



Survey of natural overwintering sites of BMSB

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A known overwintering sites of BMSB



The formation of aggregations during diapause is a remarkable habit exhibited by many heteropterans. *H. halys* adults also form aggregations when overwintering. This is often troublesome for homeowners because large numbers of bugs enter into buildings and form aggregations within them (Watanabe et al., 1994b). Consequently, this behav-



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Arden Nolville Rd

Image © 2011 GeoEye
© 2011 Google
Image USDA Farm Service Agency

Google earth

4864 ft

Imagery Date: 5/25/2010

39°27'34.75" N 78°03'01.36" W elev 718 ft

Eye alt 21831 ft



Woods

Orchard

Red Crest Dr

Arden Nollville Rd

Fox Chase Dr

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Image USDA Farm Service Agency

Google earth



Imagery Date: 6/7/2009

39°27'18.46" N 78°01'59.78" W elev. 704 ft

Eye alt 5729 ft



Woods

Orchard



Red Crest Dr

Arden Nollville Rd

Fox Chase Dr

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Image © 2011 GeoEye

Image USDA Farm Service Agency

39°27'18.46" N 78°01'59.78" W elev. 704 ft

Google earth

Eye alt 5729 ft

1133 ft

Imagery Date: 6/7/2009



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Goal:



1. Do BMSB overwinter in natural landscapes?



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1. Do BMSB overwinter in natural landscapes?
2. What kind of structure do BMSB use as overwintering site in natural landscapes?



Goal:



1. Do BMSB overwinter in natural landscapes?
2. What kind of structure do BMSB use as overwintering site in natural landscapes?
3. Does the overwintering BMSB population in natural landscapes pose a risk to agriculture?



Approach:

To find overwintering BMSB in natural landscapes:



October 2011

3 sites on
Appalachian Trail

2

5 woodlots around
2 orchards

1



Arden Nolville Rd

Image © 2011 GeoEye
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Google earth

4864 ft

39°27'34.75" N 78°03'01.36" W elev 718 ft

Eye alt 5 21831 ft

Imagery Date: 5/25/2010

October 2011



A photograph of a forest with many thin, vertical tree trunks. The ground is covered in a thick layer of brown, fallen leaves. The trees are mostly without leaves, suggesting a late autumn or winter setting. The lighting is bright, creating shadows on the leaf-covered ground.

Treasure hunting (with no map)!



Treasure hunting (with no map)!

Dead trees: 175

Ground: 151

Rock piles: 9

Treasure hunting (with no map)!



Dead trees became a prime target. (November 2011)















We sampled 774 dead trees...



We sampled 774 dead trees...

Did we find the bugs?







We sampled 774 dead trees.

We found overwintering BMSB
from 26 trees.



Goal:



1. Do BMSB overwinter in natural landscapes?
2. What kind of structure do BMSB use as overwintering site in natural landscapes?
3. Does the overwintering BMSB population in natural landscapes pose a risk to agriculture?

(Jan-Feb 2012)

Woods #3

Wife Rd

935 ft

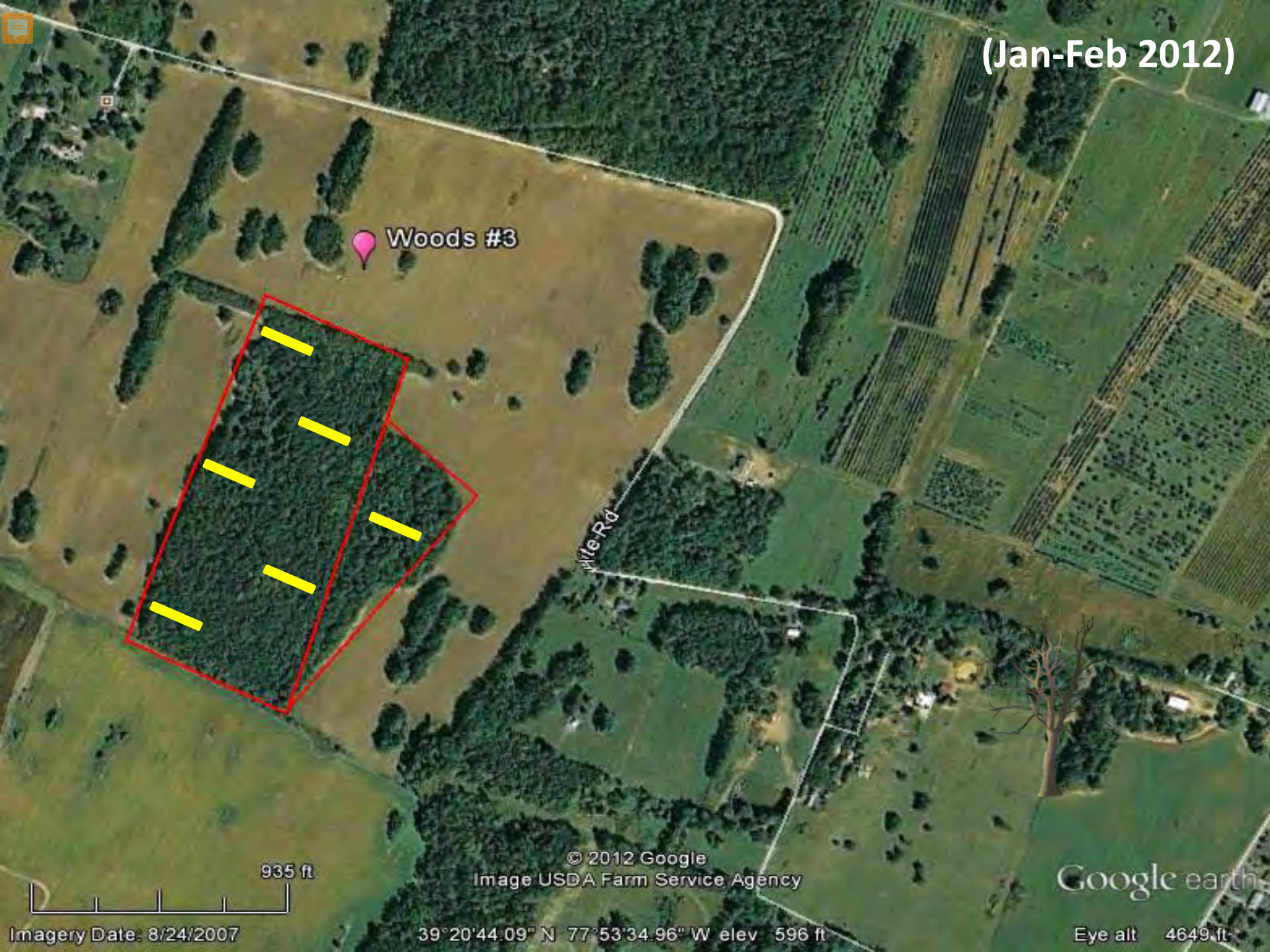
© 2012 Google
Image USDA Farm Service Agency

Google earth

Eye alt 4649 ft

Imagery Date: 8/24/2007

39°20'44.09" N 77°53'34.96" W elev 596 ft



(Jan-Feb 2012)

Woods #3

1. Transect size:
50 × 10m
2. Sampled ALL dead trees in transects



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

(Jan-Feb 2012)

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?



Woods #3

935 ft

© 2012 Google
Image USDA Farm Service Agency

Google earth

Eye alt 4649 ft

39°20'44.09" N 77°53'34.96" W elev 596 ft

Imagery Date: 8/24/2007

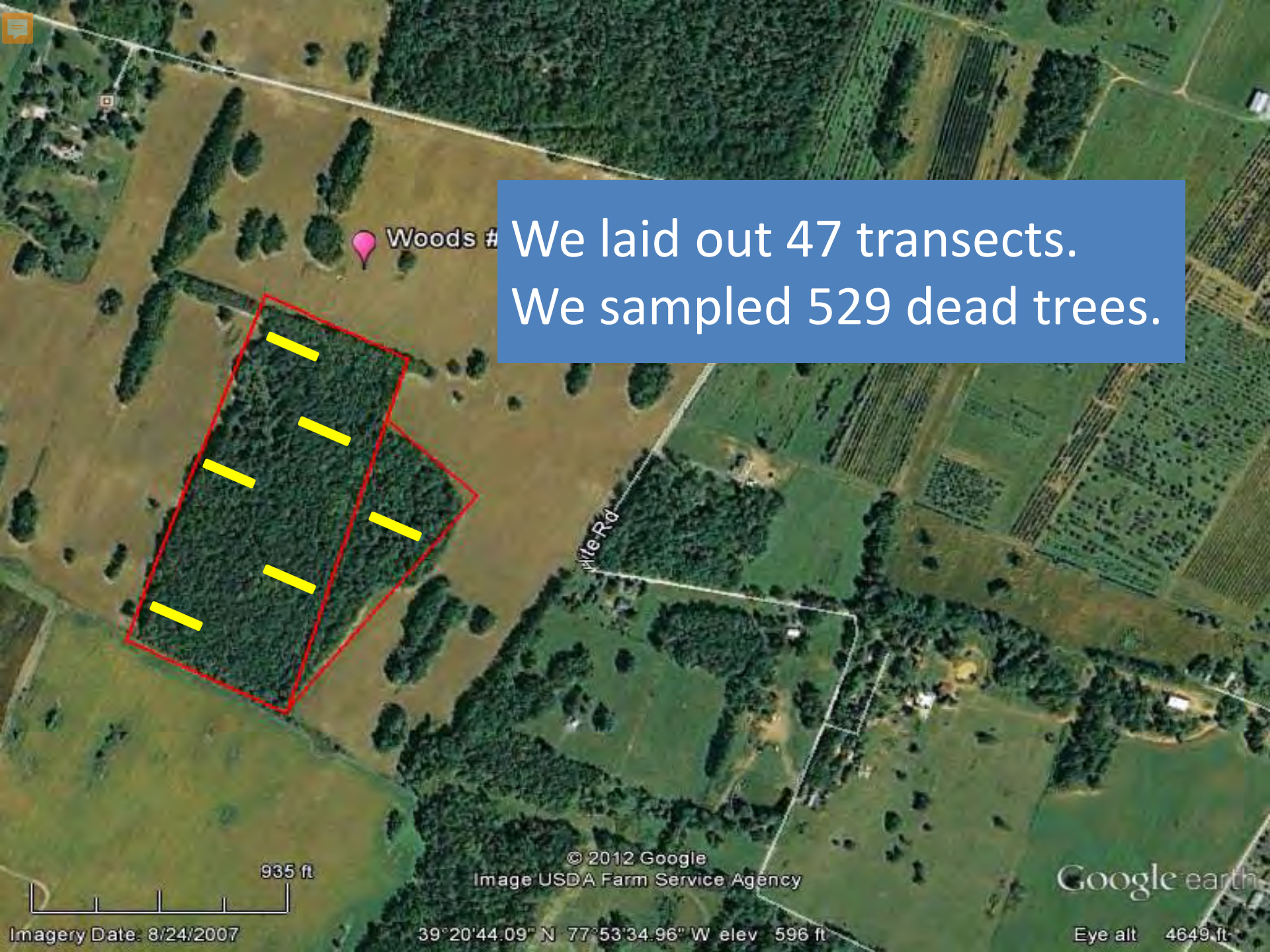


Easy



Very thorny





Woods #

We laid out 47 transects.
We sampled 529 dead trees.

