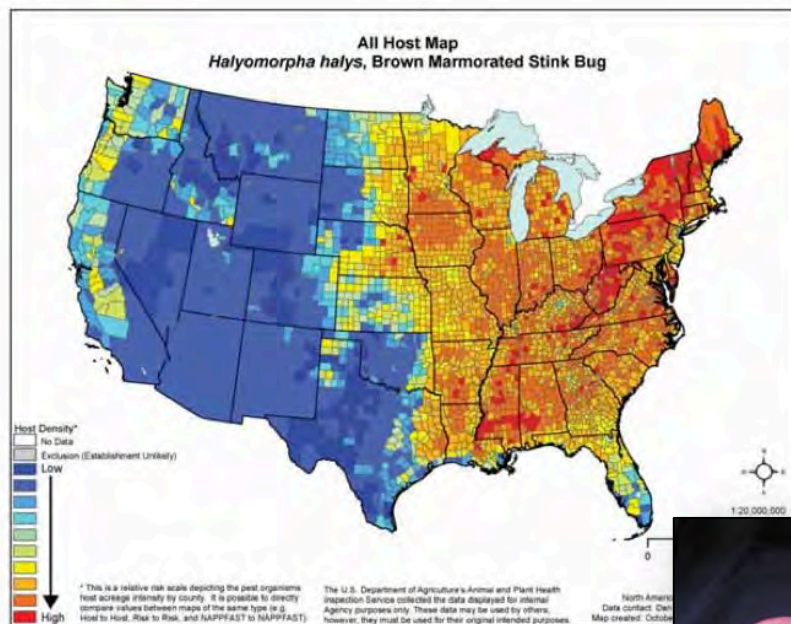


Brown Marmorated Stink Bug, *Halyomorpha halys* (Stål): What Can We Expect in WNY Tree Fruit in 2016.



Golden Delicious Apple With BMSB Feeding Injury, Campbell Hall, NY October - 2012



5 bins: Range from 38 – 57% damage



Pink Lady Apple With BMSB Feeding Injury, Campbell Hall, NY November - 2012

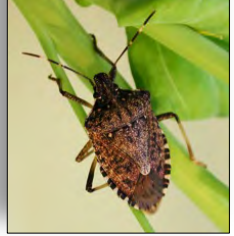


BMSB Feeding Injury Assessment, Hudson Valley Research Lab, NY 2012



BMSB in Western New York ?

Biology



Overwintering Success

Monitoring

Management

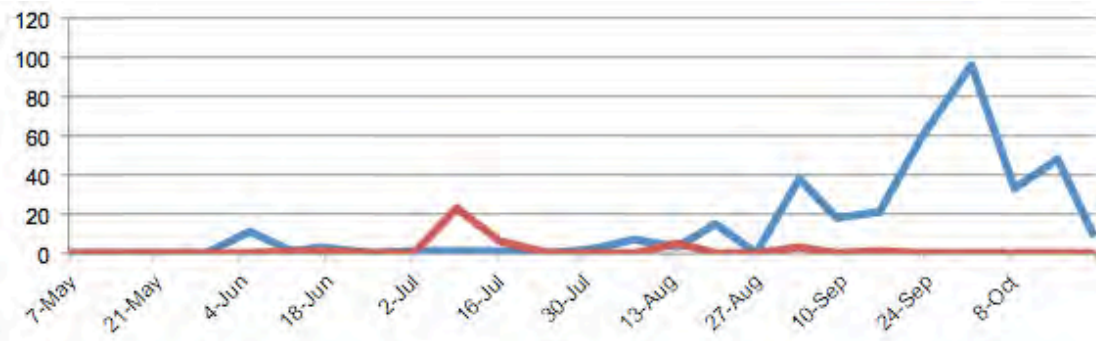
BMSB Establishment in the US

- First BMSB specimen in 1998 from Allentown, PA
- NYC boroughs in 2007 (Hoebeke. R)
- Hudson Valley urban structures in 2008
- Citizen Science project began in Sept 2010
- >800 submissions received as of Sept. 2015.
- Participant surveys suggest increasing populations in urban environment.

BMSB Establishment in the US

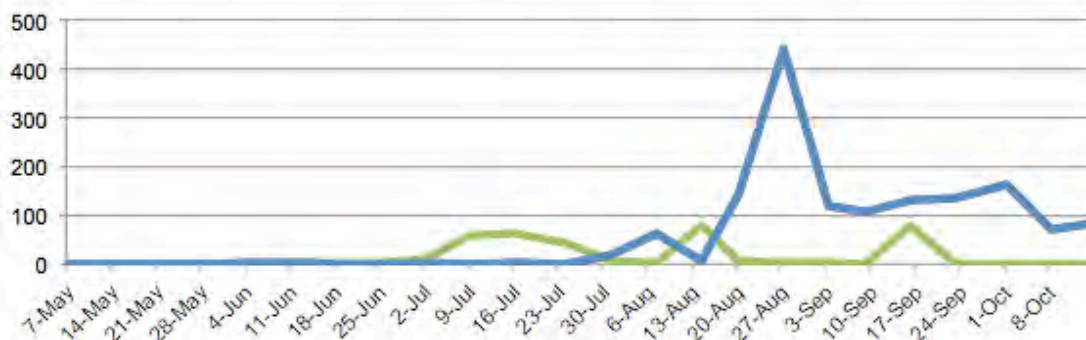
- **BMSB is a arboreal insect pest: Primarily deciduous trees**
- **Overwinters primarily in forest, also man made structures**
- **Highest numbers observed on Tree of Heaven in summer**
- **Can succeed on Catalpa, Black Walnut, Sugar Maple, Oak, Cherry, Ash, Elm, Sycamore**
- **Isolated pockets throughout the Hudson Valley**
- **Dramatic regional differences in population density**

BMSB Monitoring: 3 Diverse NY Orchards, 2013



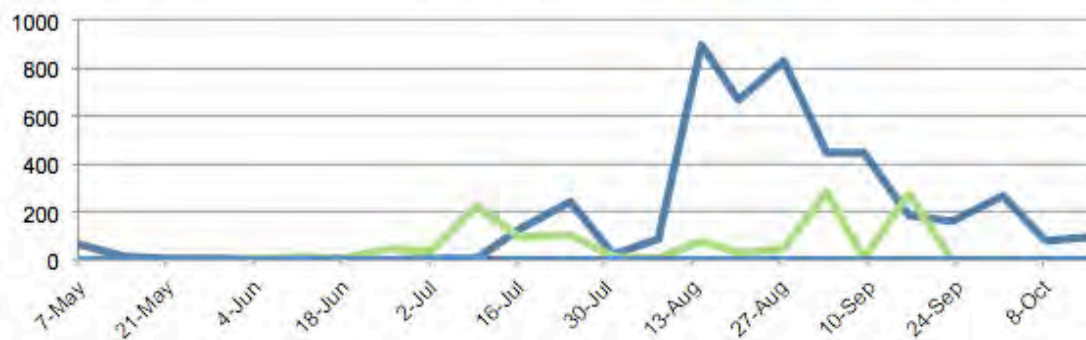
Campbell Hall, NY

Adult
Nymph



Milton, NY

Adult
Nymph



Marlboro, NY

Adult
Nymph



BMSB Establishment in the US

- BMSB is a arboreal insect pest: Primarily deciduous trees
- Highest numbers observed on Tree of Heaven, Catalpa, Black Walnut
- Can succeed on Sugar Maple, Oak, Cherry, Ash, Elm, Sycamore
- Isolated pockets throughout the Hudson Valley
- Dramatic regional differences in population density
- **Edge trap captures only indicate presence and POTENTIAL fruit injury**
- **High BMSB populations along the orchard edge have not consistently proved to require management.**

Factors Contributing to Invasive Insect Success

- **Introduced population** (the larger the number, the higher the probability of establishment).
- **Aggressiveness** (how well it out competes native species)
- **Rapid dispersal** (adult flight, immature crawling)
- **Ecological niche:** Suitable climate; Available Hosts for Food, Shelter
- **Absence of natural enemies** (parasites and predators)

Factors Contributing to Invasive Insect Success

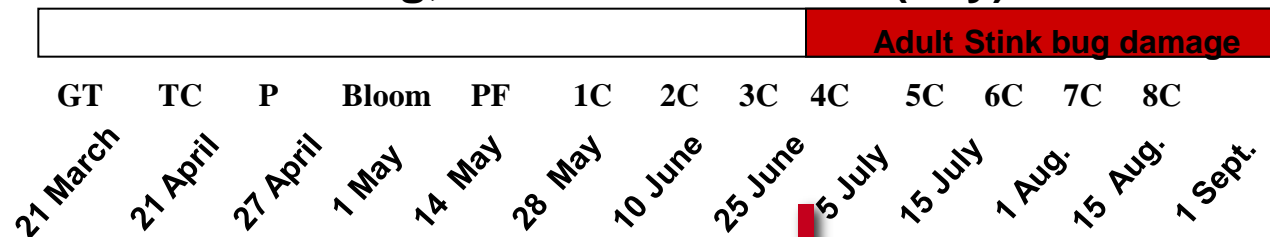
- **Introduced population** (the larger the number, the higher the probability of establishment).
- **Aggressiveness** (how well it out competes native species)
- **Rapid dispersal** (adult flight, immature crawling)
- **Ecological niche:** Suitable climate; Available Hosts for Food, Shelter
- **Absence of natural enemies** (parasites and predators)
- **Many generations** (can produce high populations)
- **Overwintering Success** (potential for early season damage)

Hudson Valley Stink Bug Complex

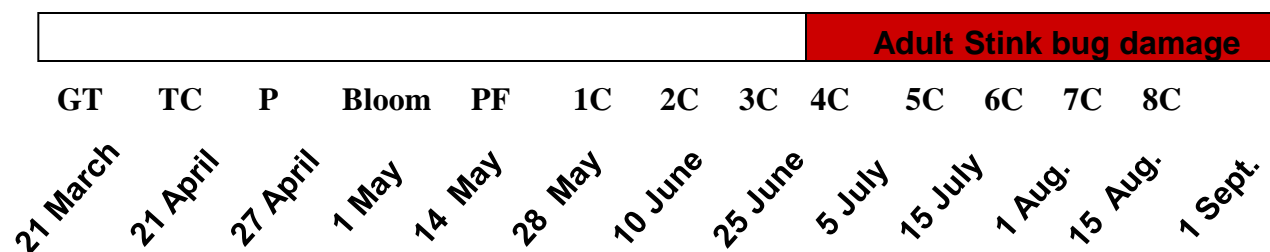
Species of economic importance



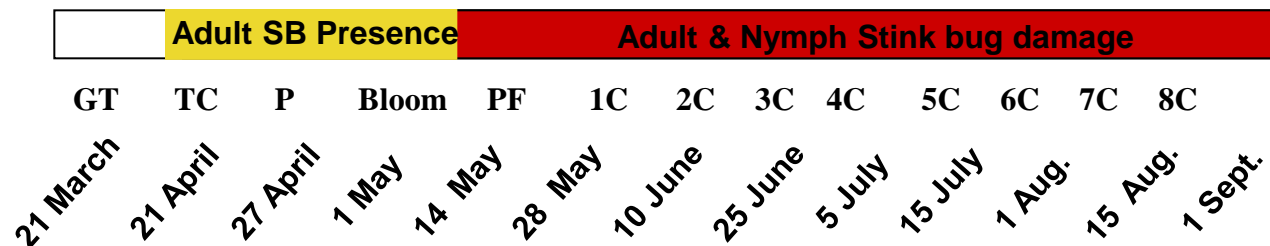
Brown Stink Bug, *Euschistus servus* (Say)



Green Stink Bug, *Acrosternum hilare* (Say).



