Subobjective 1.1.2: Movement to and from overwintering sites and overwintering survivorship.

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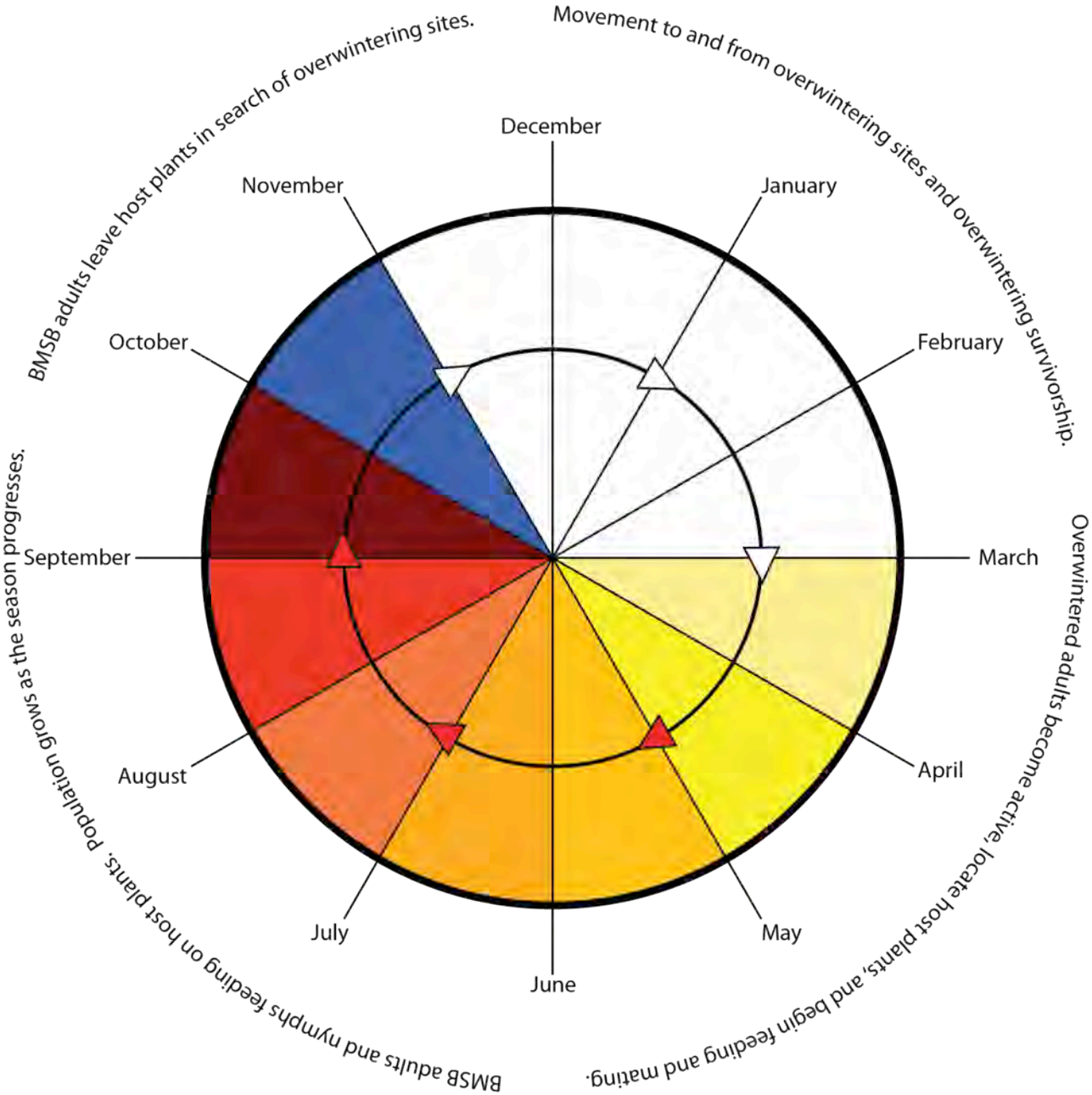

Movement to and from overwintering sites and overwintering survivorship.
Overwintered adults become active, locate host plants, and begin feeding and mating.
BMSB adults and nymphs feeding on host plants. Population grows as the season progresses.
BMSB adults leave host plants in search of overwintering sites.
December
January
February
March
April
May
June
July
August
September
October
November


W Orchard Rd
E Orchard Rd
Bakersville Rd
Keedysville Rd
Sharpsburg Pike
Smoketown Rd
University Rd
65
2193 ft
Image U.S. Geological Survey
© 2011 Google
Google earth
Imagery Date: 1/31/2008
1989
39° 30.675' N 77° 44.093' W elev 495 ft
Eye alt 9780 ft

Key Questions

- Do BMSB overwinter in the natural landscape?
- If so, what sites within the natural landscape are utilized?
- What is the range of movement into and out of overwintering sites?
- What is the survivorship rate in overwintering sites?

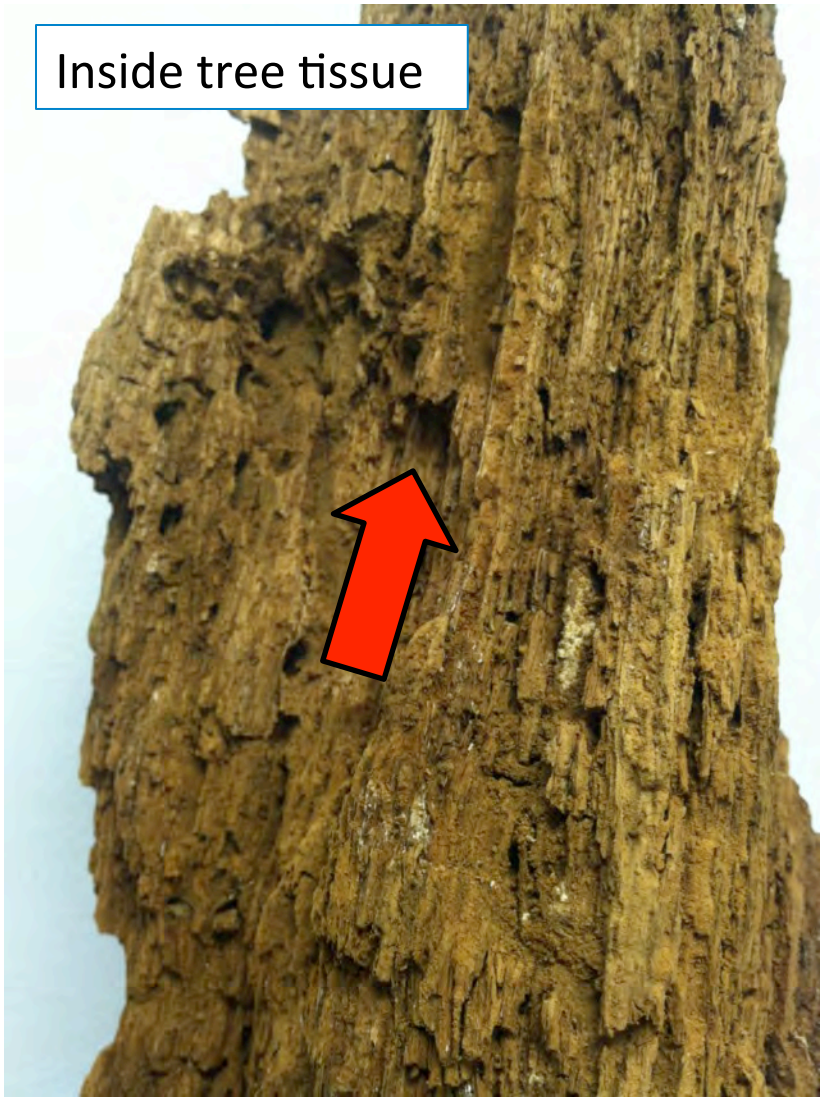
Future Applications

- Can BMSB be monitored in overwintering sites as an indicator of risk?
- Can BMSB be managed within overwintering quarters?
- As a component of developing the foundations of an IPM framework, can the landscape be managed to inhibit overwintering success?

Key Questions

- Do BMSB overwinter in the natural landscape?

Suspected Overwintering Sites




JOHN DEERE


JOHN DEERE
STAFF

We sampled 774 dead trees.

We found overwintering BMSB in 26 trees.

Key Questions

- ✓ Do BMSB overwinter in the natural landscape?
- If so, what sites within the natural landscape are utilized?

(Jan-Feb 2012)

Woods #3

1. Transect size:
   50 × 10m

2. Sampled **ALL** dead trees in transects

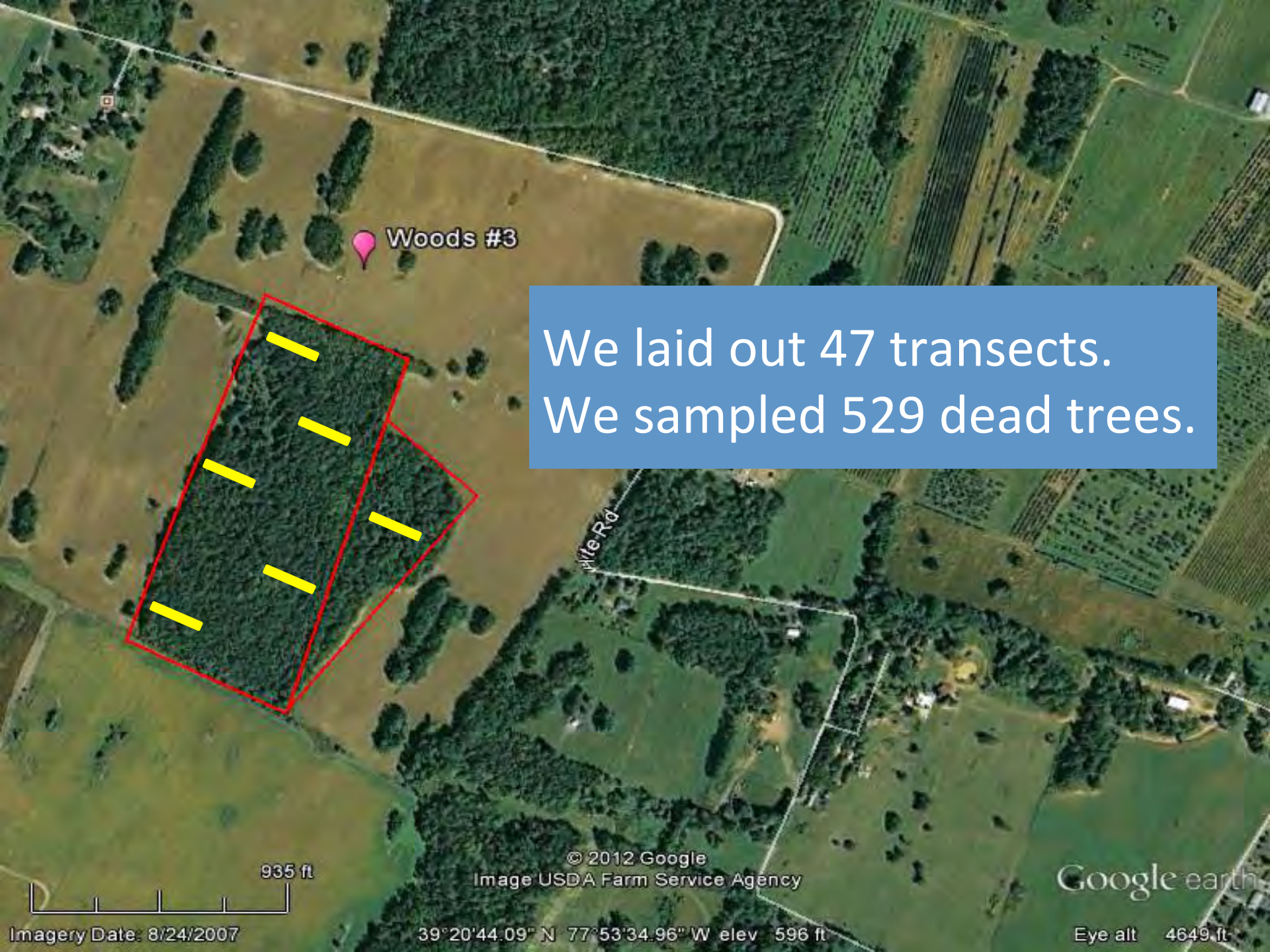
1) Tree species
2) Tree position
3) Tree size
4) % of bark
5) Peeling?
6) BMSB?

