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

Multi-State, Multi-Institution Effort

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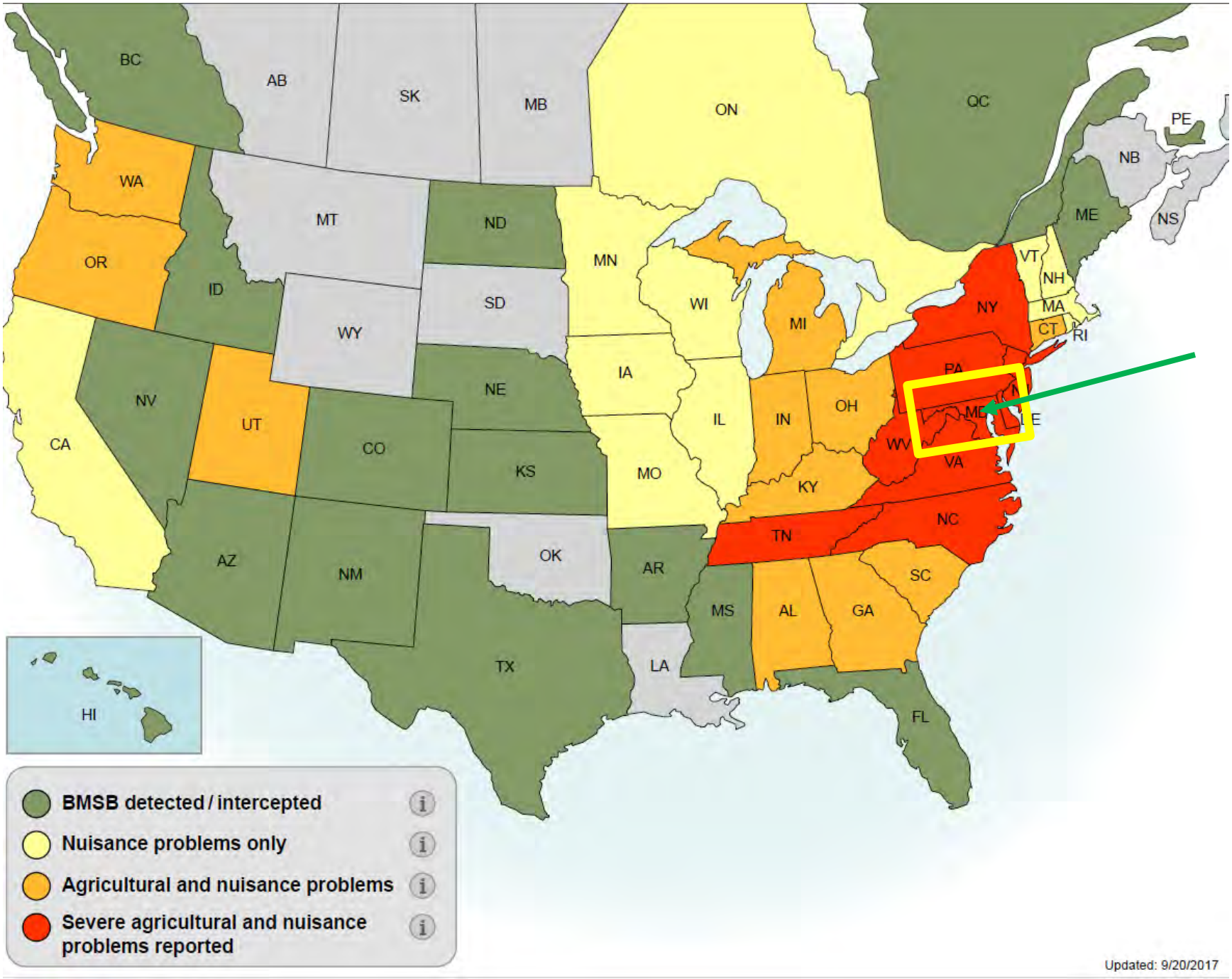
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BMSB detected / intercepted
Nuisance problems only
Agricultural and nuisance problems
Severe agricultural and nuisance problems reported
Updated: 9/20/2017

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.

Areawide Management (AWM)

Wide host range

Highly mobile

Spread in a large area

Field-by-field management may not work

Research question/hypothesis

Does areawide management (AWM) work for BMSB?

