An Areawide Biointensive Management Plan for Brown Marmorated Stink Bug (BMSB), *Halyomorpha halys* (Stål), to Reduce Impacts Throughout the Agro-Urban Interface

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VT

USDA

Multi-State, Multi-Institution Effort

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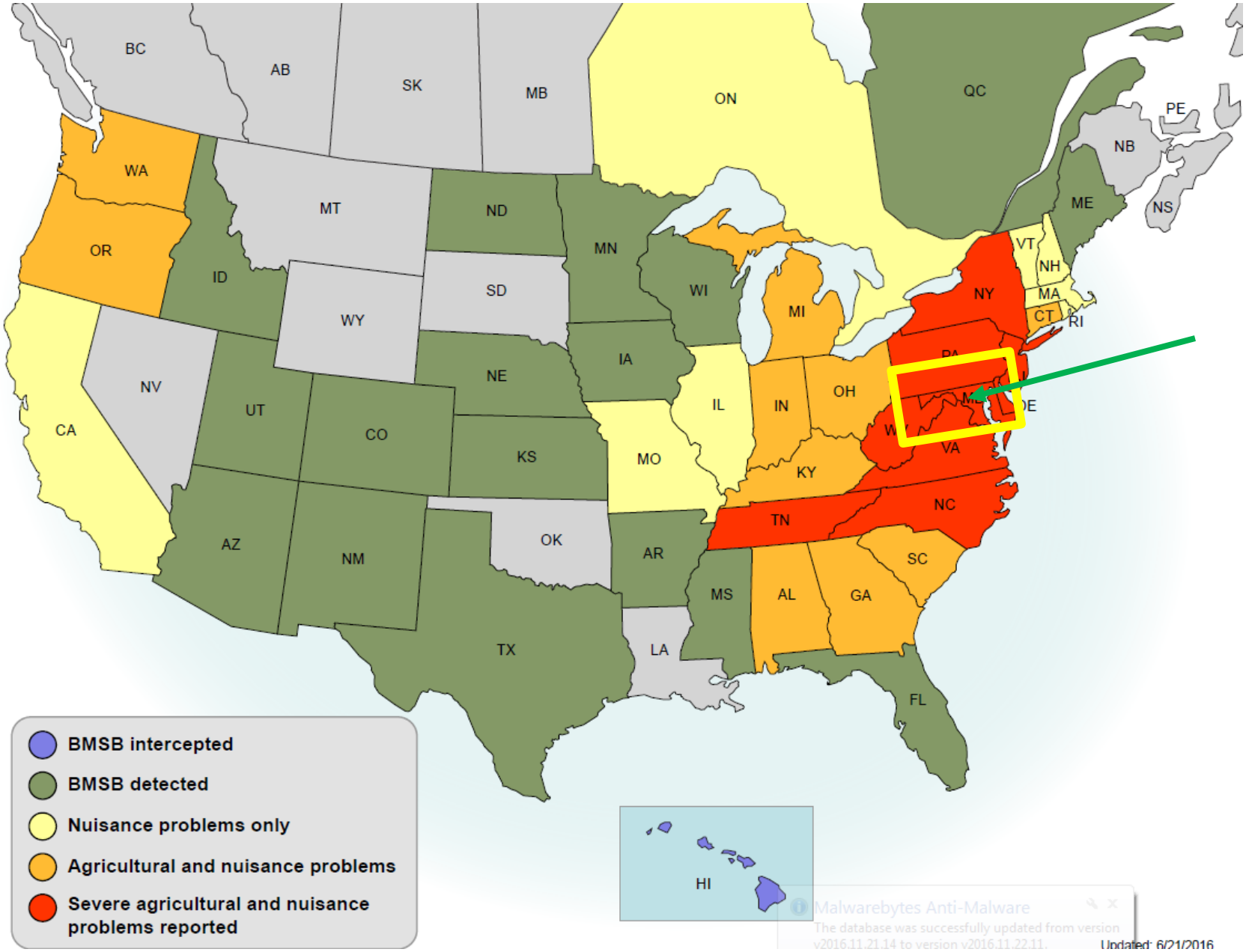
Areawide Objectives