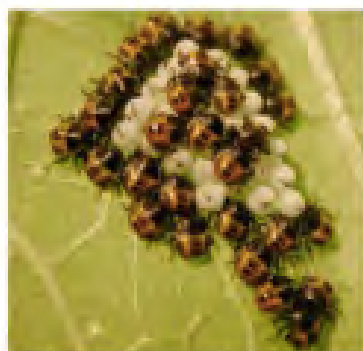
Brown marmorated stink bug, *Halyomorpha halys* (Stål)



BMSB: Insect Biology



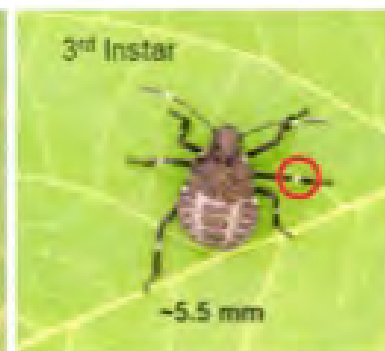
Eggs: Average 28/cluster; light green to white



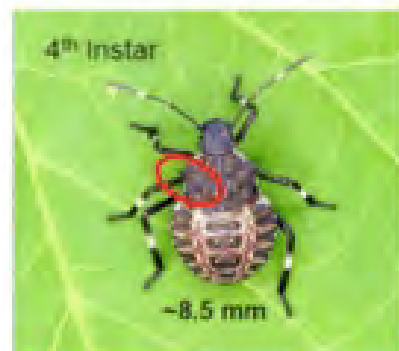
1st instar: black & red; cluster near eggs



2nd instar: striped antennae



3rd instar: striped antennae and legs



4th instar: thoracic spur striped antennae & legs



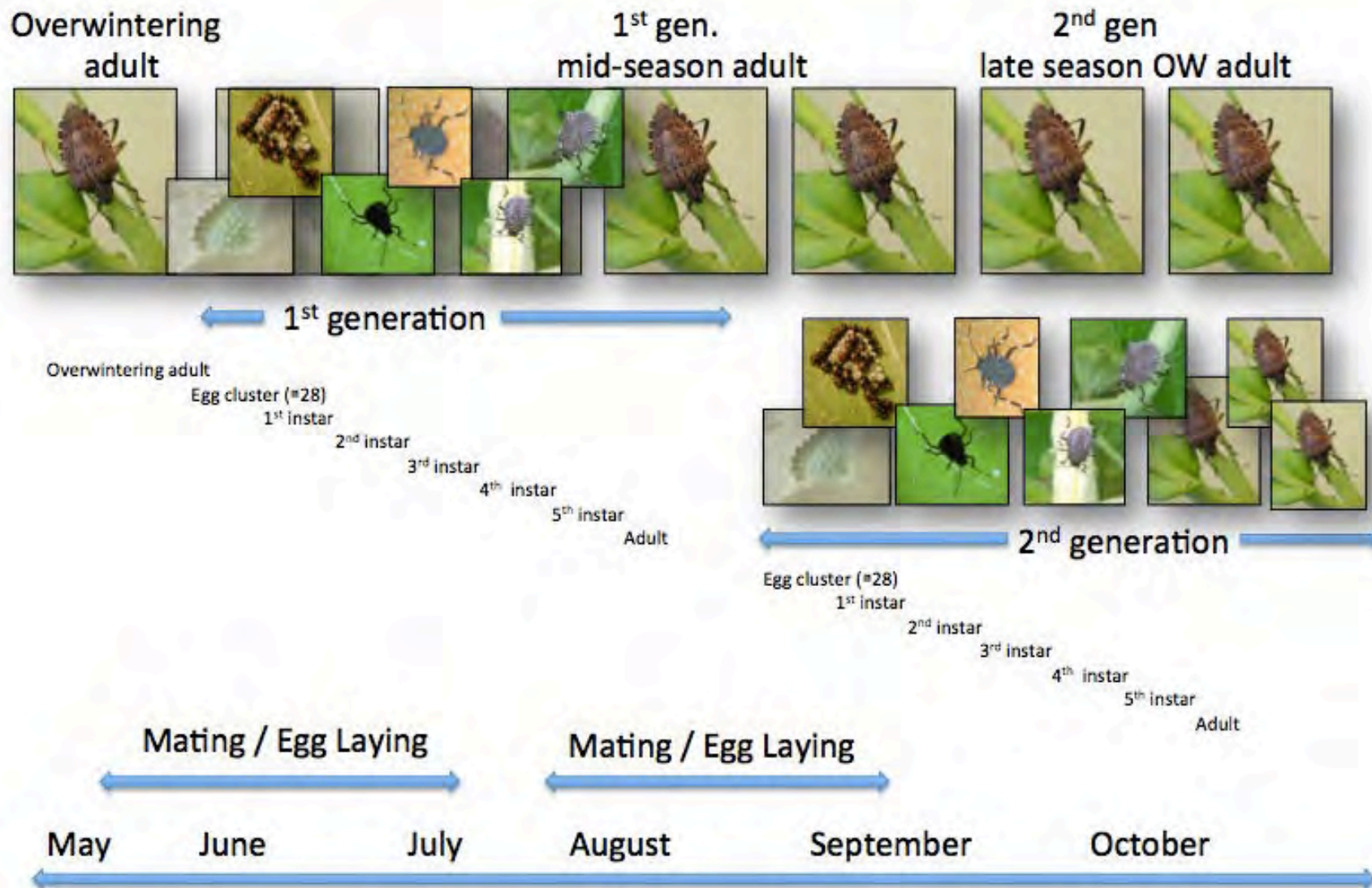
5th instar: wing pads striped antennae & legs



BMSB Adults: red eyes, 4 cream colored dots on shoulders; banding on legs and antenna, smooth blunt shoulders. Banded abdomen; 14 -17 mm in length.



BMSB Biology: 2 Generations in the HV in 2012



Factors for BMSB Success: # of Generations

- **Sunlight / Day length** (BMSB adult mating)
 - **13-14h day length** for mating and egg laying to begin
 - Geneva, NY April 29th – Aug 13th
 - HVRL Highland May 1st – Aug. 11th



Factors for BMSB Success: # of Generations

- **Degree Day Accumulations**
 - It requires **538 degree days** (DD – based 50°F) to develop from egg to adult.
 - An additional **148 DD** are required for female maturation **at 77°F**.
 - Total of **686 DD₅₀** for 1 generation;
 - **1224 DD₅₀** for a **2nd** complete the adult **OW** population



Factors for BMSB Success: # of Generations

- **Degree Day Accumulations**

- 686 DD₅₀ for 1 generation; **1224DD₅₀ for a 2nd complete OW gen.**
- **Highland** (*from May 1 – Aug. 11th*)
 - **2012: 1990.9 DD₅₀* (severe damage in Sept-Nov 15th)**
 - 2014: 1821.9 DD₅₀
 - 2015: 1949.6 DD₅₀



Factors for BMSB Success: # of Generations

- **Degree Day Accumulations**

- 686 DD₅₀ for 1 generation; **1224DD₅₀ for a 2nd complete OW gen.**
- **Highland** (*from May 1 – Aug. 11th*)
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 - 2014: 1821.9 DD₅₀
 - 2015: 1949.6 DD₅₀
- **Geneva**
 - 2015: 1759.6 DD₅₀



Factors for BMSB Success: # of Generations

- **Early Degree Day Accumulations**
 - 686 DD₅₀ for 1 generation
 - **Geneva, NY: 2015**
 - 408.4 DD₅₀ (*from Jan. to May 1*)
 - **853.2** DD₅₀ (*from May 1 – June. 30th*)
 - **Highland, NY: 2015**
 - 476.4 DD₅₀ (*from Jan. to May 1*)
 - **982.9** DD₅₀ (*from May 1 – June. 30th*)
 - **Biglerville, PA: 2015**
 - 549.0 DD₅₀ (*from Jan. to May 1*)
 - **1147.0** DD₅₀ (*from May 1 – June. 30th*)



Factors for BMSB Success: # of Generations

- **Early Degree Day Accumulations**
 - 686 DD₅₀ for 1 generation
 - **Geneva, NY: 2015** – *Slow start for BMSB development*
 - 408.4 DD₅₀ (*from Jan. to May 1*)
 - **853.2** DD₅₀ (*from May 1 – June. 30th*)
 - **Highland, NY: 2015**
 - 476.4 DD₅₀ (*from Jan. to May 1*)
 - **982.9** DD₅₀ (*from May 1 – June. 30th*)
 - **Biglerville, PA: 2015**
 - 549.0 DD₅₀ (*from Jan. to May 1*)
 - **1147.0** DD₅₀ (*from May 1 – June. 30th*)



Factors for BMSB Success: # of Generations

- **Degree Day Accumulations**
 - **Early low Degree Day accumulations likely inhibit the start of the development of BMSB**
 - **Requiring longer periods of time to reach maturation for 1st generation development**
 - **Late season sunlight requirements then become the limiting factor for 2nd generation in Northern climates**
 - ***In northern regions, BMSB will likely have one generation / yr.***

