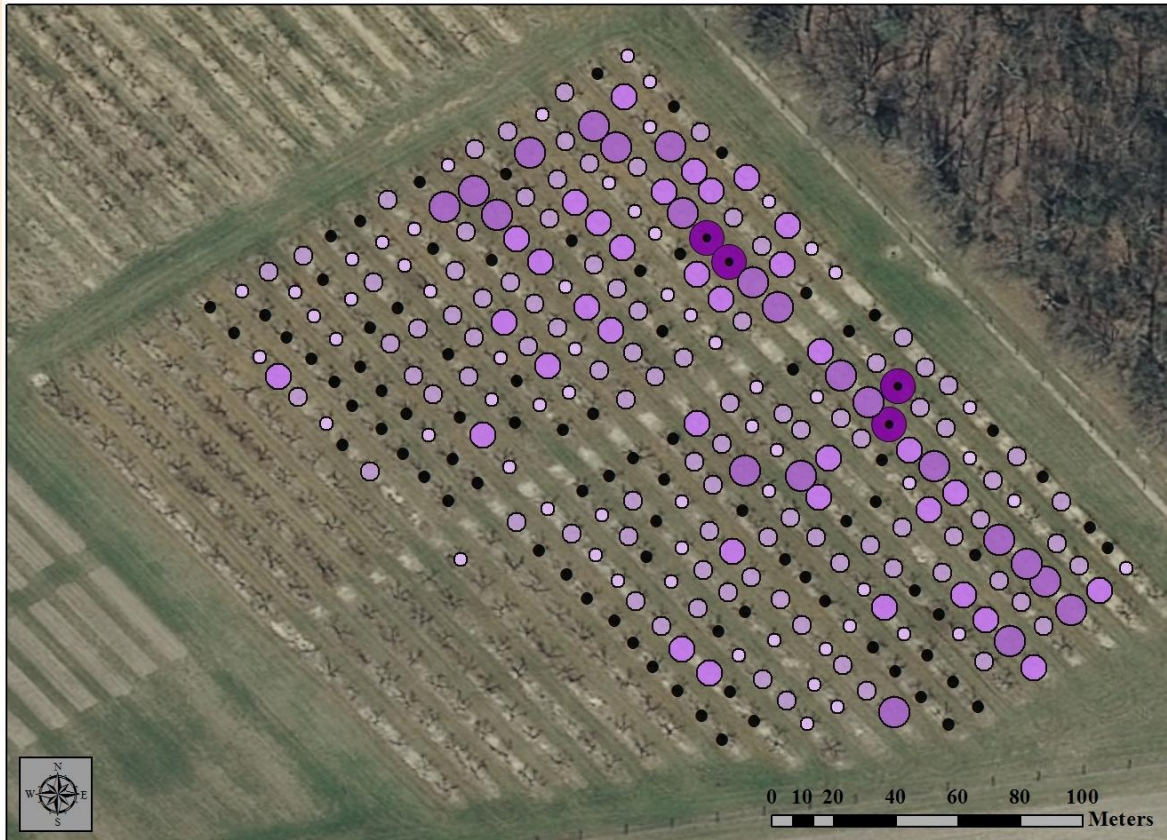


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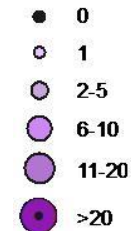


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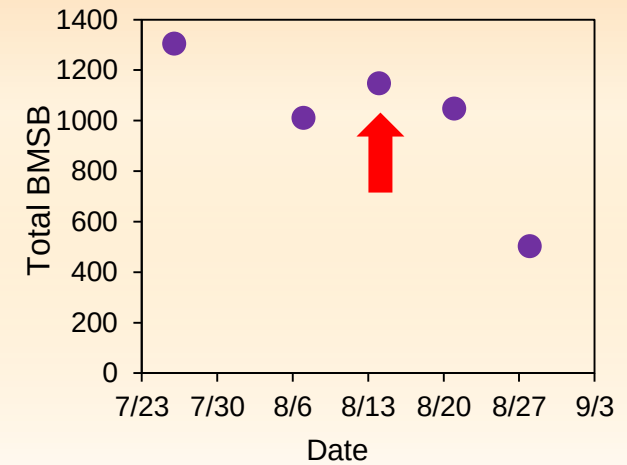
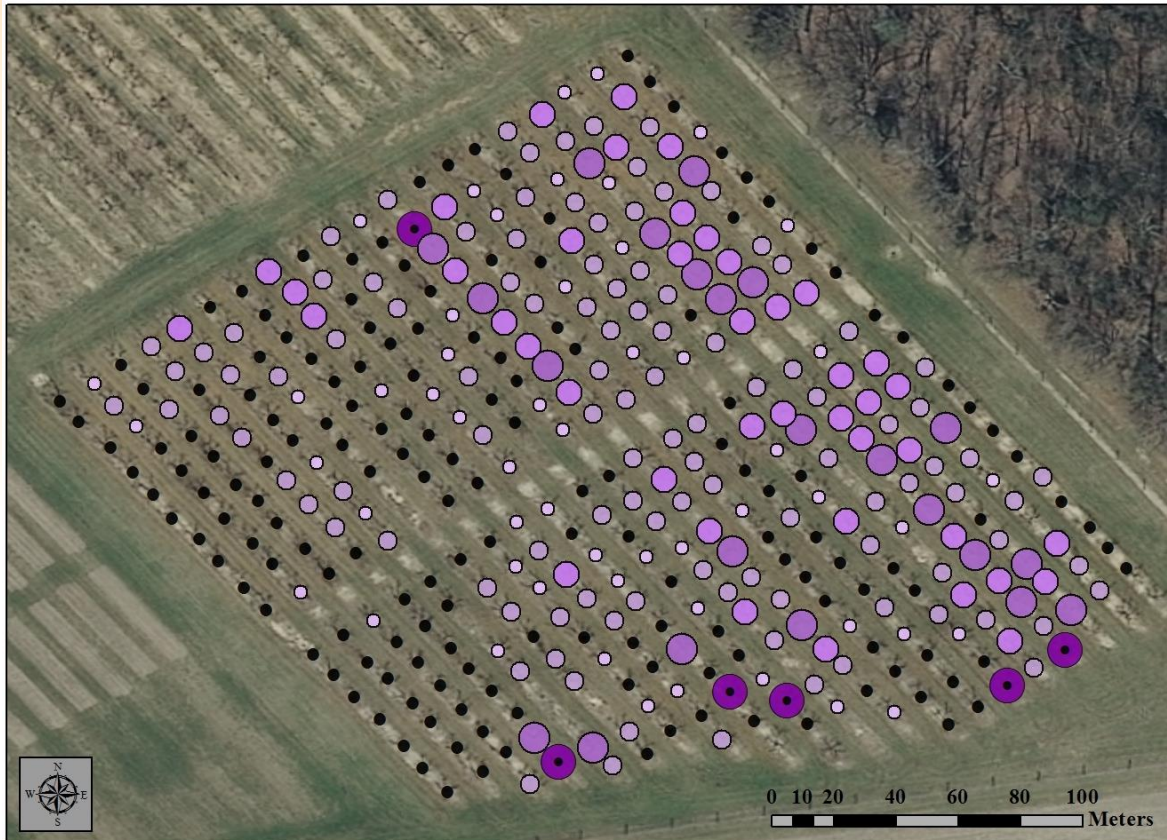