Biointensive AWM may reduce BMSB populations

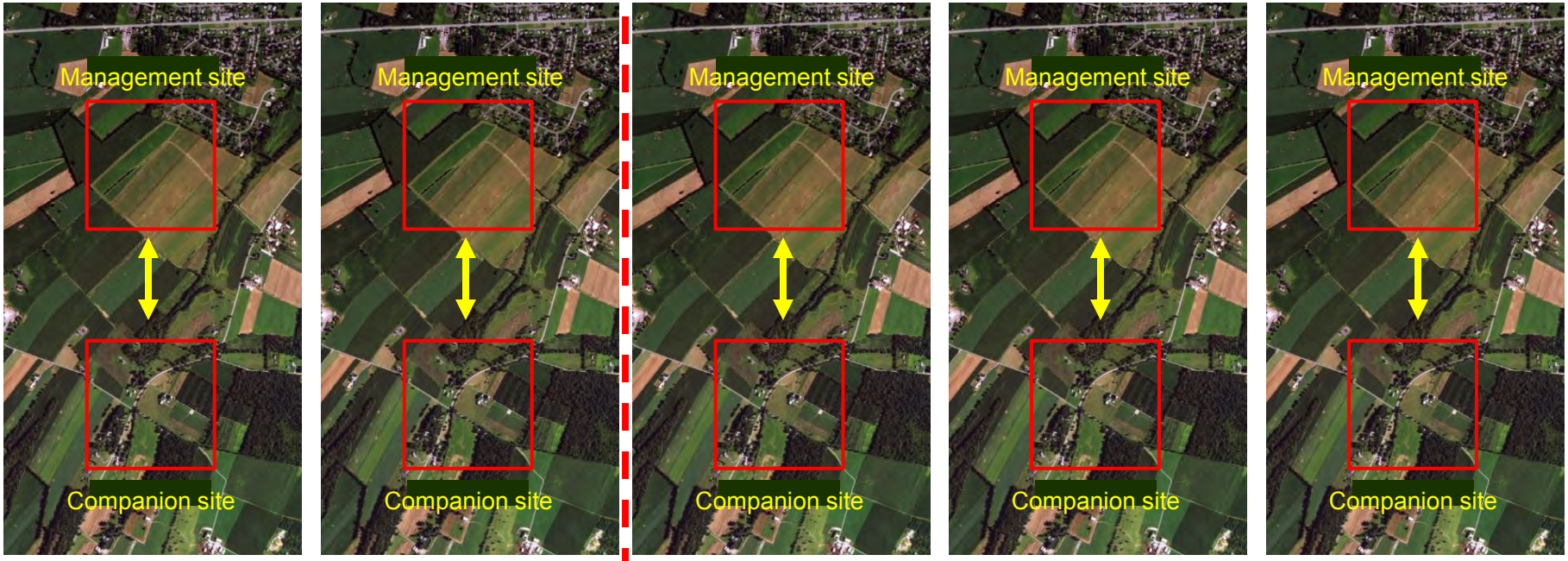
Design of Areawide Management

Areawide Management of BMSB

Baseline Data

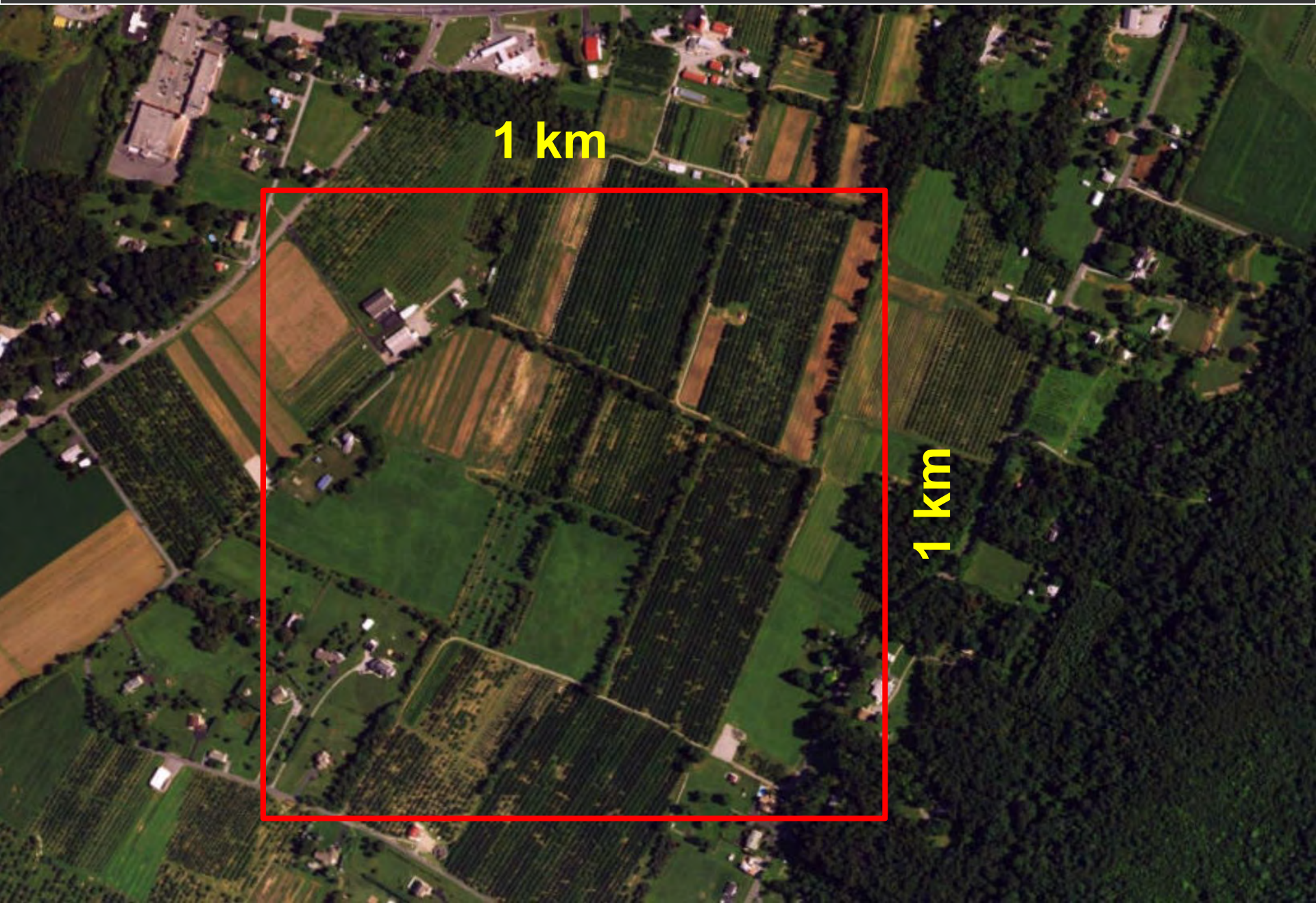
Biointensive Management of BMSB