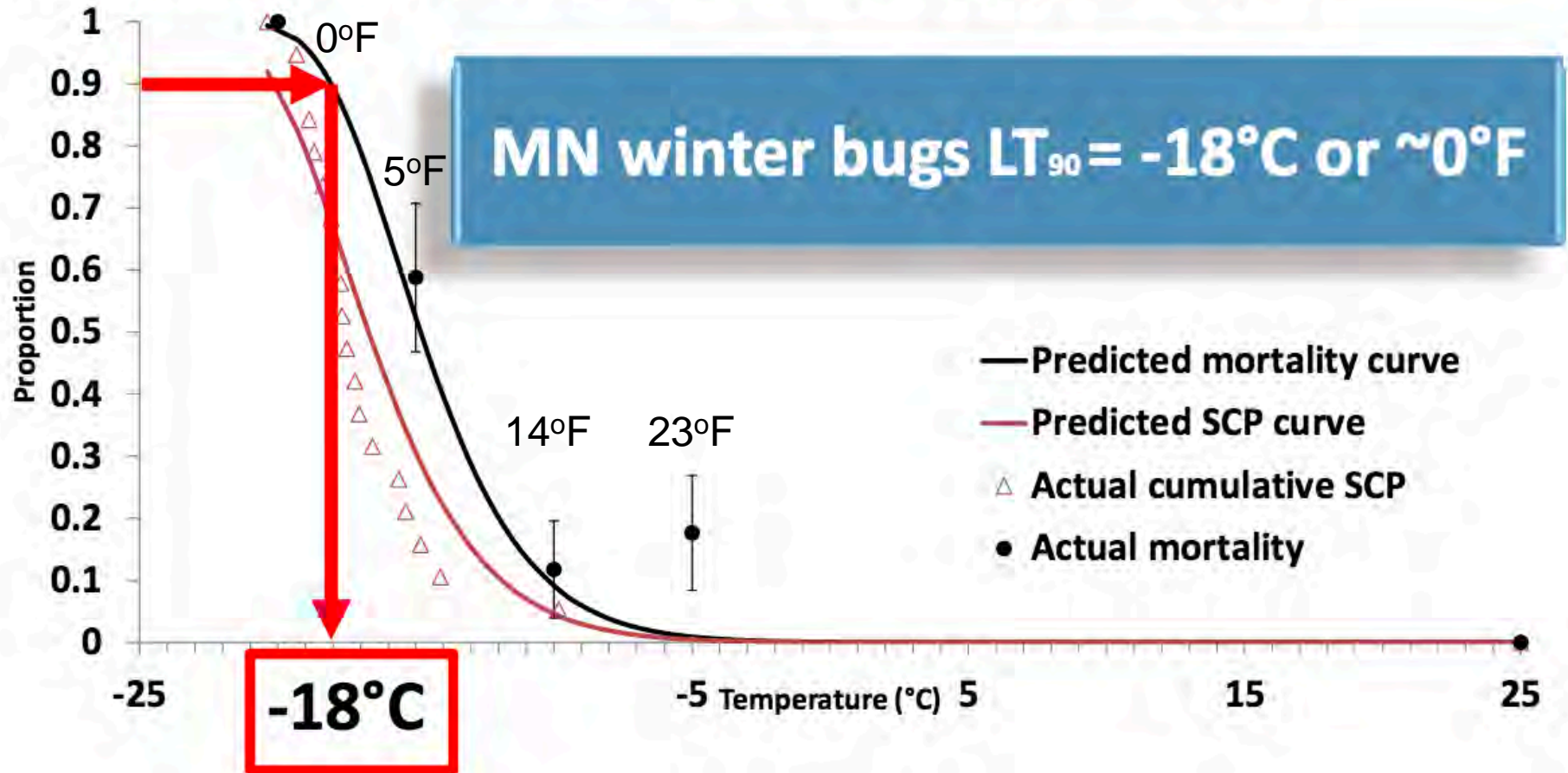


Factors for BMSB Success: Overwintering

- **Overwintering habitat**
 - A smaller percent of the population will aggregate in buildings where temperature extremes allow for survival in northern climates
 - In woodland habitat, temperatures below -18°C or -0.4°F will kill 90% of the population (Kuhar, T. 2016)

Factors for BMSB Success: Overwintering

Predicted and observed BMSB: Cumulative SCP & proportion mortality

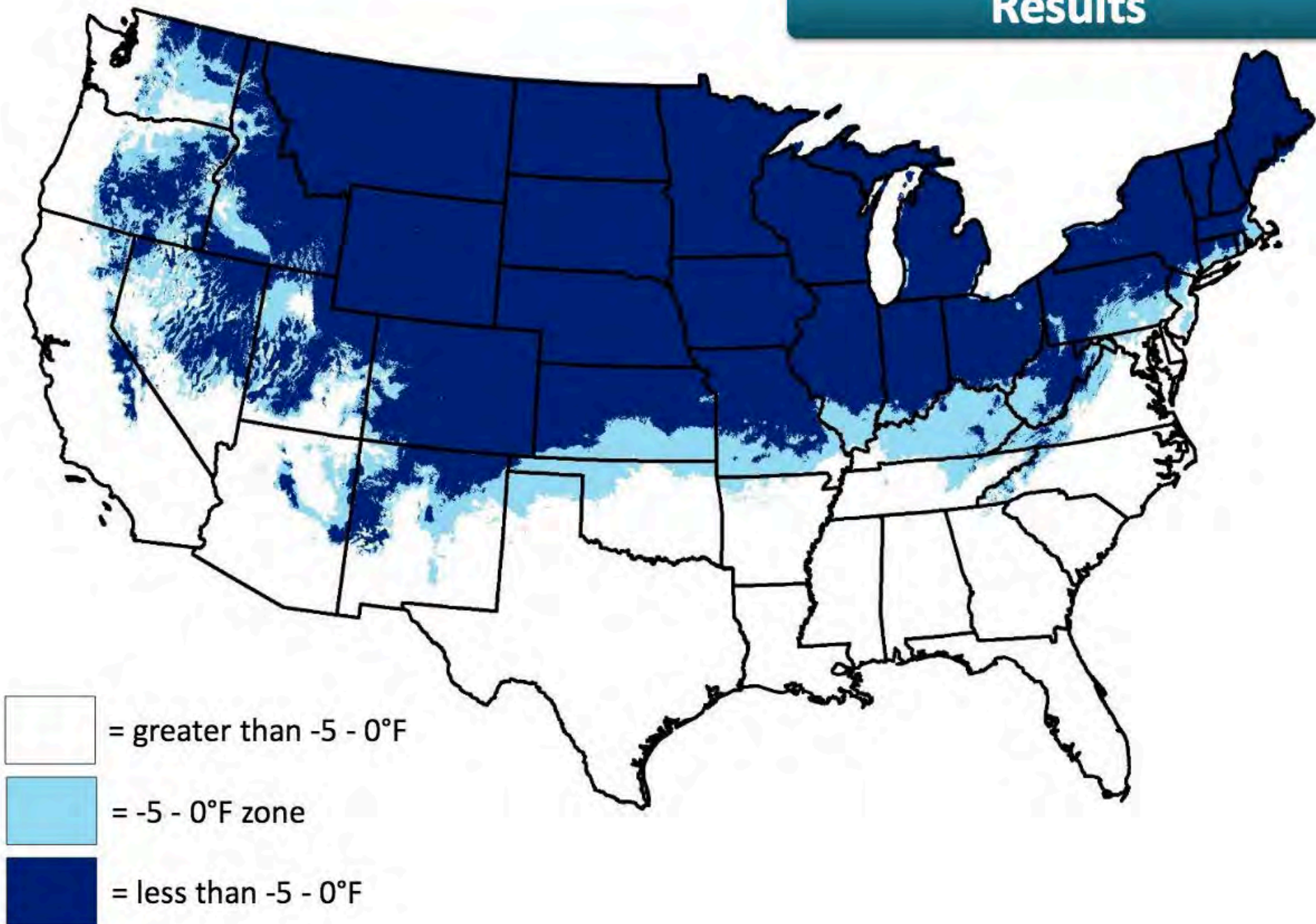


SCP: n=19 bugs

Mortality: n=17 bugs/each temp (mean \pm 95% confidence interval)