935 ft

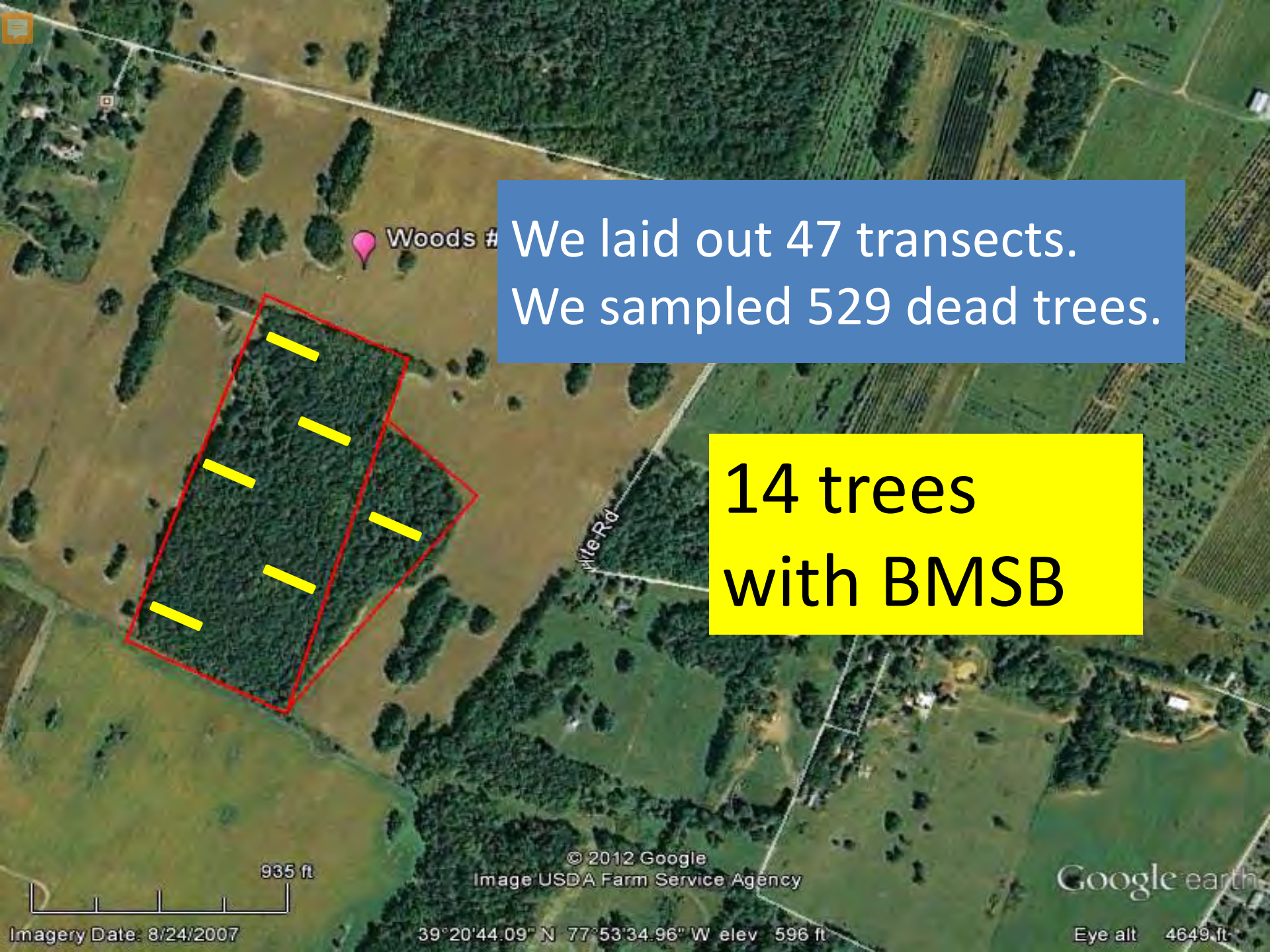
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Image USDA Farm Service Agency

Google earth

Imagery Date: 8/24/2007

39°20'44.09" N 77°53'34.96" W elev 596 ft

Eye alt 4649 ft



Woods #

We laid out 47 transects.
We sampled 529 dead trees.

14 trees
with BMSB

935 ft

© 2012 Google
Image USDA Farm Service Agency

Google earth

Imagery Date: 8/24/2007

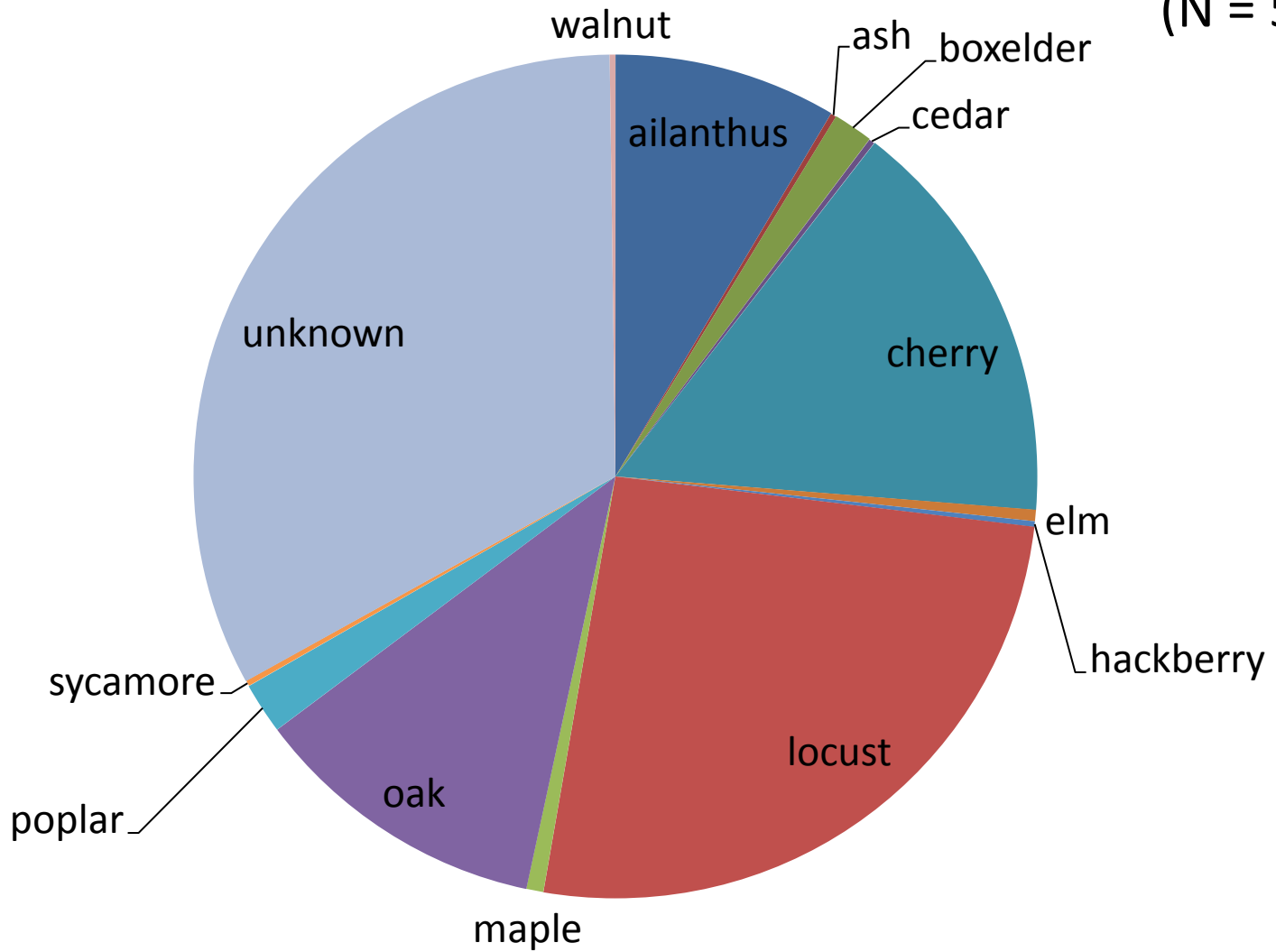
39°20'44.09" N 77°53'34.96" W elev 596 ft