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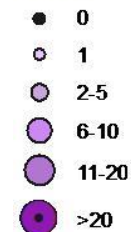


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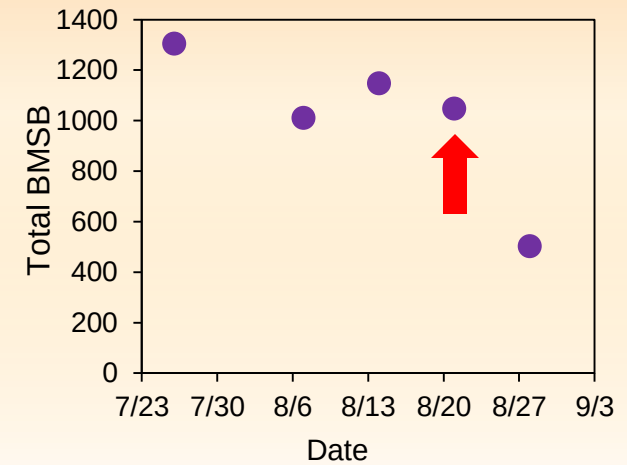
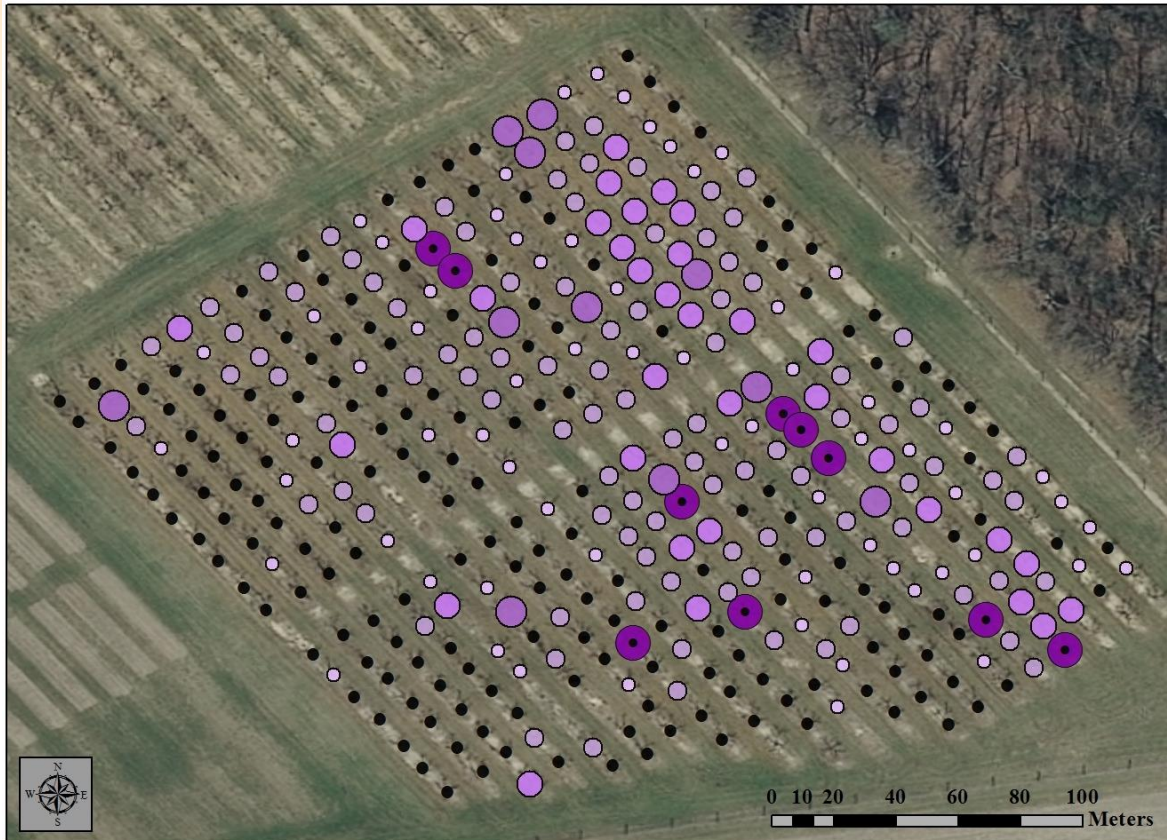


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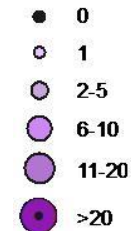