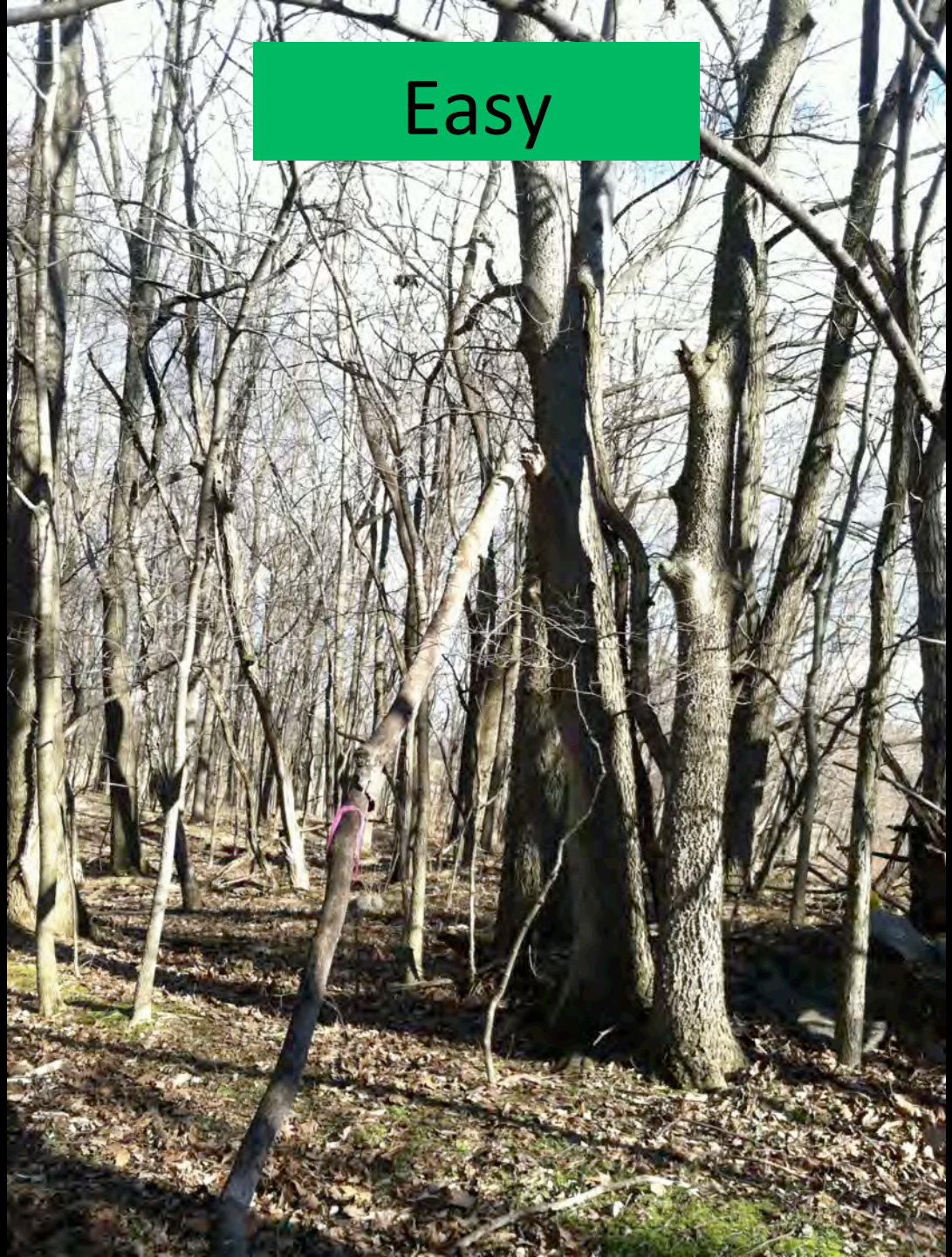
Hile Rd

935 ft

Google earth

Imagery Date: 8/24/2007 39°20'44.09" N 77°53'34.96" W elev 596 ft Eye alt 4649 ft

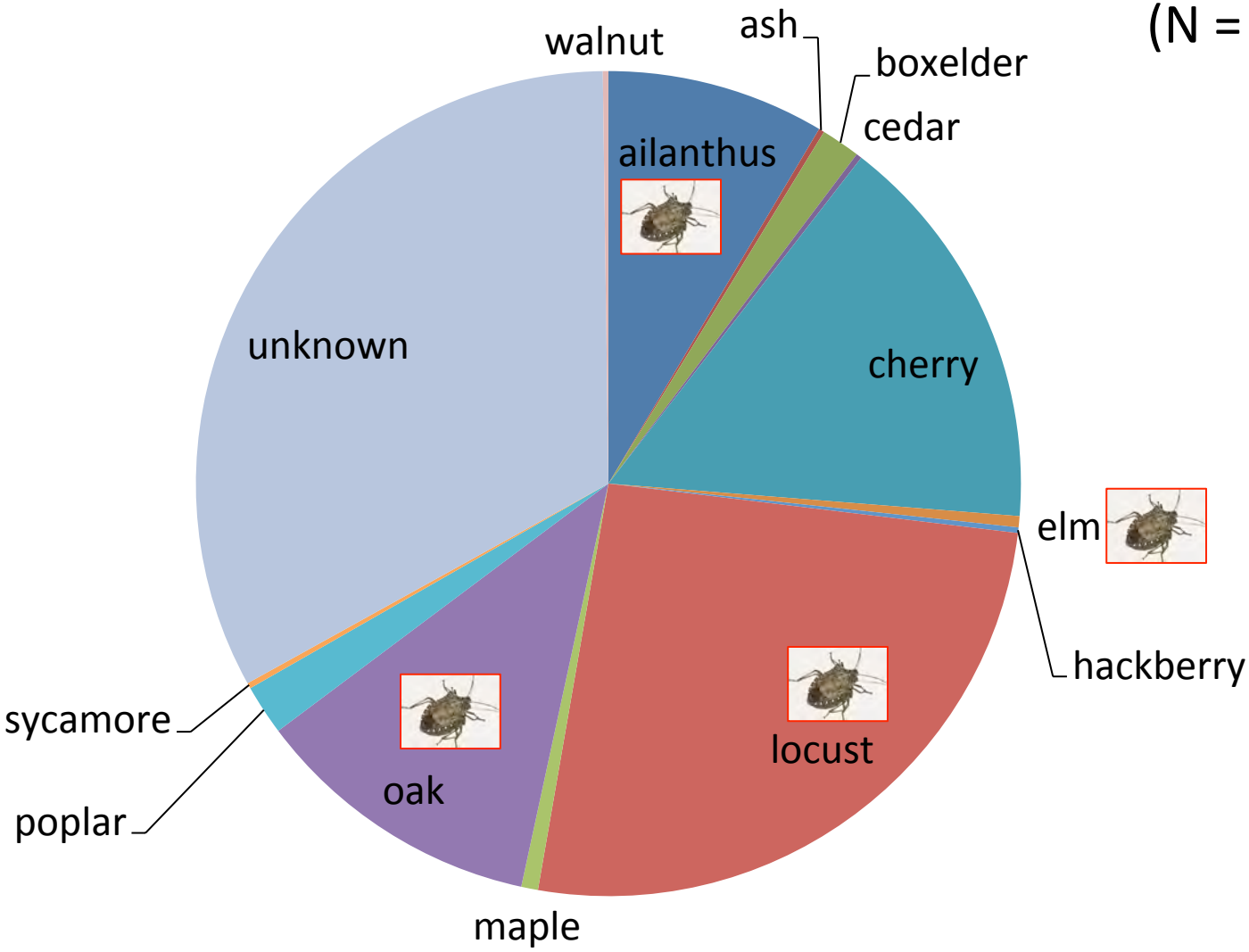

Woods #3
We laid out 47 transects.
We sampled 529 dead trees.
Hile Rd
935 ft
© 2012 Google
Image USDA Farm Service Agency
Google earth
Imagery Date: 8/24/2007
39°20'44.09" N 77°53'34.96" W elev 596 ft
Eye alt 4649 ft