- We propose to:
  - (1) implement biorational management of BMSB in key specialty and row crops;
  - (2) advance strategies for enhanced biological control of BMSB;
  - (3) assess impact of biointensive management on BMSB populations at a landscape scale;
  - (4) promote adoption and implementation of biointensive tactics for management of BMSB.
- Through these combined landscape-level approaches, suppression of BMSB populations can truly be achieved, reducing the ecological and environmental impacts of this devastating invasive species.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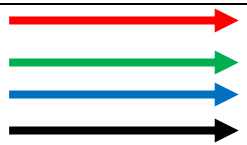
BMSB intercepted
BMSB detected
Nuisance problems only
Agricultural and nuisance problems
Severe agricultural and nuisance problems reported
Malwarebytes Anti-Malware
The database was successfully updated from version v2016.11.21.14 to version v2016.11.22.11.
Updated: 6/21/2016

Areawide Timeline

Table 1. BMSB Areawide timeframe for completion for each objective and fiscal year.

Objective	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Objective 1. Implement biorational management of BMSB in key specialty and row crops.					
Objective 2. Advance strategies for enhanced biological control of BMSB.					
Objective 3. Assess impact of biointensive management on BMSB populations at landscape.					
Objective 4. Adoption and implementation of biointensive tactics for management of BMSB.					



Operational Component (emphasis in first year)
Research Component
Outreach and Technology Transfer Component
Assessment Component (emphasis at start and conclusion of project)

Objective 1.Implement biorational management in key specialty and row crops.

- 5 locations with 1 sq km Areawide and Companion sites.
- Targeting apple, peach and soybean as key crops.

- Implement monitoring tactics to make management decisions.
  - Explore sticky cards as replacement for pyramid traps in apple
  - Monitoring system for peach.
  - Promote adoption of existing soybean thresholds.
- Implement border-based management strategies.
  - Border sprays (integrated with threshold), attract and kill
- Develop a cross-crop management strategy
  - Highlight periods of risk and susceptibility
- Impact of management systems on non-targets and secondary pests