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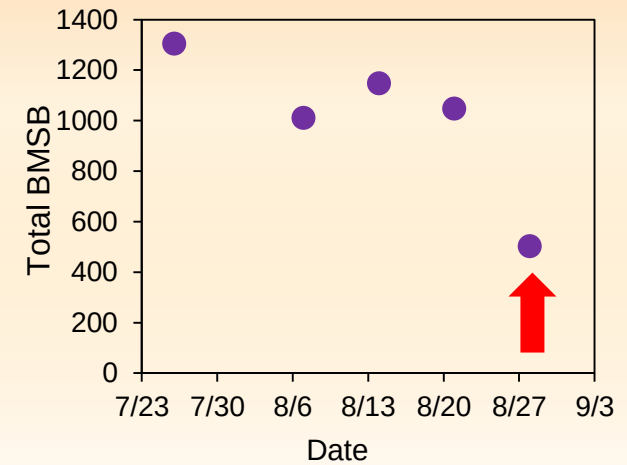
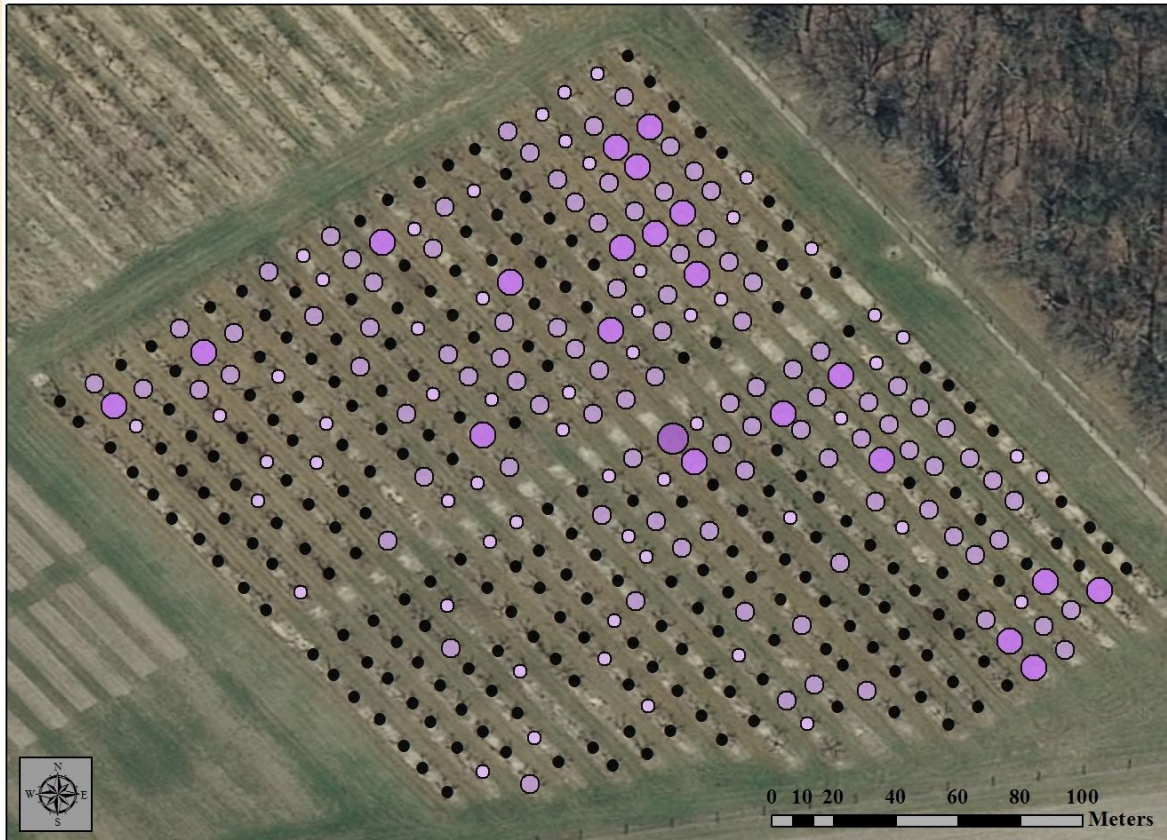


