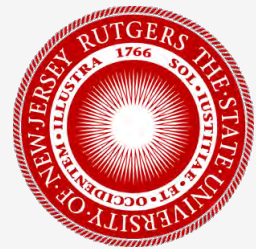


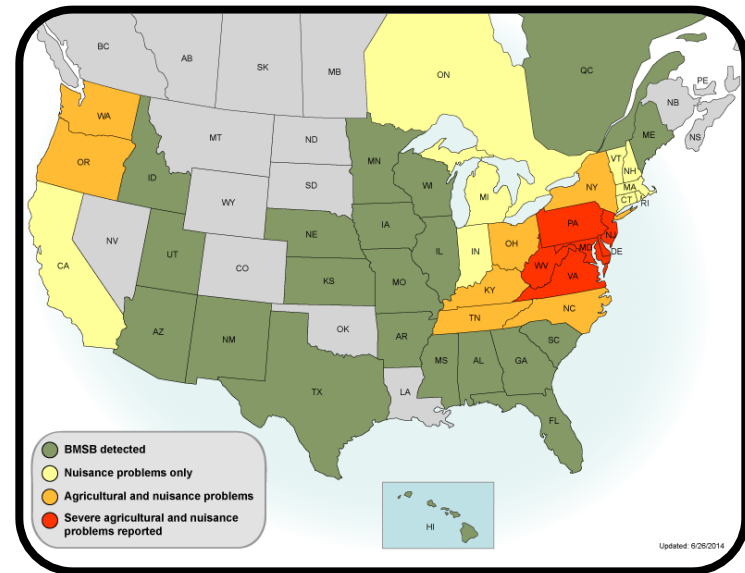
BMSB Working Group Meeting  
December 3<sup>rd</sup>, 2014

Patterns and  
predictions for  
visual sampling  
of the brown  
marmorated  
stink bug

John Cambridge  
George Hamilton  
Rutgers University



# *Halyomorpha halys* (BMSB)



Leskey, T. (2014, 06 26). *Where is bmsb?*. Retrieved from <http://www.stopbmsb.org/where-is-bmsb/>

# Detection in Peaches



## Sampling Methods

- Timed visual
- Beat sheet
- Blacklight
- Pheromone

Leskey, T. C., & Hogmire, H. W. (2005). Monitoring stink bugs (Hemiptera: Pentatomidae) in mid-Atlantic apple and peach orchards. *Journal of economic entomology*, 98(1), 143-153.

# Research Topic: Diel Sampling



To characterize the relationship between timed visual observations of brown marmorated stink bugs and the time of day sampling occurred at.

Null hypothesis: average BMSB field counts will not differ between times of the day.

# Study Sites

Rutgers Agricultural Research  
and Extension Center



Rutgers Fruit and Ornamental  
Research Extension Center



# Study Design: Diel Sampling



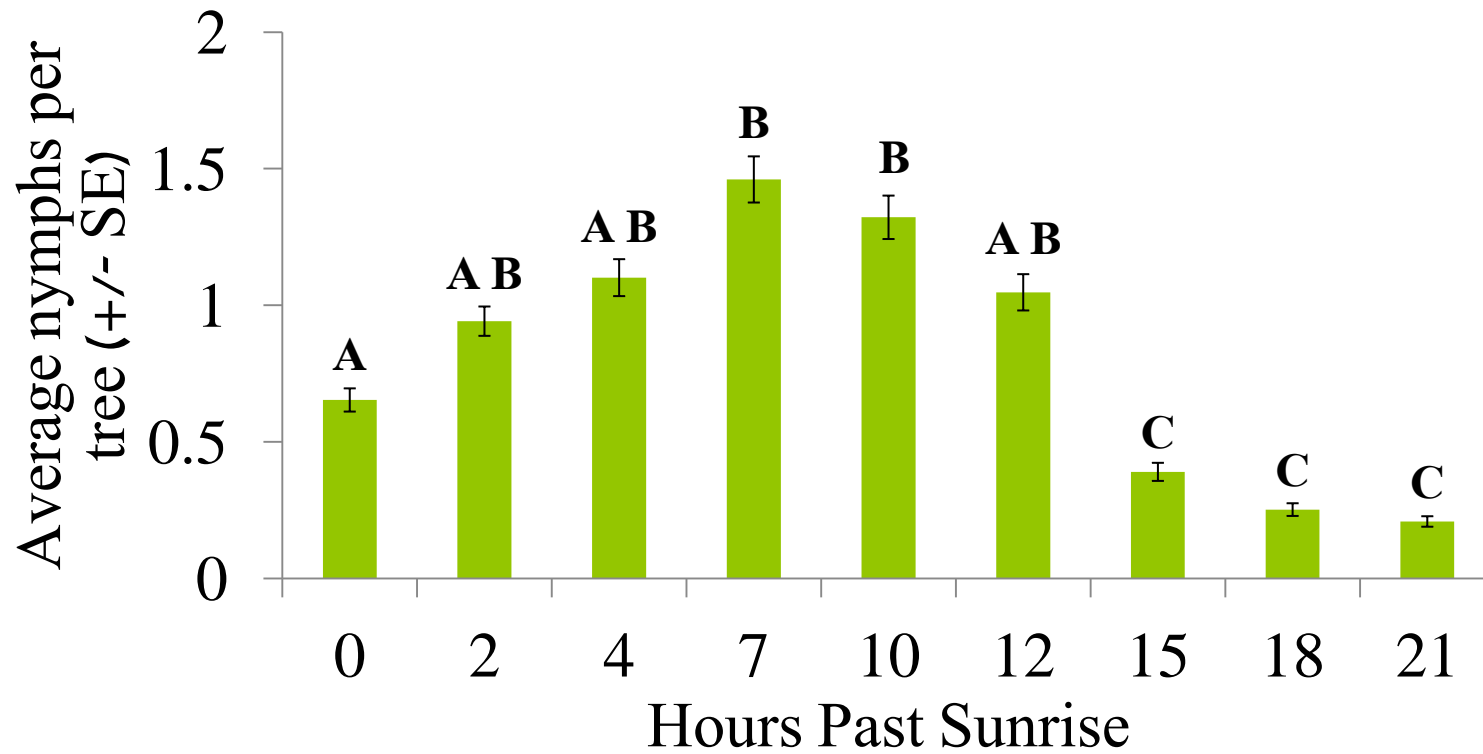
- Two minute visual counts were used as the method of detection.
- Data were collected once a week from June through August at 0, 2, 4, 7, 10, 12, 15, 18, and 21 hours past sunrise.