Easy

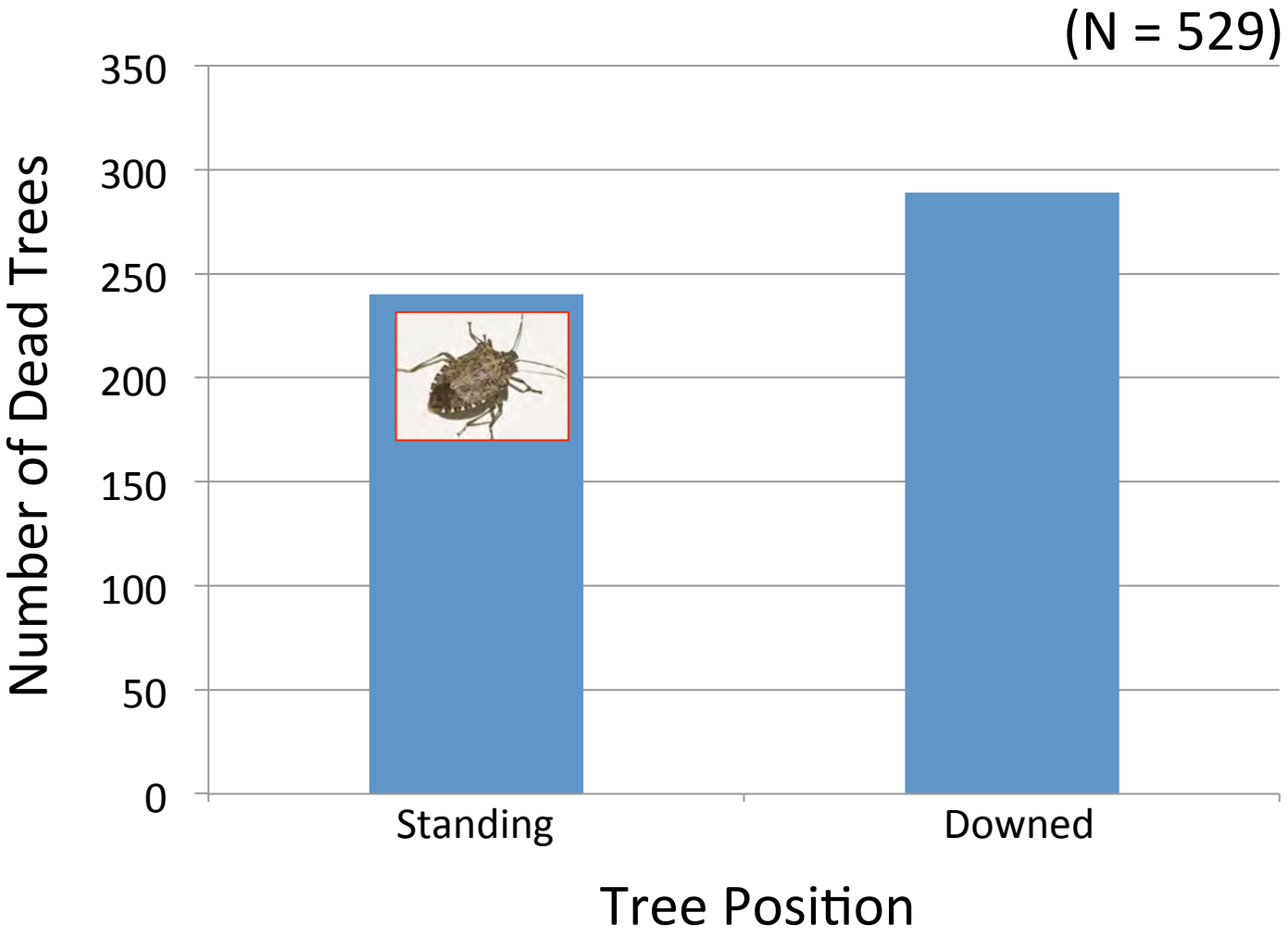

Not

1. Dead tree species

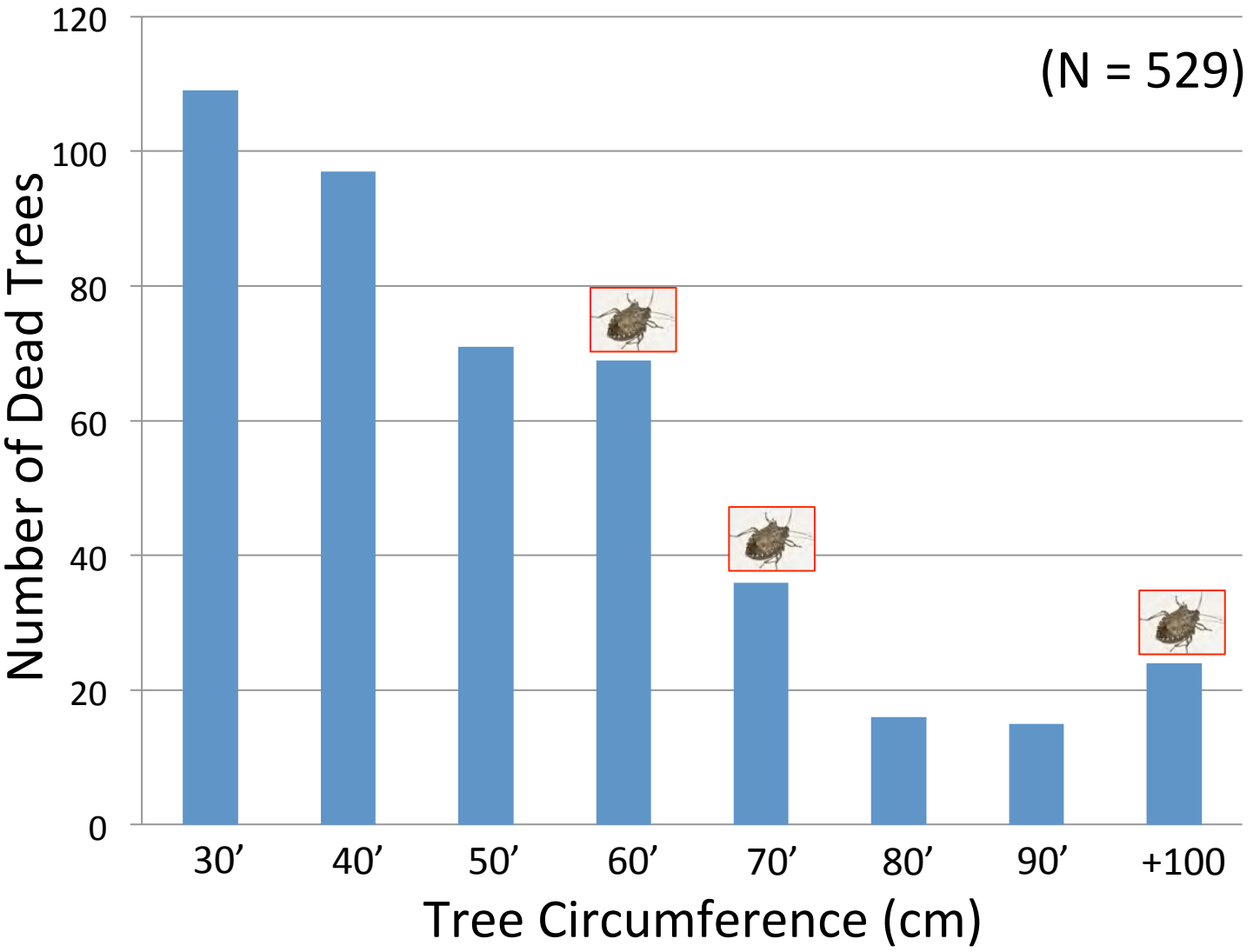
(N = 529)



2. Dead tree position



3. Dead tree size



BMSB Positive Trees

1. Standing
2. NOT small
3. Oak / Locust
4. Peeling bark
5. Porous
6. Dry


Tight, Dry,
and Protected

Success rate of finding overwintering BMSB in dead trees

	Transect Sampling	
	Tree-targeted Sampling	

Success rate of finding overwintering BMSB in dead trees

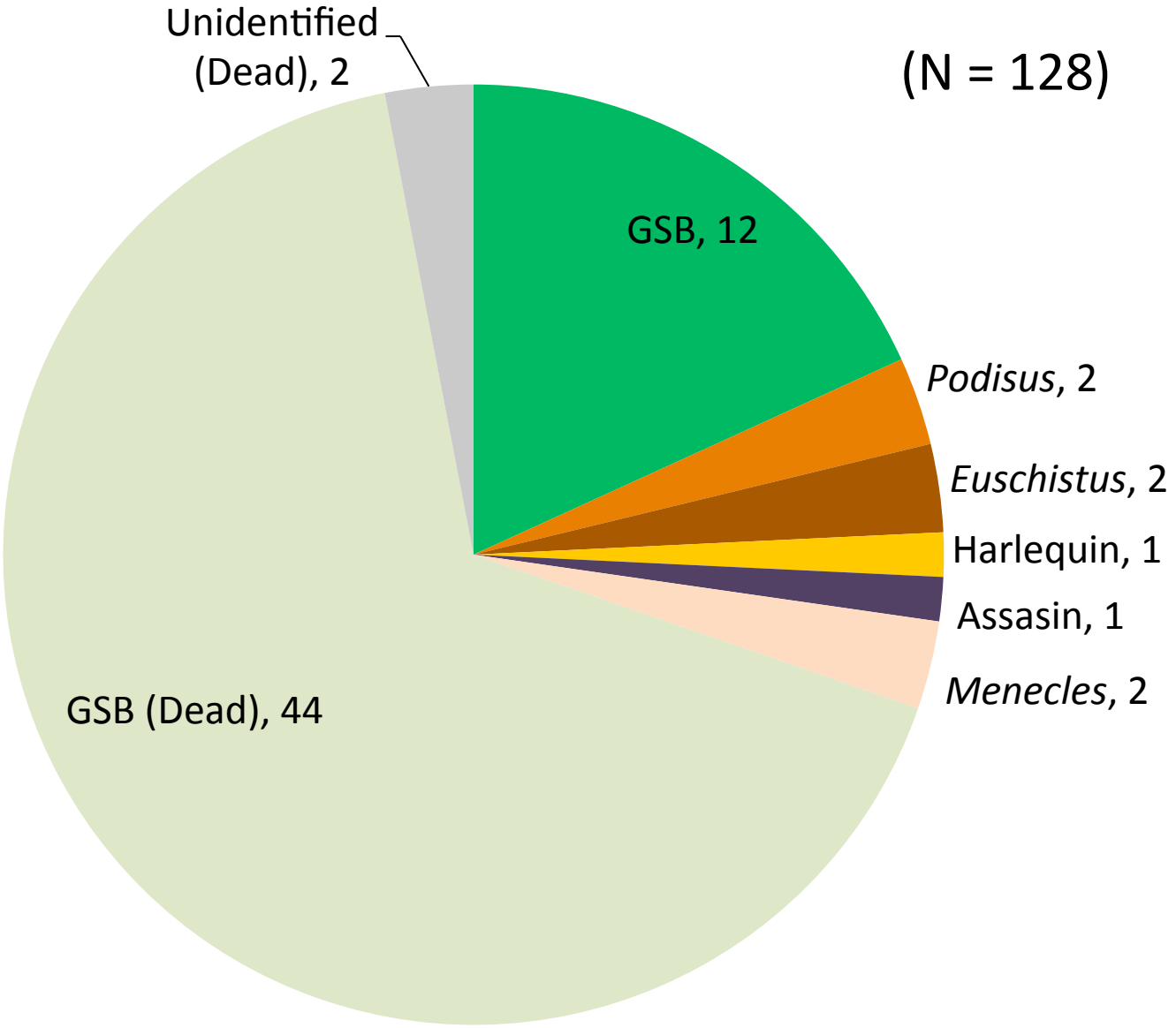
	Transect Sampling	3%
	Tree-targeted Sampling	

Success rate of finding overwintering BMSB in dead trees

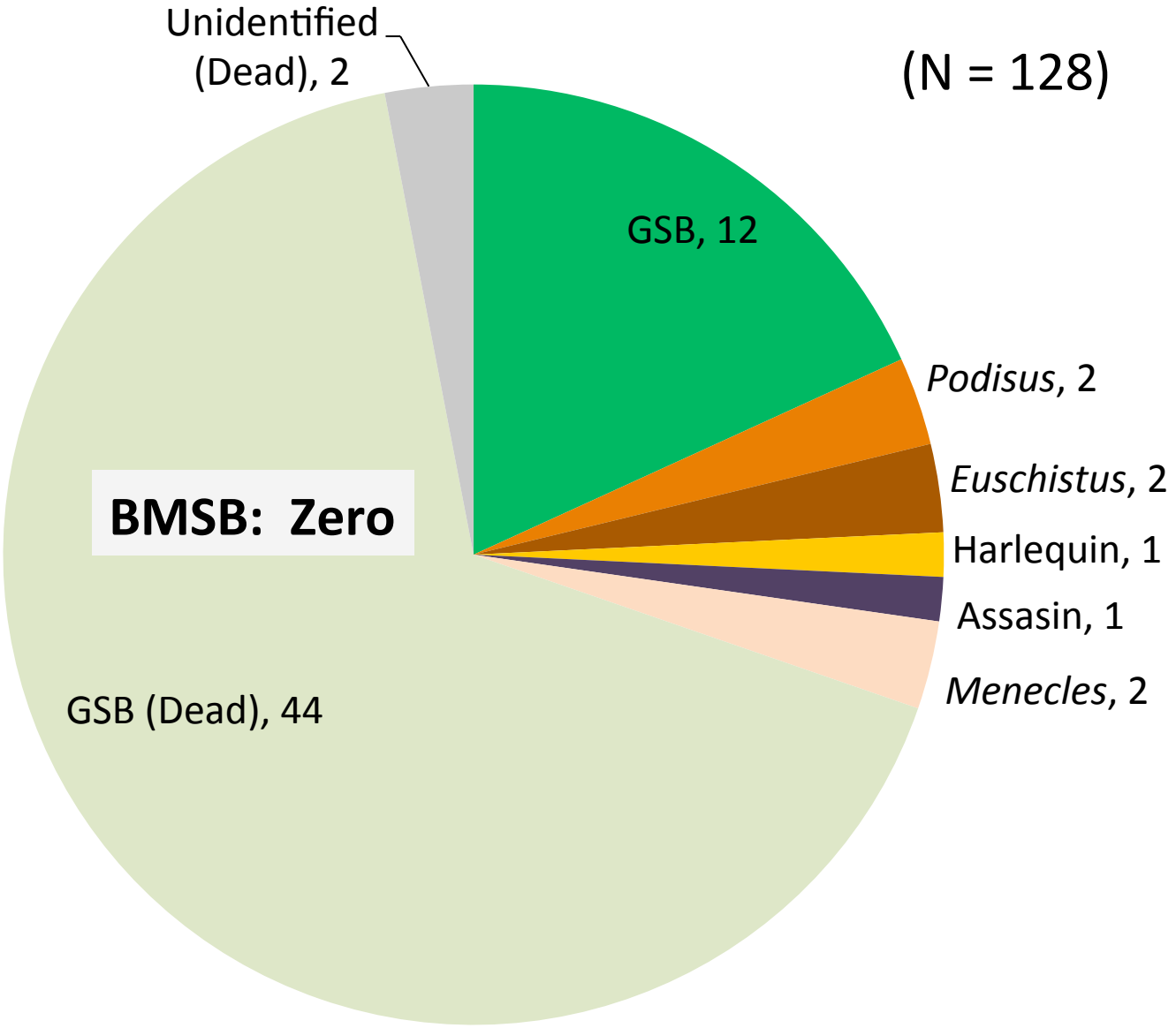
	Transect Sampling	3%
	Tree-targeted Sampling	33%