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RAREC

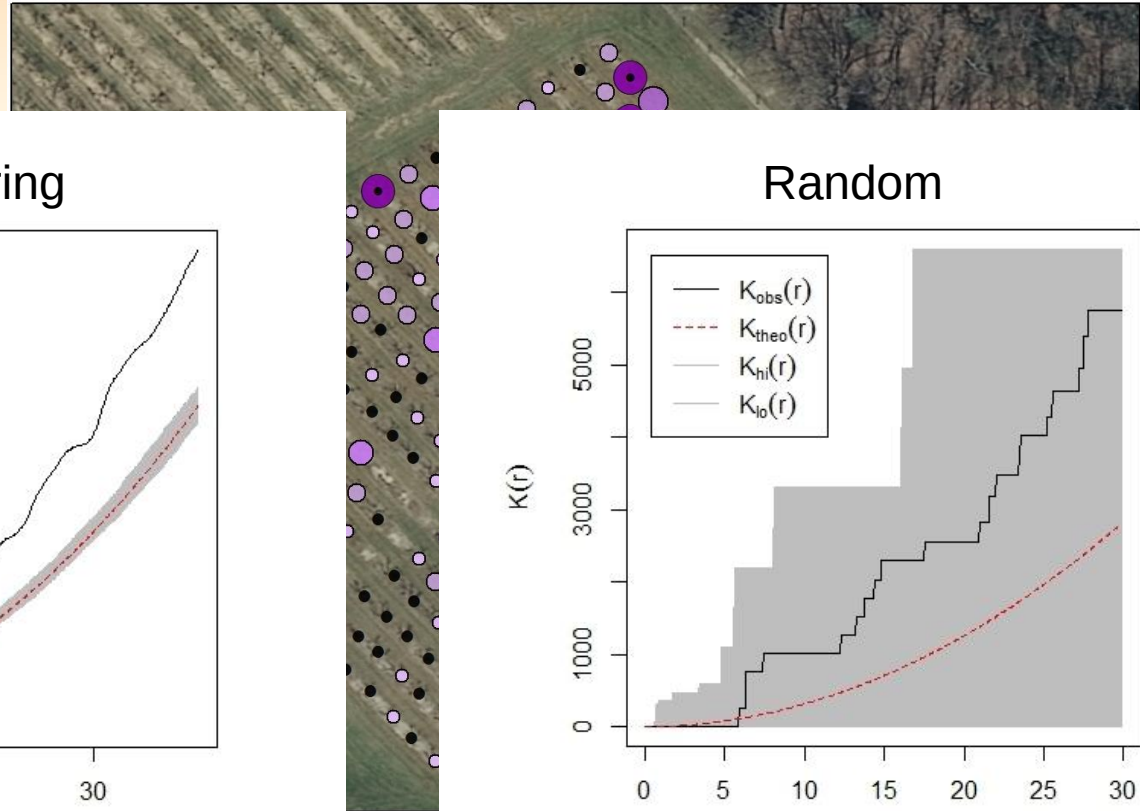
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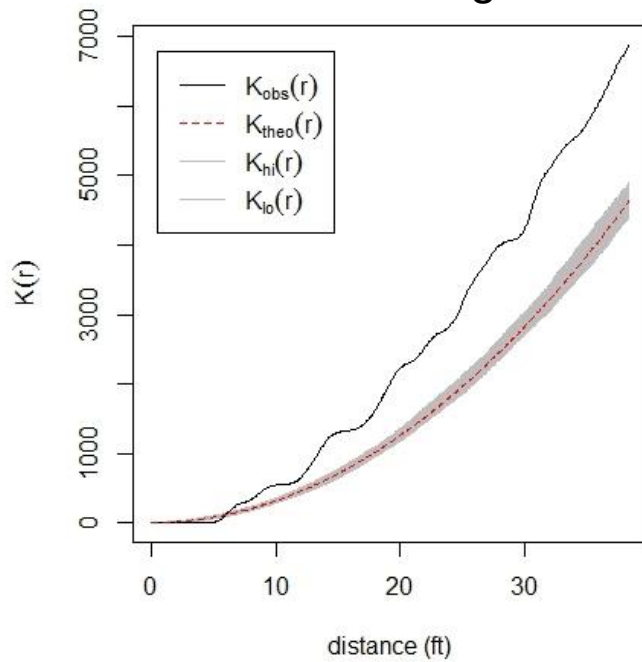
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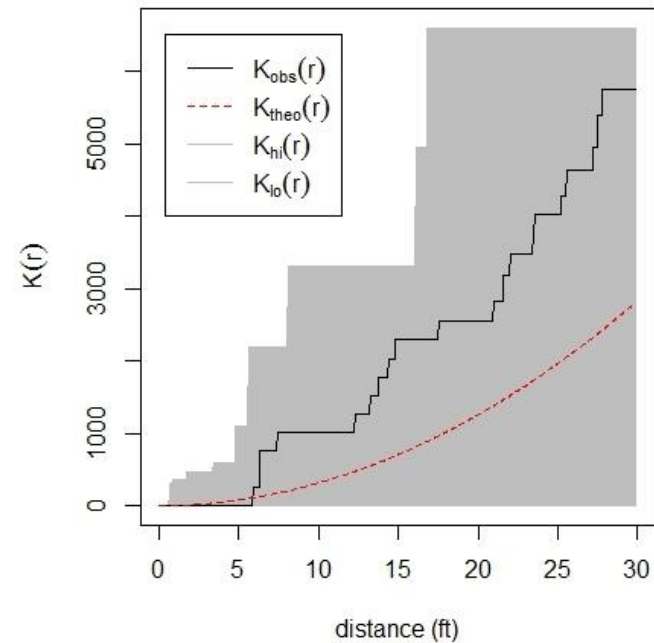
Ripley's K



Clustering

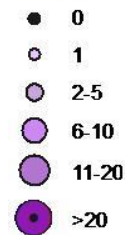
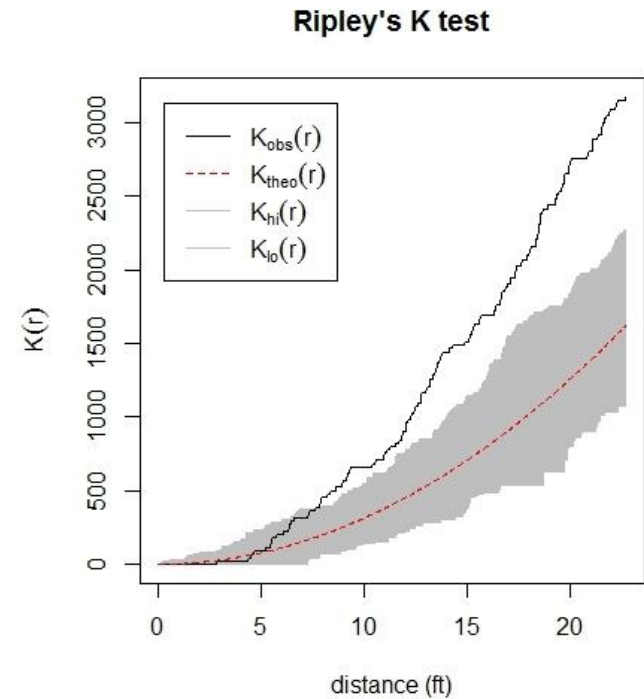