Regression curves fitted with a Weibull distribution

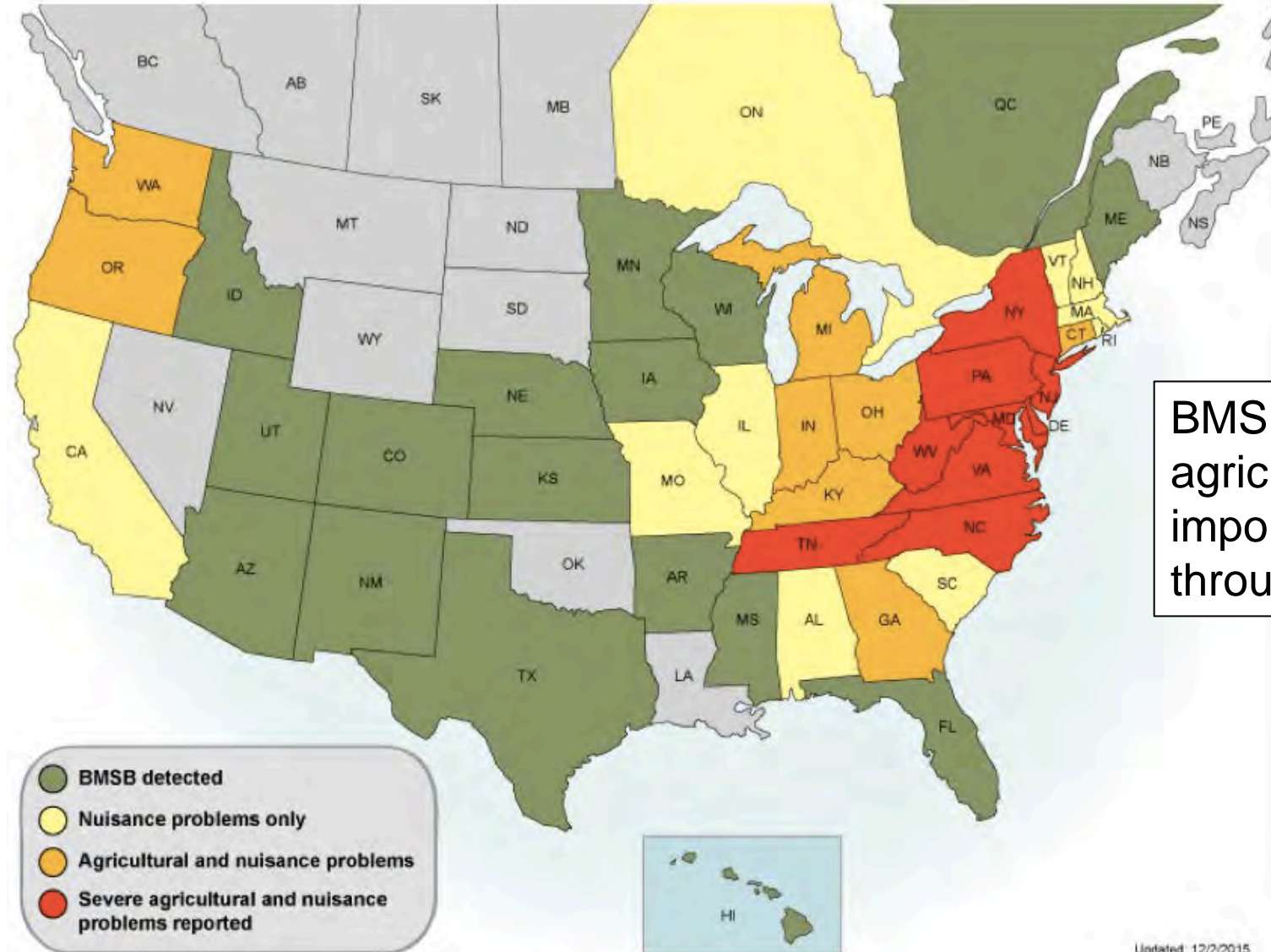
Results



BMSB Establishment in the US

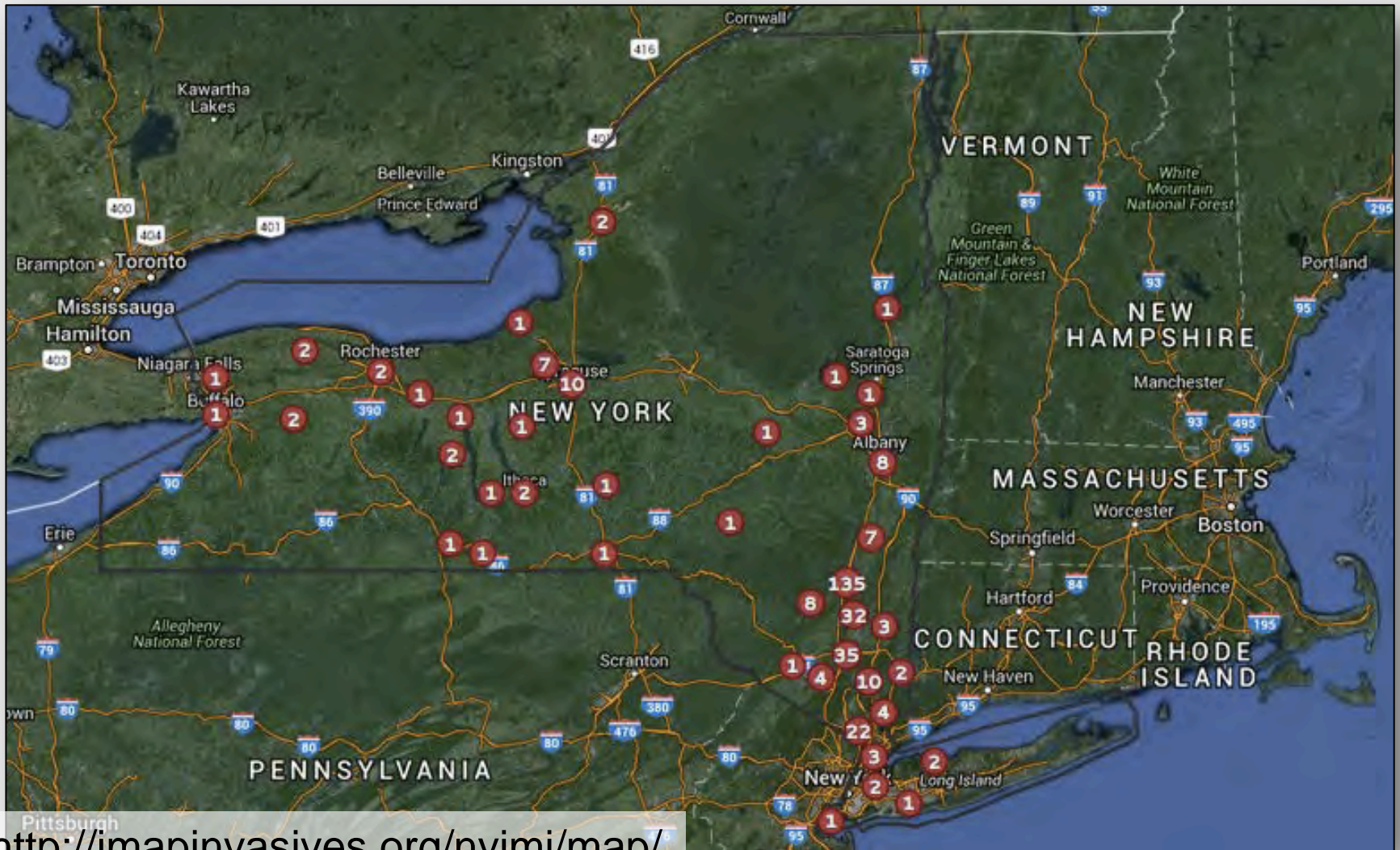


BMSB increasing in agricultural importance throughout the US



New York Invasive Species Public Map

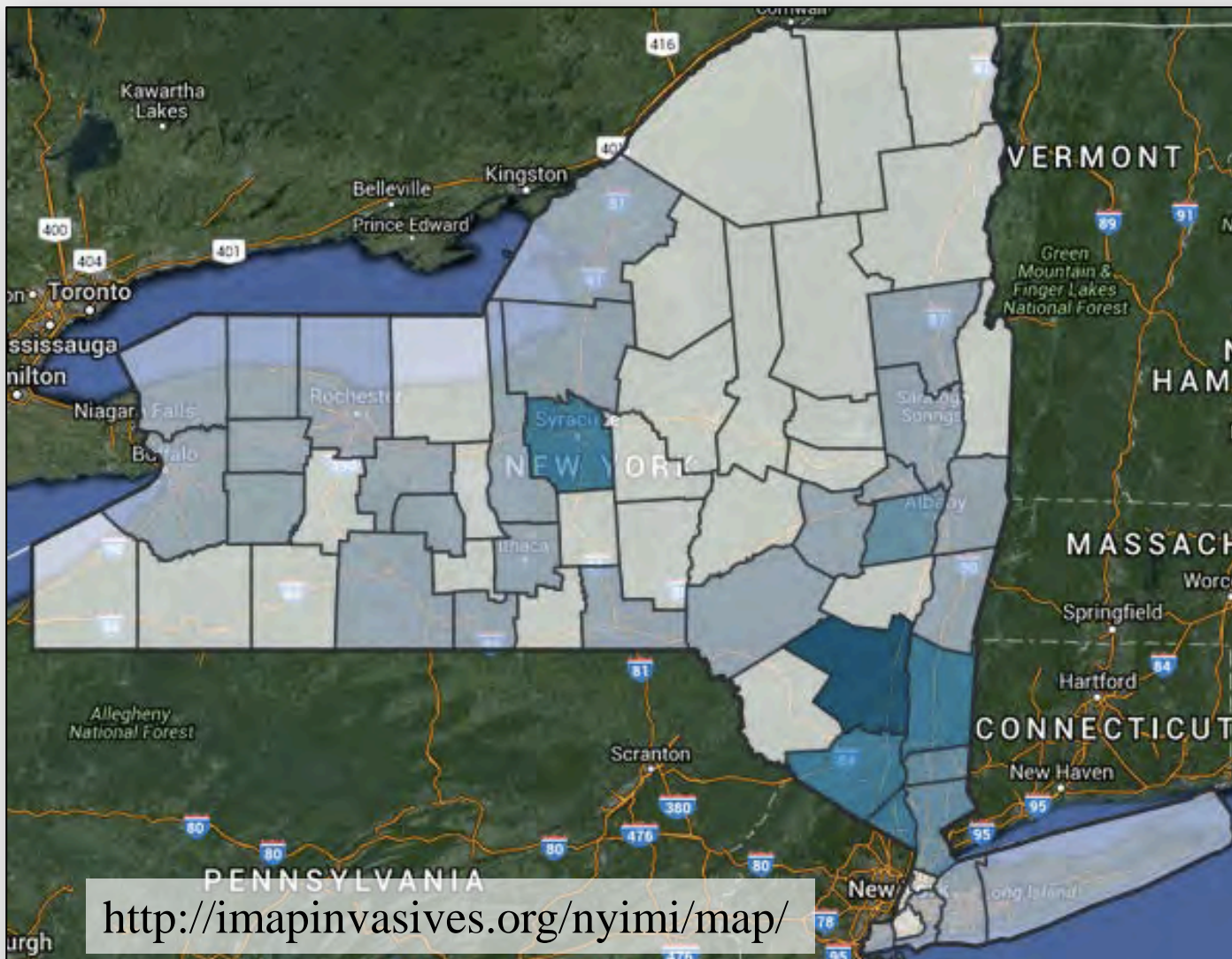
BMSB Distribution in NYS



New York Invasive Species Public Map

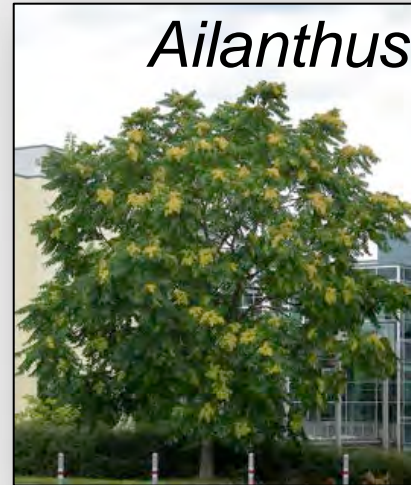
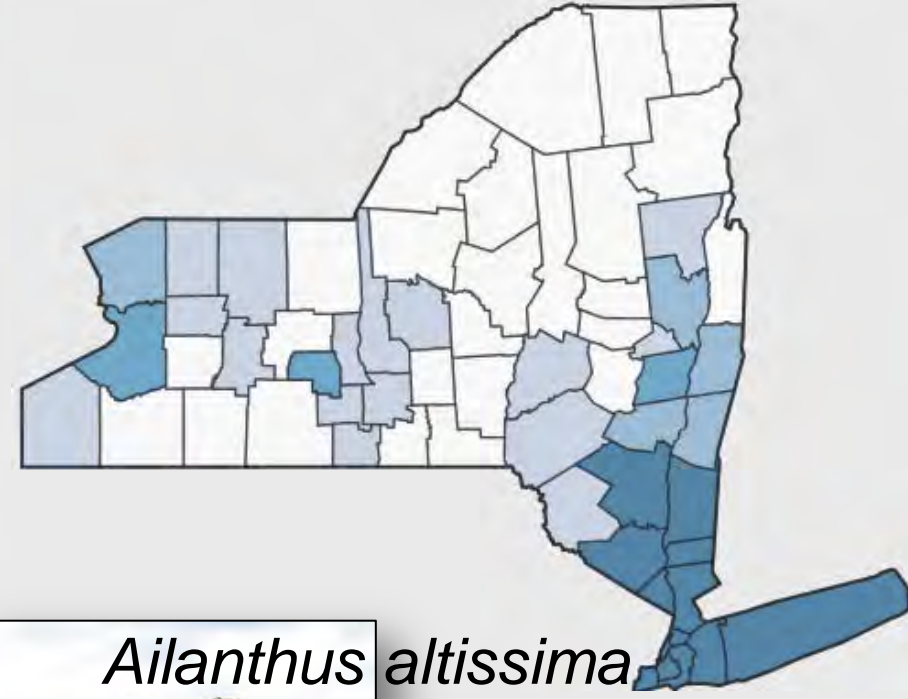
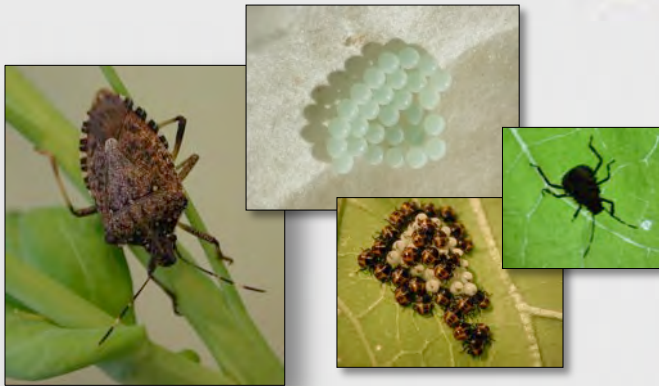
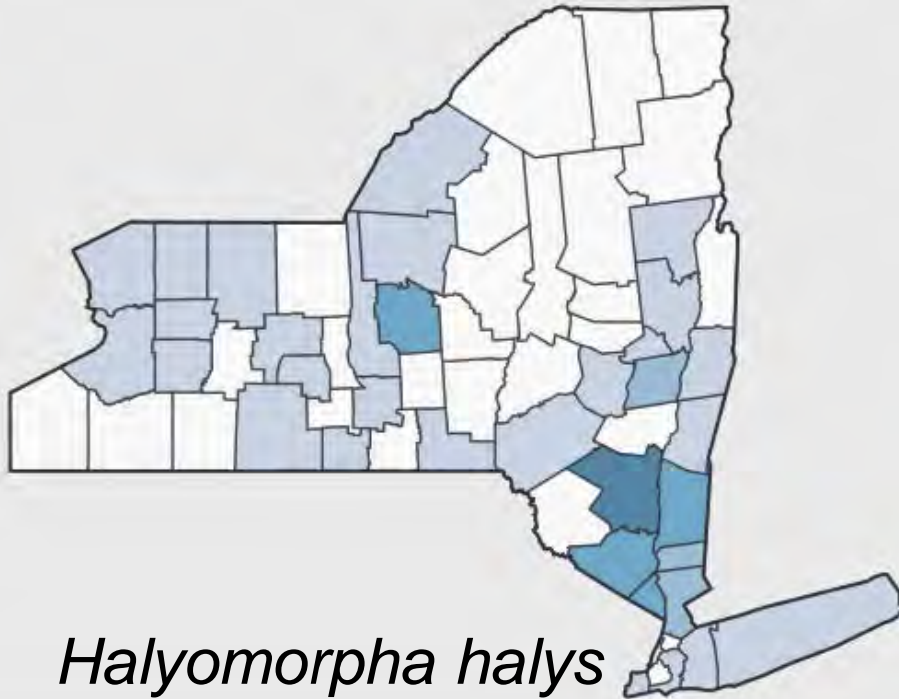
BMSB Distribution in NYS