Objective 2. Advance Strategies for Biological Control of BMSB

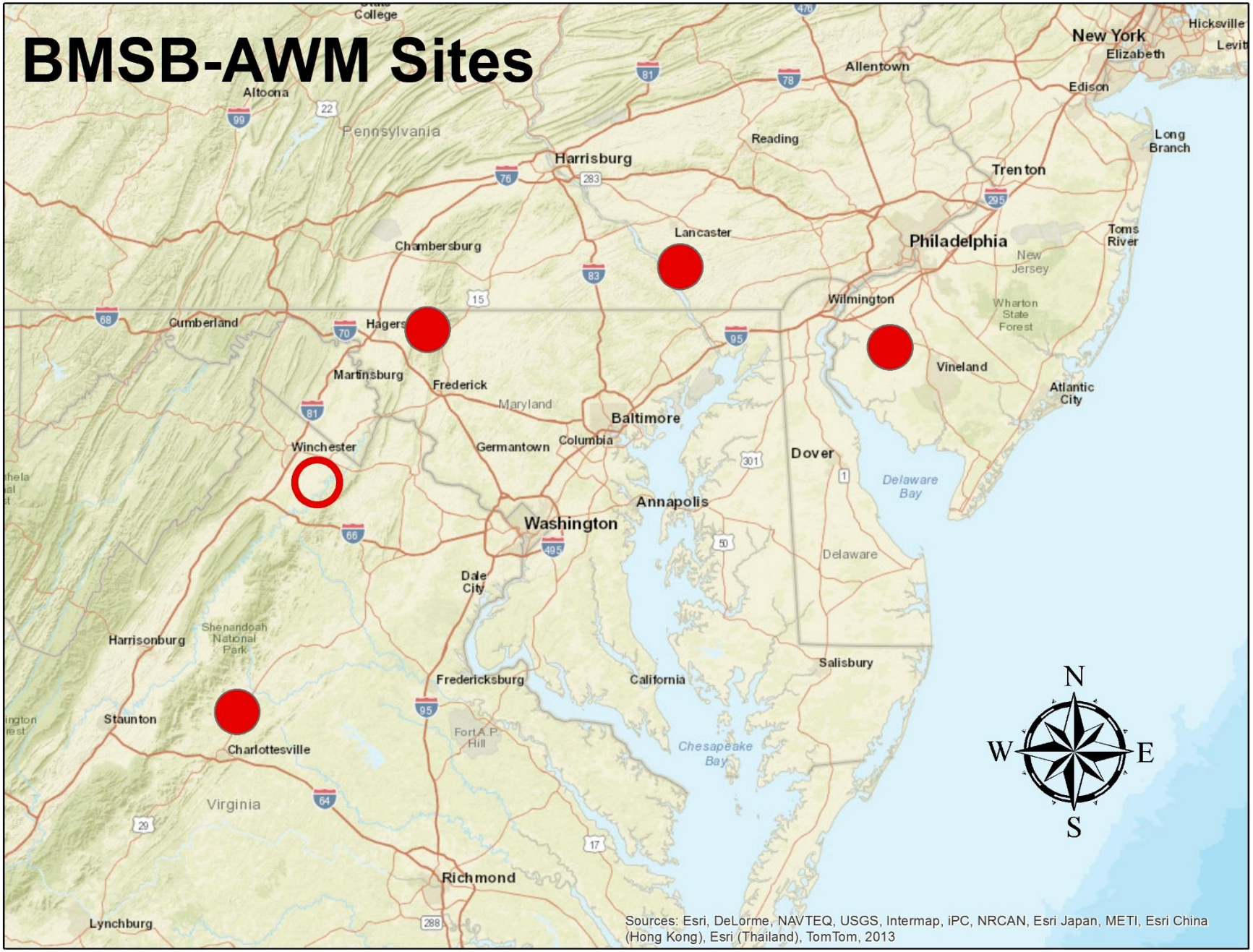
- 5 sites with 1 sq km Areawide and Companion sites.
- Targeting apple, peach and soybean as key crops.

- Conduct *Trissolcus japonicus* surveys
- Determine specific habitat/host preference for native and *T. japonicus* and interactions between them
- Measure impact of key biological control agents in Areawide and Companion sites
- Develop strategies for enhanced biological control at landscape scales.
  - Use of pheromones and kairomones, enhanced crop residue as overwintering shelters/harborage

Objective 3. Assess impact of biointensive management at the landscape scale

- 5 sites with 1 sq km Areawide and Companion sites.
- Targeting apple, peach and soybean as key crops.

- Monitoring across landscape elements with standardized traps.
- Assess crop injury and changes in BMSB populations in Areawide and Companion sites.
- Model changes in BMSB spatial distribution patterns, phenology and density in Areawide and Companion sites.
- Refine individual-based model with additional inputs
- Measure impact of management systems on non-targets and secondary pests