Random



Cream Ridge

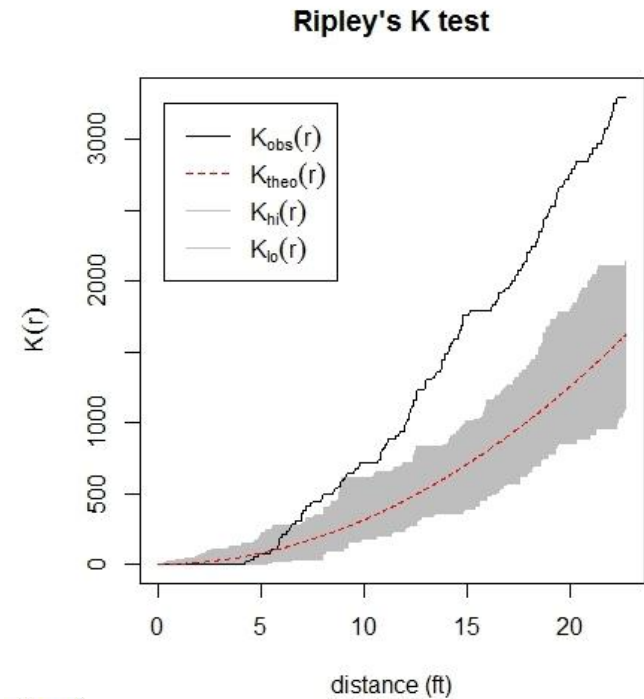
5/30/2012



Clustering found

Cream Ridge

8/30/2012



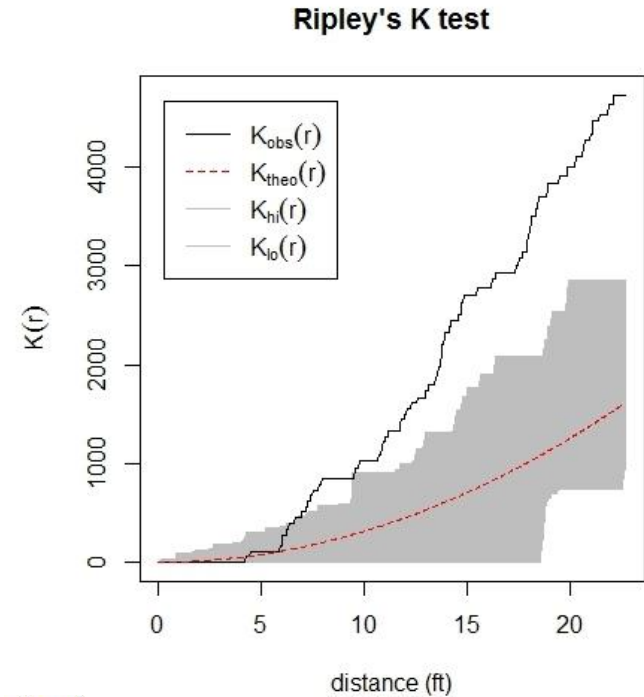
Count

- 0
- 1
- 2-5
- 6-10
- 11-20
- >20

Clustering found

Cream Ridge