# Study Design: Diel Sampling



- Night time counts were performed using head lamps.
- Start times were randomized over the course of the summer.

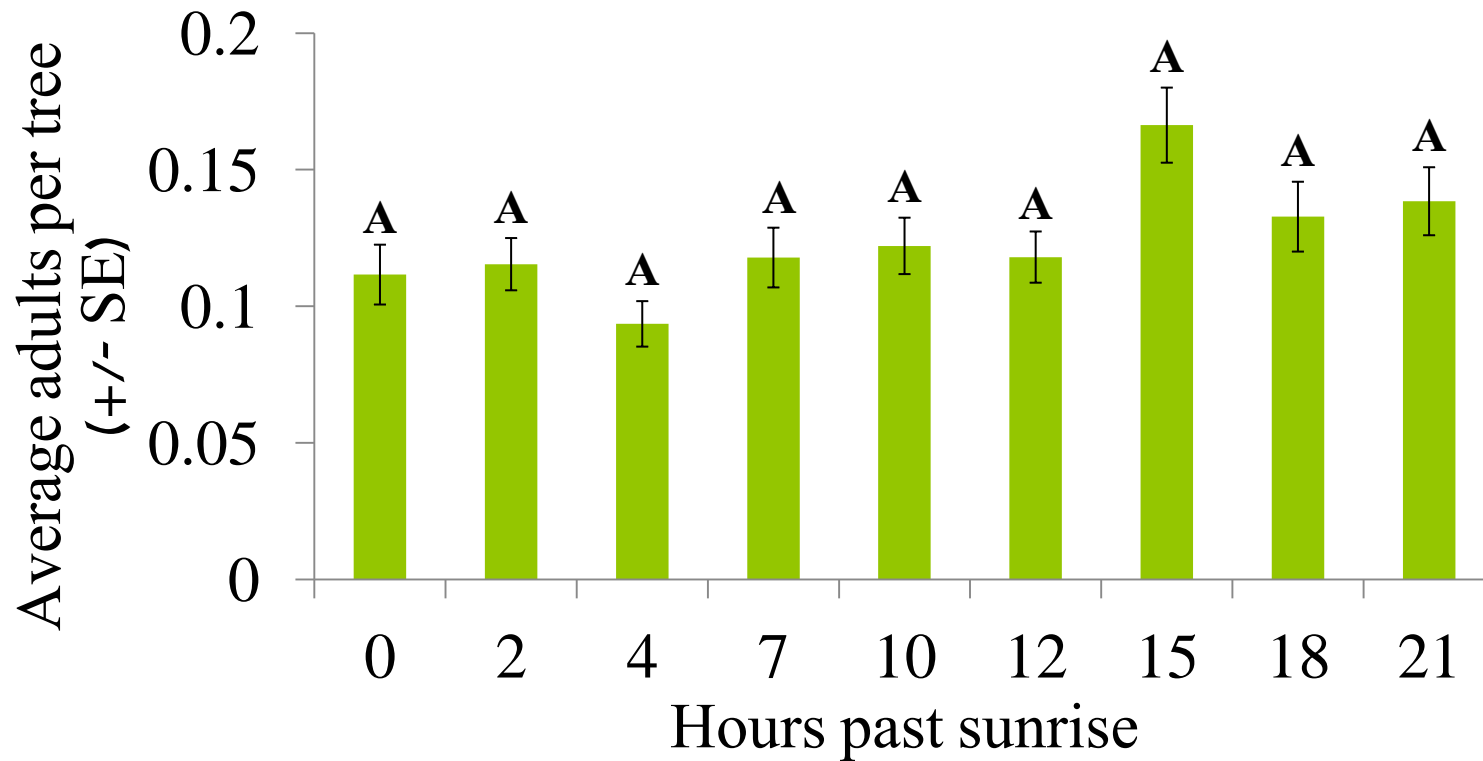
# Results: Nymphs



Columns with the same letters are not significantly different at  $p \leq 0.05$ , Pairwise Wilcoxon Rank Sum Test