Leaf Litter Sampling
1m
1m

Leaf Litter Sampling



Leaf Litter Sampling



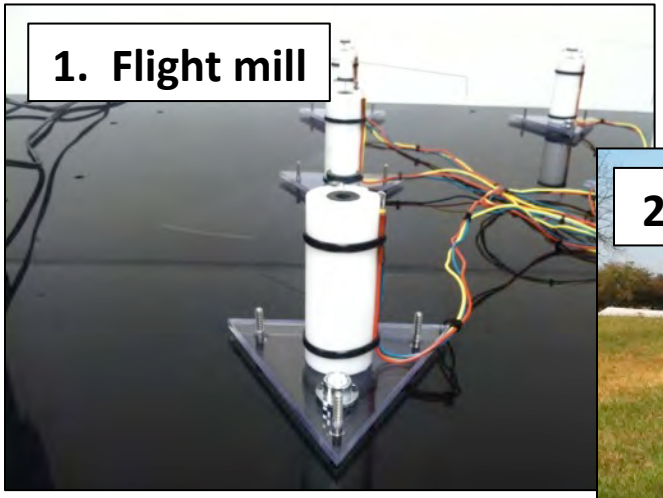

Rock
Outcroppin
g

Key Questions

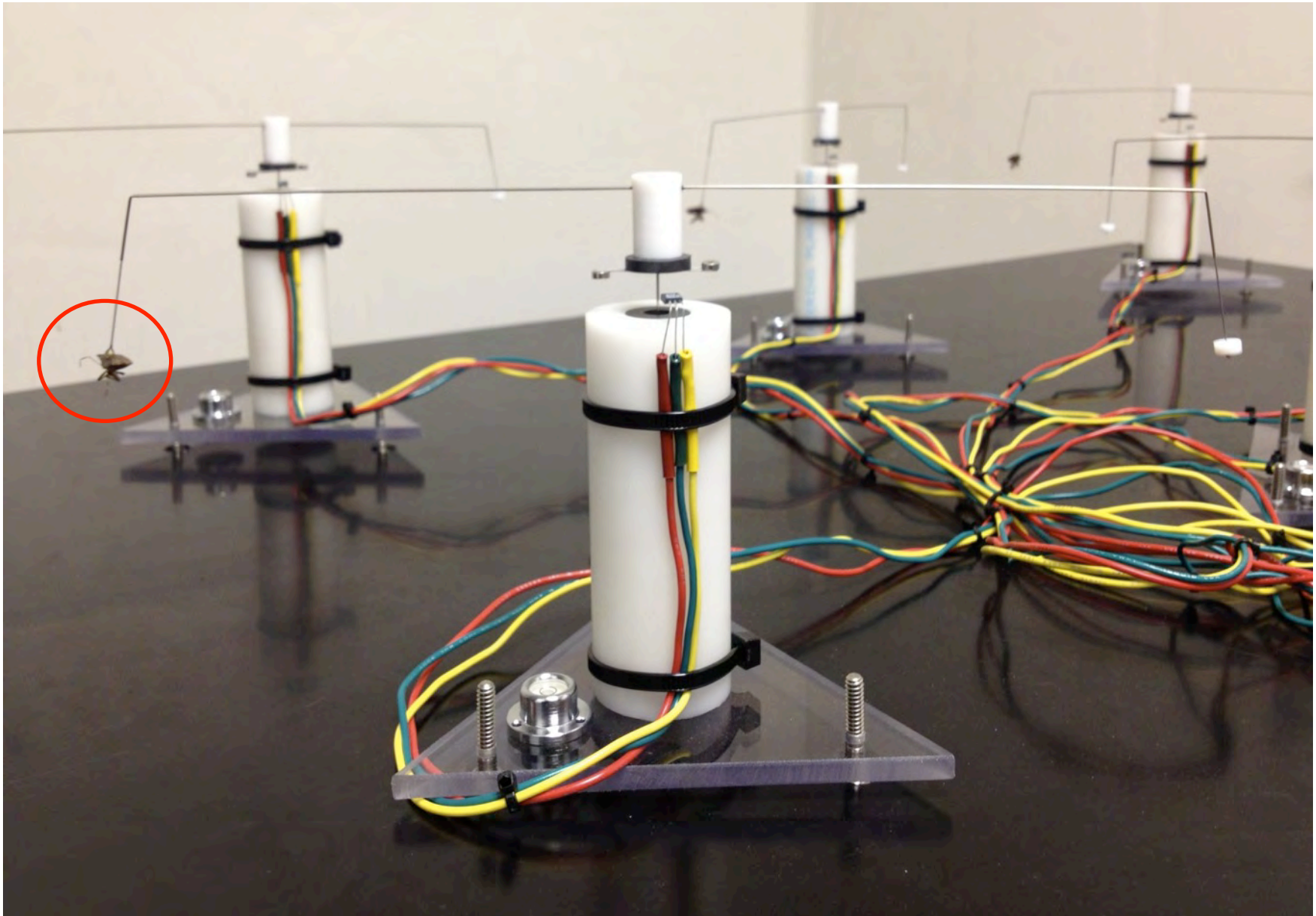
- ✓ Do BMSB overwinter in the natural landscape?
- ✓ If so, what sites within the natural landscape are utilized?
- What is the range of movement into and out of overwintering sites?


13%
Dispersal?
Dispersal?
Arden Nollville Rd
Image © 2011 GeoEye
© 2011 Google
Image USDA Farm Service Agency
4864 ft
Imagery Date: 5/25/2010
39°27'34.75" N 78°03'01.36" W elev 718 ft
Google earth
Eye alt 15 21831 ft

Laboratory and Field Trials to Define Dispersal Capacity, Detection, and Behavior

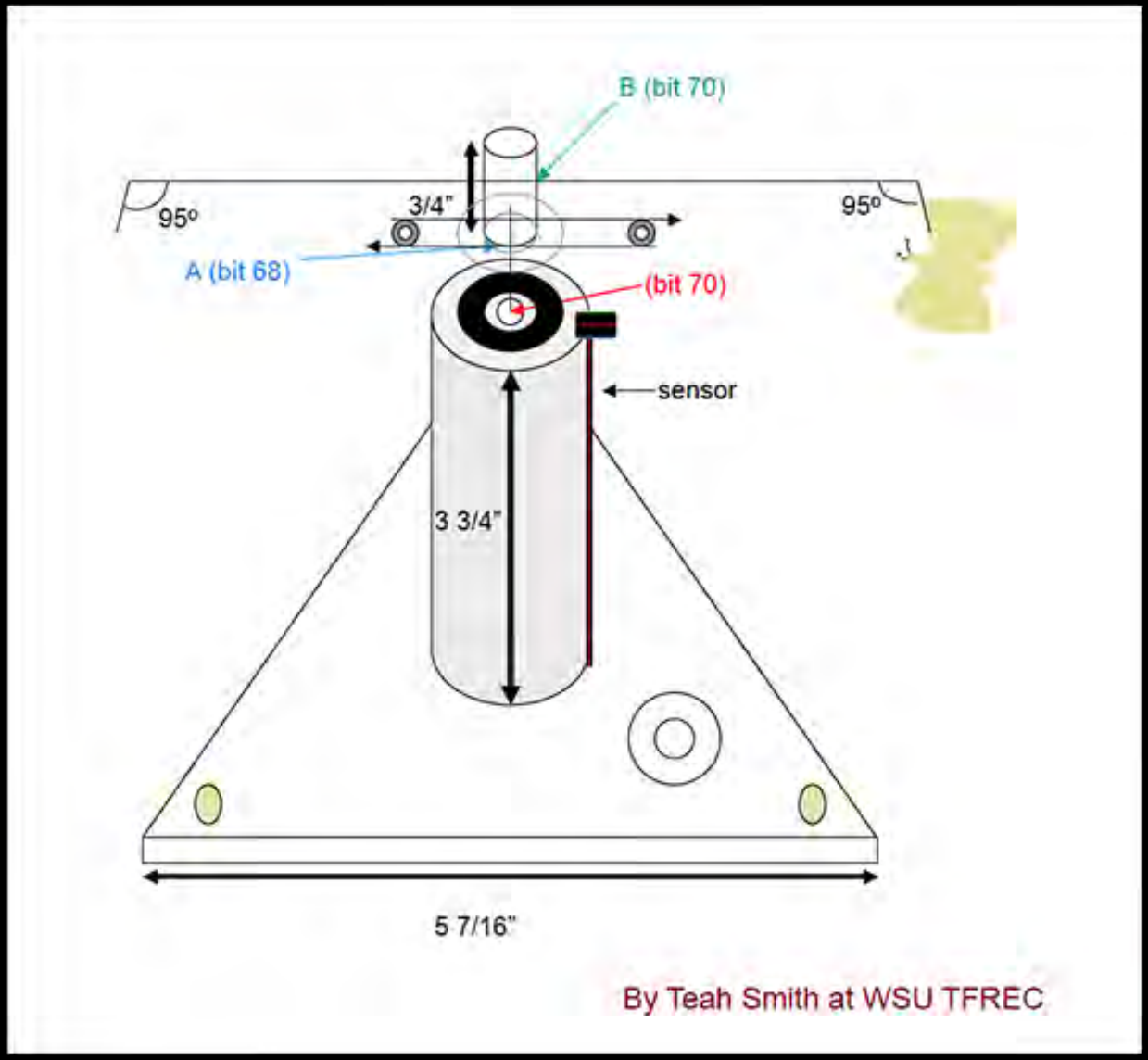


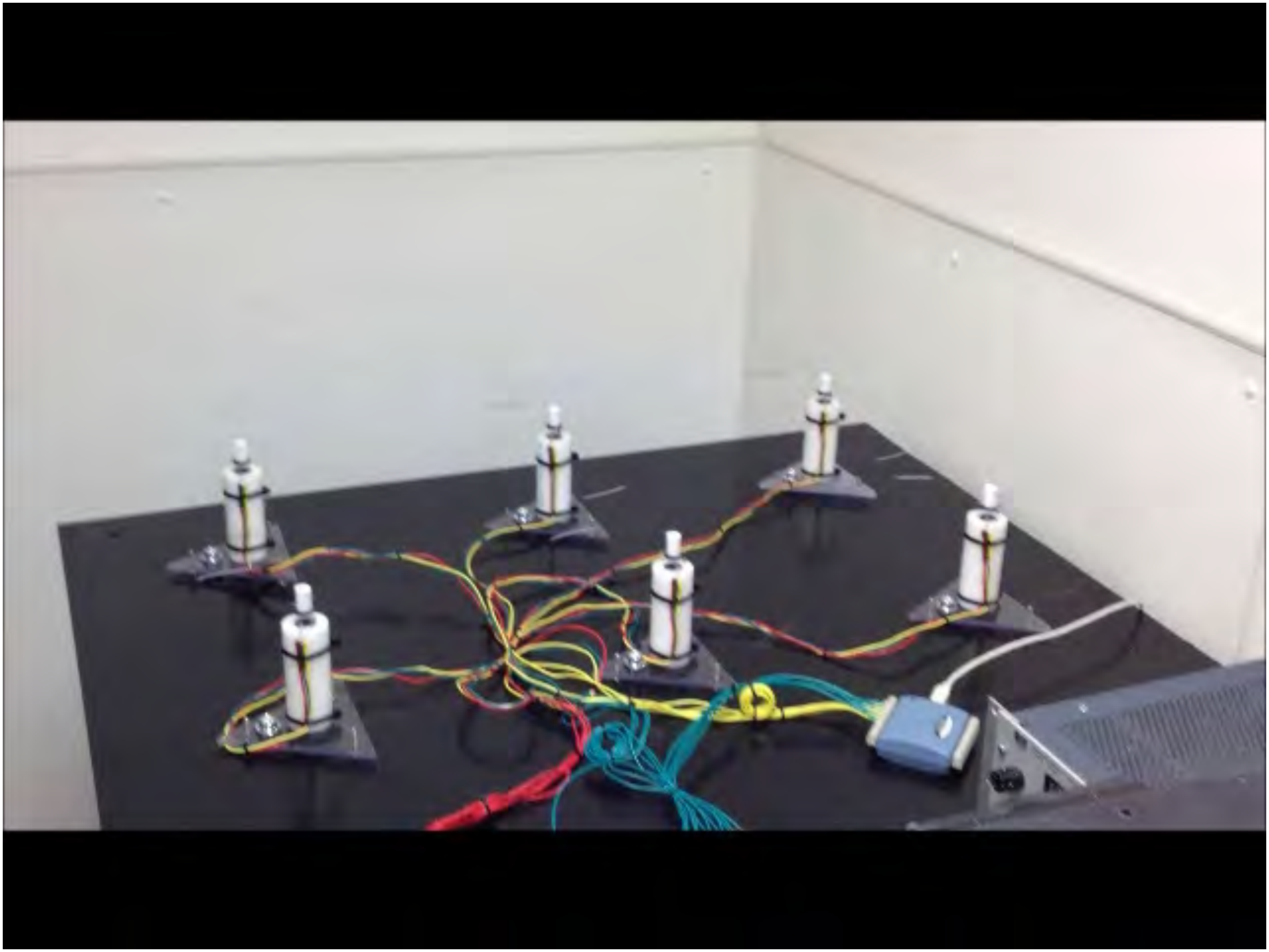
1. Flight Mill: Measuring the Flight Capacity of BMSB