BMSB Reports




New York Invasive Species Public Map

BMSB Distribution in NYS



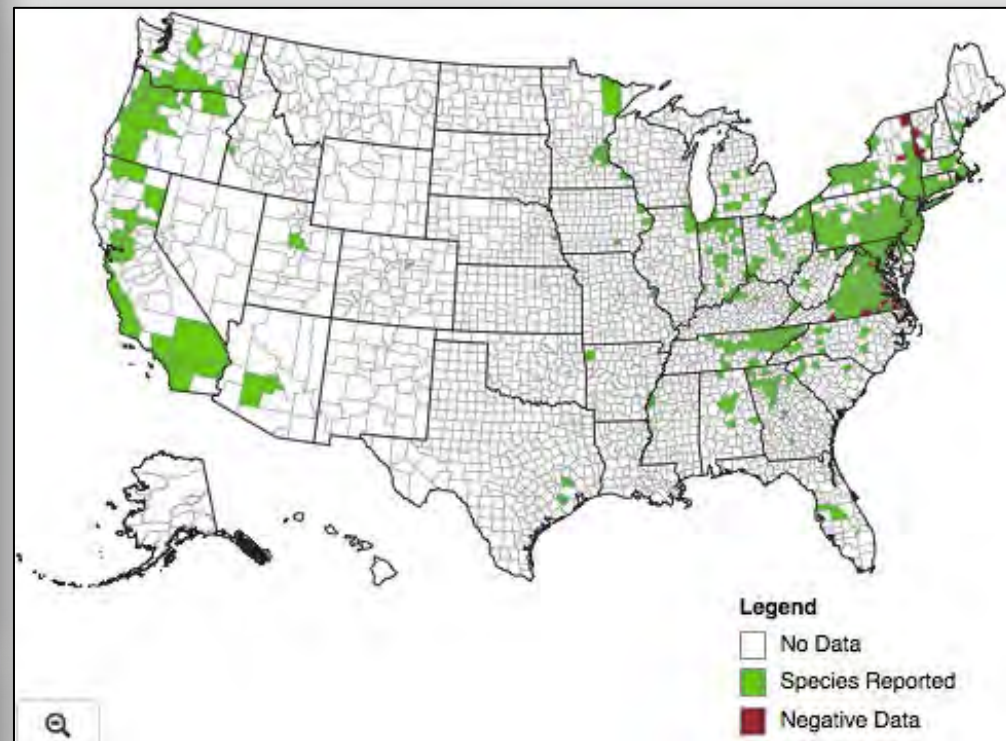
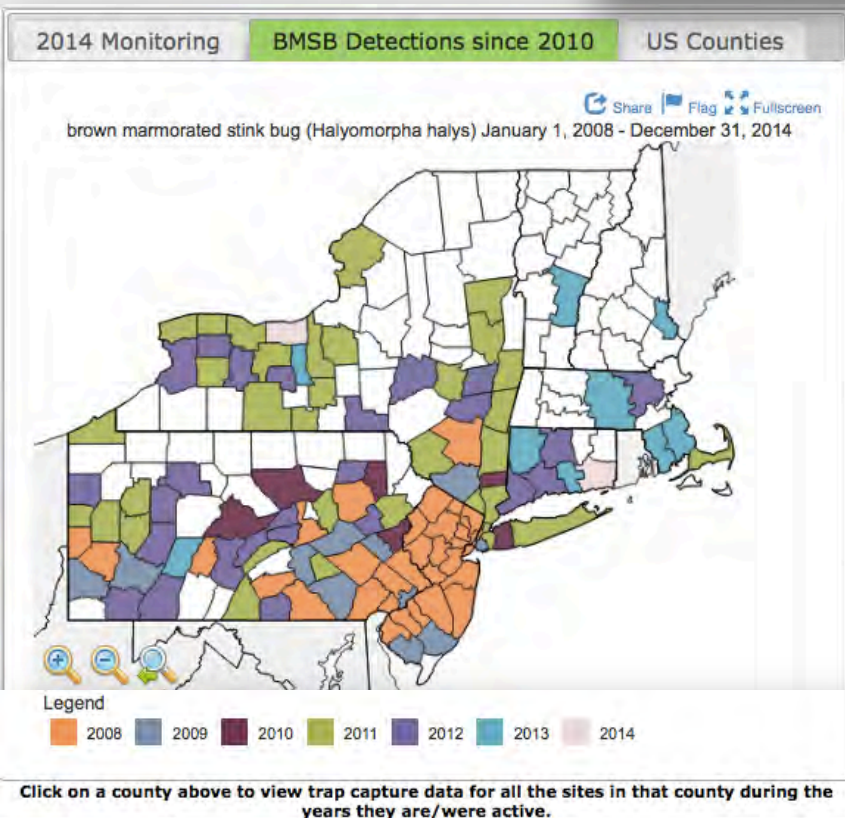
EDDMaps.org/bmsbny/ BMSB Distribution in NYS Tree Fruit Orchards