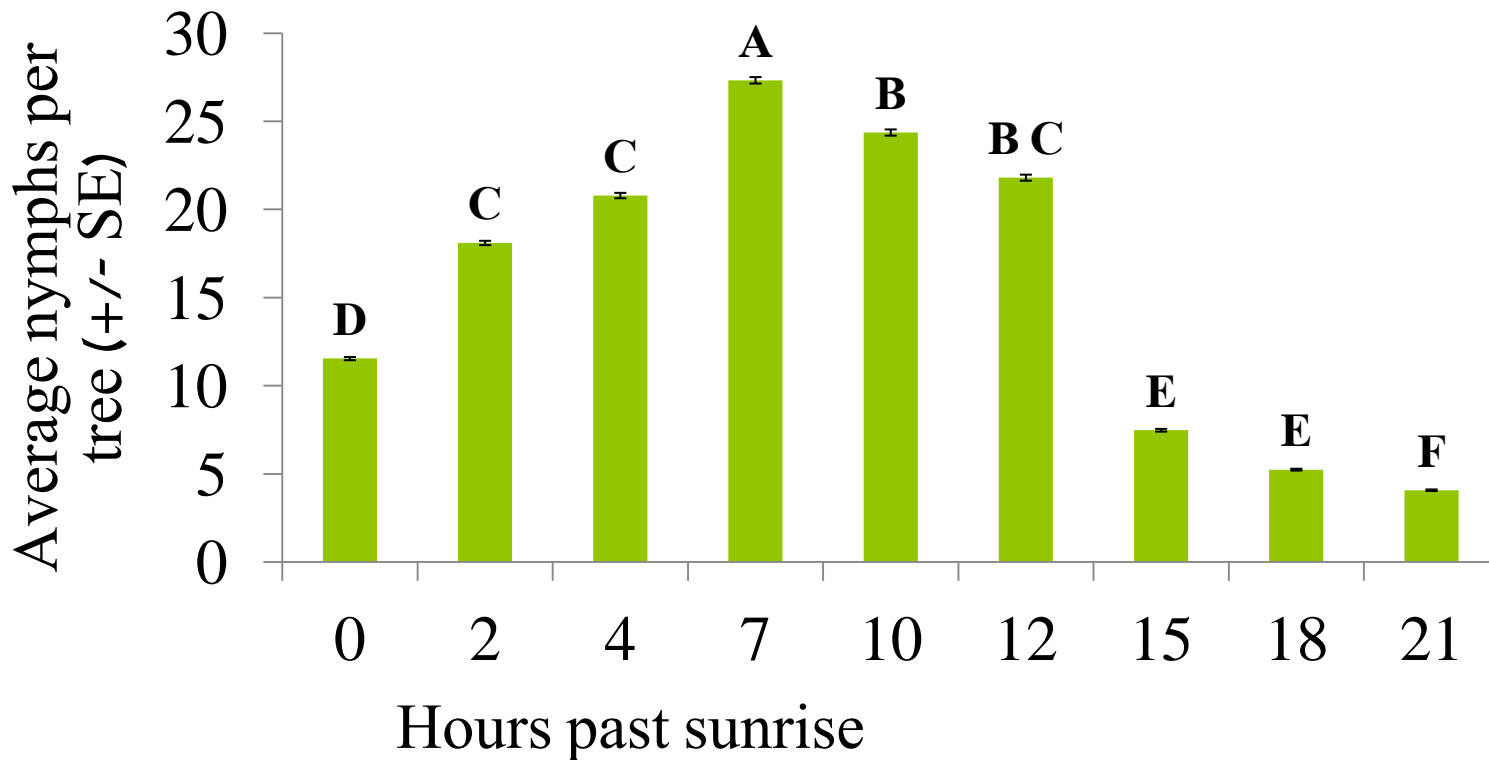


# Results: Adults



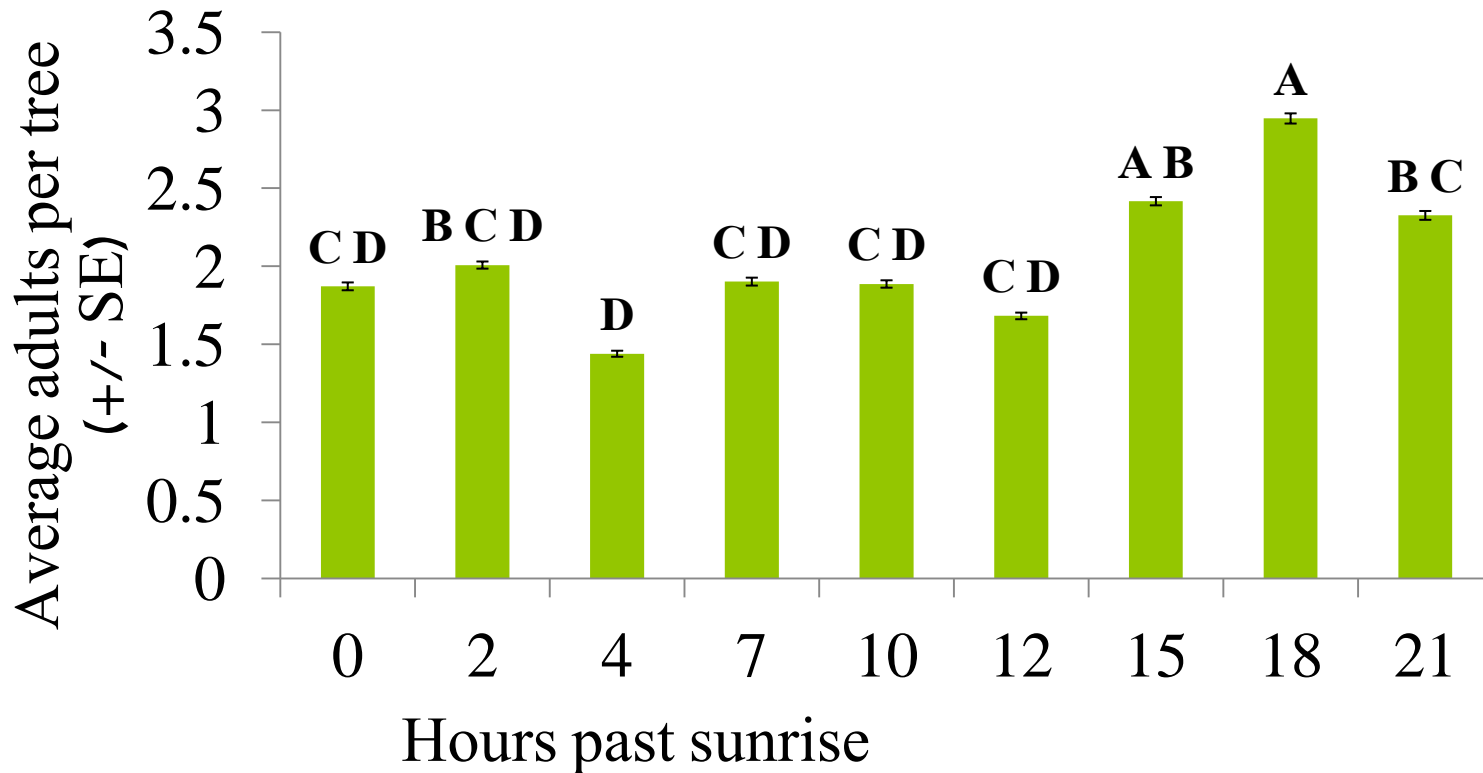
Columns with the same letters are not significantly different at  $p \leq 0.05$ , Pairwise Wilcoxon Rank Sum Test