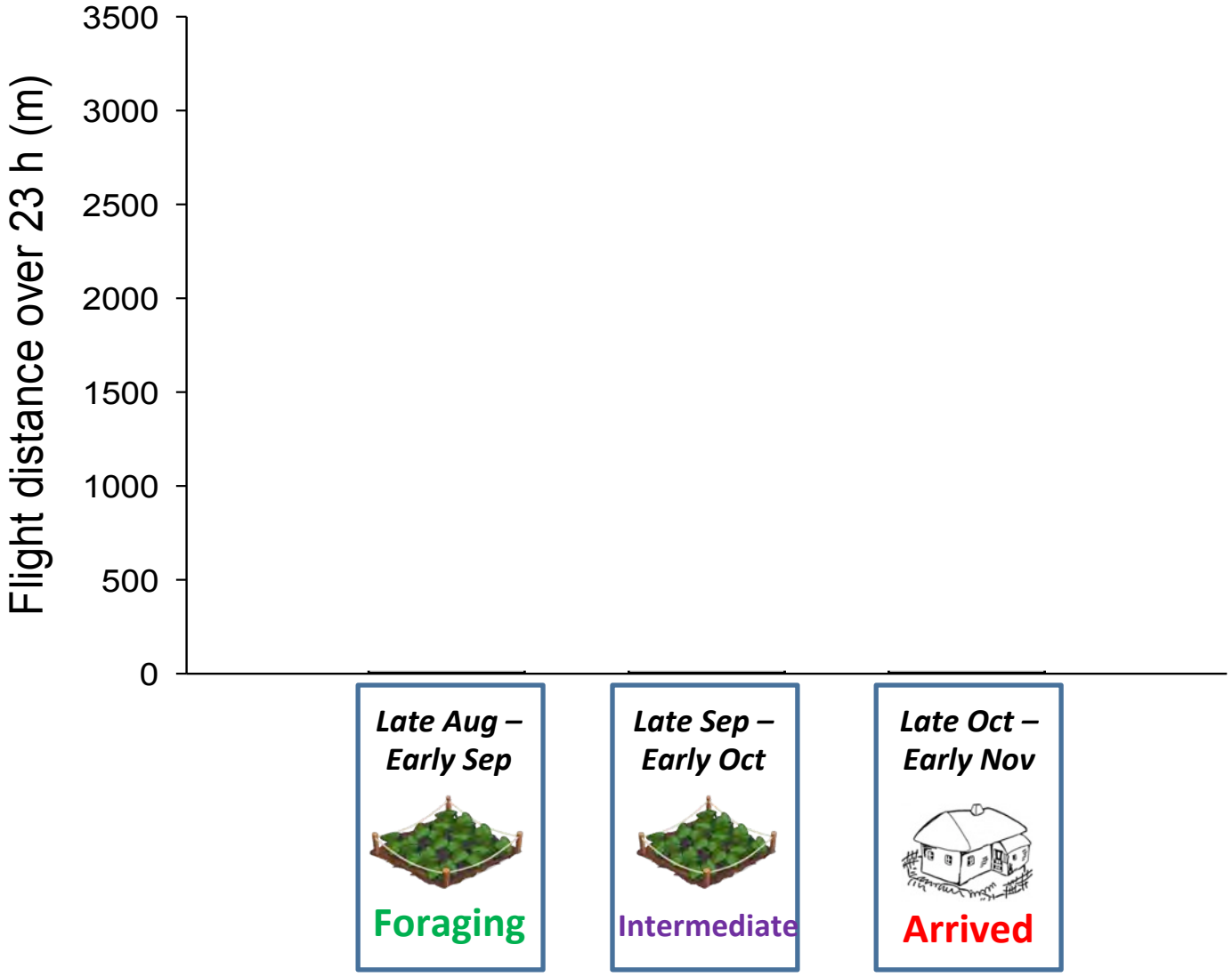


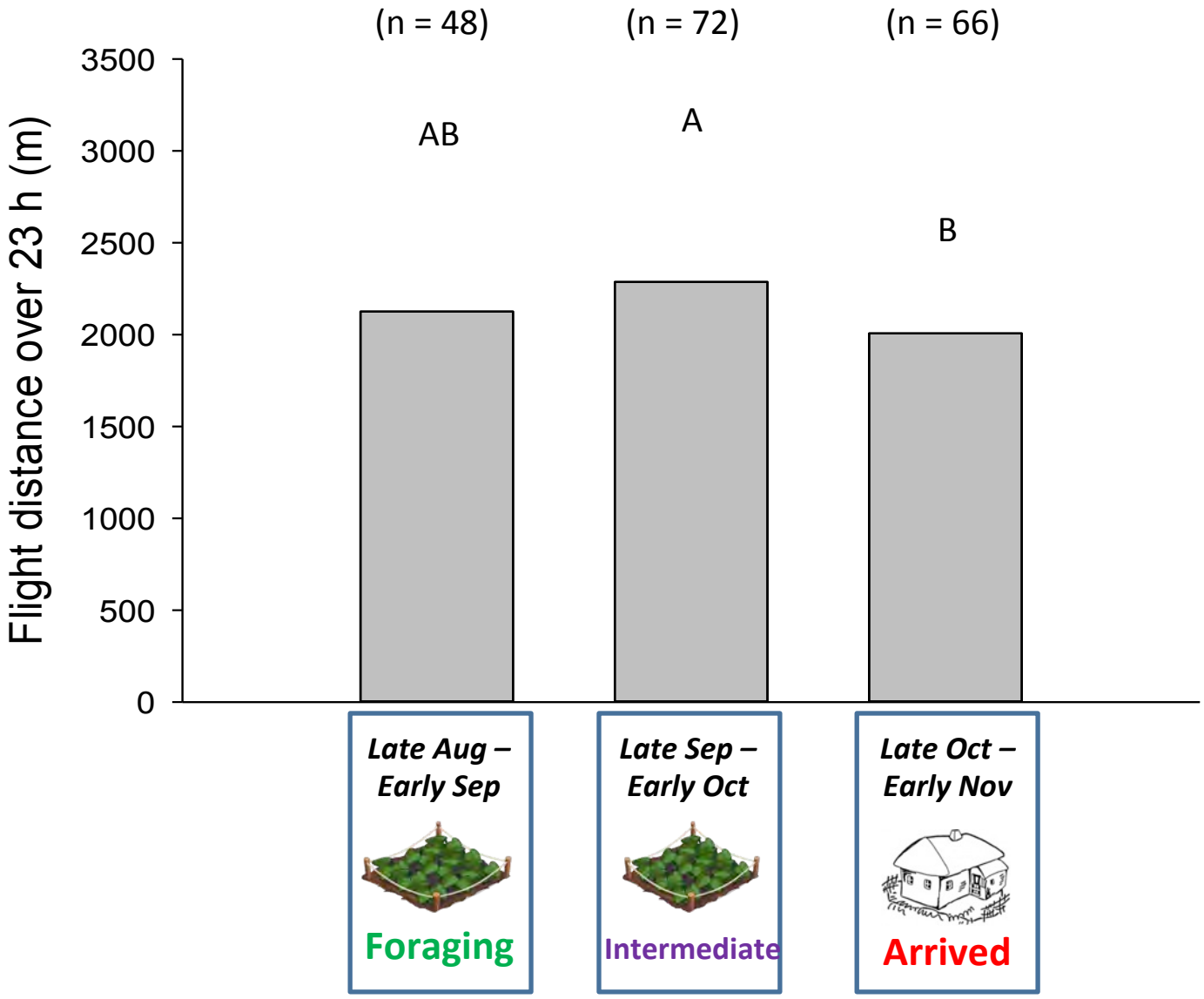
Dr. Vincent Jones

WASHINGTON STATE UNIVERSITY

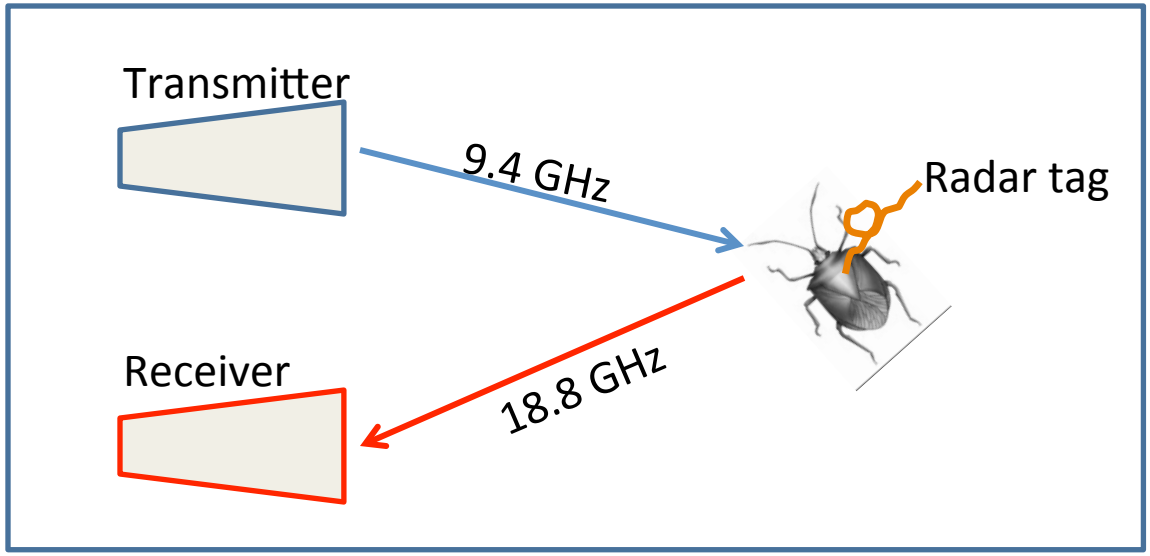


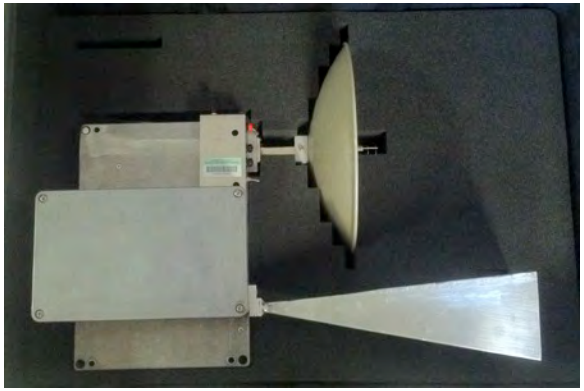


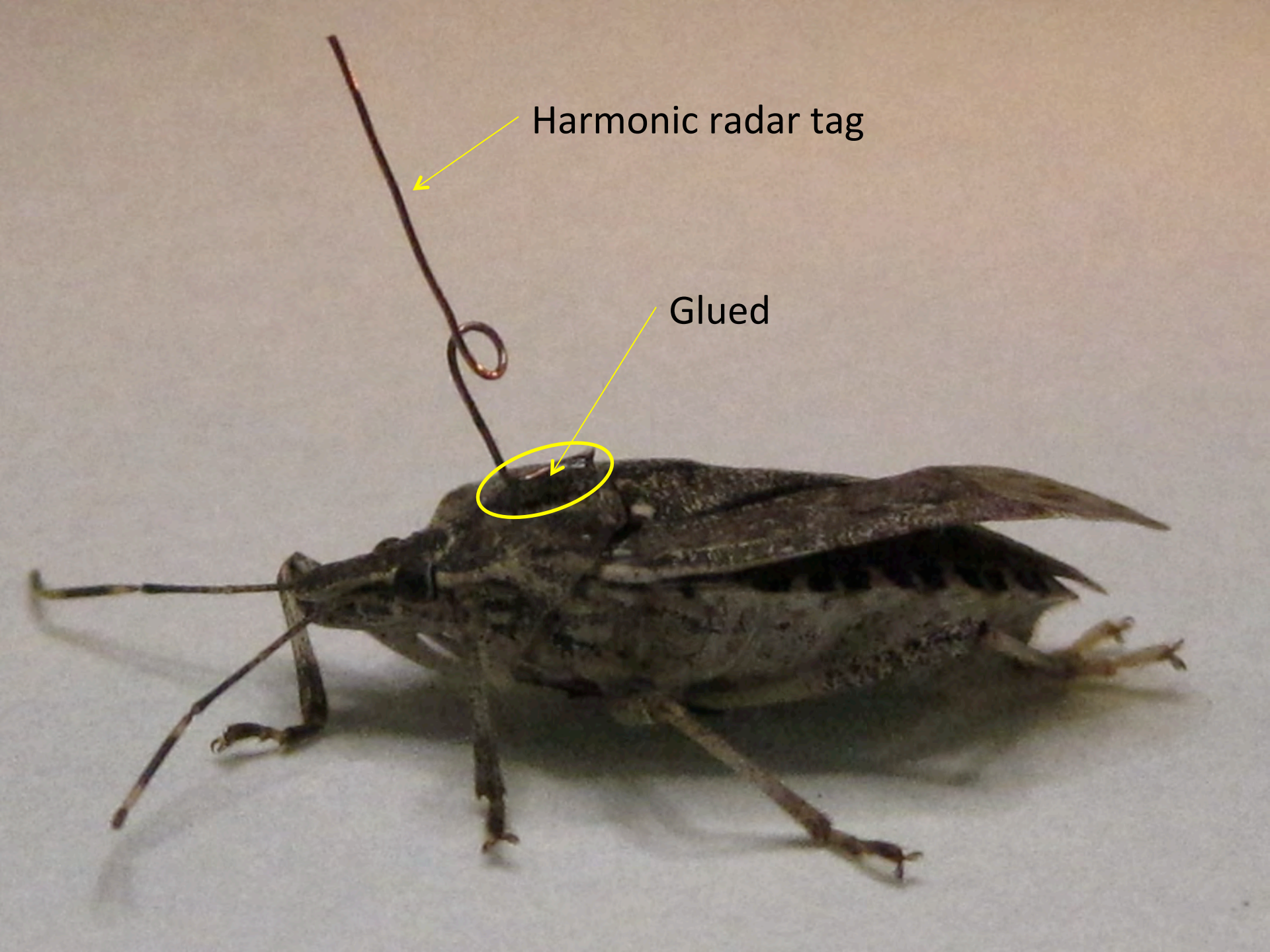

Flight distance over 23 h (m)
3500
3000
2500
2000
1500
1000
500
0