Eye alt 4649 ft



1. Dead tree species

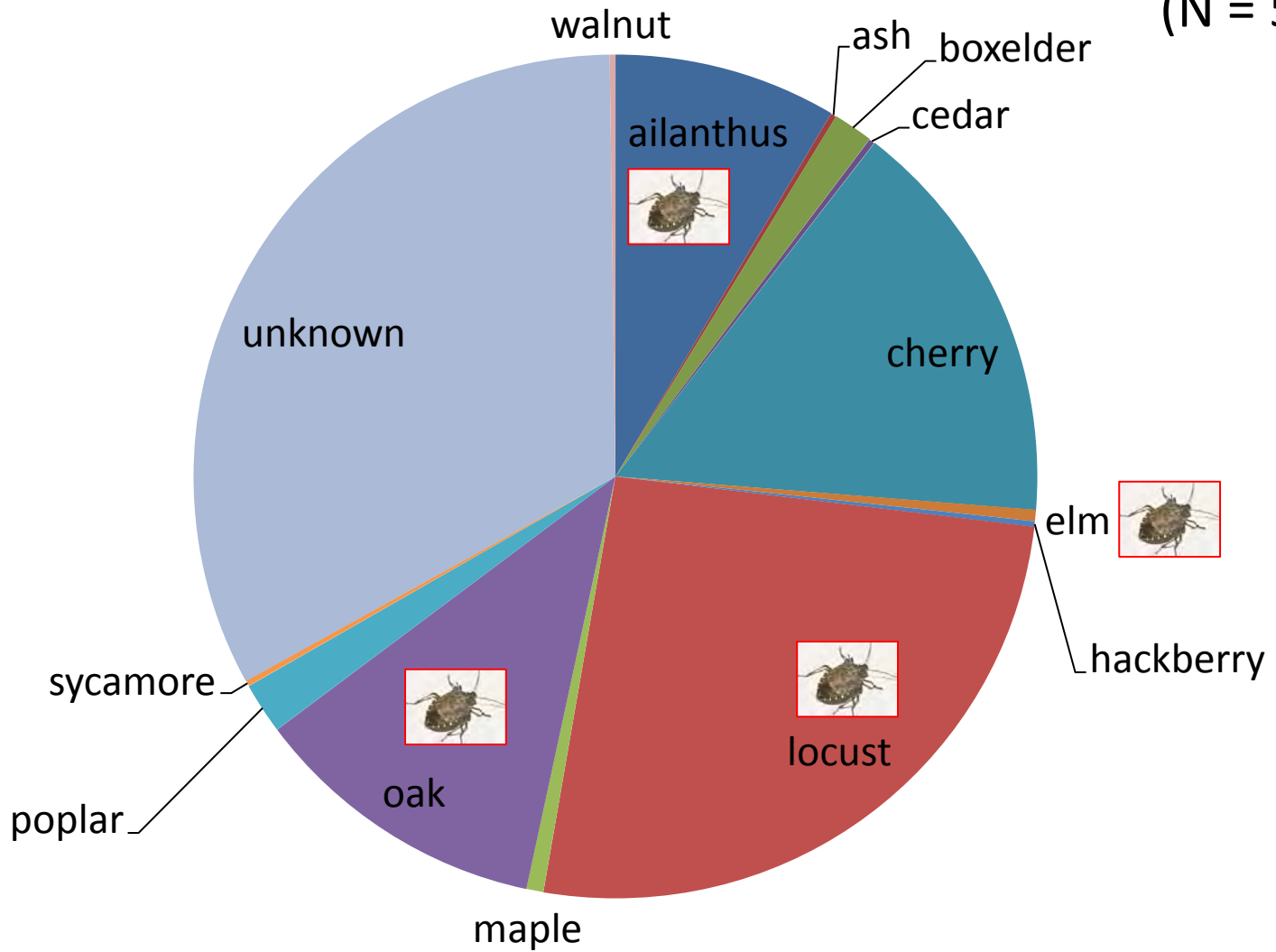
(N = 529)





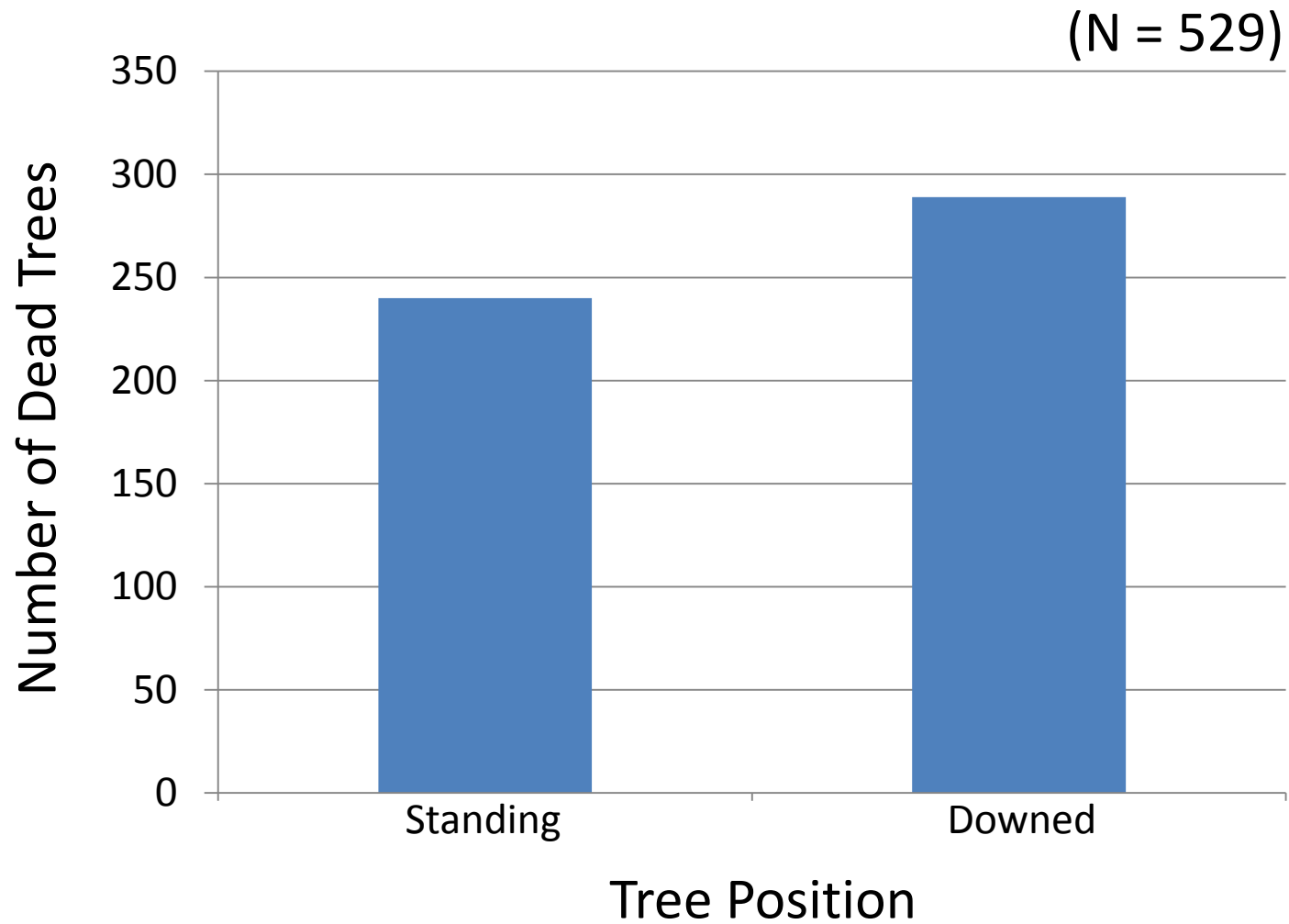
1. Dead tree species

(N = 529)