# Results: RAREC Nymphs 2013



Columns with the same letters are not significantly different at  $p \leq 0.05$ , Pairwise Wilcoxon Rank Sum Test

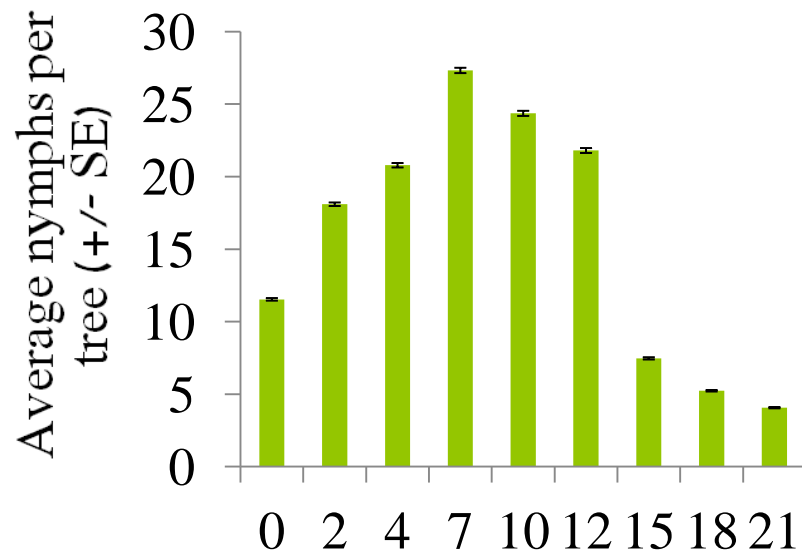
# Results: RAREC Adults 2013



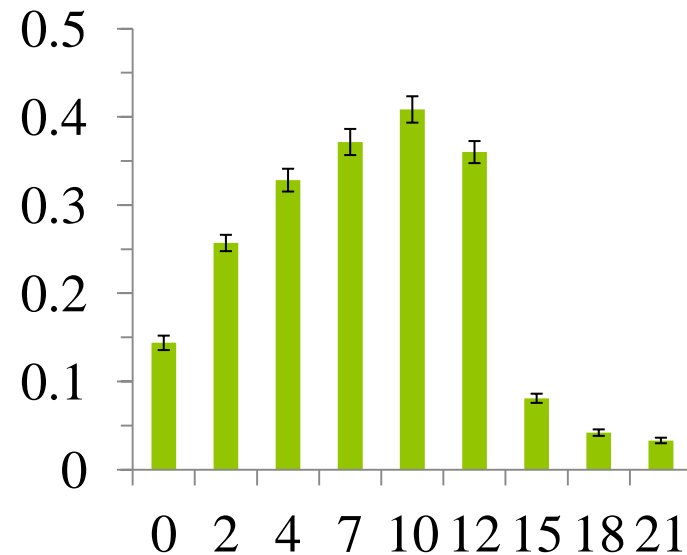
Columns with the same letters are not significantly different at  $p \leq 0.05$ , Pairwise Wilcoxon Rank Sum Test