Late Aug – Early Sep
Foraging
Late Sep – Early Oct
Intermediate
Late Oct – Early Nov
Arrived

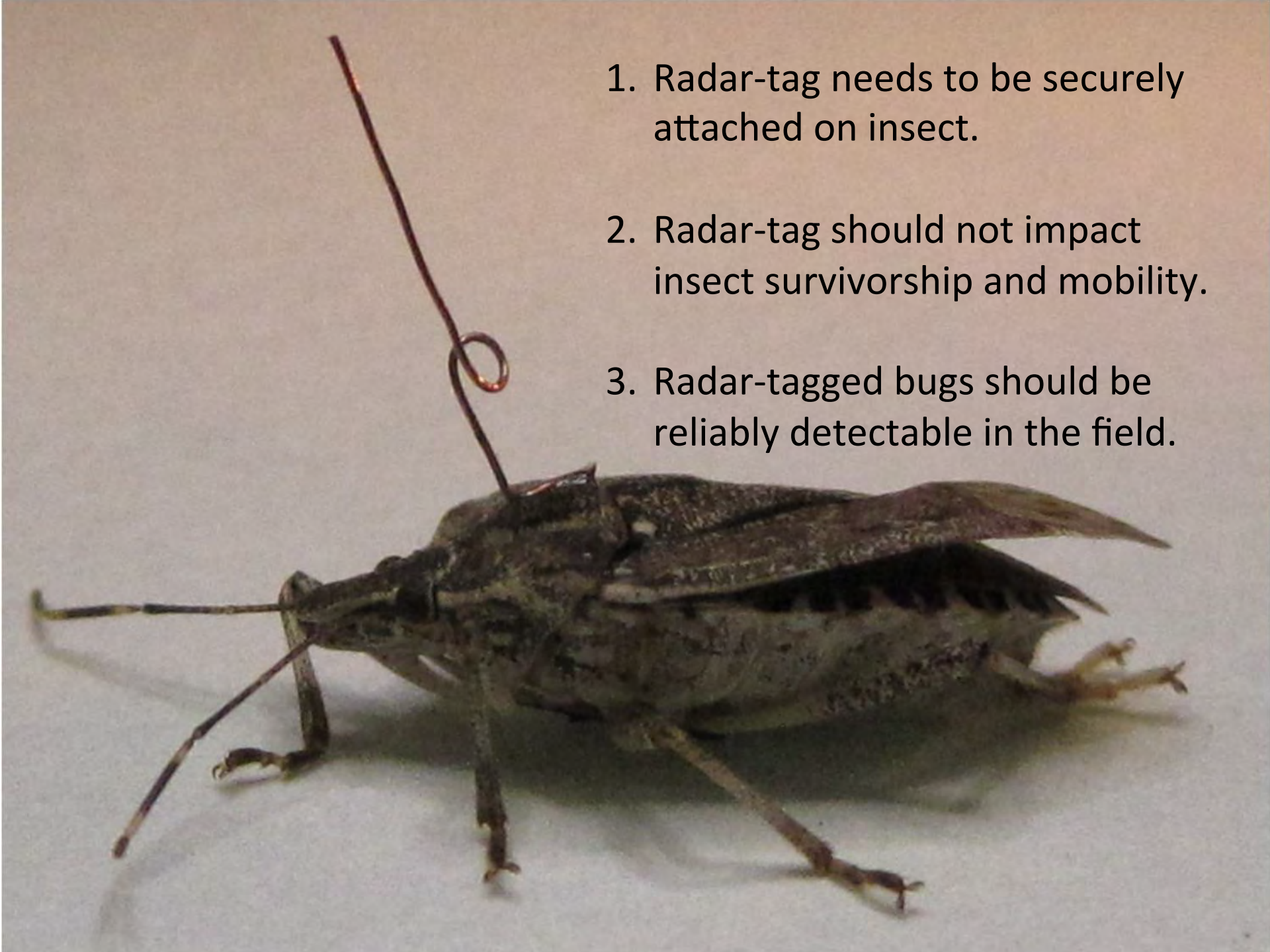

(n = 48)
(n = 72)
(n = 66)
AB
A
B
Flight distance over 23 h (m)
3500
3000
2500
2000
1500
1000
500
0
Late Aug – Early Sep
Late Sep – Early Oct
Late Oct – Early Nov
Foraging
Intermediate
Arrived