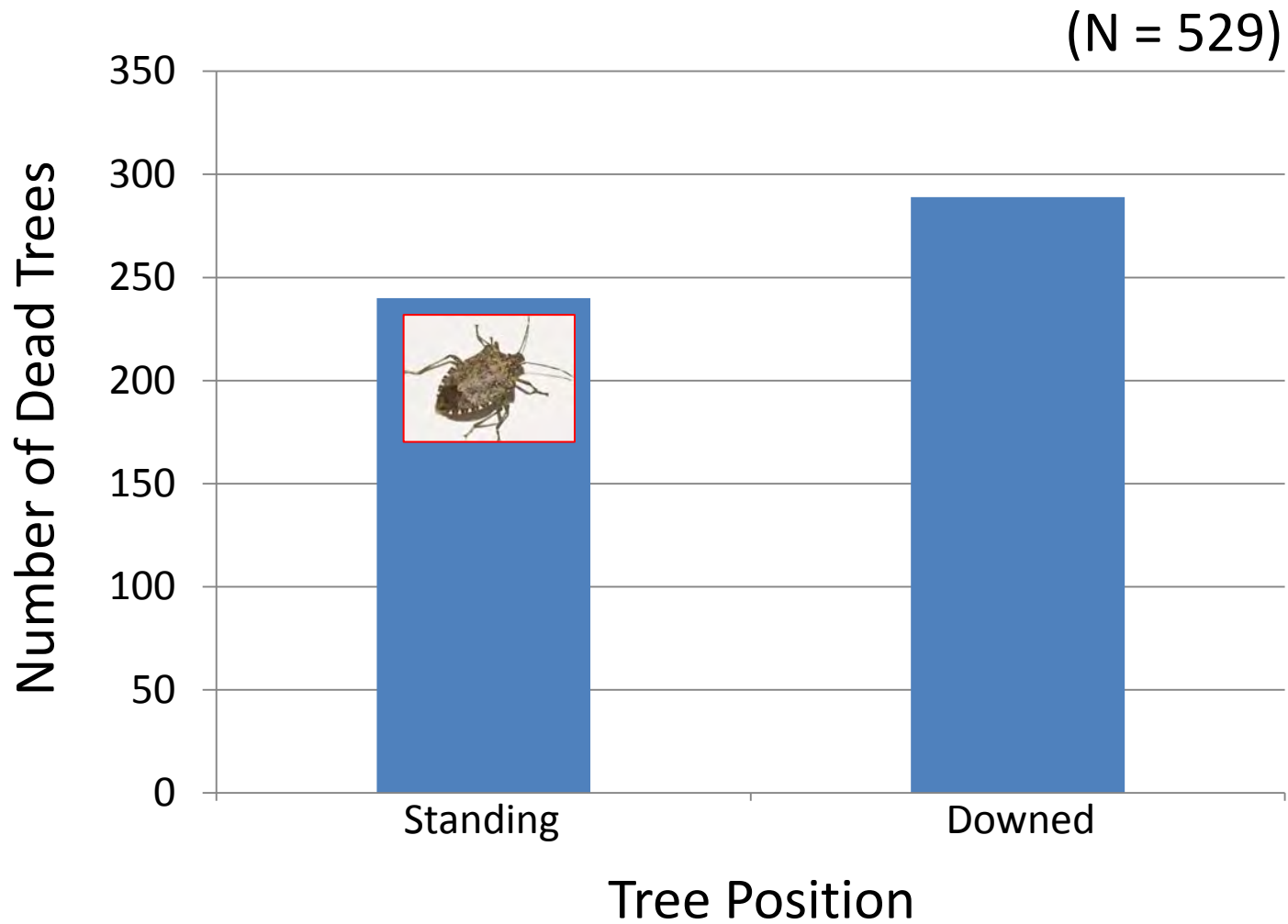


2. Dead tree position



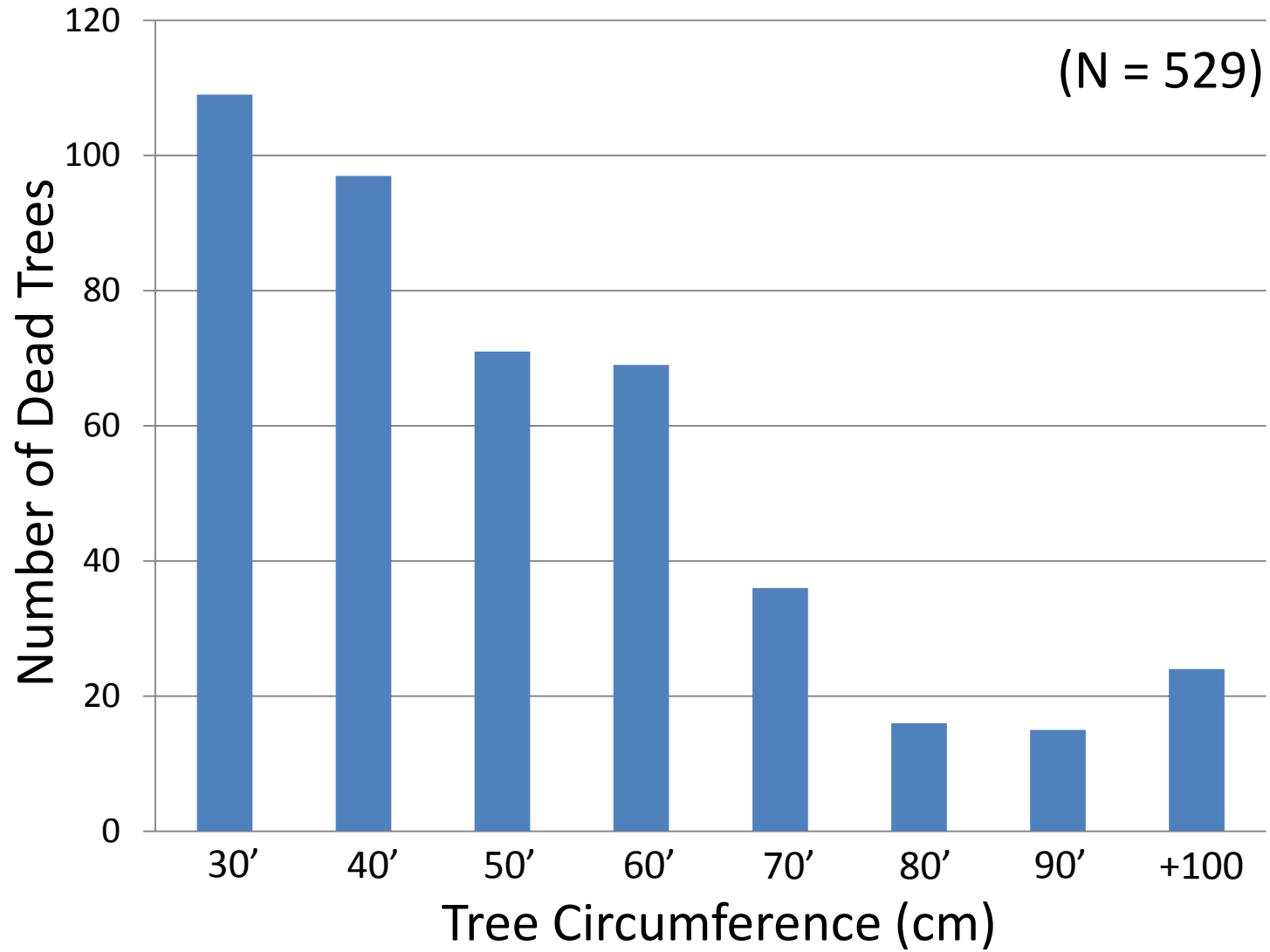


2. Dead tree position



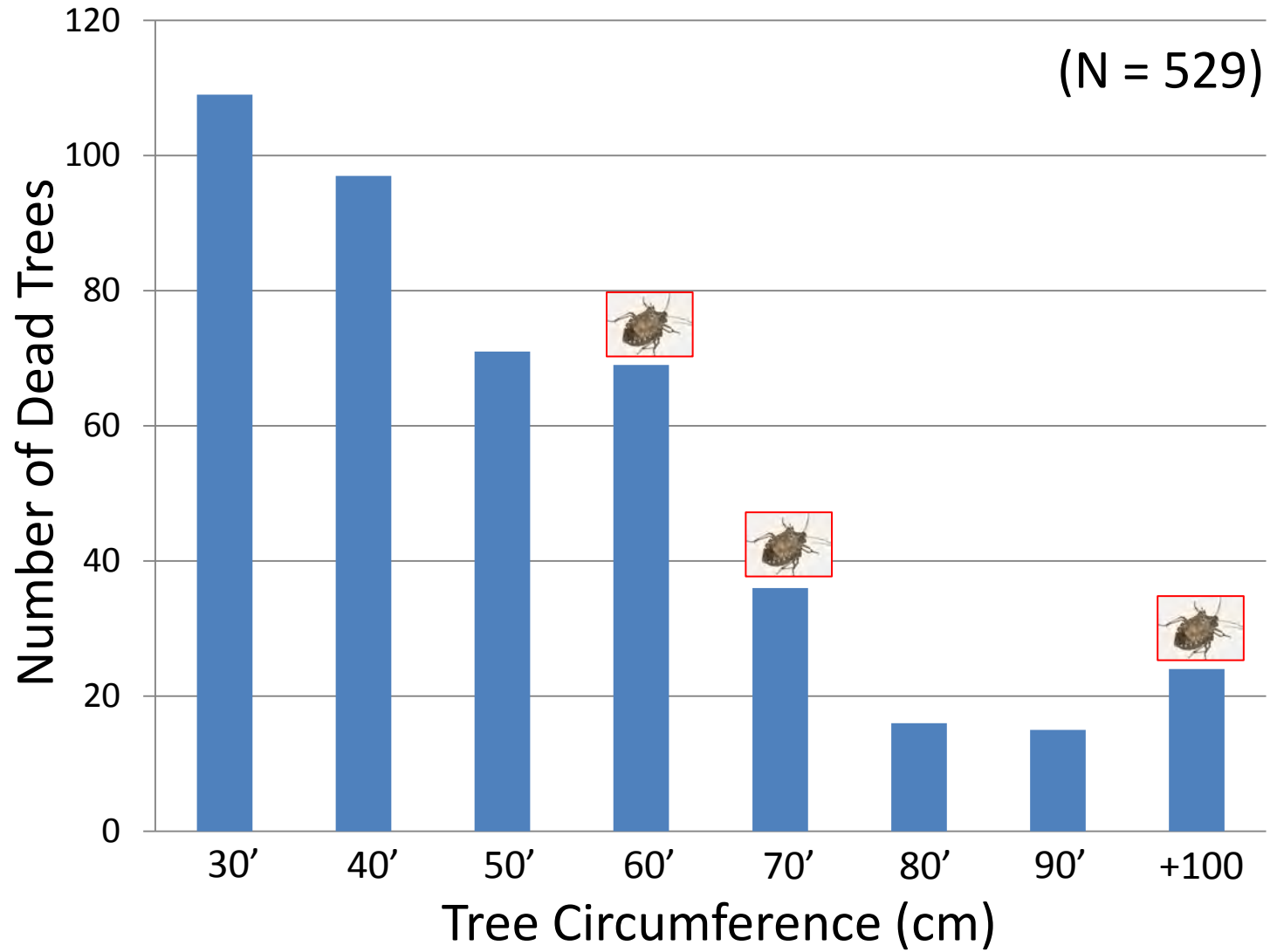


3. Dead tree size





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



BMSB Positive Trees

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



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

	<p>Transect Sampling</p>	<p>3%</p>
	<p>Tree-targeted Sampling</p>	<p>33%</p>

Leaf Litter Sampling





Leaf Litter Sampling

Table 1.—Overwintered Pentatomoidea, Coreidae, and Reduviidae trapped emerging from six habitats*

Species	No. of bugs trapped ^b						Total
	Woodland		Woods edge	Open			
	Deciduous	Pine		Dry	Wet	Kudzu	
Pentatomoidea							
<i>Euschistus servus</i> (Say)	9	3	6	29	45	23	115
<i>Euschistus tristigma</i> (Say)	53	3	15	2	11	2	86
<i>Acrosternum hilare</i> (Say)	42	0	4	0	0	0	46
<i>Podisus maculiventris</i> (Say)	12	1	4	0	0	0	17
<i>Dendrocoris humeralis</i> (Uhler)	16	0	0	0	0	0	16
<i>Brochymena arborea</i> (Say)	14	2	0	0	0	0	16
<i>Banasa calva</i> (Say)	12	0	0	0	0	0	12
<i>Holcostethus limbolarius</i> Stal	2	0	3	2	0	3	10
<i>Oebalus pugnax</i> (F.)	1	6	0	1	0	0	8
<i>Thyanta accerra</i> McAtee	0	0	1	3	2	0	6
<i>Thyanta calceata</i> (Say)	0	0	1	3	2	0	6
<i>Mormidea lugens</i> (F.)	0	0	0	0	6	0	6
<i>Neottiglossa cavifrons</i> Stal	0	0	0	0	5	0	5
<i>Hymenarcys nervosa</i> (Say)	0	0	0	0	0	4	4
<i>Nezara viridula</i> (L.)	4	0	0	0	0	0	4
<i>Stiretrus ancharago</i> (F.)	0	0	0	3	1	0	4
<i>Euschistus crassus</i> (Say)	0	1	0	0	1	0	2
<i>Trichopepla semivittata</i> (Say)	0	2	0	0	0	0	2
<i>Amaurochrous cinctipes</i> (Say)	0	0	0	0	1	0	1
<i>Banasa euchlora</i> Stal	1	0	0	0	0	0	1
Scutelleridae							
<i>Stethaulax marmorata</i> (Say)	3	0	0	1	0	0	4
<i>Diolcus chrysorrhoeus</i> (F.)	1	0	0	0	0	0	1
<i>Chelysoma guttatum</i> (Herrich-Schaeffer)	0	0	0	1	0	0	1
Cydnidae							
<i>Sehirus cinctus</i> (Palisot de Beauvois)	1	0	0	2	1	16	20
Corimelaenidae							
<i>Galgupha loboprostethia</i> Sailer	0	0	0	7	0	0	7
<i>Galgupha</i> sp.	0	0	0	0	0	1	1
<i>Corimelaena lateralis</i> (F.)	0	0	0	0	1	0	1
Coreidae							
<i>Leptoglossus oppositus</i> (Say)	31	0	0	0	0	0	31
<i>Alydus pilosulus</i> (Herrich-Schaeffer)	0	0	0	16	1	0	17
<i>Alydus eurinus</i> (Say) adults, nymphs	0	0	0	12	0	0	12
<i>Leptoglossus phyllopus</i> (L.)	0	0	2	2	2	0	6
<i>Acanthocephala femorata</i> (F.)	2	0	1	1	1	0	5
<i>Acanthocephala terminalis</i> (Dallas)	2	0	1	0	0	0	3
<i>Anasa armigera</i> (Say)	0	0	0	2	0	0	2
<i>Leptoglossus corculus</i> (Say)	1	0	0	0	0	0	1
<i>Leptoglossus fulvicornis</i> (Westwood)	1	0	0	0	0	0	1
<i>Acanthocephala declivis</i> (Say)	1	0	0	0	0	0	1
<i>Megalotomus quinquespinosus</i> (Say)	0	0	0	0	1	0	1
Reduviidae							
<i>Zelus exsanguis</i> (Stal) nymphs	8	0	0	0	1	0	9
<i>Sinea spinipes</i> (Herrich-Schaeffer)	7	1	0	0	0	0	8
<i>Stenopoda cinerea</i> Laporte	0	0	0	8	0	0	8
<i>Zelus cervicallis</i> Stal	5	0	0	0	0	0	5
<i>Rocconota annulicornis</i> (Stal)	2	0	0	1	0	0	3
<i>Sinea diadema</i> (F.)	2	0	0	0	0	0	2
<i>Rhinginia cruciata</i> (Say)	2	0	0	0	0	0	2
<i>Pnirontis languida</i> Stal	0	0	0	0	2	0	2
<i>Pygolampis pectoralis</i> (Say)	0	1	0	0	0	0	1

