# Cold tolerance and overwintering behavior of kudzu bugs (*Megacopta cribraria*) at its northern limit

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# Outline

Background

Maryland Status

Cold Tolerance

Conclusions

# Background

- Pentatomoidae
  Plataspidae
- Eggs laid on leaves and stems
- Nymphs develop through five instars
- Overwinter as adults

# Background

## Reproductive Hosts

### Legumes[1]

Kudzu
Soybean
Pigeon Pea

### Non-Legumes[2]

Firecracker Plant
Cotton

Image: survivalgardener.com


1. Blount, J. L., G. D. Buntin, and A. N. Sparks. 2015. "Host Preference of Megacopta Cribraria (Hemiptera: Plataspidae) on Selected Edible Beans and Soybean." *Journal of Economic Entomology* 108 (3): 1094–1105.
2. Eger, Joseph E., L. M. Ames, D. R. Suiter, T. M. Jenkins, D. A. Rider, and S. E. Halbert. 2010. "Occurrence of the Old World Bug Megacopta Cribraria (Fabricius) (Heteroptera: Plataspidae) in Georgia: A Serious Home Invader and Potential Legume Pest." *Insecta Mundi* 121: 1–11.

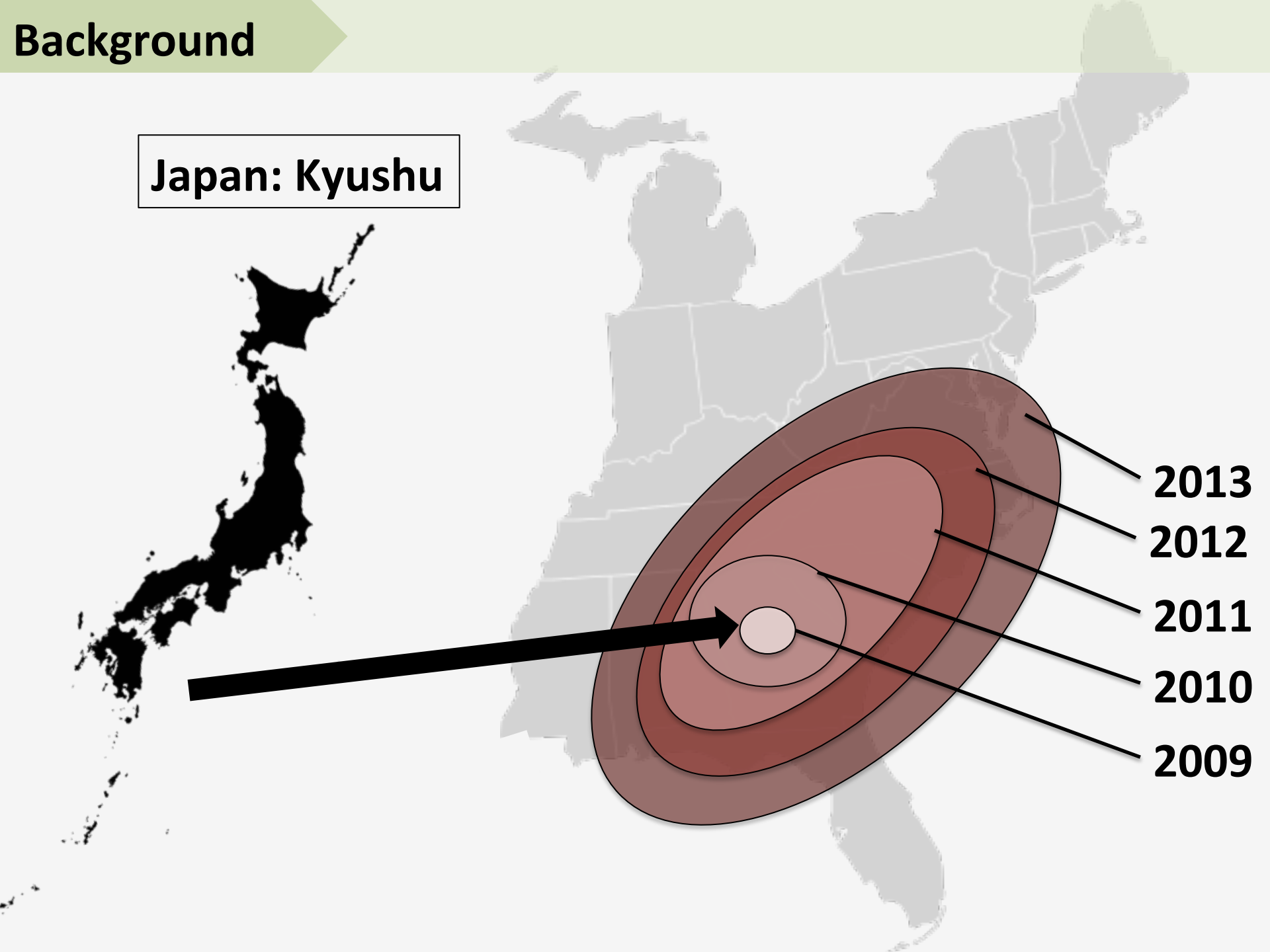
# Background

## Impacts on Soybeans

- High summer densities in the Southeast
- Feeds on stems and leaves
- Reduces number of seeds per pod and seed weight
- Yield losses in untreated plots up to 59%[1]
- Can invade directly into soybeans from overwintering

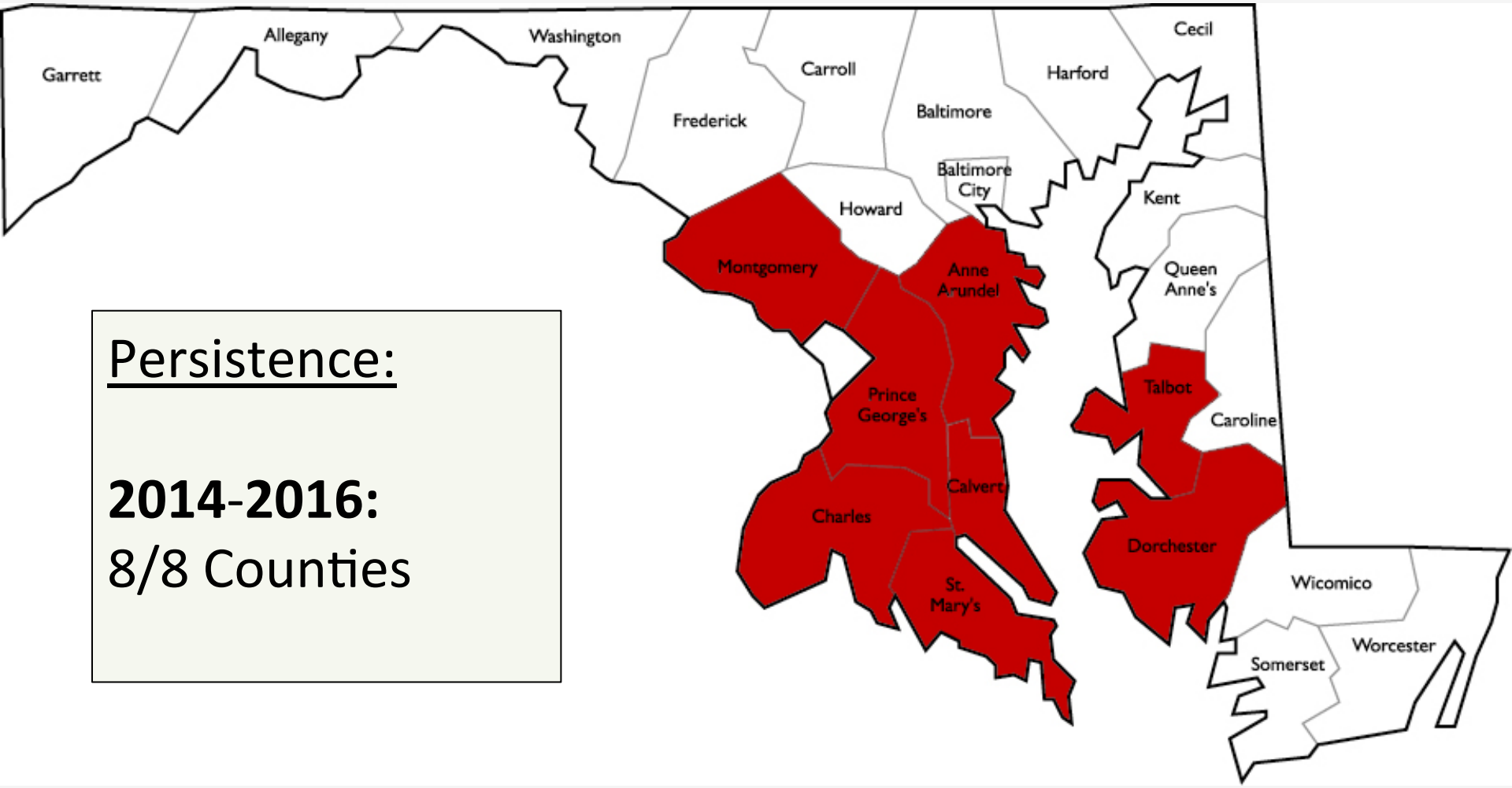
1. Seiter, Nicholas J., Jeremy K. Greene, and Francis P. F. Reay-Jones. 2013. “Reduction of Soybean Yield Components by Megacopta Cribraria (Hemiptera: Plataspidae).” *Journal of Economic Entomology* 106 (4): 1676–83. doi:10.1603/EC13121.