Year 1 | Year 2 | Year 3 | Year 4 | Year 5

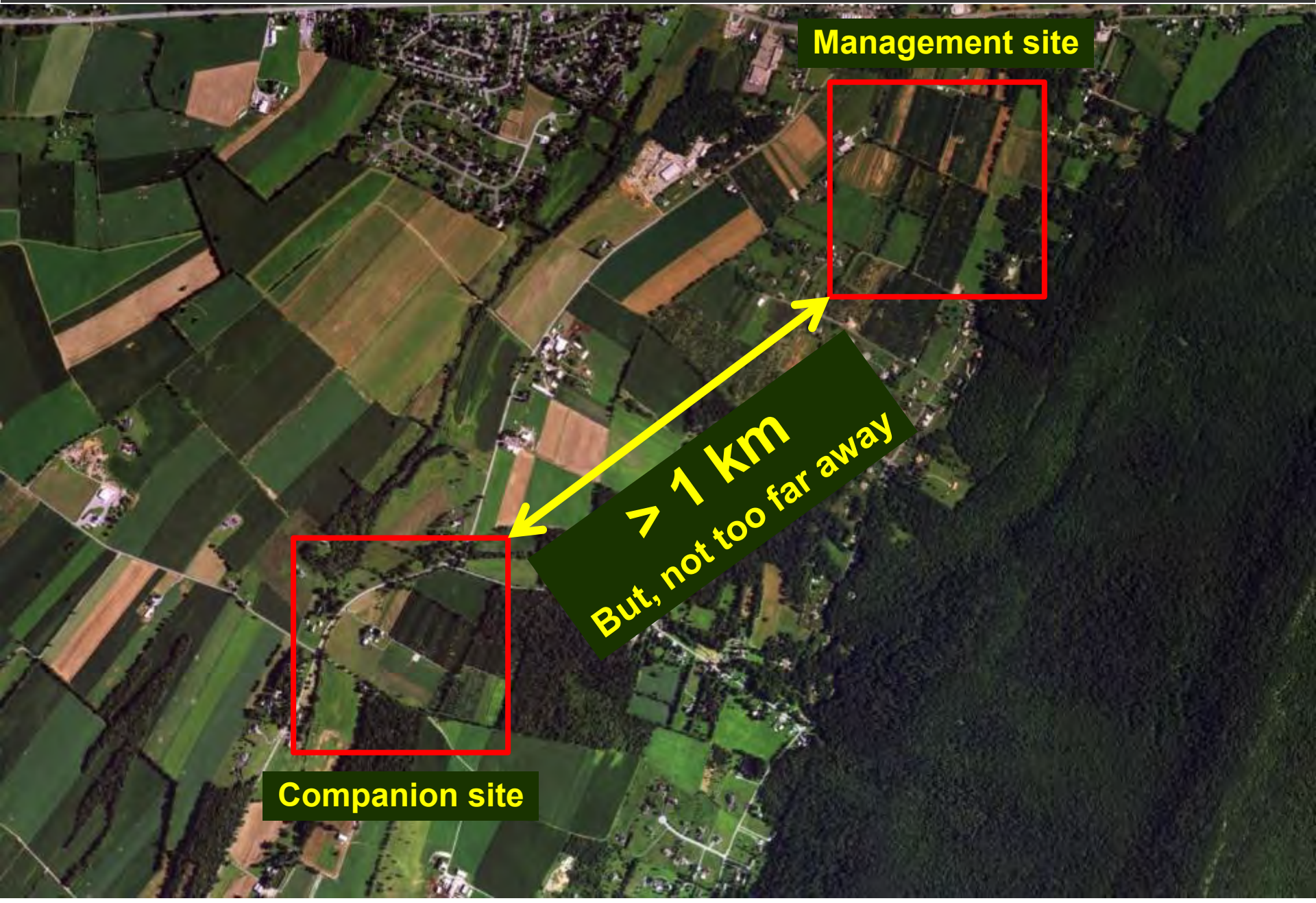


Replicated AWM Research

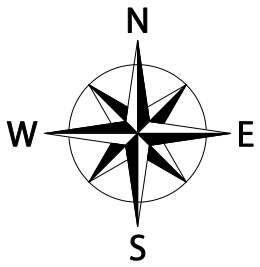
Size of Management and Companion Sites



Distance between Management & Companion Sites



Mapping Landscape Elements