# High vs Low Populations

**Summer 2013: Nymphs**



**Summer 2014: Nymphs**

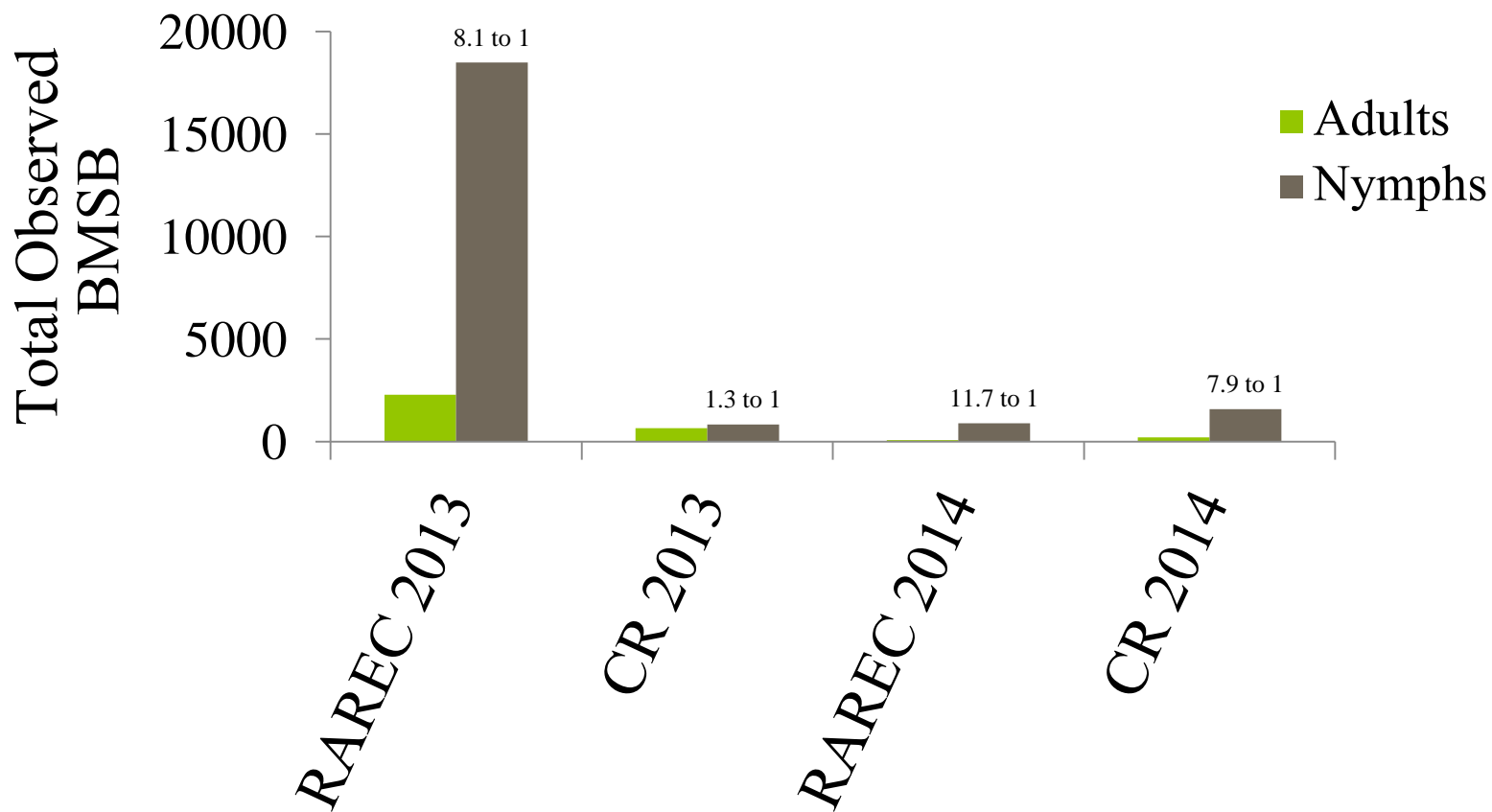


Hours past sunrise

# All Life Stages Love Peaches

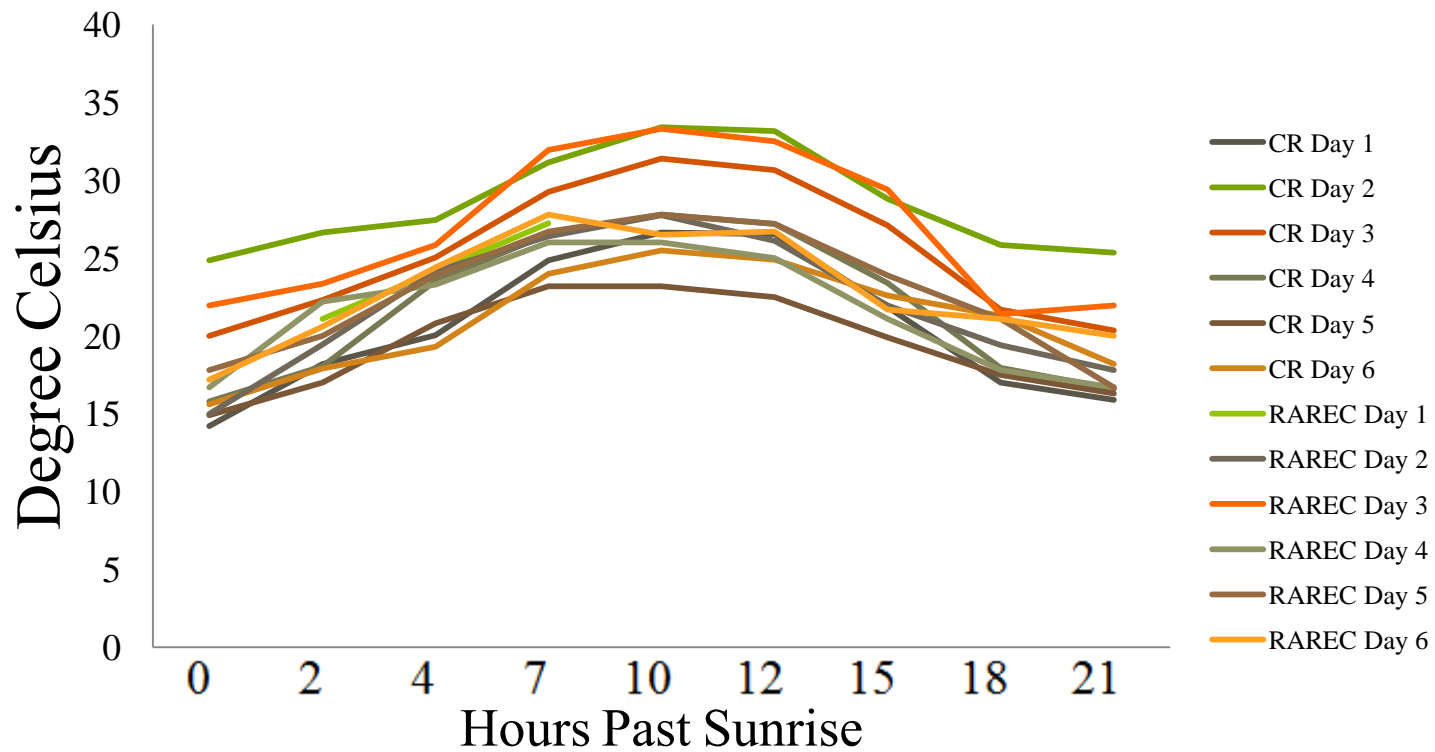


# Ratio of Nymphs to Adults



# Temperature

## Temperature 2014



# Research Topic: In-Tree Movement



To characterize the position of BMSB within a peach tree over the course of a 24 hour period.



# Study Design: In-Tree Movement



- Six minute visual counts were used as the method of detection.
- Nymphs were marked with fluorescent powder when they were spotted.