# Background



# MD Status

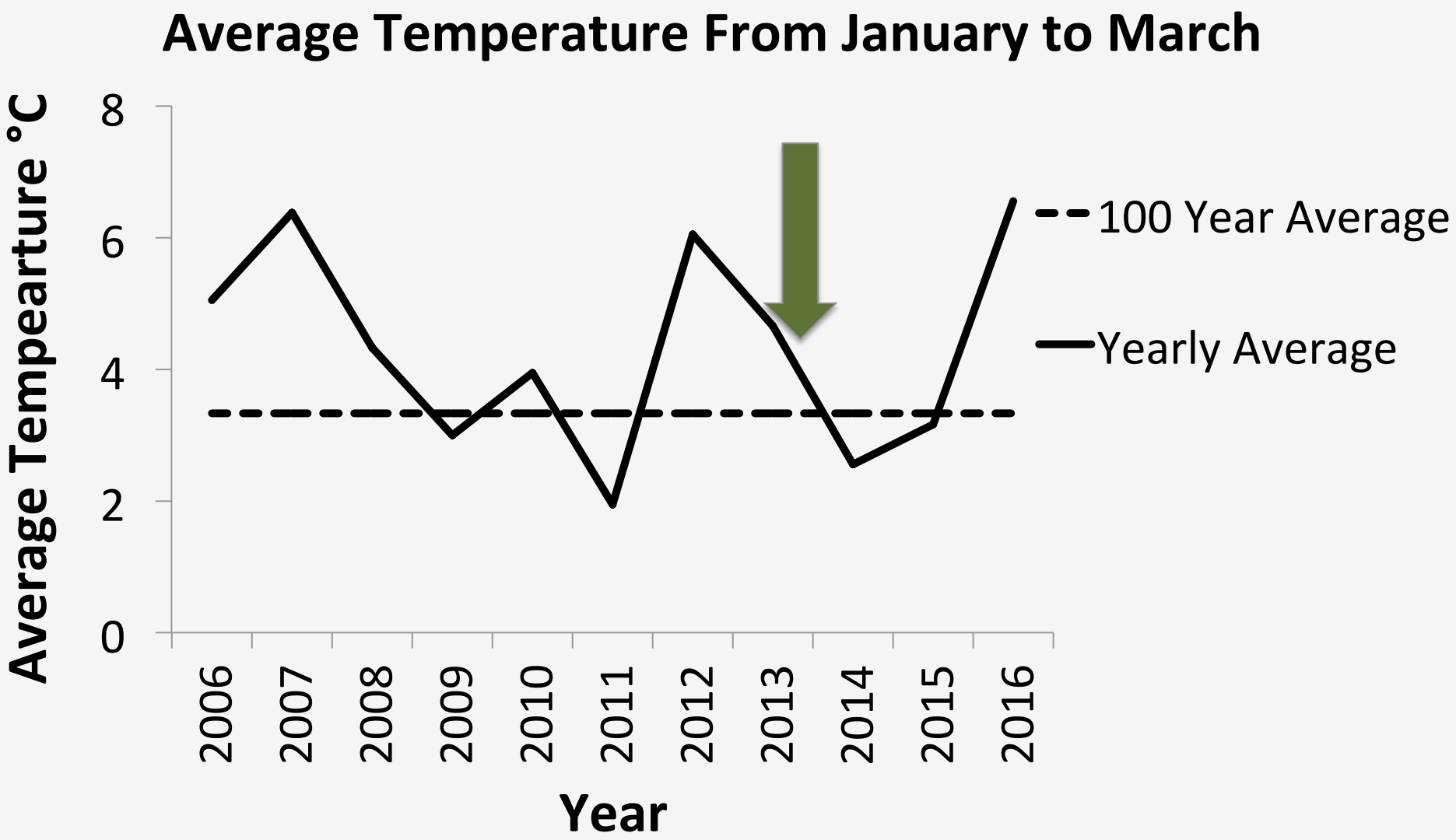
## Maryland Distribution: 2013-2016




Persistence:

**2014-2016:**
8/8 Counties

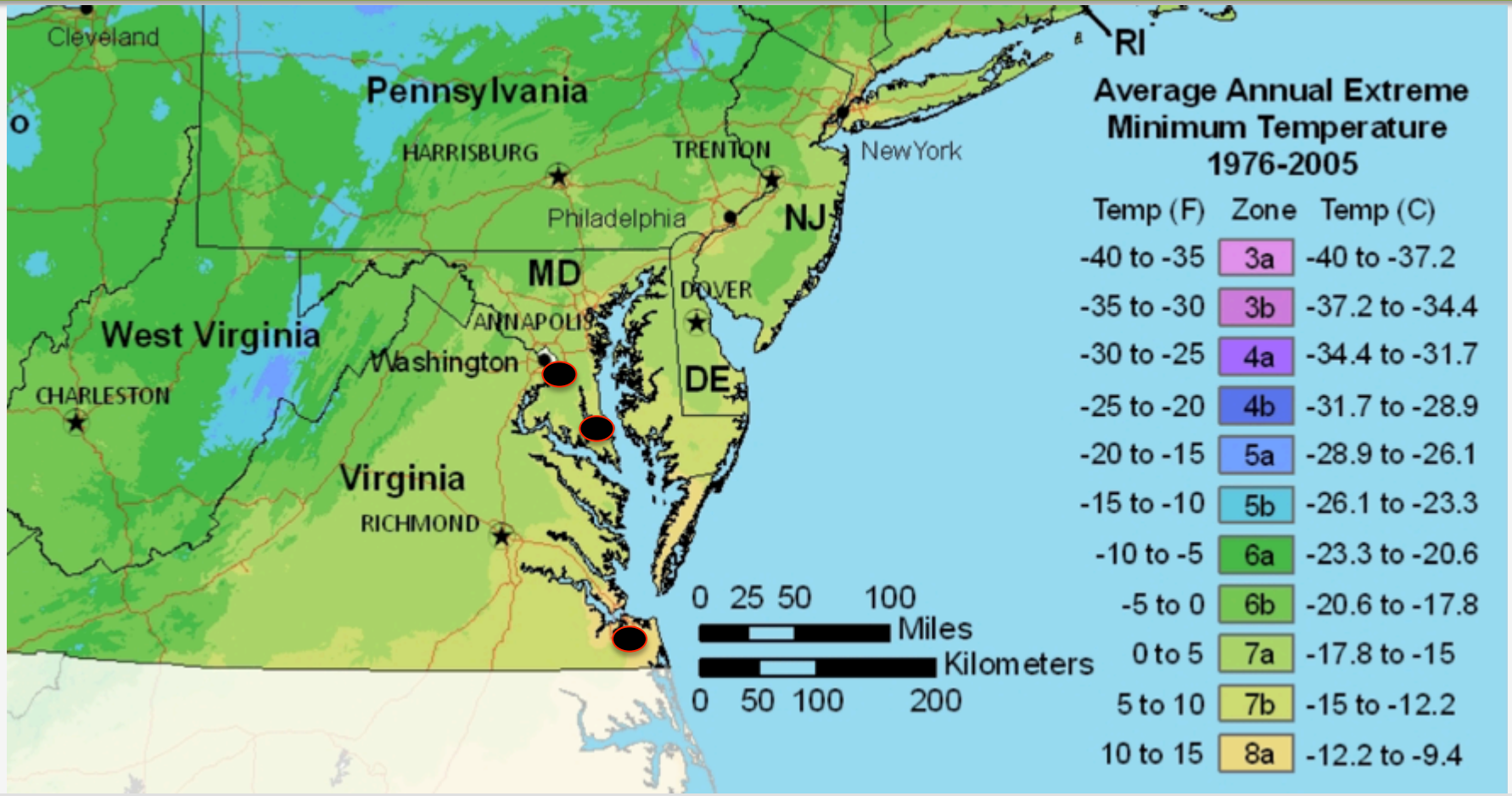
# MD Status




NOAA National Centers for Environmental information, Climate at a Glance: U.S. Time Series, Average Temperature, published September 2016, retrieved on September 21, 2016 from http://www.ncdc.noaa.gov/cag/

## Objective (1):

Determine the supercooling point and lethal temperature$_{50}$ for three climatic zones over the fall.




USDA Plant Hardiness Zone Map, 2012. Agricultural Research Service, U.S. Department of Agriculture. Accessed from http://planthardiness.ars.usda.gov.

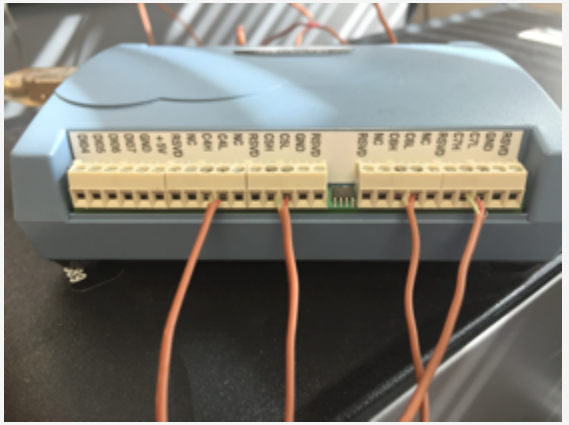
## Supercooling Point (SCP)

- Collected 20 (10M, 10F) bugs per location per month
- Attached a thermocouple
- Placed in cooling bath
- Cooled at a rate of 0.27° C/min
- Starting 25° C, ending -25° C