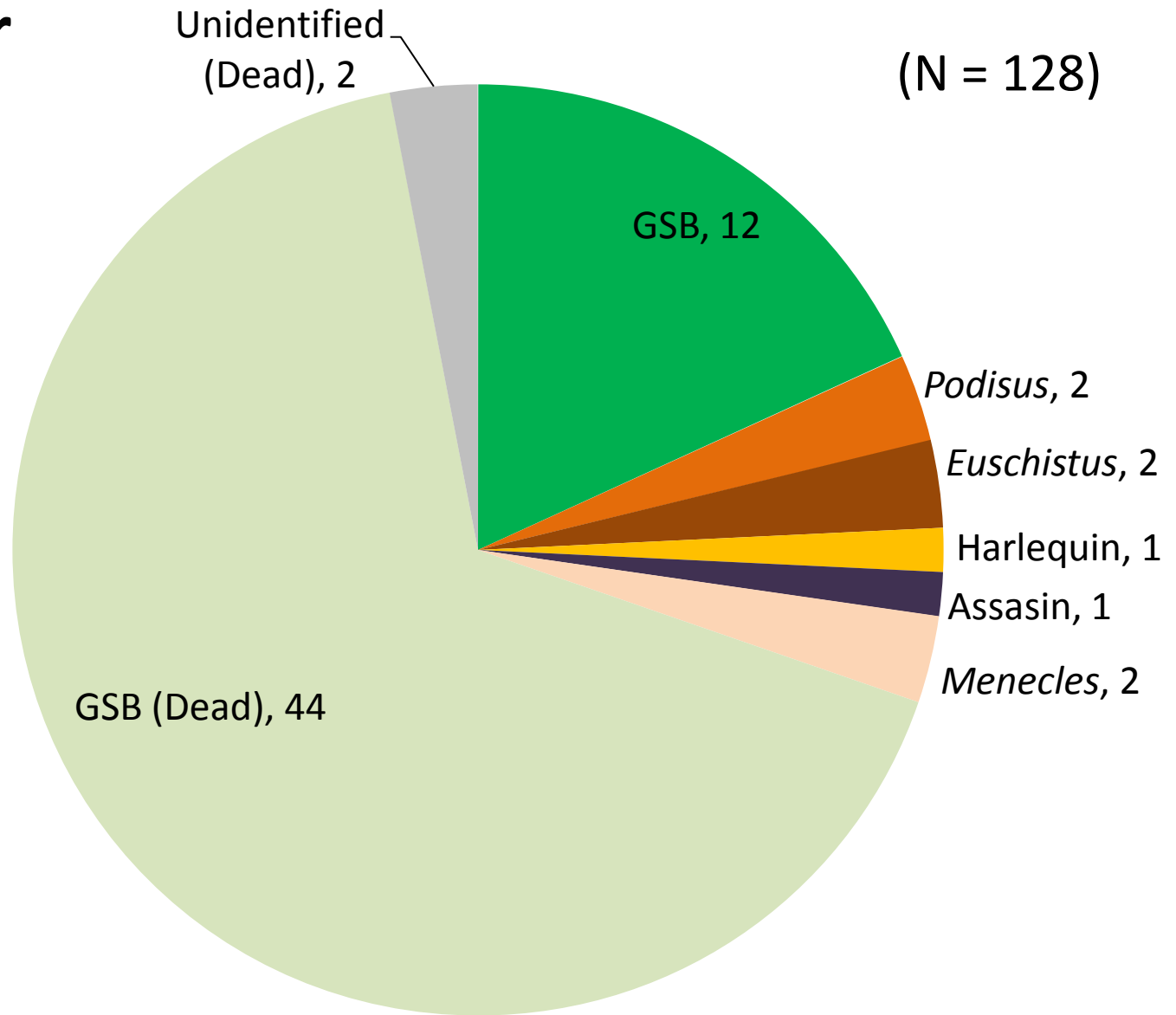
* Blackville, S. C., 1976 through 1978.

^b Traps consisted of wire screened cones with 0.47-liter jars on top and nylon screened cages (1.2 by 1.2 by 1.5 m). Total area covered each year was 86.9 (1976), 118.4 (1977), and 127.3 m² (1978).

Jones & Sullivan
(1981)

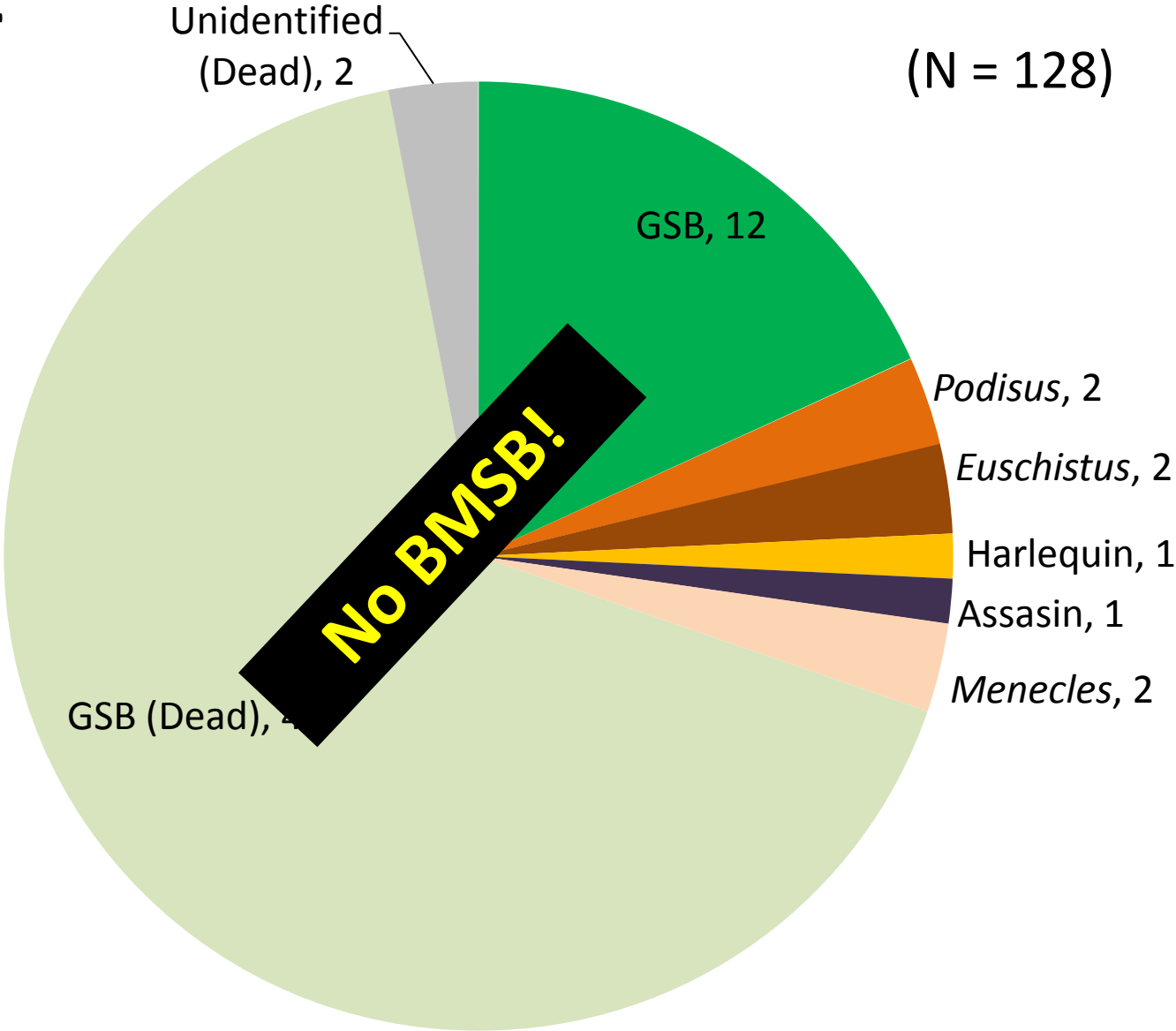


Leaf Litter Sampling





Leaf Litter Sampling





Goal:

- ✓ 1. Do BMSB overwinter in natural landscapes?
- ✓ 2. What kind of structure do BMSB use as overwintering site in natural landscapes?
3. Does the overwintering BMSB population in natural landscapes pose a risk to agriculture?



Goal:

✓ 1. Do BMSB overwinter in natural landscapes?

✓ 2. What kind of structure do BMSB use as overwintering site in natural landscapes?

Ongoing

3. Does the overwintering BMSB population in natural landscapes pose a risk to agriculture?

Does the overwintering BMSB population in natural landscapes pose the risk to agriculture?



4864 ft

Image © 2011 GeoEye
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Image USDA Farm Service Agency

Google earth

Imagery Date: 5/25/2010

39°27'34.75" N 78°03'01.36" W elev 718 ft

Eye alt 21831 ft

Does the overwintering BMSB population in natural landscapes pose the risk to agriculture?