# Study Design: In-Tree Movement



- At night, 6 minute counts were broken into 4 minutes with one the UV flashlight followed by 2 minutes with that in addition to a white head lamp.
- Black light flashlights were used to confirm previous marking.


# Data Sheet

- Several metrics of tree location were recorded for each BMSB observed.

Date	Time	Hours	Row	Tree	Number	Color	...
7/17/2014	9:43	4	2	17	1	0	...
7/17/2014	9:43	4	2	19	1	0	...
7/17/2014	9:43	4	3	3	1	2	...
7/17/2014	9:43	4	2	17	1	0	...

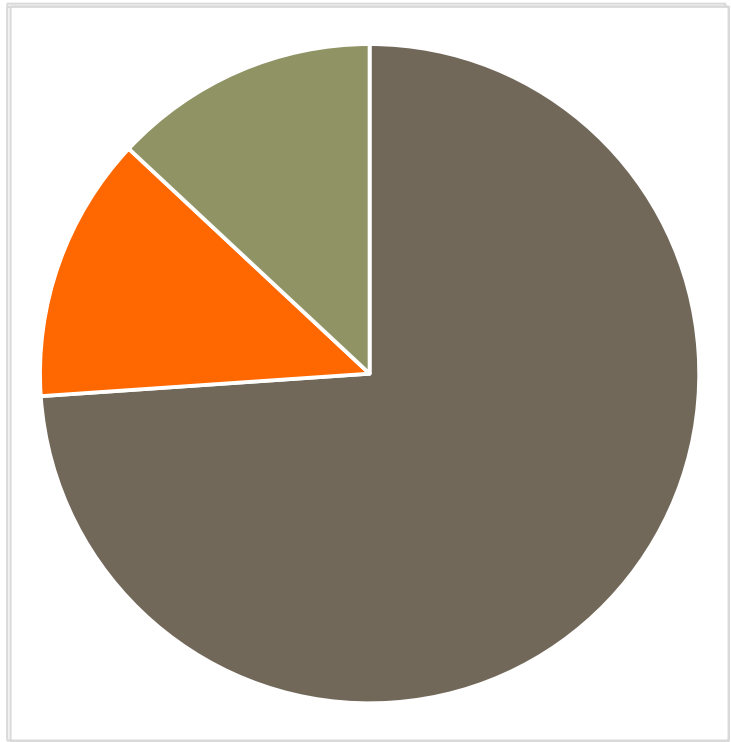
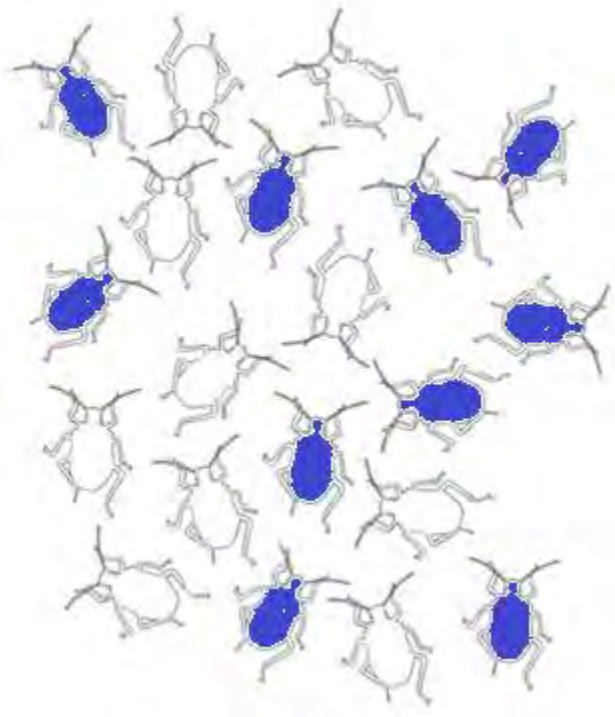
...	Stage	Surface	Height	Outside	Cluster	Clock	Observer
...	3	3	3	0	1	7	Allison
...	1	2	2	0	1	7	Daniel
...	3	2	0	1	1	3	Jaswin
...	3	3	3	0	1	7	Allison