9/13/2012



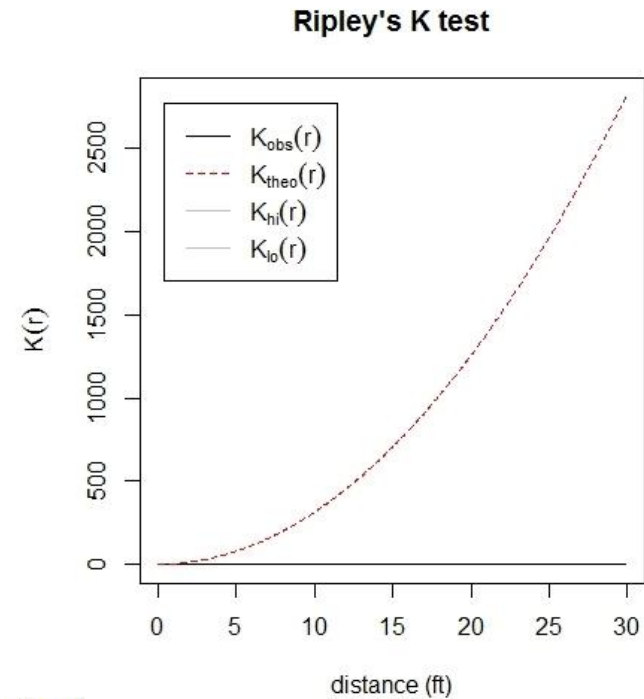
Count

- 0
- 1
- 2-5
- 6-10
- 11-20
- >20

Clustering found

Cream Ridge

5/28/2013



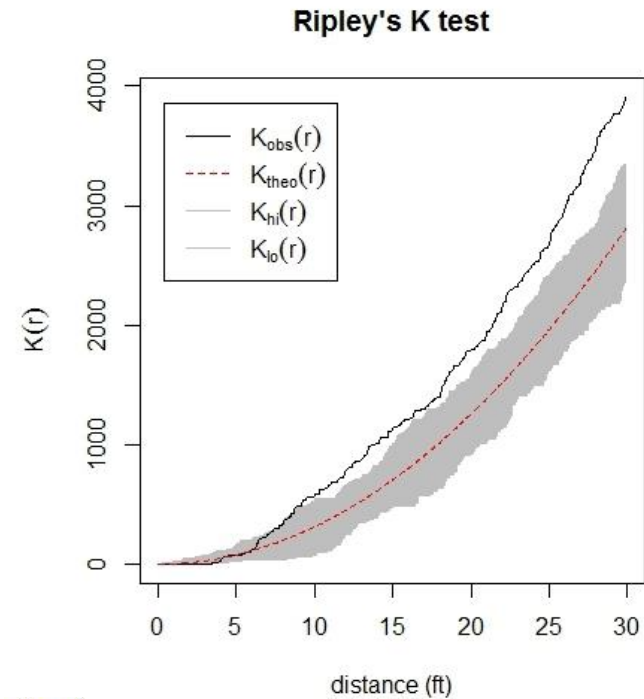
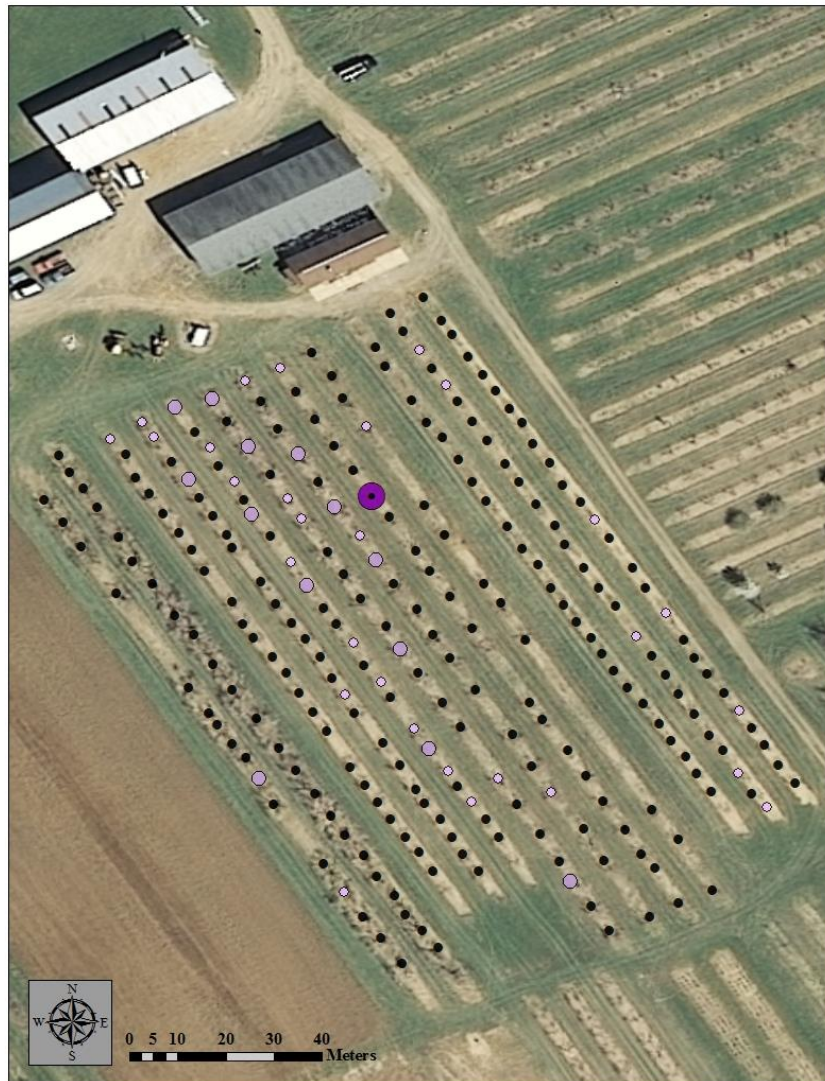
Count