Arden Nolville Rd

Image © 2011 GeoEye
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Does the overwintering BMSB population in natural landscapes pose the risk to agriculture?

BMSB Mobility



Arden Nolville Rd

Image © 2011 GeoEye
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Eye alt 5 21831 ft

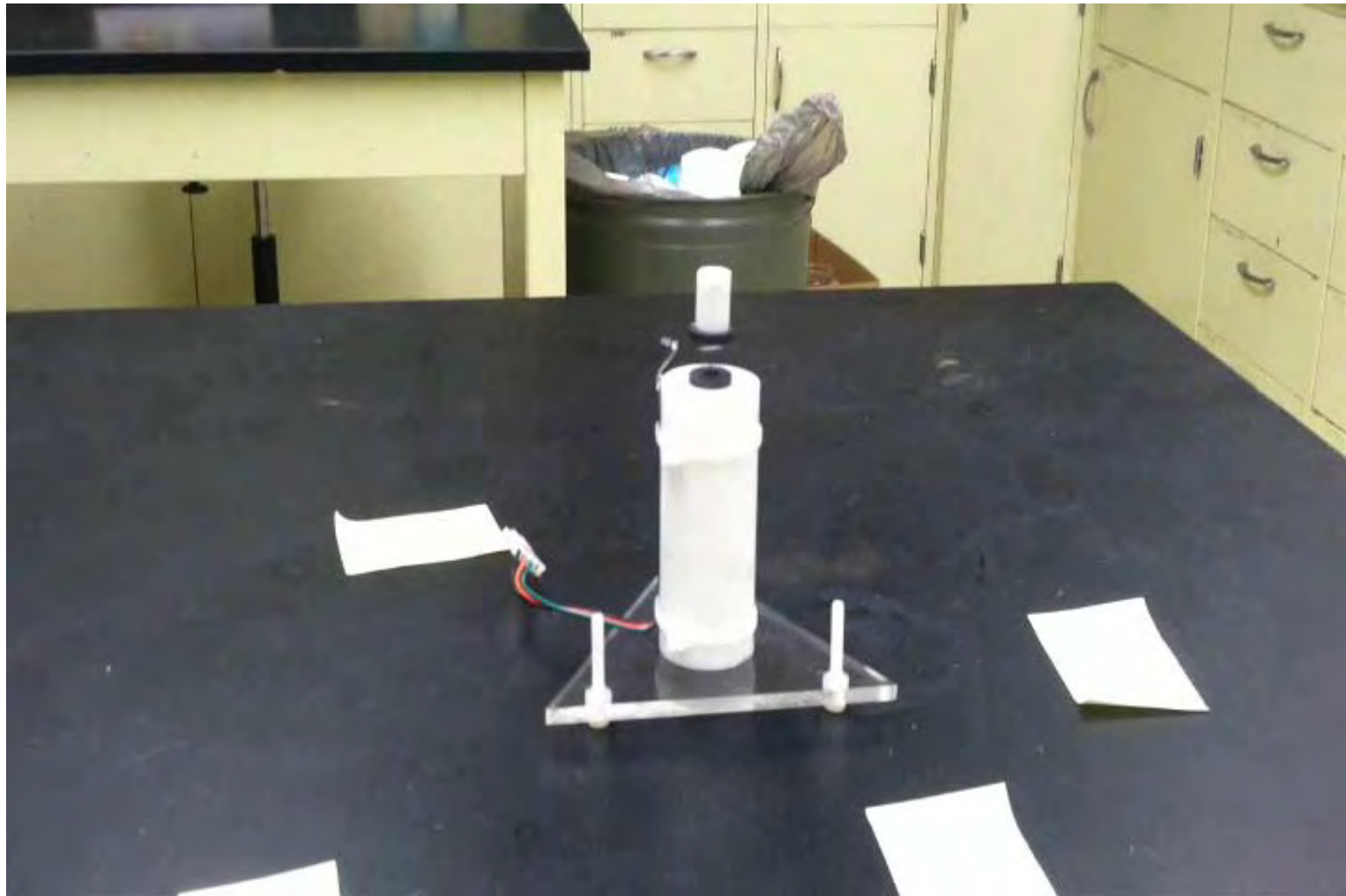
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Measuring BMSB mobility (1): Flight mill