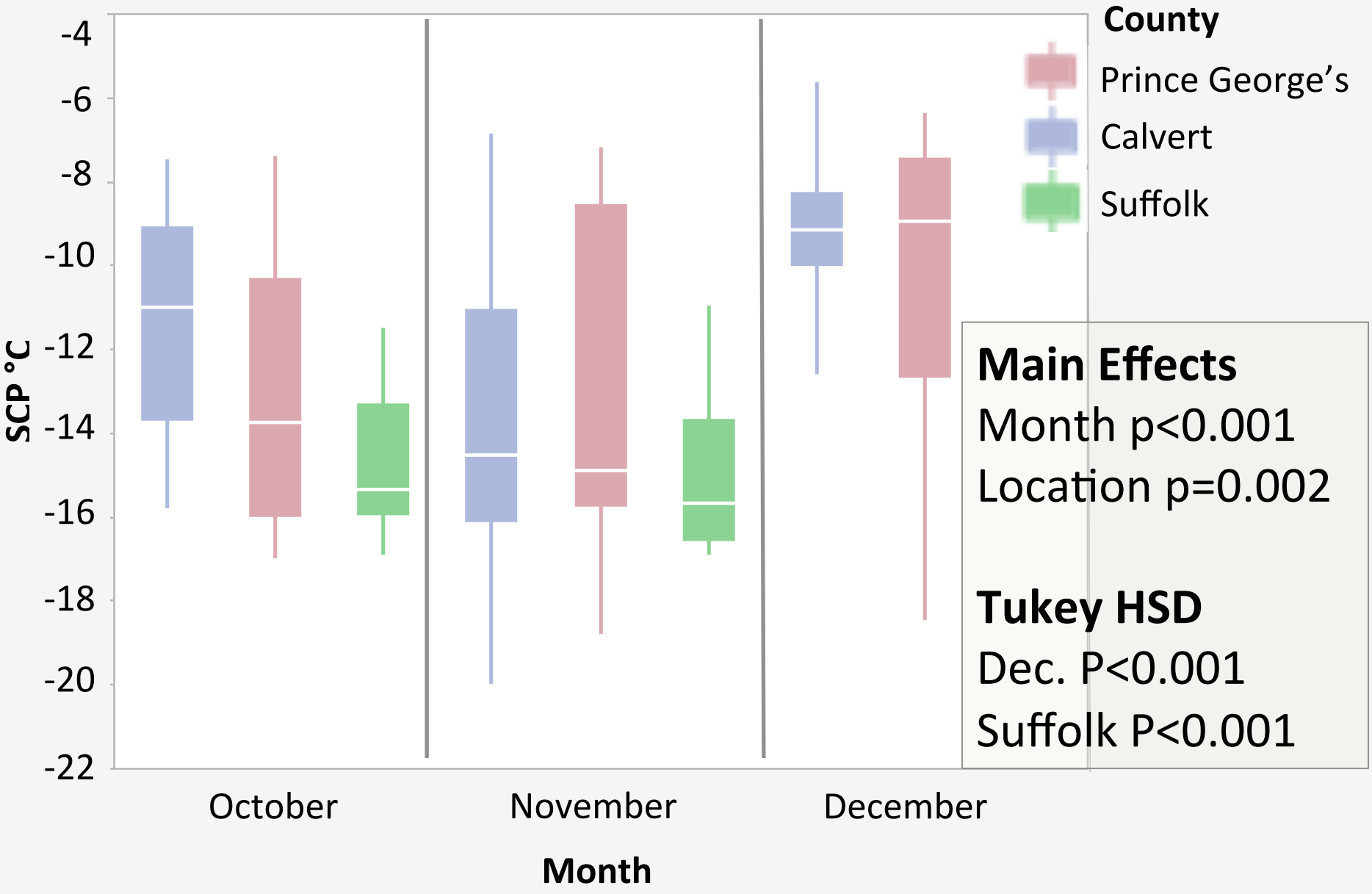
## Analysis

- ANOVA: sex, month, county, interactions
- $\alpha$=0.05

Refrigerated Recirculating Bath
PolyScience
AP07R-40



# Results: SCP


-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
SCP °C
October
November
December
Month
County
Prince George's
Calvert
Suffolk
Main Effects
Month p<0.001
Location p=0.002
Tukey HSD
Dec. P<0.001
Suffolk P<0.001

## Lethal Temperature ($LT_{50}$)

- 40 bugs per location per temperature (8 vials of 5)
- Cooling/warming rate 0.15° C/min
- Held minimum temperature for 12hrs