- 0
- 1
- 2-5
- 6-10
- 11-20
- >20

No clustering

Cream Ridge

8/27/2013



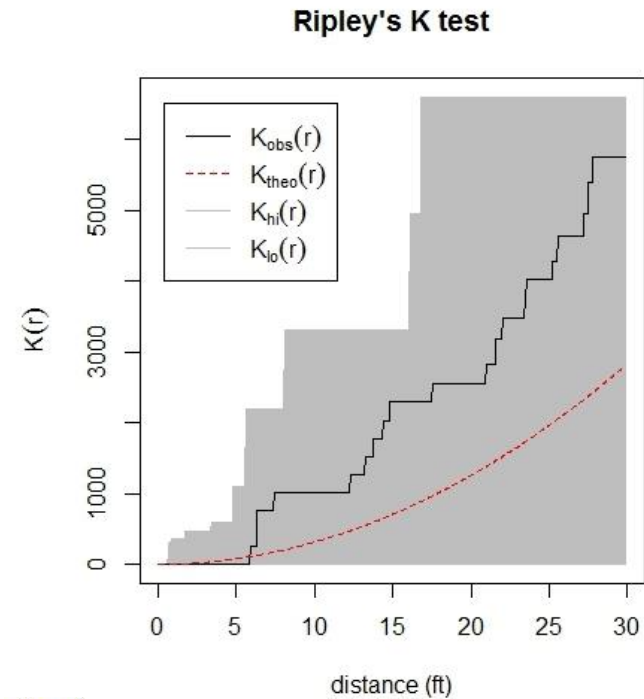
Count

- 0
- 1
- 2-5
- 6-10
- 11-20
- >20

Clustering found

Cream Ridge

9/5/2013



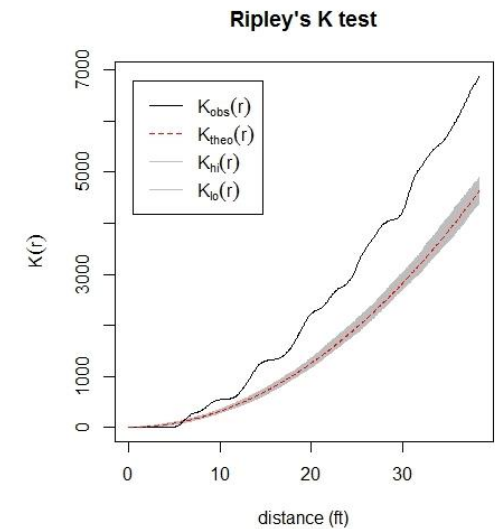
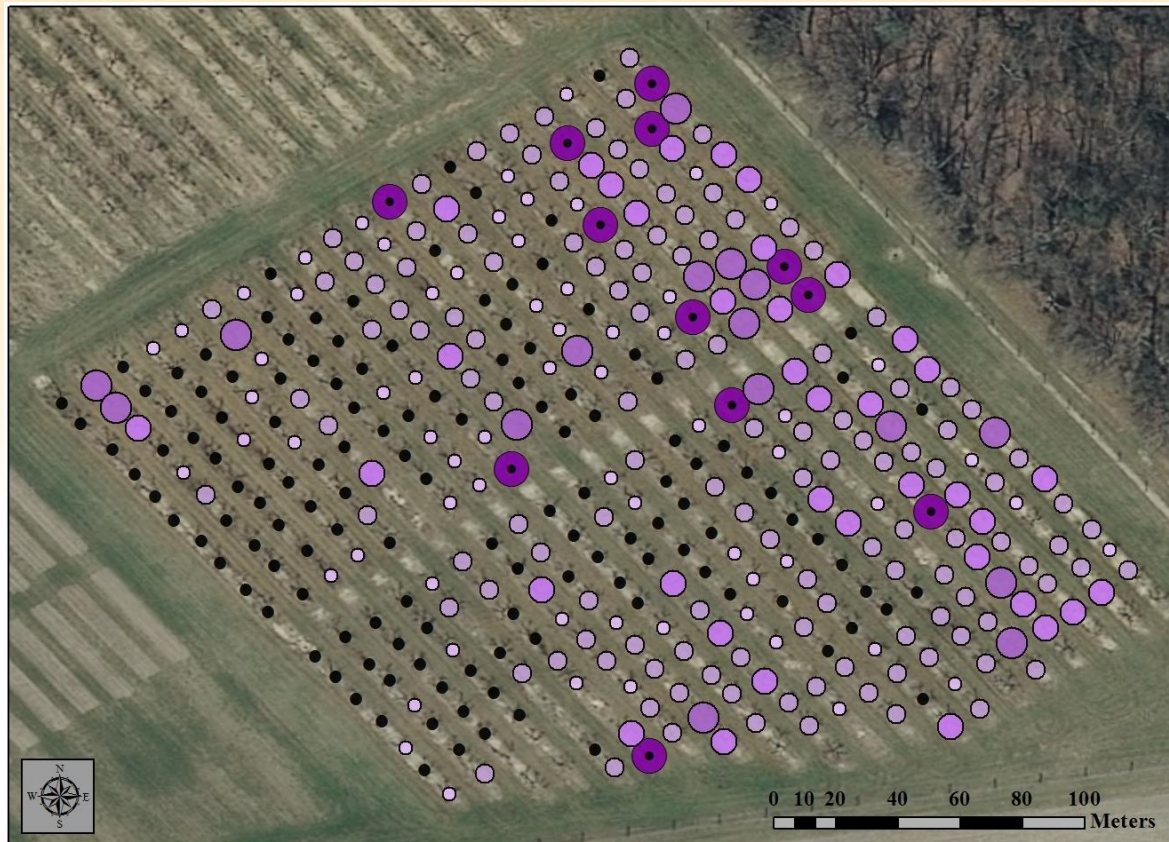
Count