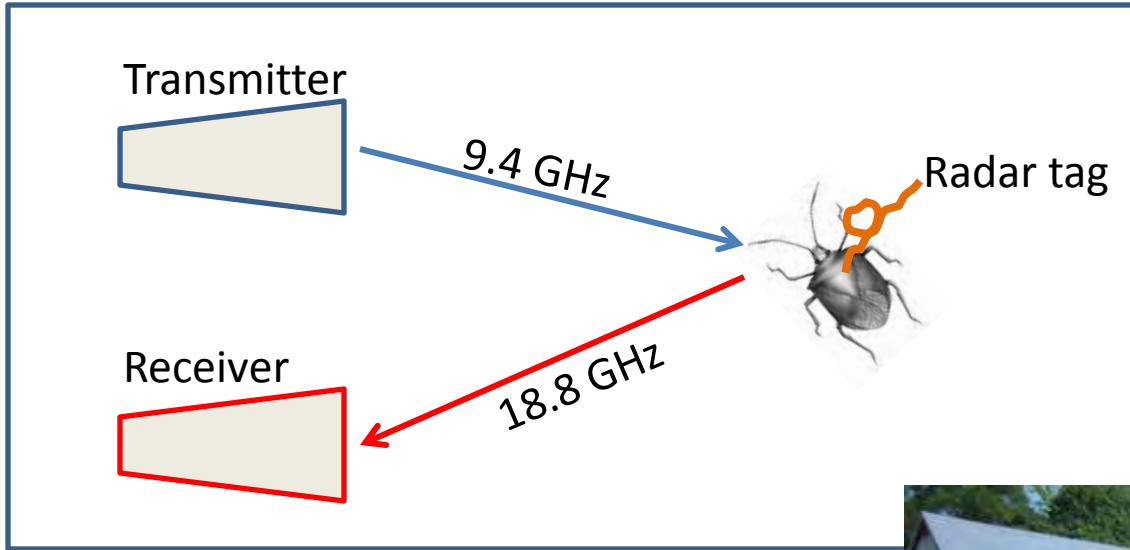


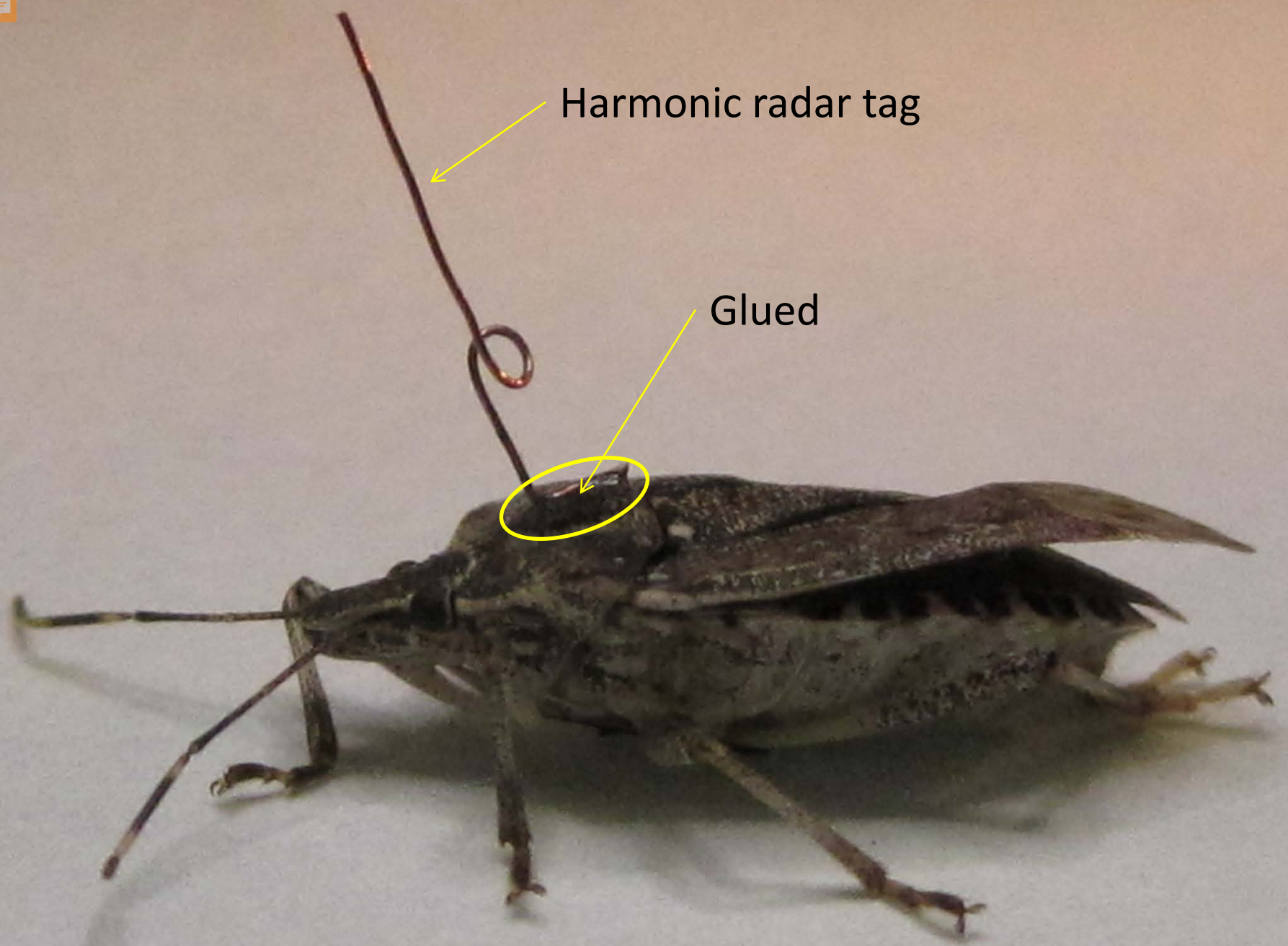


Measuring BMSB mobility (1): Flight mill



Measuring BMSB mobility (2): Harmonic radar





Harmonic radar tag

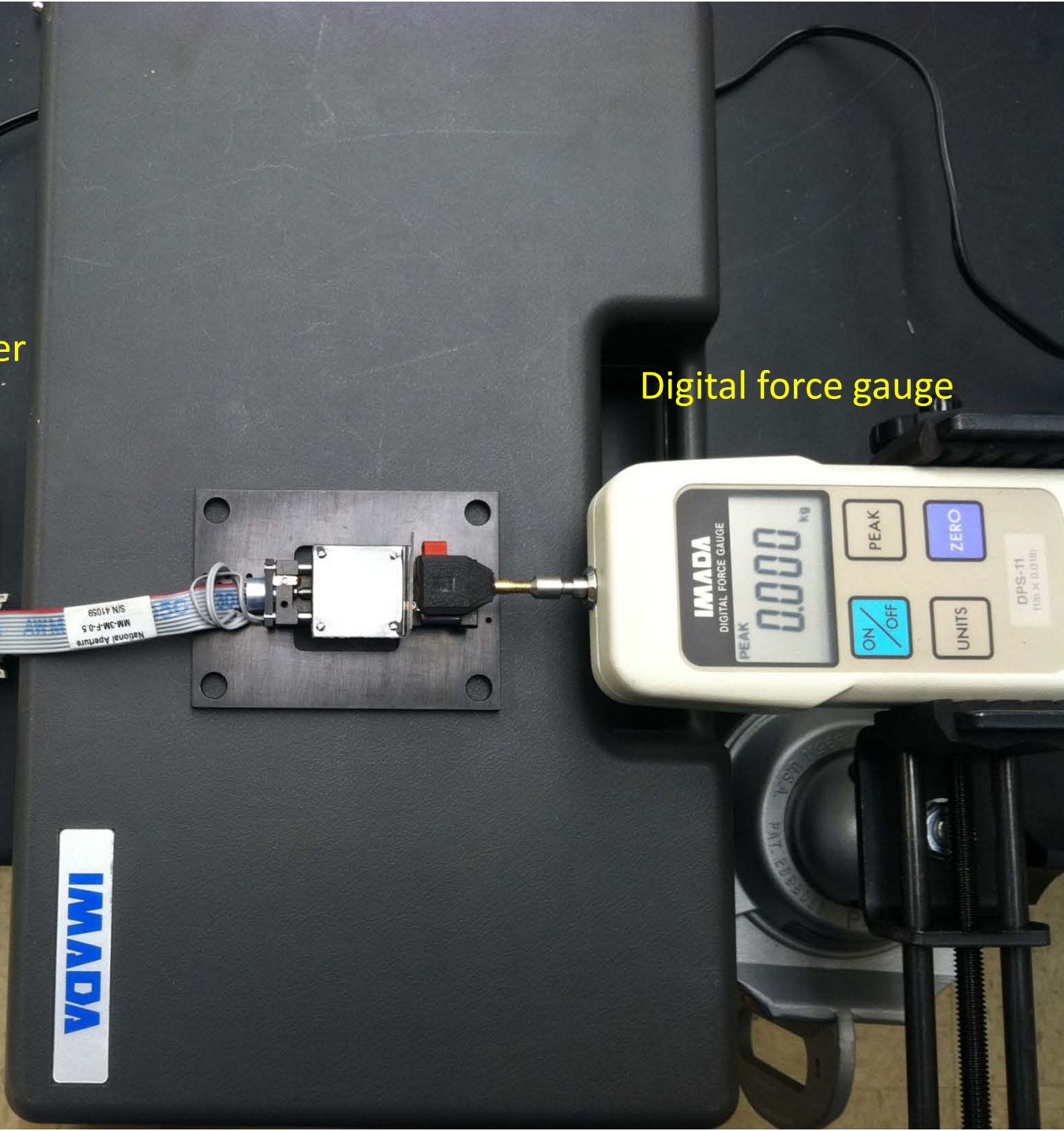
Glued

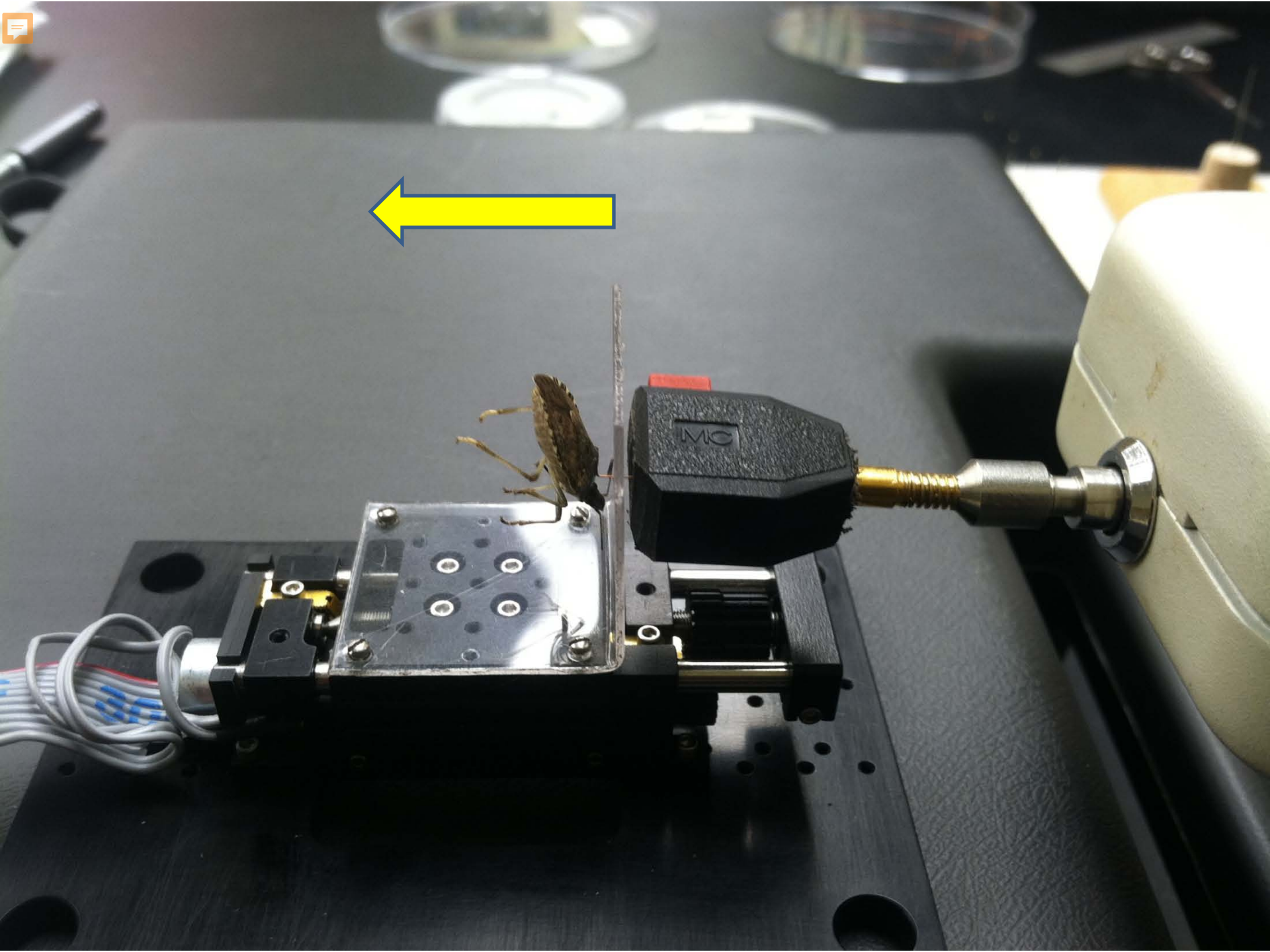


Pulling motor controller



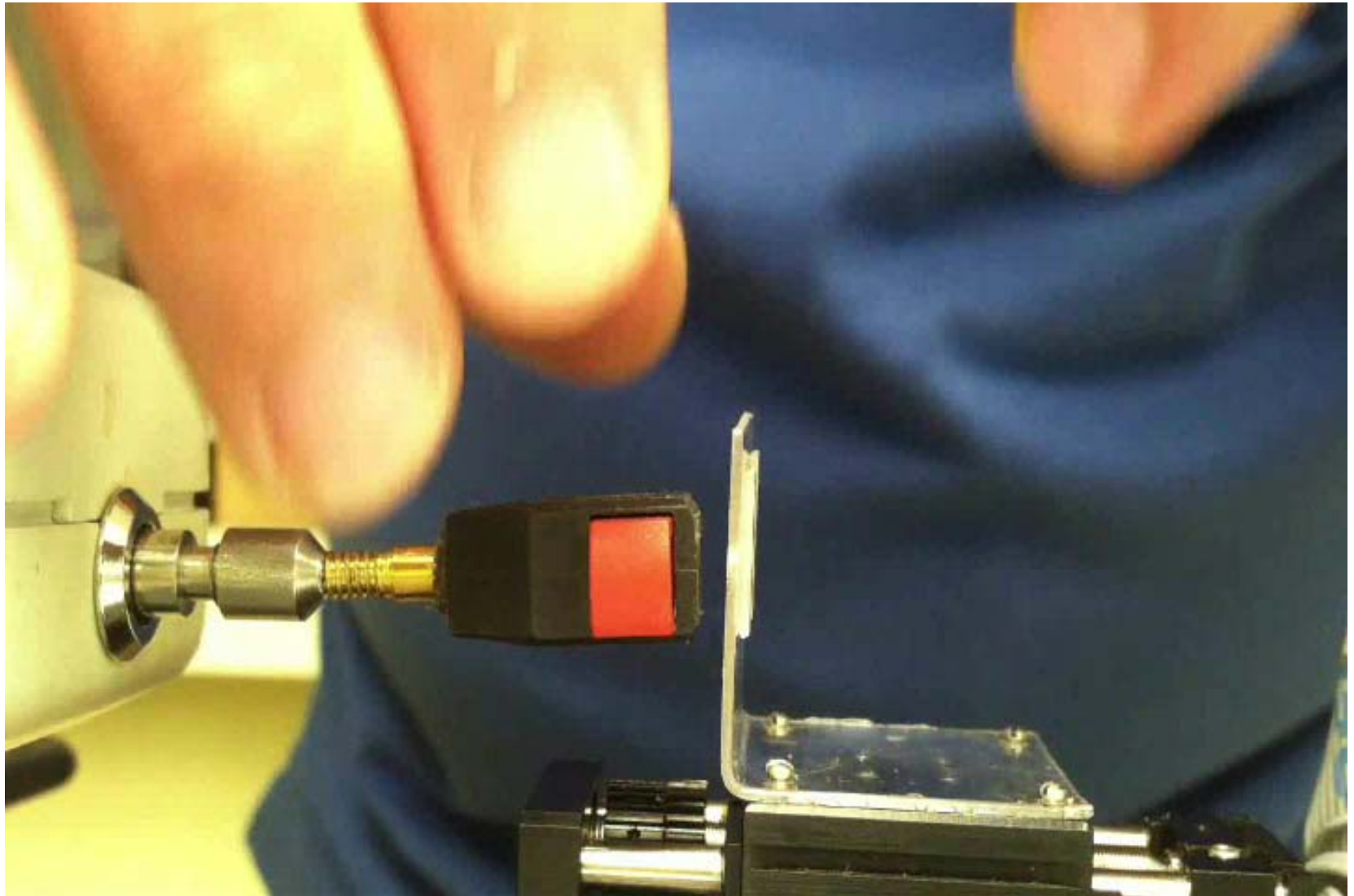
Digital force gauge







The strength of bond between radar tag and bug

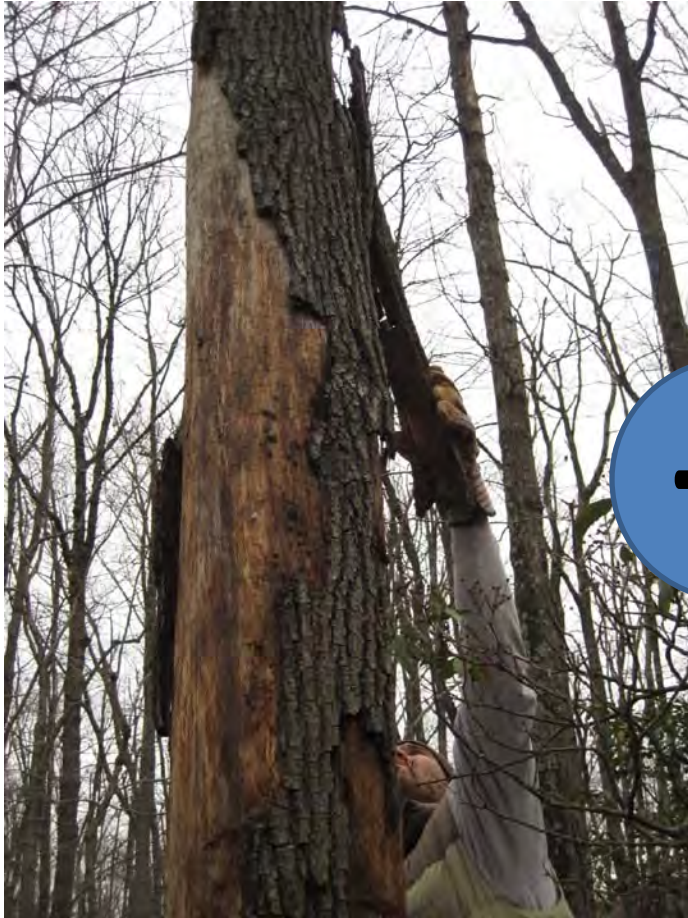




VISUALIZER



Does the overwintering BMSB population in natural landscape pose the risk to agriculture?