- Min temp. -10, -6, -4, -2, +2 °C
- Death assessed 24hrs after run

## Analysis

- Logistic regression (probit analysis)
- Prediction of 50% survival

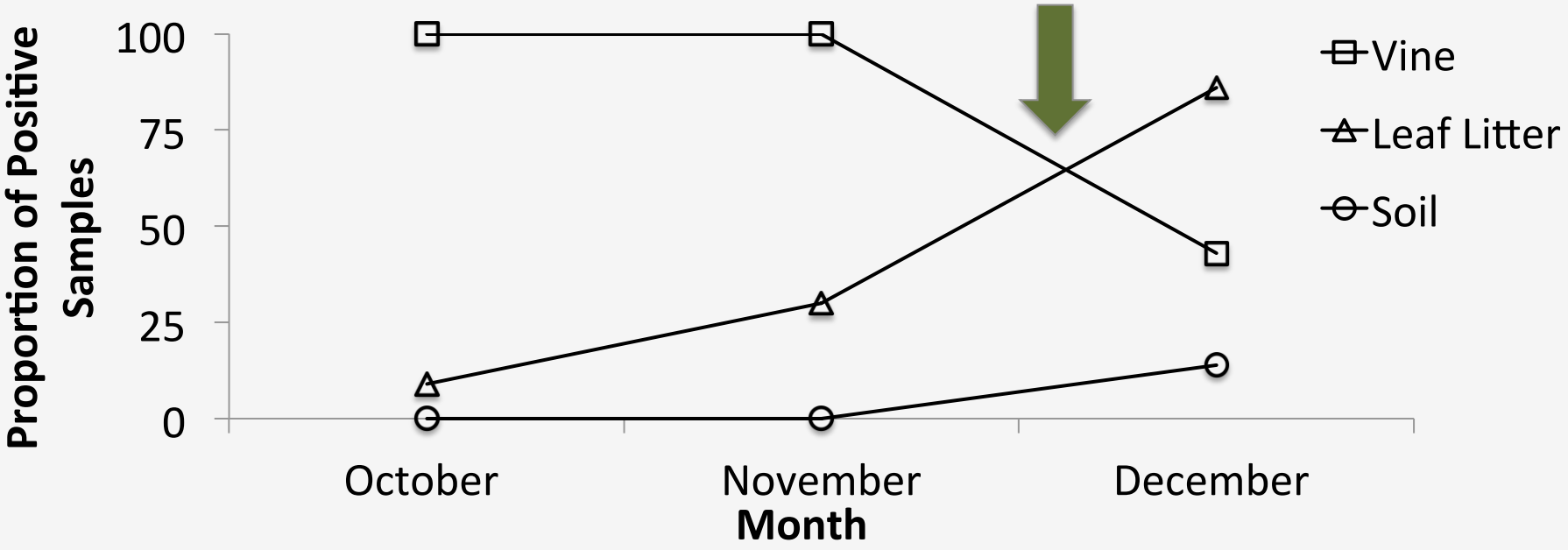
| Month | County | $LT_{50}$ (°C) | 95% Confidence Interval Lower (°C) | 95% Confidence Interval Upper (°C) |
|---|---|---|---|---|
| October | Prince George's | -5.1 | -5.8 | -4.4 |
| | Calvert | -4.0 | -4.9 | -3.1 |
| | Suffolk | -4.8 | -5.3 | -4.4 |
| November | Prince George's | -6.6 | -7.6 | -5.8 |
| | Calvert | -4.9 | -5.9 | -4.0 |