2. Field Detection Techniques: Harmonic Radar





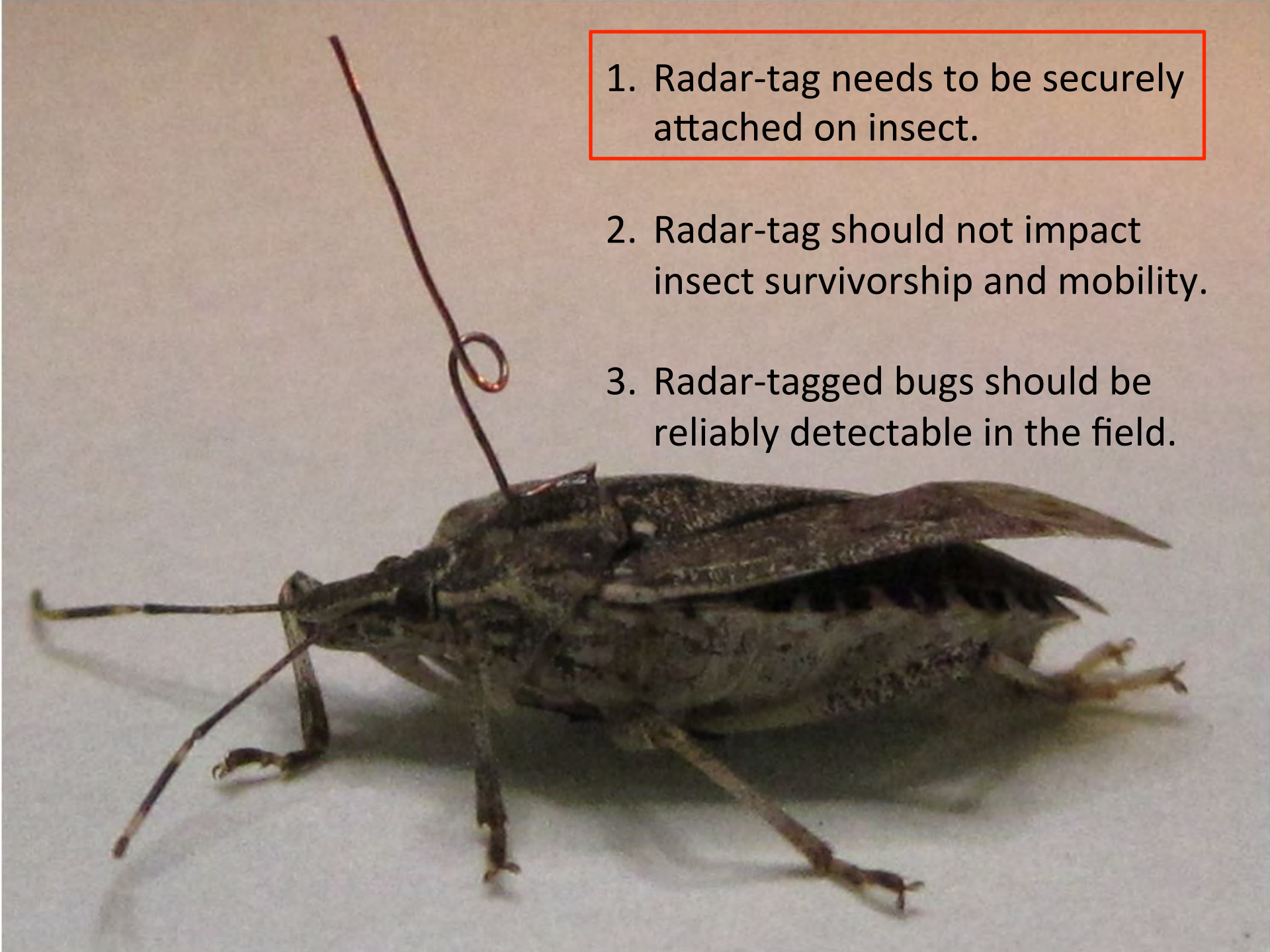

Harmonic radar tag
Glued



1. Radar-tag needs to be securely attached on insect.

2. Radar-tag should not impact insect survivorship and mobility.

3. Radar-tagged bugs should be reliably detectable in the field.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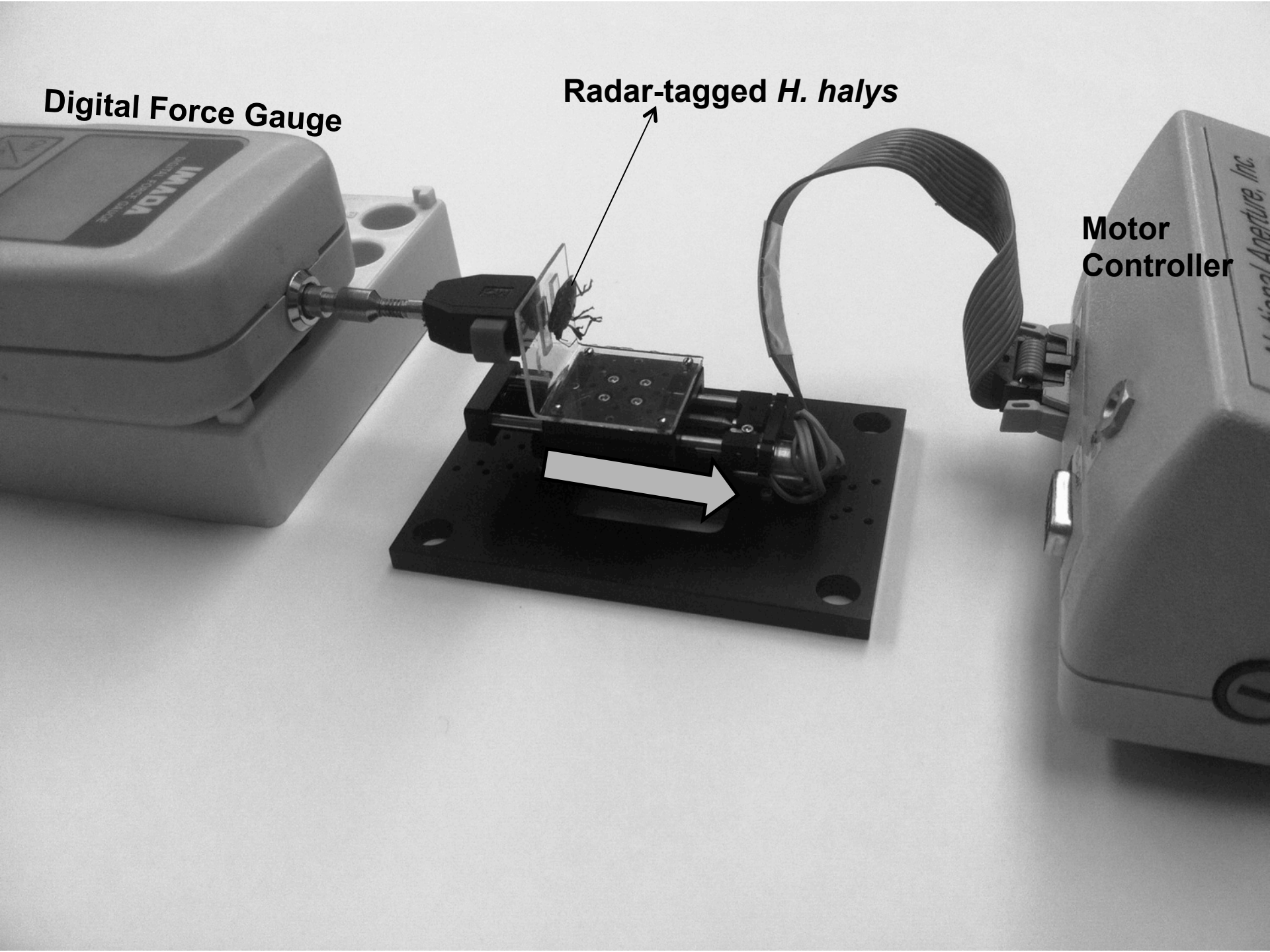
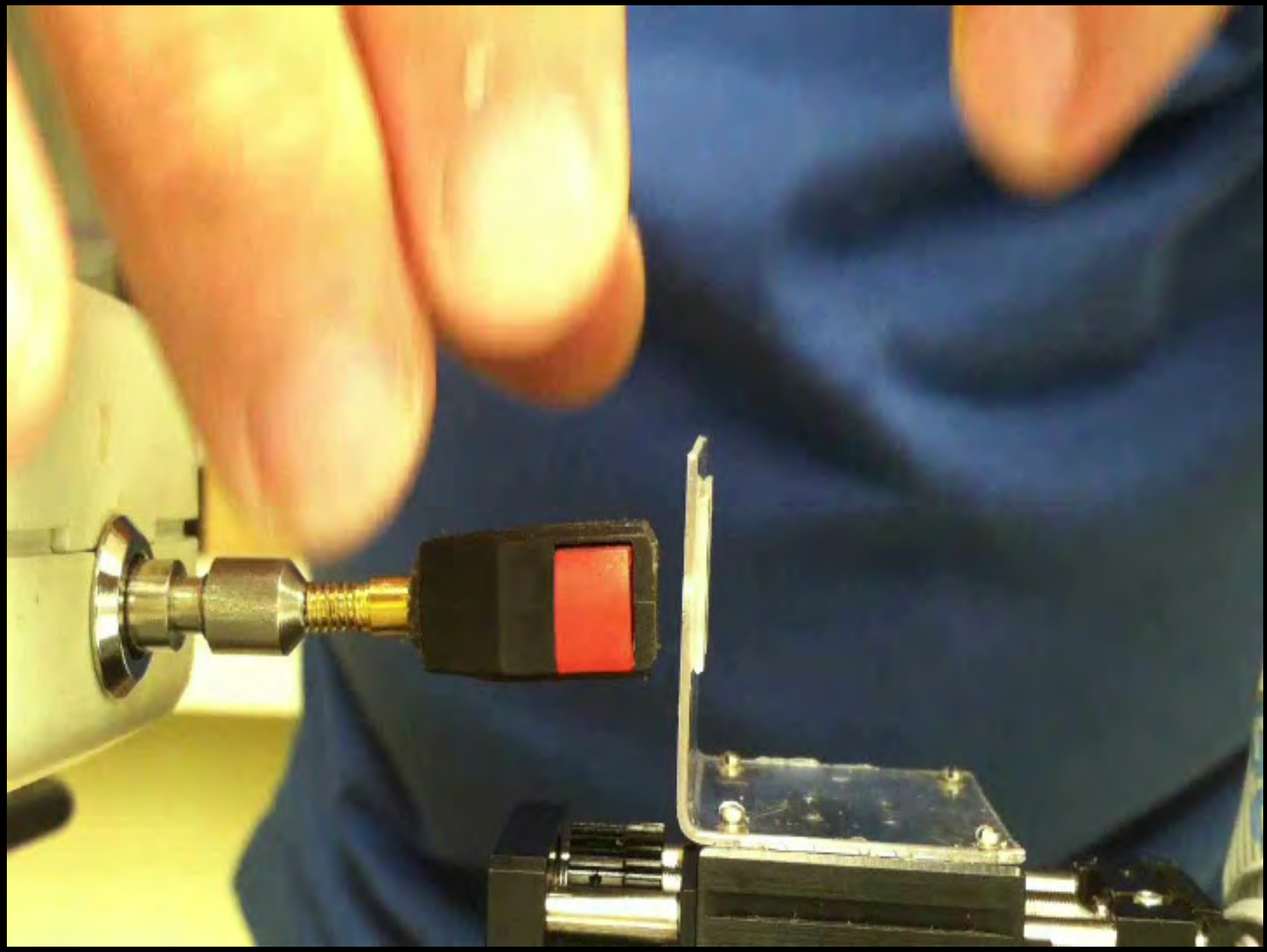
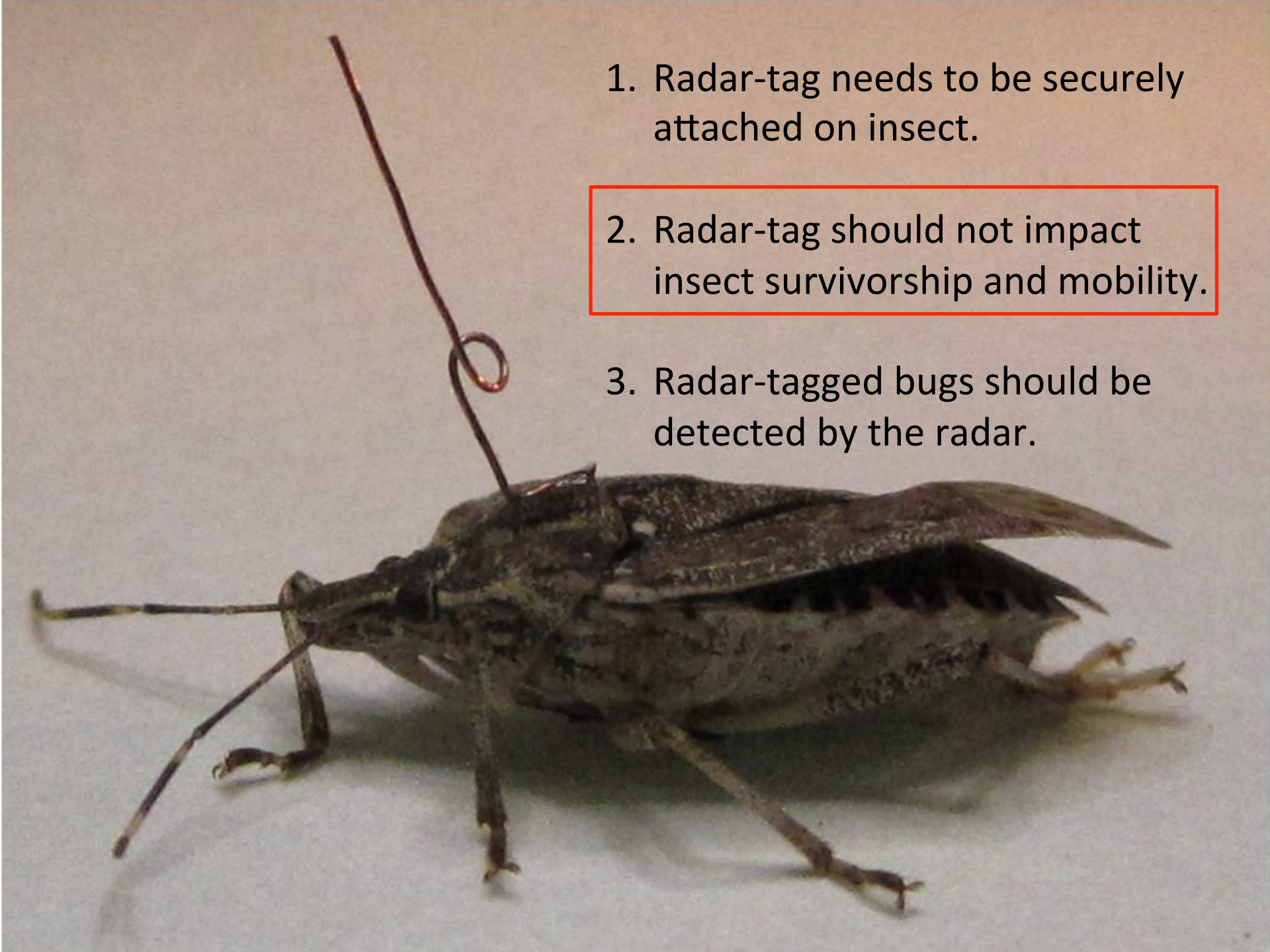

Digital Force Gauge
Radar-tagged *H. halys*
Motor Controller

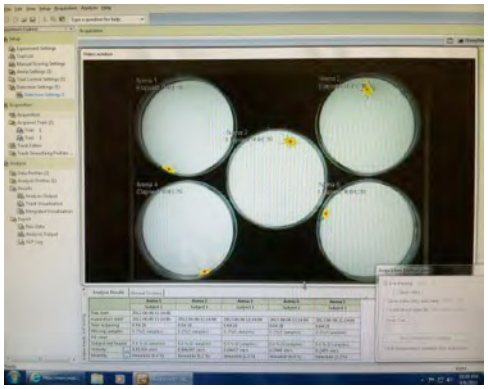
The strength of bond between radar tag and insect



The adhesive strength of glue bond between radar tag and insect:

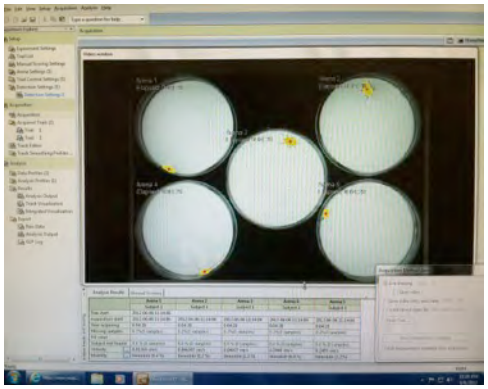
ca. 170-g force


1. Radar-tag needs to be securely attached on insect.
2. Radar-tag should not impact insect survivorship and mobility.
3. Radar-tagged bugs should be detected by the radar.