EDDMapS
Early Detection & Distribution Mapping System

**Hudson Valley
Research Laboratory**
Supporting the
NYS Agricultural Community

EDDMapS Home

Welcome to BMSBNY

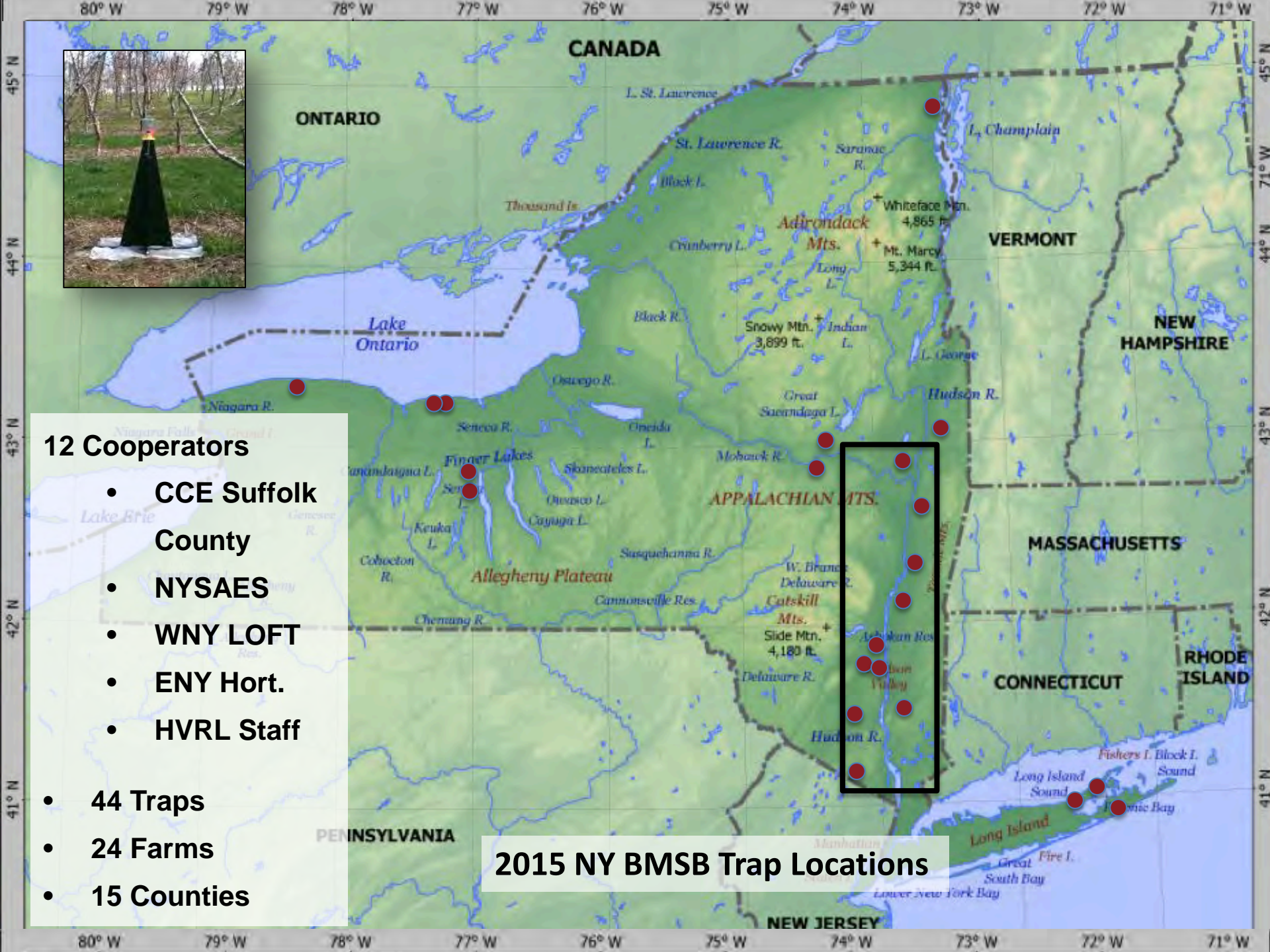




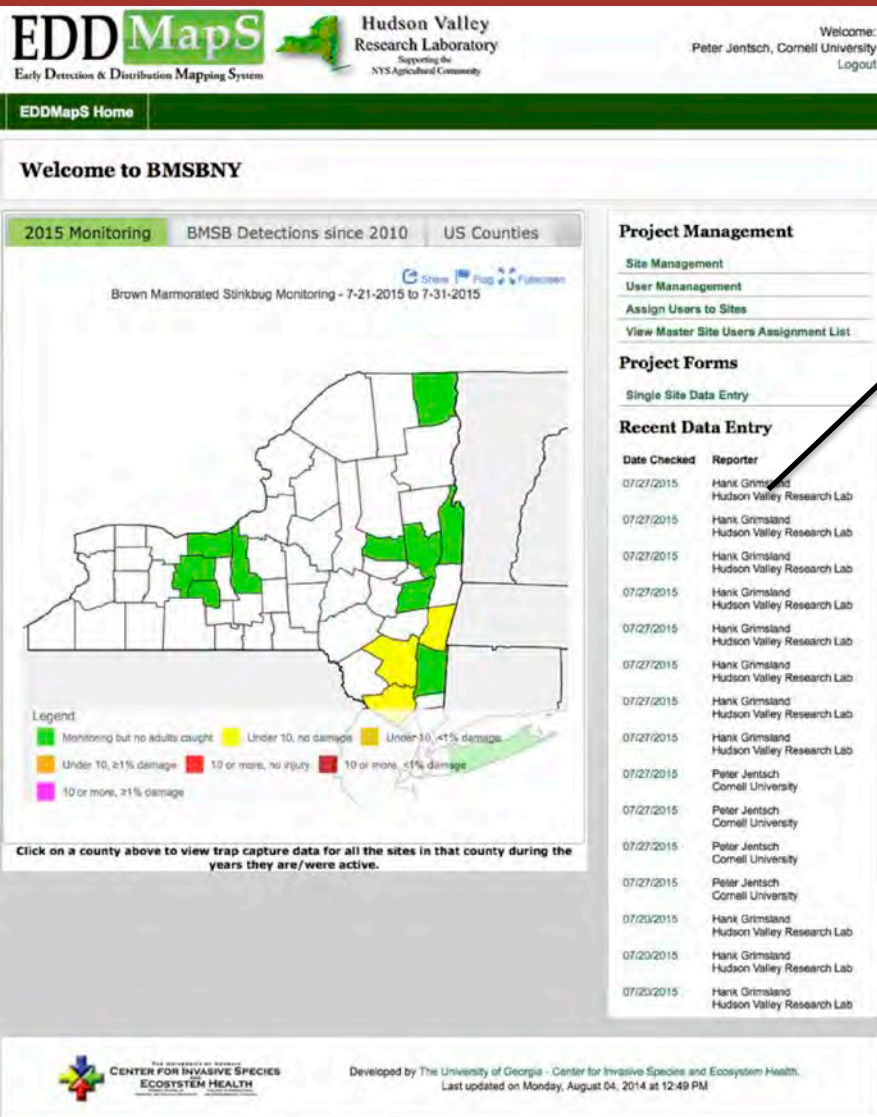
12 Cooperators

- CCE Suffolk County
- NYSAES
- WNY LOFT
- ENY Hort.
- HVRL Staff
- 44 Traps
- 24 Farms
- 15 Counties

2015 NY BMSB Trap Locations



EDDMaps.org/bmsbny/ BMSB Distribution in NYS Tree Fruit Orchards



Presence / absence data
○ Individual site access

EDDMaps.org/bmsbny/

BMSB Distribution in NYS Tree Fruit Orchards

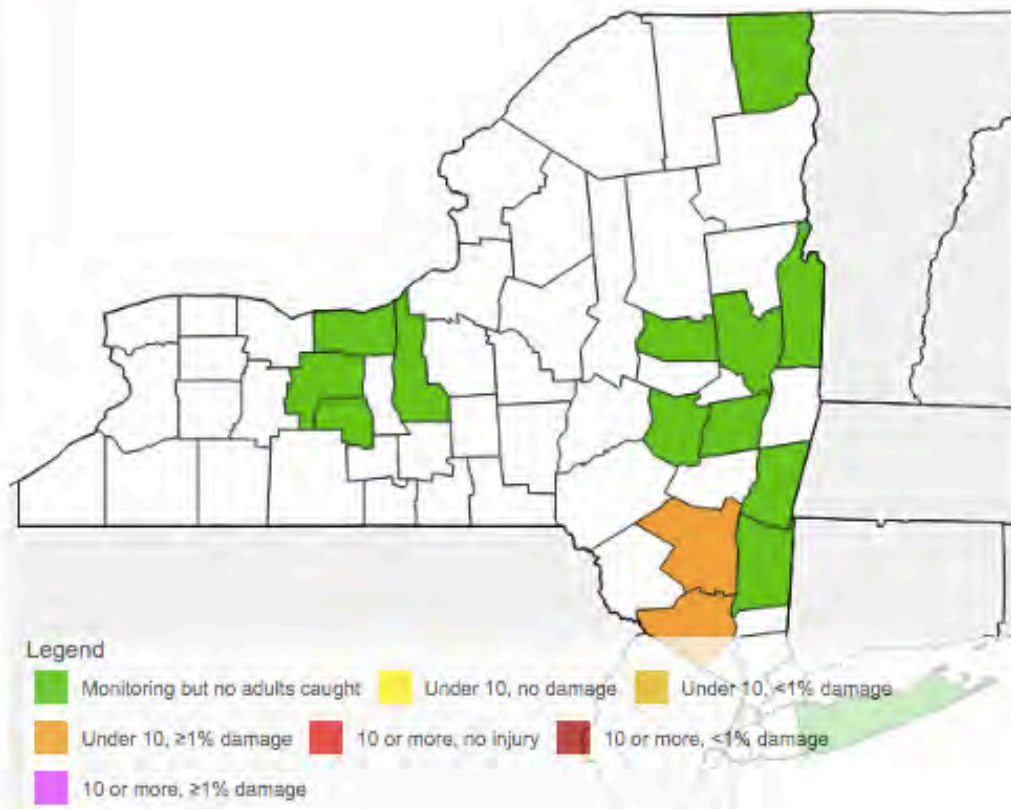
2014 Monitoring

BMSB Detections since 2010

US Counties

Share | Flag | Fullscreen

Brown Marmorated Stinkbug Monitoring - 10-10-2015 to 10-20-2015



- Presence / absence
- Population Threshold + Damage Levels by county





Welcome to BMSBNY

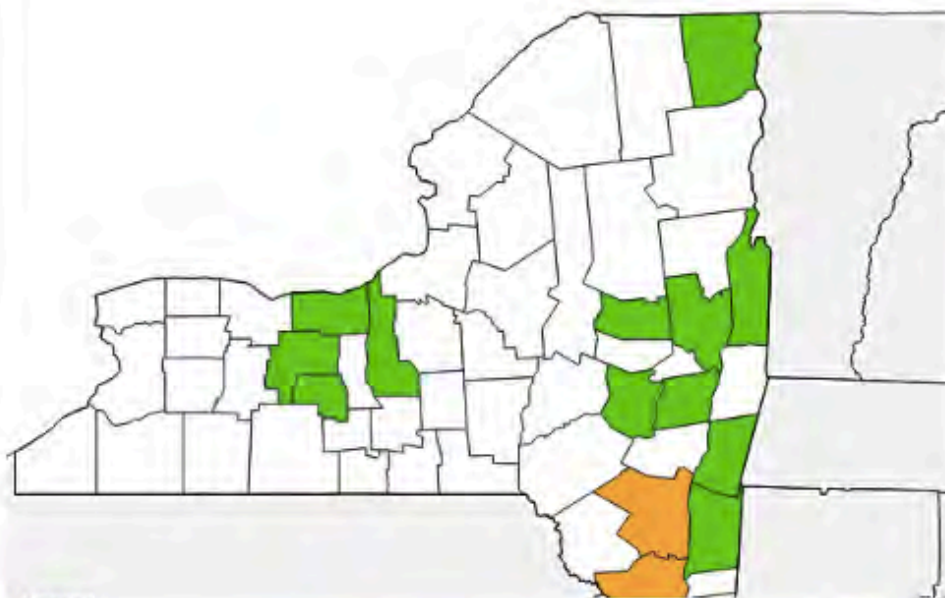
2014 Monitoring

BMSB Detections since 2010

US Counties

[Share](#) [Flag](#) [Fullscreen](#)

Brown Marmorated Stinkbug Monitoring - 10-10-2015 to 10-20-2015



Legend


- Monitoring but no adults caught
- Under 10, no damage
- Under 10, <1% damage
- Under 10, ≥1% damage
- 10 or more, no injury
- 10 or more, <1% damage
- 10 or more, ≥1% damage

15 NYS counties / 44 Sites

- Absence (Green)
 - Monitoring but no adults caught
- Presence (Yellow)
 - Under 10, no damage
- Presence + Damage Levels
 - Under 10, <1% damage
- Presence + Damage Levels
 - Under 10, ≥1% damage
- BMSB Threshold + Damage Levels
 - 10 or more, no injury
- BMSB Threshold + Damage Levels
 - 10 or more, <1% damage
- BMSB Threshold + Damage Levels
 - 10 or more, ≥1% damage

BMSB Management Threshold: Communication

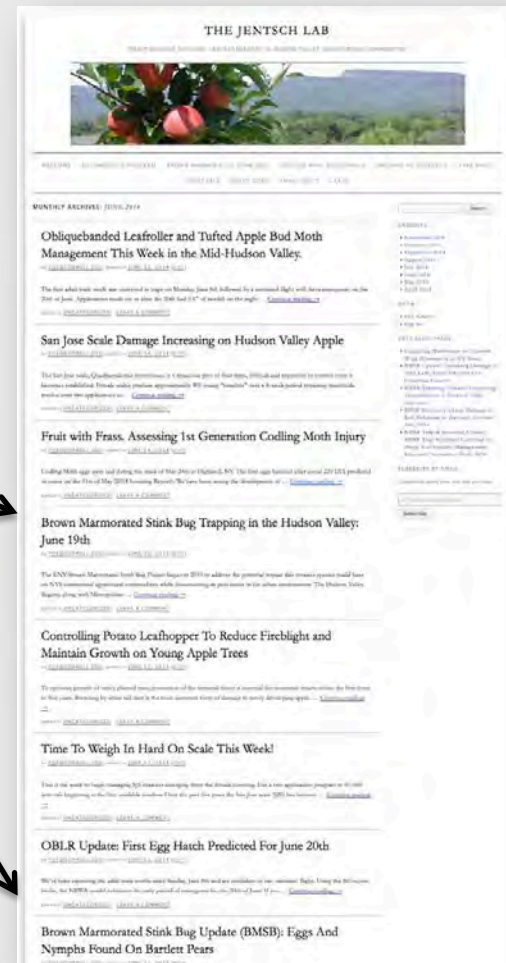
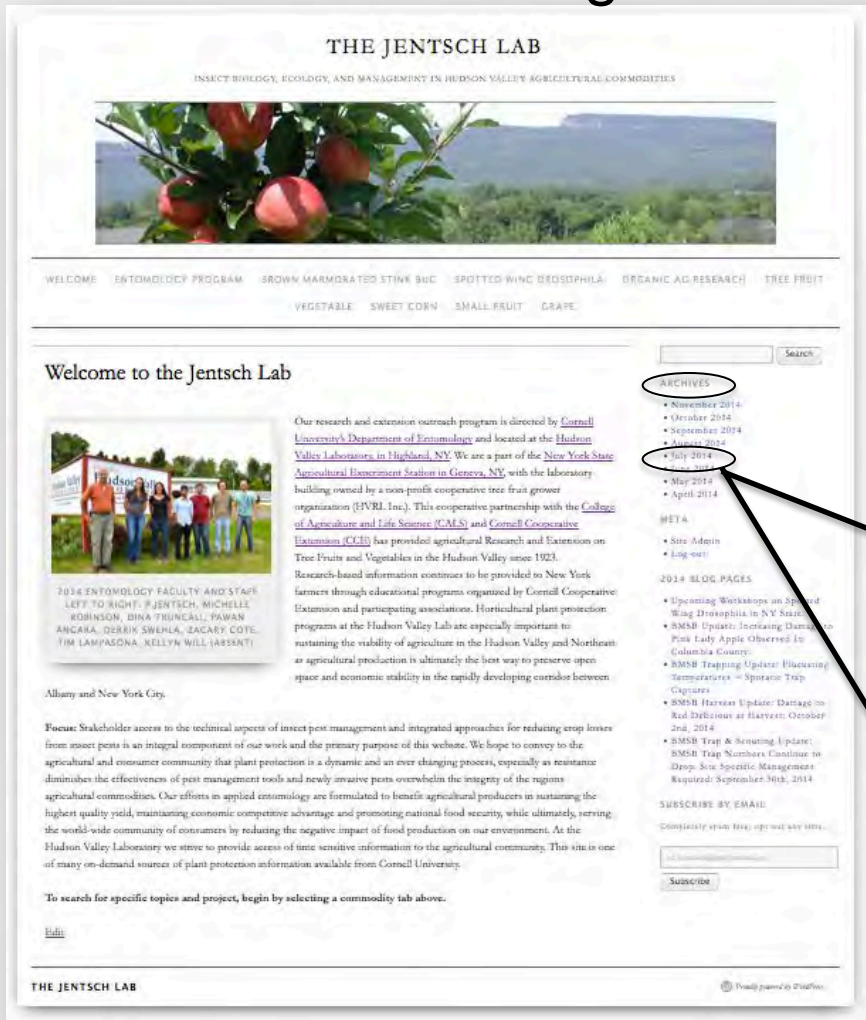