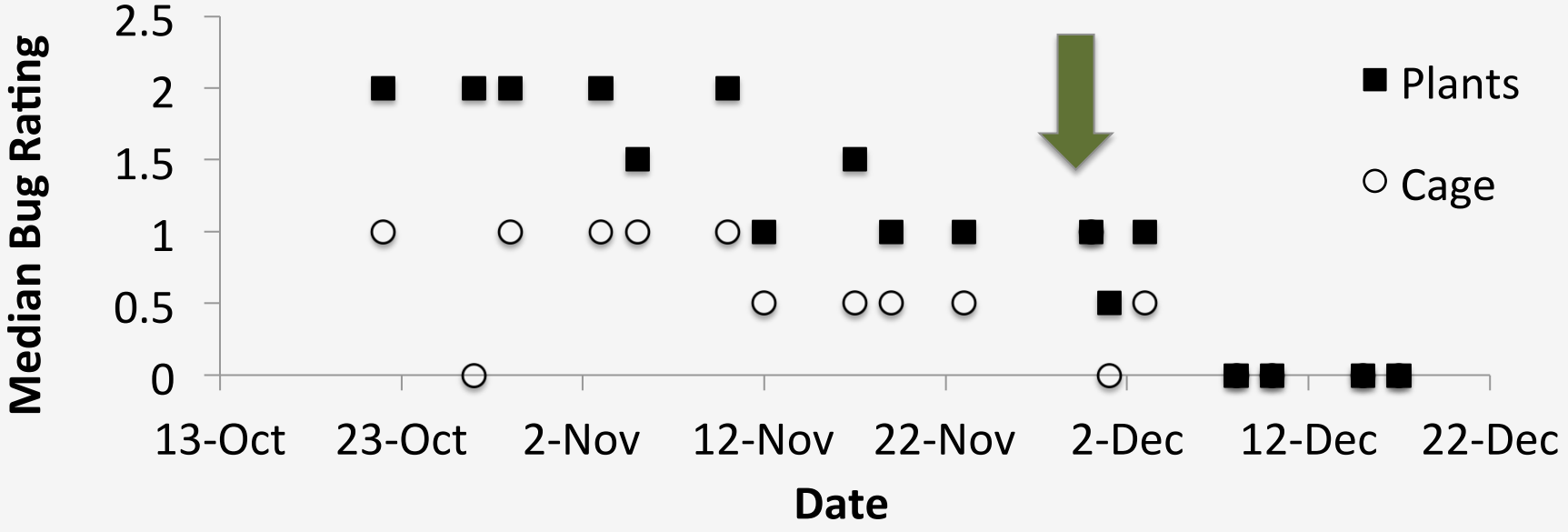
Objective (2):

Determine the fall movement of kudzu bugs to overwintering locations.