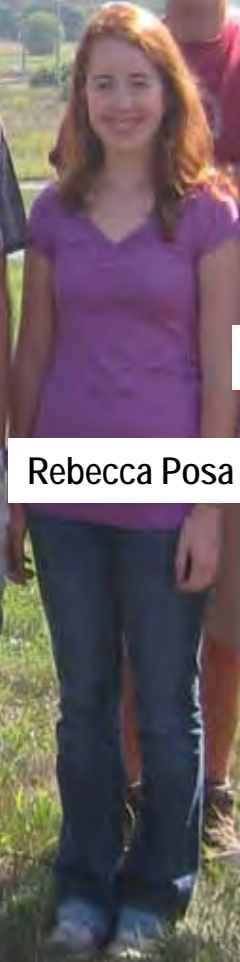
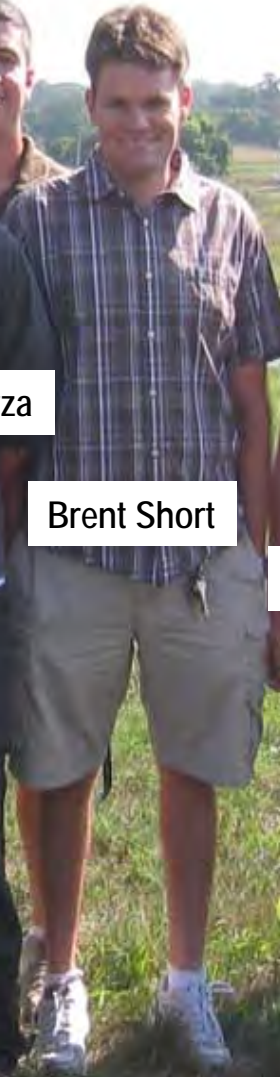
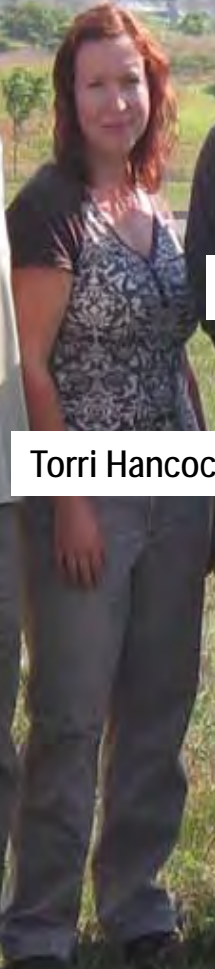
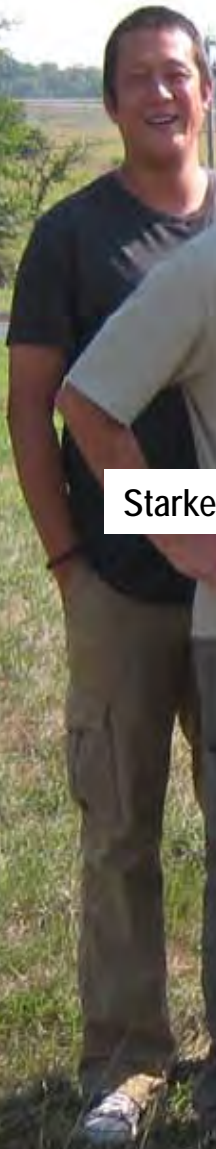


*How did we sample 1,400
dead trees over the winter?*

Doo-Hyung Lee

Sean Wiles

John Cullum



Starker Wright

Torri Hancock

Cameron Scorza

Brent Short

Rebecca Posa

Tracy Leskey

*How can we sample more than
1,400 over this coming winter?*

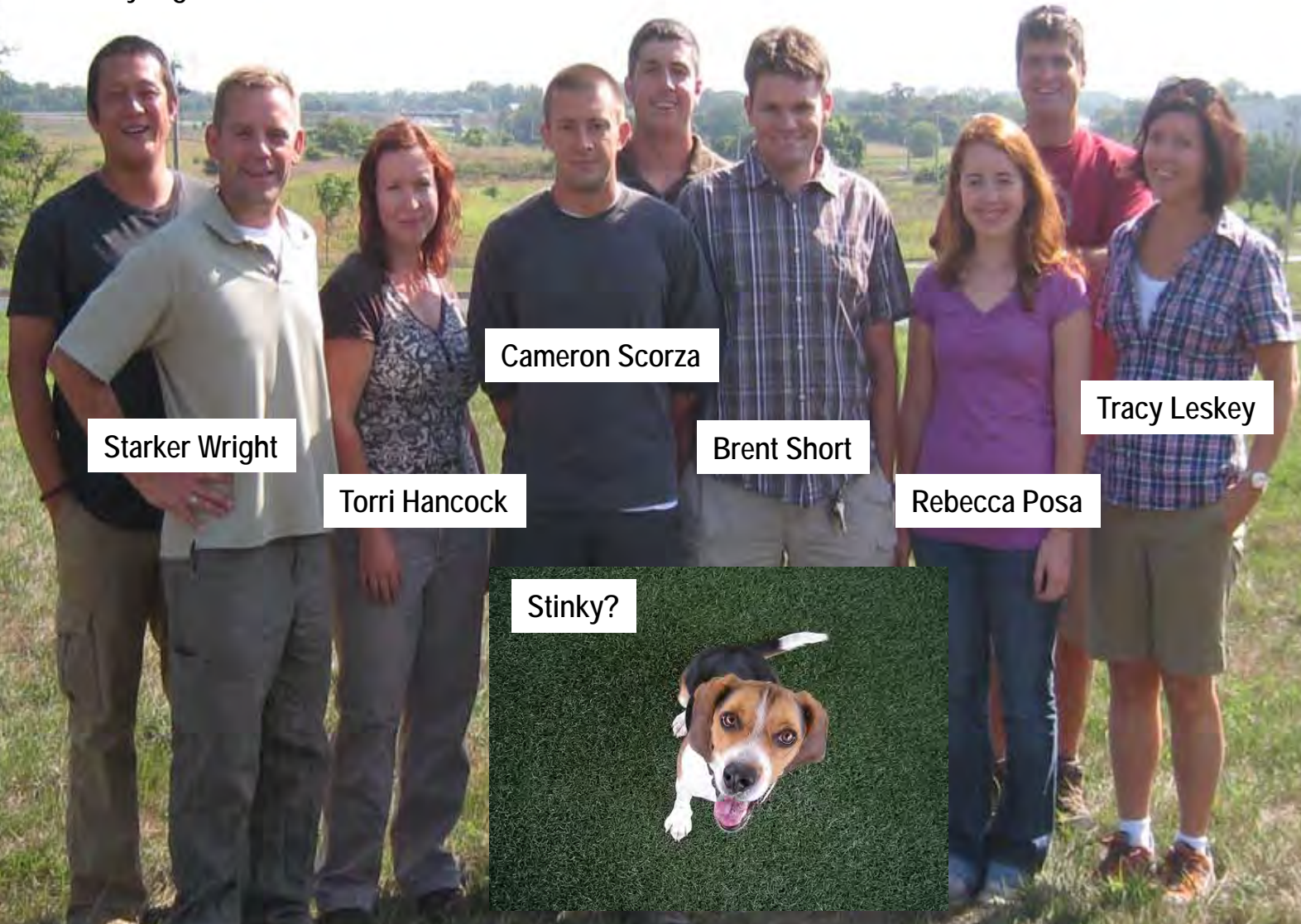


Acknowledgements

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Stinky?



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