Radar-tag did <u>not</u> impact *H. halys*

- Survivorship. (lab)
- Horizontal & vertical walking ability. (lab)

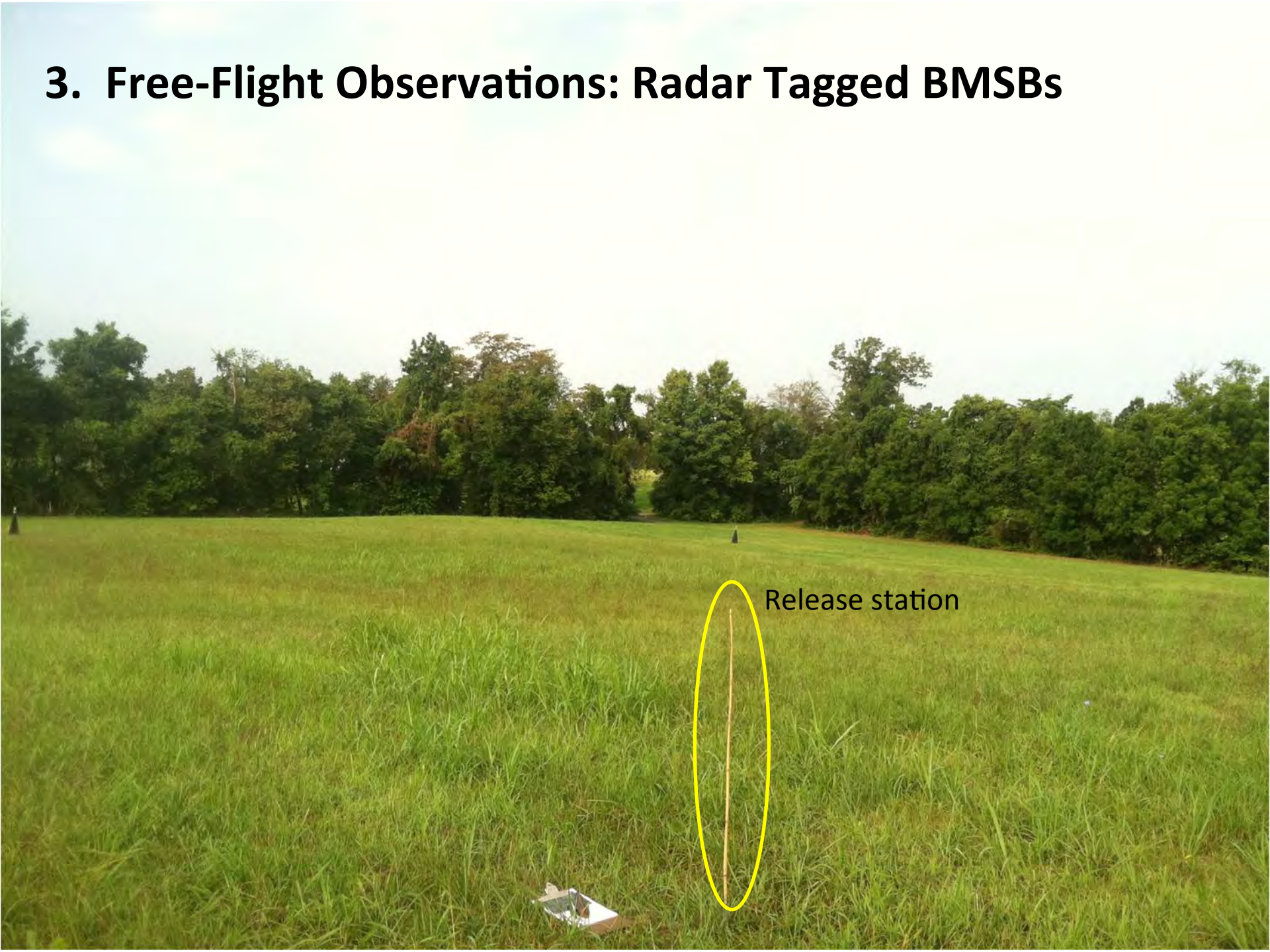


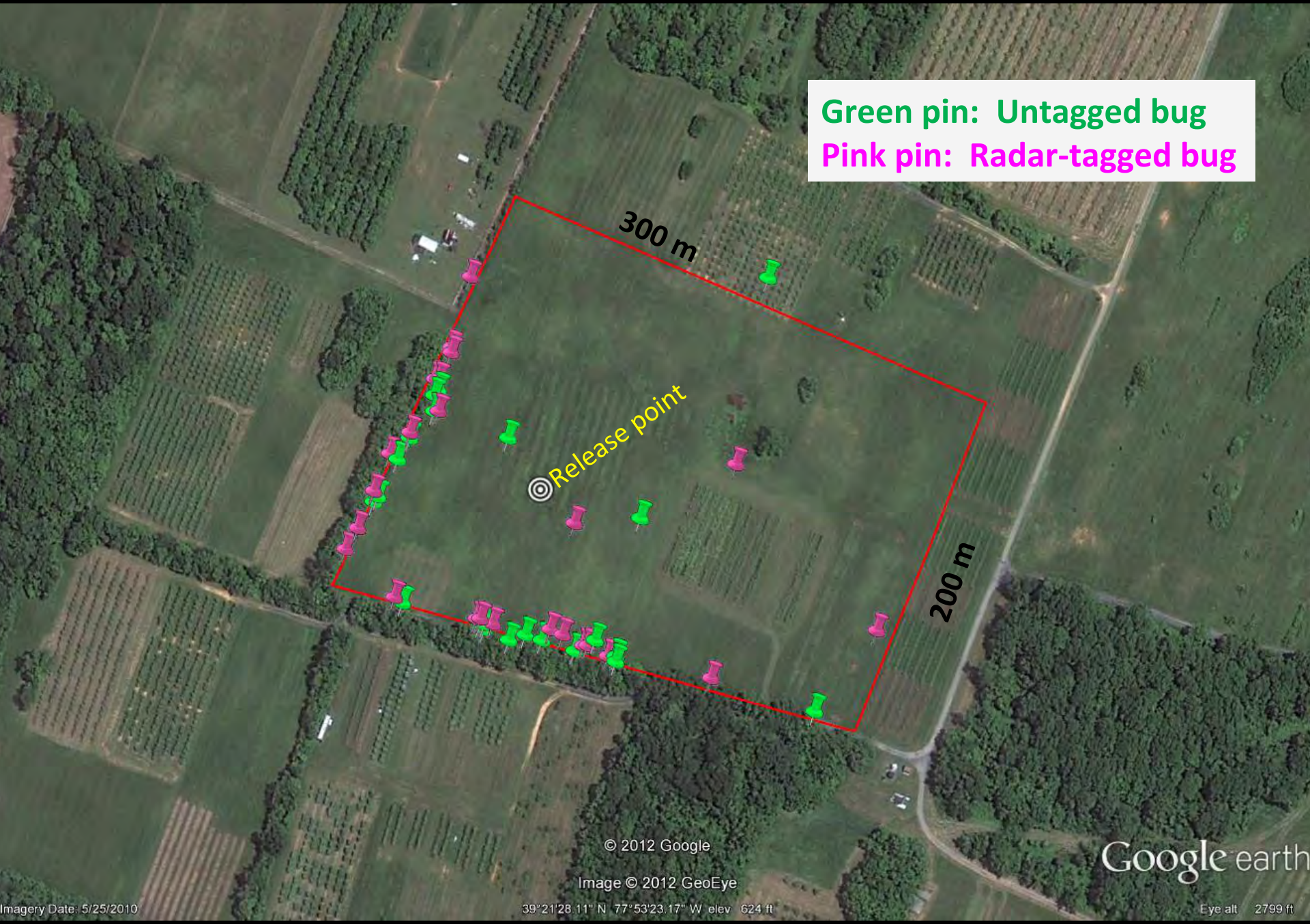
Radar-tag did <u>not</u> impact *H. halys*

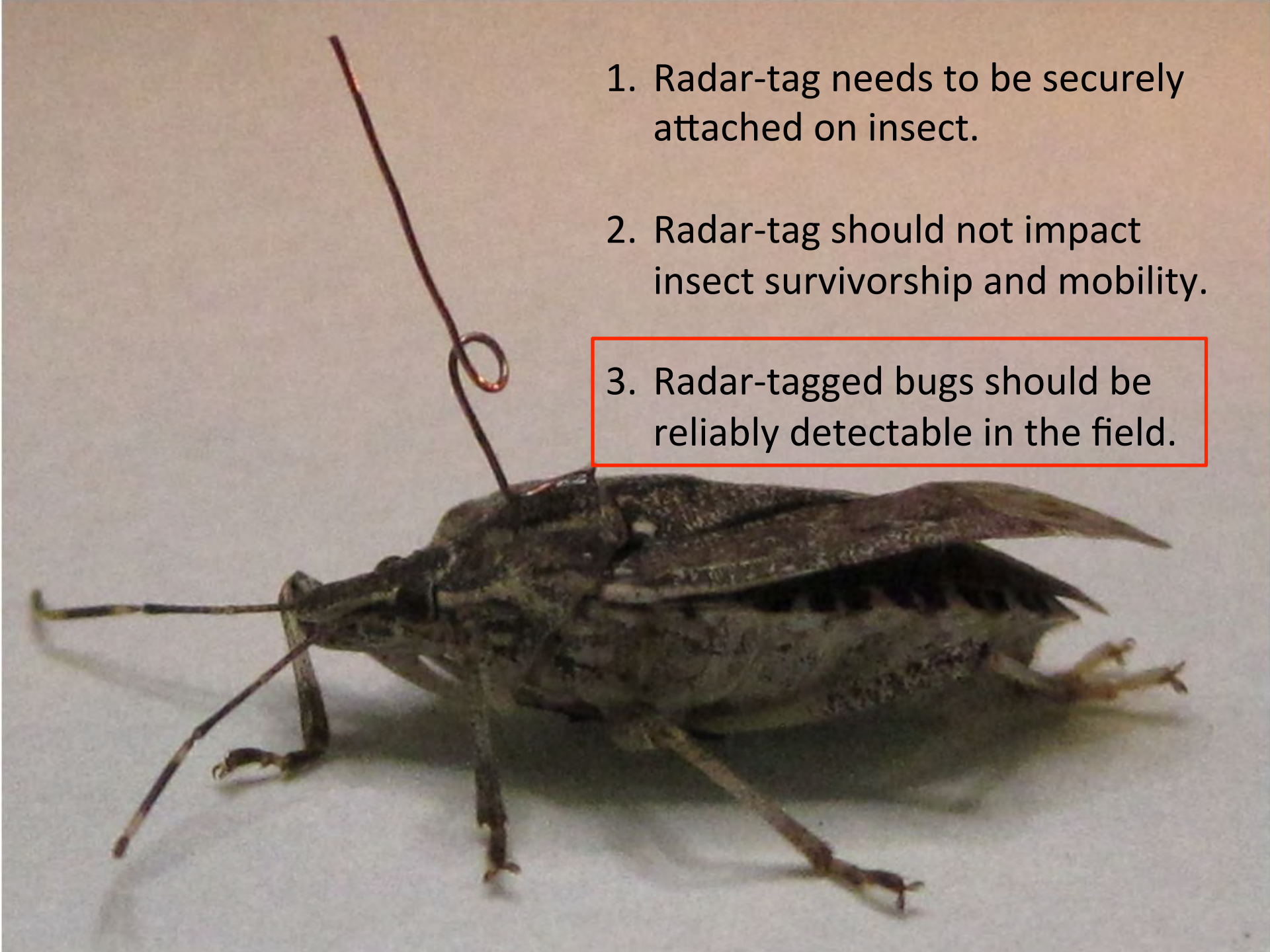
- Survivorship. (lab)
- Horizontal & vertical walking ability. (lab)

- Flight capacity. (field)

3. Free-Flight Observations: Radar Tagged BMSBs




Green pin: Untagged bug
Pink pin: Radar-tagged bug
300 m
200 m
Release point
© 2012 Google
Image © 2012 GeoEye
Google earth
Imagery Date: 5/25/2010
39°21'28.11" N 77°53'23.17" W elev 624 ft
Eye alt 2799 ft


1. Radar-tag needs to be securely attached on insect.
2. Radar-tag should not impact insect survivorship and mobility.
3. Radar-tagged bugs should be reliably detectable in the field.

Made in
Canada

Radar-tagged bugs were reliably detectable from ca. 15 m.

Key Questions

- ✓ Do BMSB overwinter in the natural landscape?
- ✓ If so, what sites within the natural landscape are utilized?
- ✓ What is the range of movement into and out of overwintering sites?

Summary

- 13% of dead trees can potentially harbor overwintering *H. halys*.
- *H. halys* have capacity to fly >1 km within a day.
- Harmonic radar system has a promising potential for use with *H. halys*.
- Flight by *H. halys* was affected at least by temperature and sun's position.