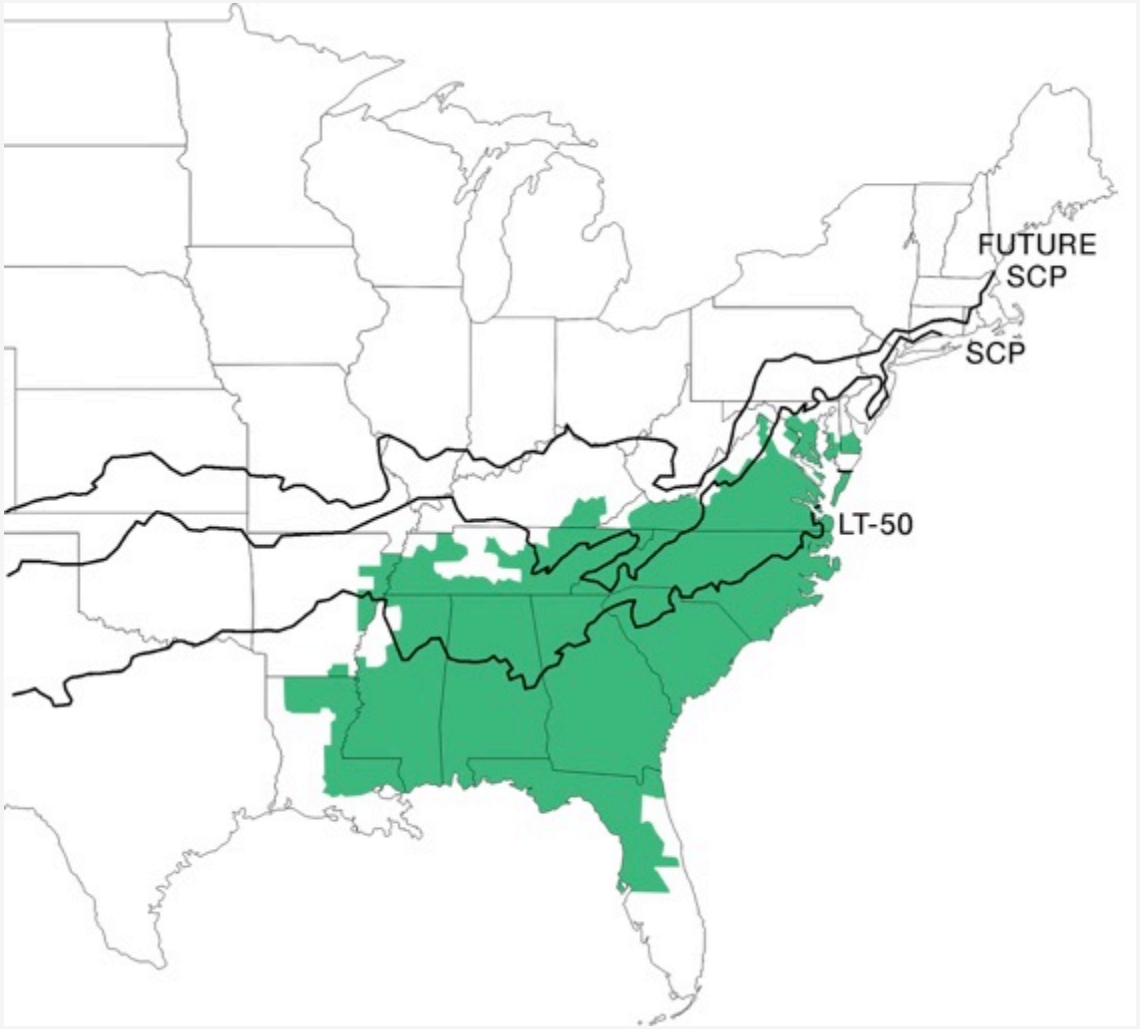
| Field | Cage |
| --- | --- |
| • Once a month<br>• Vine/Leaf Litter/Soil | • 2000+ Bugs<br>• Scored twice a week |

# Results: Movement



# Conclusions




- Predict spring populations
- Forecast range expansions
- Aide integrated pest management

# Thanks!

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