- **2015: Employed a 10 Adult / Trap Threshold**
- **Disseminate recommendations using ENY CCE Hort News; Scaffolds Newsletter; HVRL Lab Blog Site** 
- **Growers subscribe to receive email Internet based link for BMSB mgt. recommendations as BMSB traps and damage levels are assessed**
- **Hudson Valley Research Lab: Blog site**
- **<https://blogs.cornell.edu/jentsch/>**

BMSB Management Threshold: Communication

Email link to BlogSite

Insect Alerts & Recommendations



BMSB Management Threshold: Communication

Brown Marmorated Stink Bug: August 15th Update

by PJJ5@CORNELL.EDU posted on [AUGUST 16, 2014](#)

Brown Marmorated Stink Bug (BMSB) numbers last week show continued increase of late instar nymph movement to pheromone baited Tedders traps. The late start to the season may have pushed forward the emergence of the

BMSB Update: August 20. Confirmed Late Season Feeding to Apple, Peach and Pepper

by PJJ5@CORNELL.EDU posted on [AUGUST 20, 2014](#)

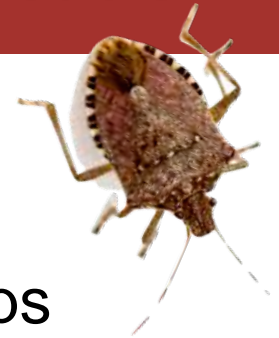


Extensive damage from BMSB Observed On Peach in Highland, NY: August 25th

by PJJ5@CORNELL.EDU posted on [AUGUST 25, 2014](#)

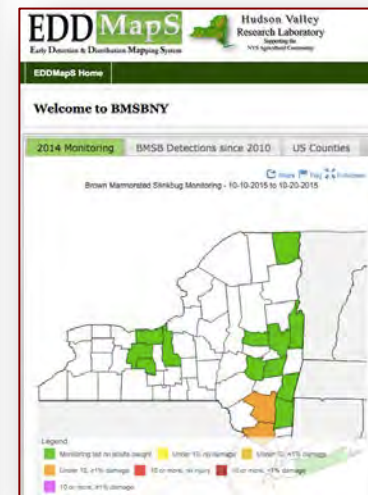
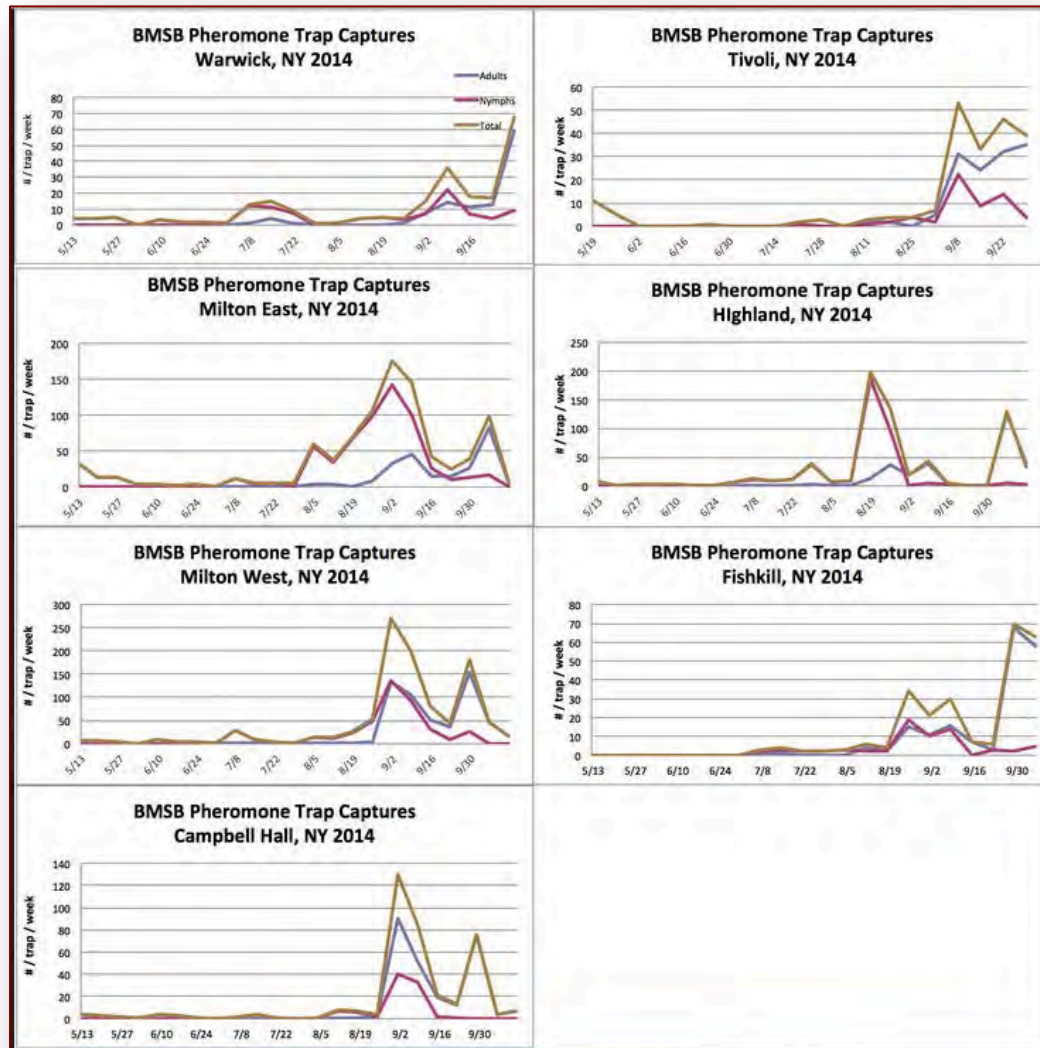


BMSB Management Threshold: Communication



Link to EDDMaps

- Counties at threshold



BMSB Management Threshold: Communication

Recommend NYS Registered Insecticides

- Whole orchard, ARM, Border applications



Product	Active ingredient	Rate / A	REI Hrs.	PHI Days	Efficacy (USDA)	Max. per crop / season	App. Interval
Actara 25WDG	Thiamethoxam	2.0-5.5 oz/A	12	35	+++	16.5 oz./A (0.258 lb. a.i./A)	10d
Asana XL 0.66EC	Esfenvalerate	4.8-14.5 fl oz/A	12	21	++	101 fl oz/A (0.525 lb AI/A).	NA
Baythroid XL 1EC	Beta-Cyfluthrin	1.4-2.8 fl oz/A	12	7	++	2.8 fl oz/A (0.022 lb AI/A).	14d
Bifenture EC	Bifenthrin	5.2-12.8 fl oz/A	12	14	++++	32 fl ozs (0.50 lbs ai)	30d
Bifenture 10DF	Bifenthrin	12.8-32.0 oz/A	12	14	++++	80 ozs (0.50 lbs ai)	30d
Brigade WSB	Bifenthrin	12.8-32.0 oz/A	12	14	++++	80 ozs (0.50 lbs ai)	30d
Danitol 2.4EC	Fenpropathrin	10.66-21.33 fl oz/A	24	14	+++	42.56 fl ozs (0.80 lbs ai)	10d
Endigo ZC	Thiamethoxam / Lambda-cyhalothrin	5-6 fl fl oz/A	24	35	++++	19 fl oz./A (0.172 lb ai) NY	10d
Lannate 2.4LV*	Methomyl	2.25 pt/A	72	14	++++	240 ozs (0.50 lbs ai)	7d
Lannate 90SP*	Methomyl	8-16 oz/A	72	14	++++	5.0 lbs	7d
Leverage 360	Beta-Cyfluthrin / Imidacloprid	2.4-2.8 fl oz/A	12	7	+++	2.8 fl oz/A	14d
Surround 95WP	Kaolin	25-50 lb/A	4	0	+	NA	0d
Thionex 50WP	Endosulfan	Max. 5 lb/A	20 days	21	++++	6.0 lbs	NA
Thionex EC	Endosulfan	1.33-2.67 qts./A	7 days	21	++++	2-2/3 qts (2.0 lbs ai)	NA
Voliam Xpress EC	Chlorantraniliprole / Lambda-cyhalothrin	6-12 fl oz/A	24	21	+++	31.0 fl oz/A	10d
Vydate 2L*	Oxamyl	4-8 pt/A	48	14	++	281 fl oz/A (128 oz AI/A).	7d
Warrior 1CS	Lambda-cyhalothrin	2.56-5.12 fl oz/A	24	21	++	20.48 fl. oz. (0.28 lb. a.i.)**	5d
Warrior II 2.08CS	Lambda-cyhalothrin	1.28-2.56 fl oz/A	24	21	++	10.24 fl. oz. (0.28 lb. a.i.)**	5d

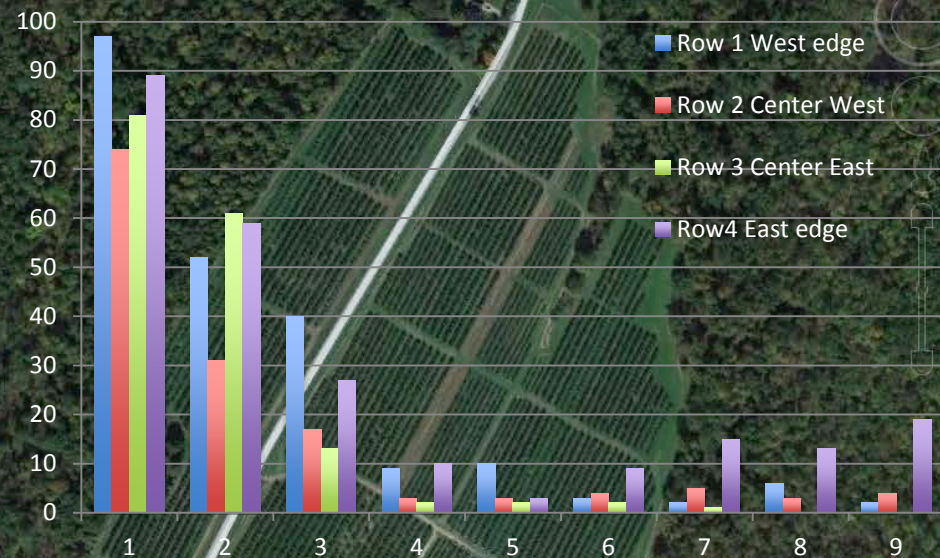
* Although these materials have excellent topical ratings in lab bioassay studies, field efficacy studies have shown economic fruit injury from BMSB feeding, suggesting low residual levels.