BMSB-AWM Sites
College
Altoona
Pennsylvania
Harrisburg
Reading
Allentown
New York
Elizabeth
Hicksville
Edison
Long Branch
Trenton
Philadelphia
New Jersey
Toms River
Lancaster
Chambersburg
Wilmington
Wharton State Forest
Vineland
Atlantic City
Cumberland
Hagers
Martinsburg
Frederick
Maryland
Baltimore
Columbia
Germantown
Winchester
Dover
Delaware Bay
Annapolis
Washington
Delaware
Dale City
Harrisonburg
Shenandoah National Park
Salisbury
Fredericksburg
California
Staunton
Charlottesville
Fort A.P. Hill
Chesapeake Bay
Virginia
Richmond
Lynchburg
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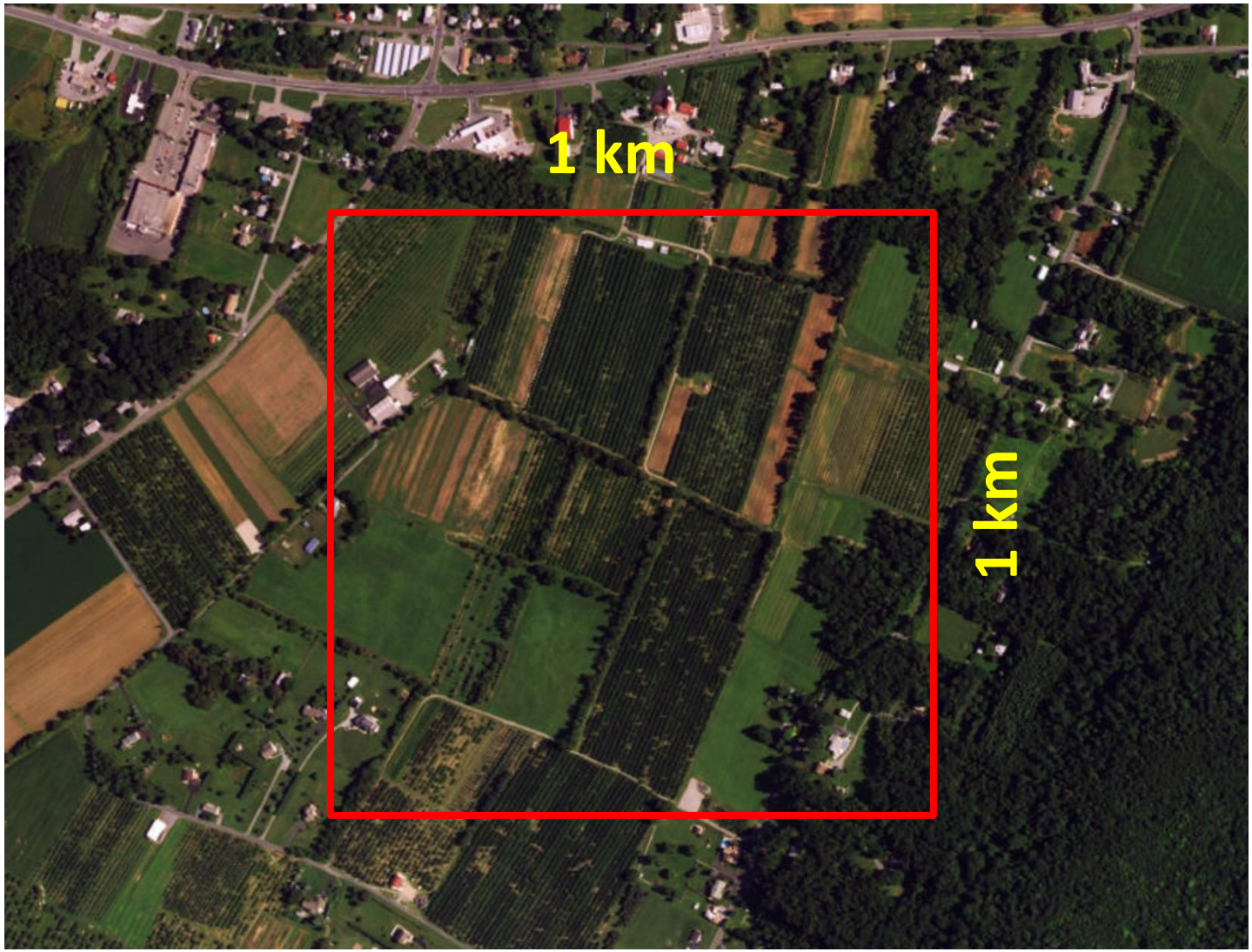
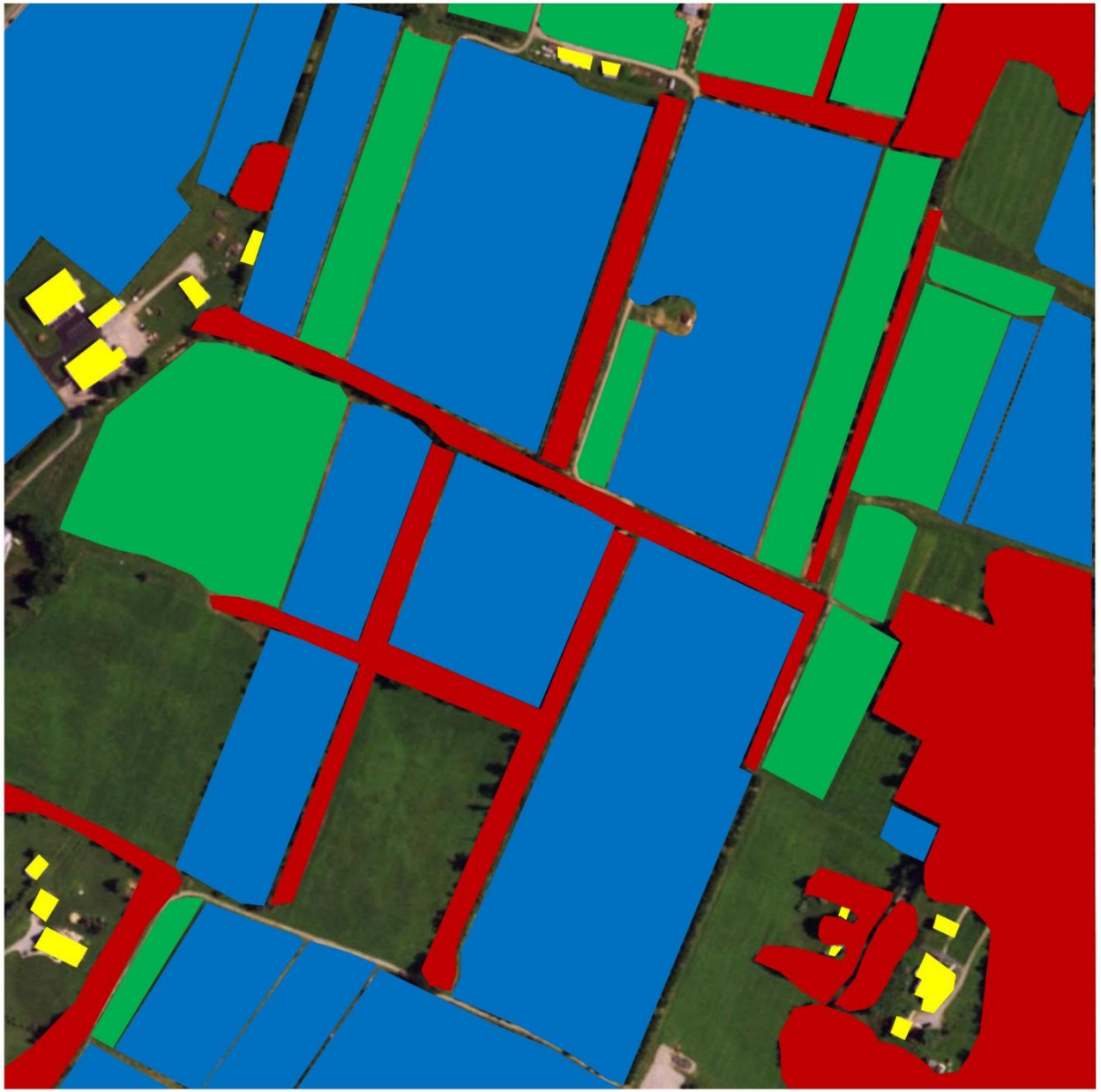
Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013