# Results: Color & Stage

 = Previously observed

- 2nds and 3rds
- 4ths and 5ths
- Adults

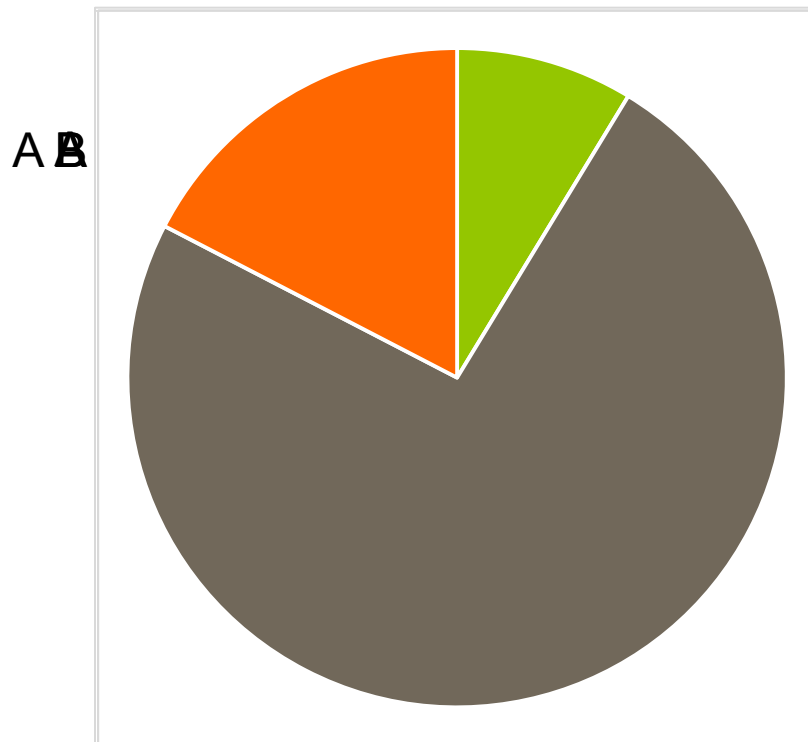
80%



0 2 4 7 10 12 15 18 21

# Results: Surface & Height

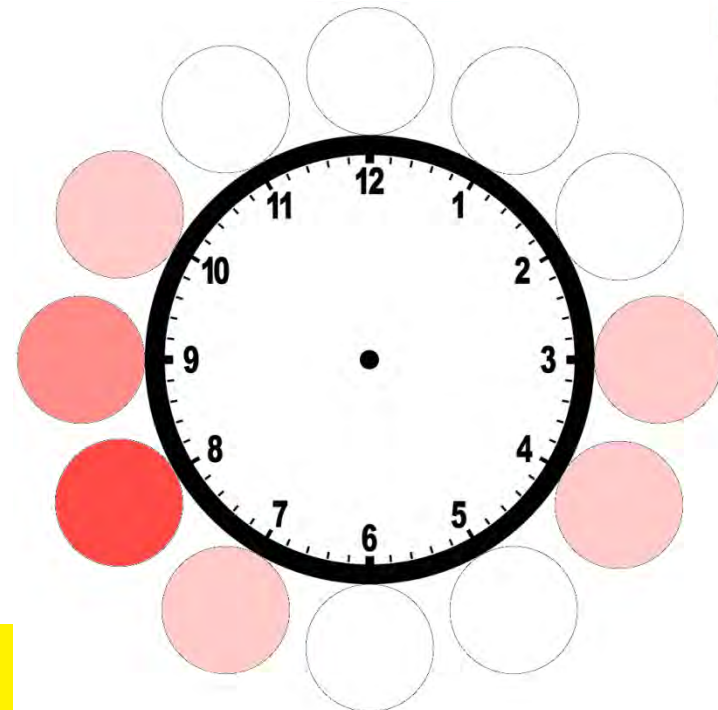
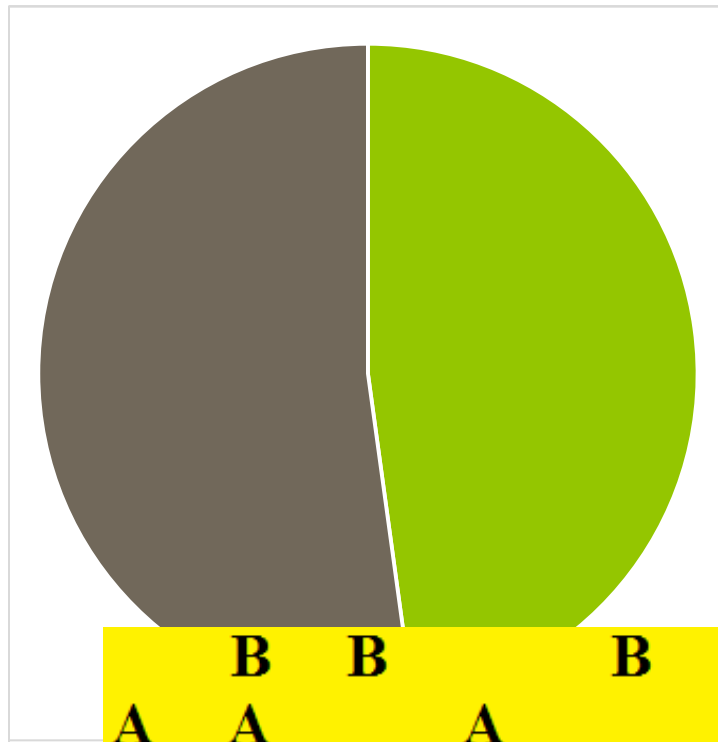
■ Fruit ■ Leaf ■ Branch