- 0
- 1
- 2-5
- 6-10
- 11-20
- >20

No clustering

RAREC

7/26/2013



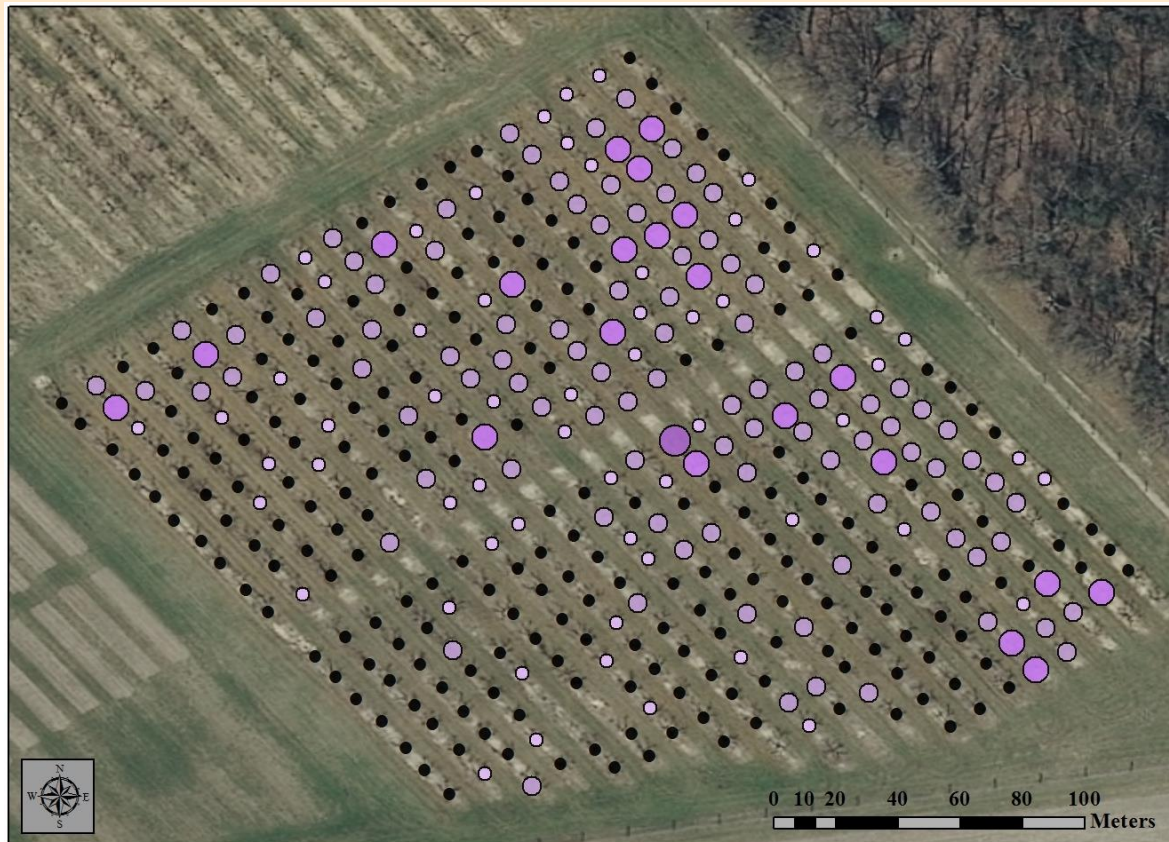
Count

- 0
- 1
- 2-5
- 6-10
- 11-20
- >20

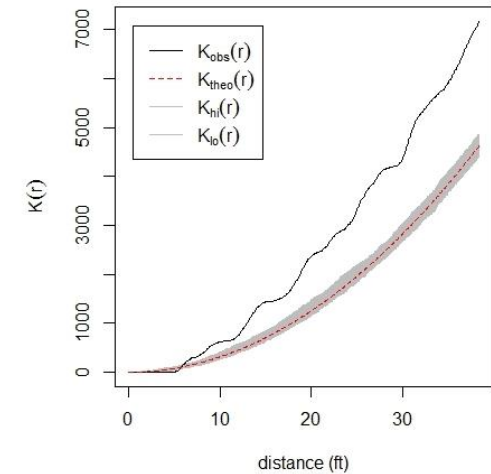
Clustering found

RAREC

8/29/2013



Ripley's K test



Count

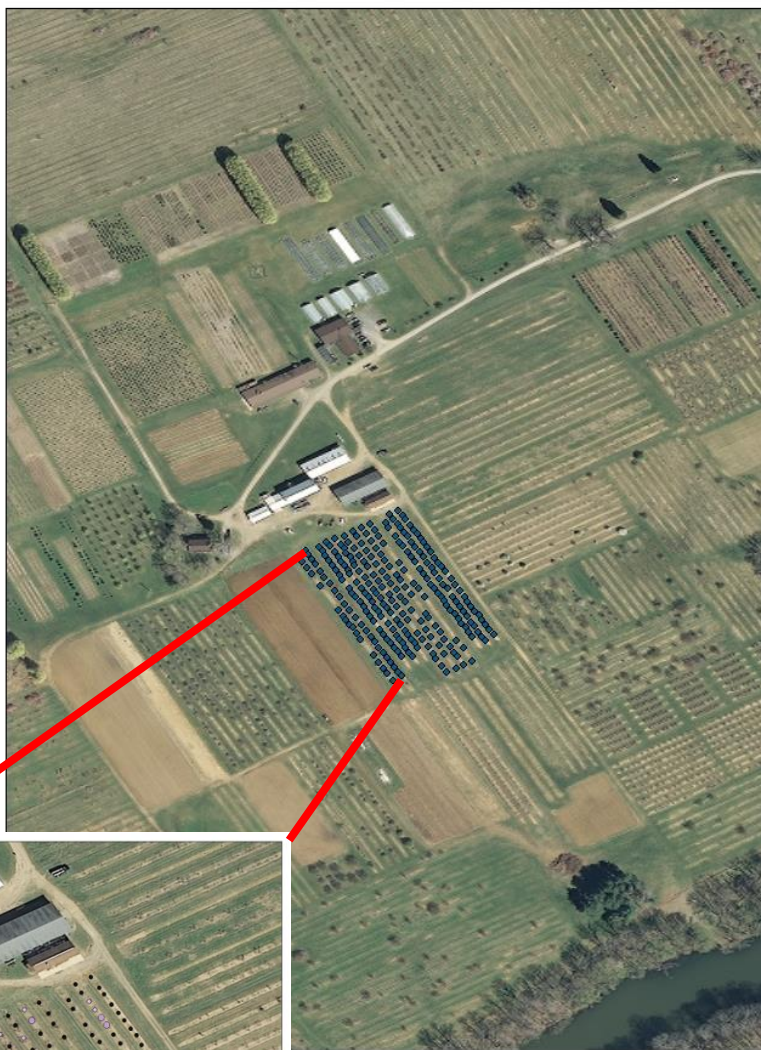
- 0
- 1
- 2-5
- 6-10
- 11-20
- >20

Clustering found

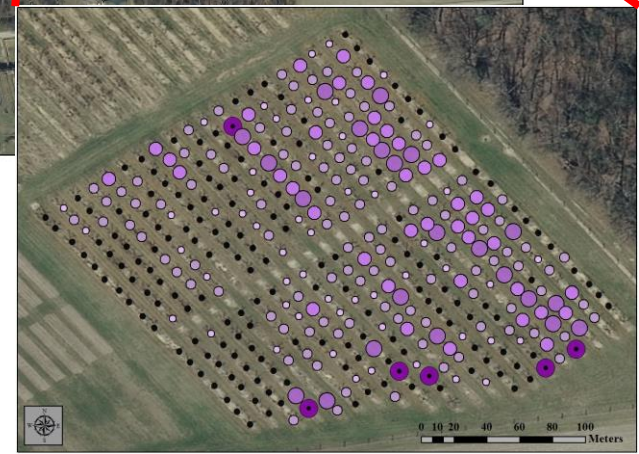
Conclusions

- 🏠 Populations are clustered at all sample dates in 2012 and at the high population dates in 2013.
- 🏠 Populations were not clustered at the low population date at Cream Ridge in 2013.
- 🏠 Clustering was not consistent across consecutive years.

Cream Ridge



RAREC



Potential Factors Influencing Populations

- Variety
 - Ripening time
- Distance from
 - Forest
 - Structures
- Control methods
 - Insecticidal border sprays

Next Steps

-  Investigate how clustering is affected by landscape features e.g., forested areas, structures, as well as geographic location.
-  Determine the influence of abiotic and landscape factors using principal component analysis (PCA) and conditionally autoregressive model (CAR).
-  Correlate numbers of nymphs and adults with damage co-kriging.

Thanks!

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USDA-NIFA: SCRI
NE-SARE Graduate student grant

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