Example site located in Smithsburg, MD



Smithsburg, MD

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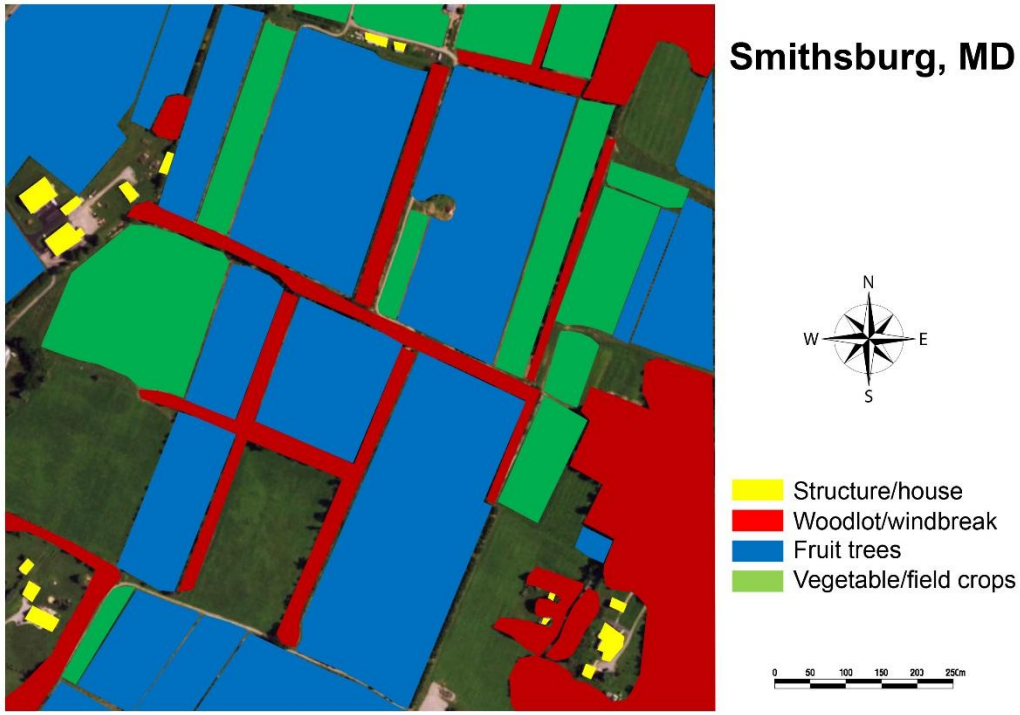
Structure/house
Woodlot/windbreak
Fruit trees
Vegetable/field crops

0 50 100 150 200 250m

Preliminary mapping based on aerial imagery



41.6% Fruit trees

14.2% Vegetable/field crops

17.5% Woodlot/windbreak

0.9% Structure/house

25.7% Lawn/open area

Companion (control) site will have a similar composition of land-use types

Monitoring and Surveillance Programs for NZ

- Pyramid traps and clear sticky cards on wooden posts.
- Monitoring Loading (1x, 5/50) and Surveillance Loading (4x, 20/200) loading.
- Trece and AgBio
- Twelve sites in WV, MD and VA.
- Season-long trap captures.

Ministry for Primary Industries
Manatū Ahu Matua

Correlations Between Sticky Cards Baited With Trece High and Low

Objective 4. Promote adoption and implementation of biointensive BMSB management tactics

- 5 sites with 1 sq km Areawide and Companion sites.
- Targeting apple, peach and soybean as key crops.

- Surveys will be used to develop outreach materials and to ultimately assess adoption
- Develop and deliver BMSB programs and educational materials for specialty and row crop growers.
- Develop and distribute BMSB programs and educational materials for homeowners and businesses
- Measure economic impact and develop a management strategy evaluation that evaluates the effectiveness of Areawide management

Areawide Outcomes