0 2 4 7 10 12 15 18 21

# Results: Outside & Clock

■ Inside ■ Outside



A B B A B A A A A  
**0** 2 4 7 10 12 15 18 21

# Research Topic: Observer Variance



To characterize the effect that different observers have on the comparability of data sets.

Null hypothesis: All observers will detect the same number of BMSB.

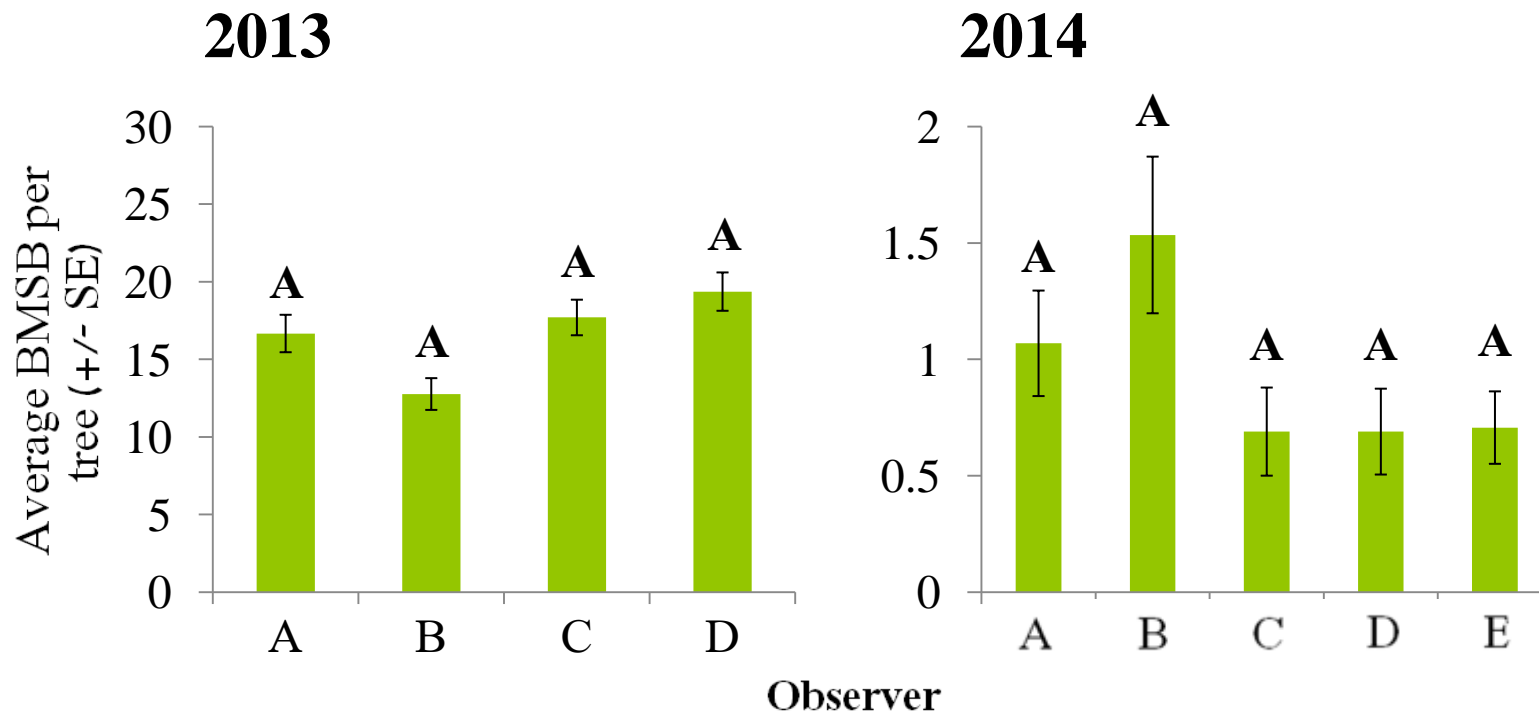
# Study Design: Observer Variance



- Two minute visual counts were used as the method of detection.
- All observers sampled the same set of trees in series.



# Results: Observer Variance



Columns with the same letters are not significantly different at  $p \leq 0.05$ , Blocked ANOVA Test

# Conclusions



- There are differences in BMSB visual counts depending on the number of hours past sunrise sampling occurred at.
- 10 hours past sunrise (mid-day) is the time of peak activity.
- Data collected by different observers does not vary significantly.

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- Dr. Dan Ward

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- Raynee Morris
- Deepti Sailam
- Daniel Sanchez
- Jaswin Singh
- Not Pictured
- Kanan Sharma
- Monica Sinha
- David Kim



# Questions?

Thank you!