** Post bloom applications

(+) low to (++++) high efficacy



**A strong edge effect
observed from wooded
edge toward the interior
of the block in Pink
Lady harvested in early
November.**



**Along 30' of border fruit
74-98% injury was
assessed.**

**>21% injury was
documented at packout.**

Campbell Hall, NY
Commercial apple



Management Options



- BMSB nymphs and adults are very mobile.
- Movement from tree to tree and flight in and out of the orchard has been observed.
- **Attract and kill options can be employed using pheromone lures in 'baited trees' or netting** along the orchard perimeter to aggregate populations for directed applications.

Application options include:

- **Whole orchard** applications upon 1st infestation
- **Alternate row middle** applications at 7d intervals
- **Border row** applications at 7d intervals

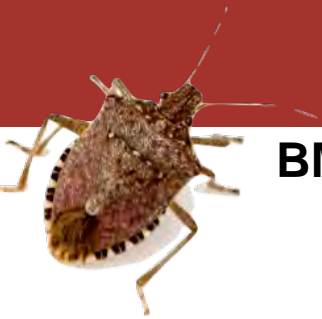
Management Options



Insecticide Group	Product	Active Ingredient	% Adult BMSB Mortality¹	
Pyrethroid	Bifenture	bifenthrin	100	●
	Danitol	fenpropathrin	95	●
	Warrior II	lambda-cyhalothrin	73	
Carbmate	Lannate	methomyl	92	●
	Vydate	oxymyl	68	
Neonicotinoid	Actara	thiamethoxam	92	●
	Assail	acetamiprid	87	
	Calypso	thiacloprid	58	
Pre-mix	Leverage 360	imidacloprid and bifenthrin	95	●
	Endigo	lambda-cyhalothrin and thiamethoxam	98	●
	Voliam Flexi	chlorantraniliprole and thiamethoxam	98	●

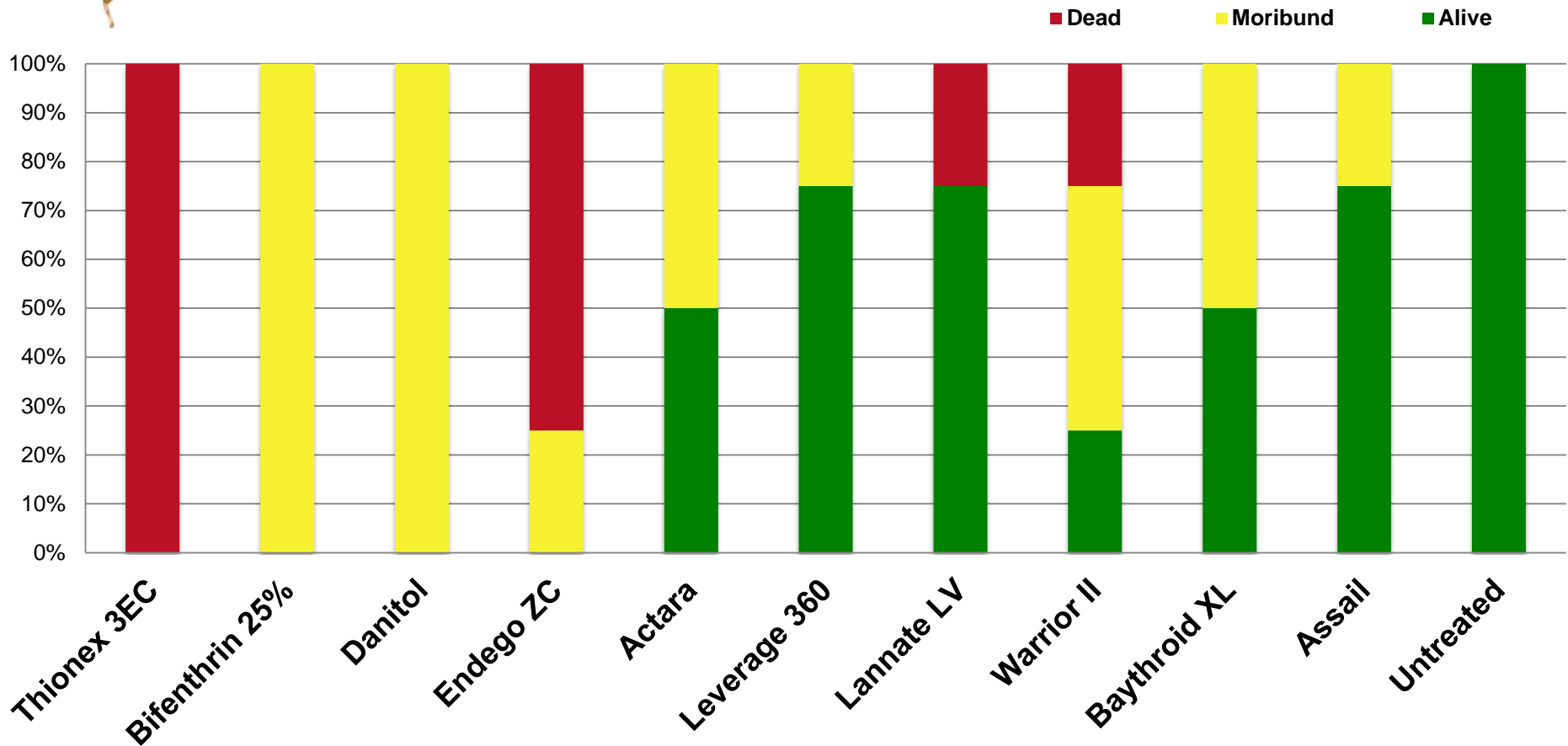
1. Direct contact activity of insecticides against BMSB adults in a lab setting may be very high, yet the activity of field-aged residue may, over time, quickly become ineffective at preventing feeding injury.





Management Options

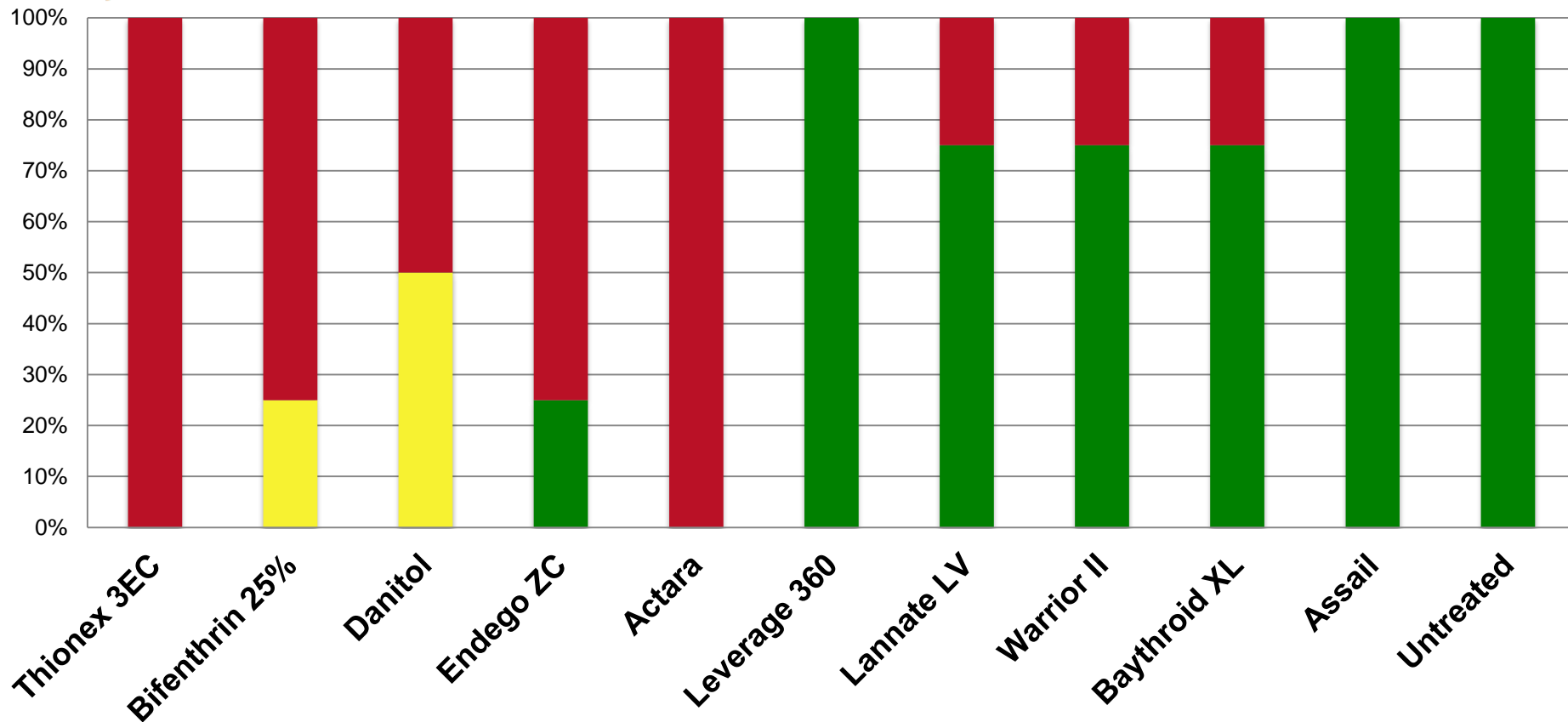
**BMSB Adult Exposure to Insecticide Residue of Apple Foliage
24h Old Residue @ 1 d**





Management Options

**BMSB Adult Exposure to Insecticide Residue of Apple Foliage
24h Old Residue @ 3 d**



Conclusion



- Cold Winter Temperature, low Degree Day Accumulations in spring and sunlight constraints reduce the success of BMSB in northern regions including WNY.
- Constraints will likely limit BMSB to a single generation / year.
- A single generation of BMSB will likely result in low levels of tree fruit injury depending on seasonal survival, host resource availability, moisture requirements in periods of drought.
- Consider ARM and Border Applications under low-moderate populations levels using the most effective insecticide.



Thank You



Support from the Tree Fruit and Agrichemical Industry
NYSAES, CCE, Technical staff and field assistants