Structure/house

Woodlot/windbreak

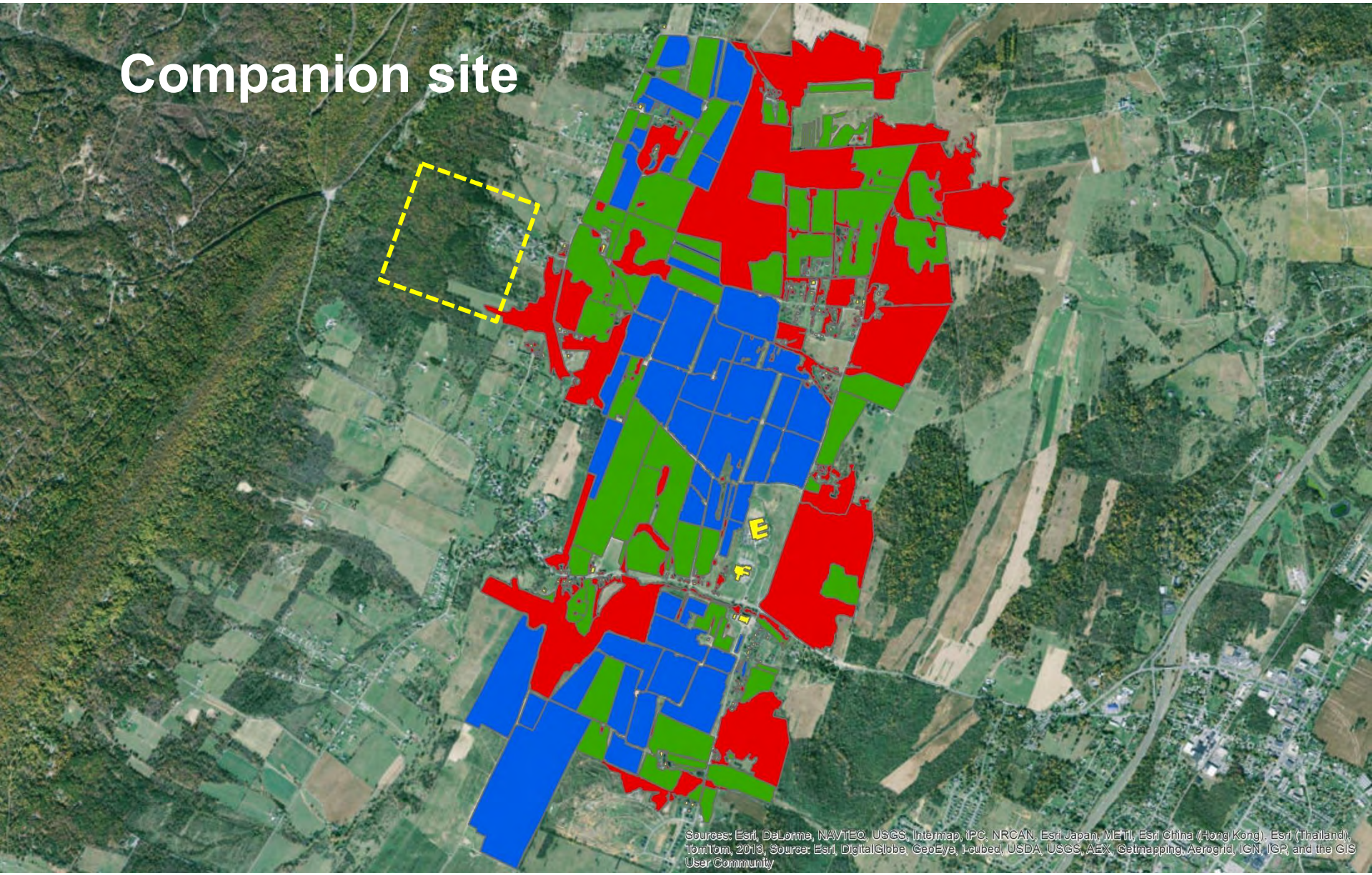
Fruit trees

Vegetable/field crops

Matching Landscape Elements between Two Sites

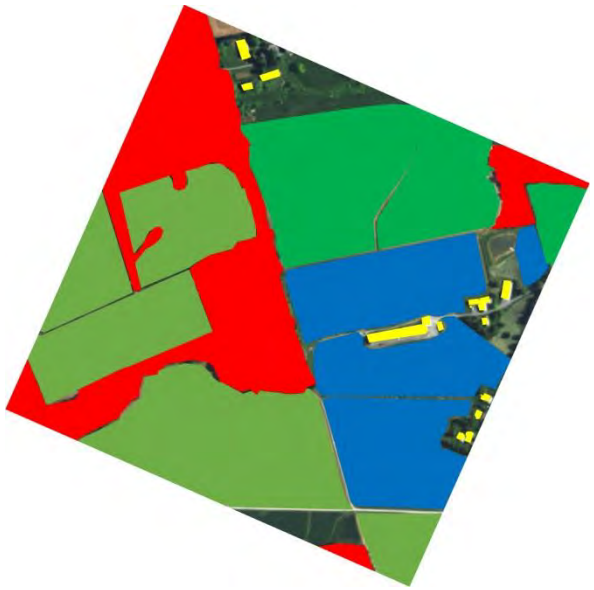
Management site

Matching Landscape Elements between Two Sites



Matching Landscape Elements between Two Sites

Management



20%	Woodlot	13%
20%	Fruit trees	34%
46%	Field crops	37%
1%	Structure	2%
13%	Lawn/others	14%

Companion

Stratified Systematic Sample Layout

trap

Structure/house

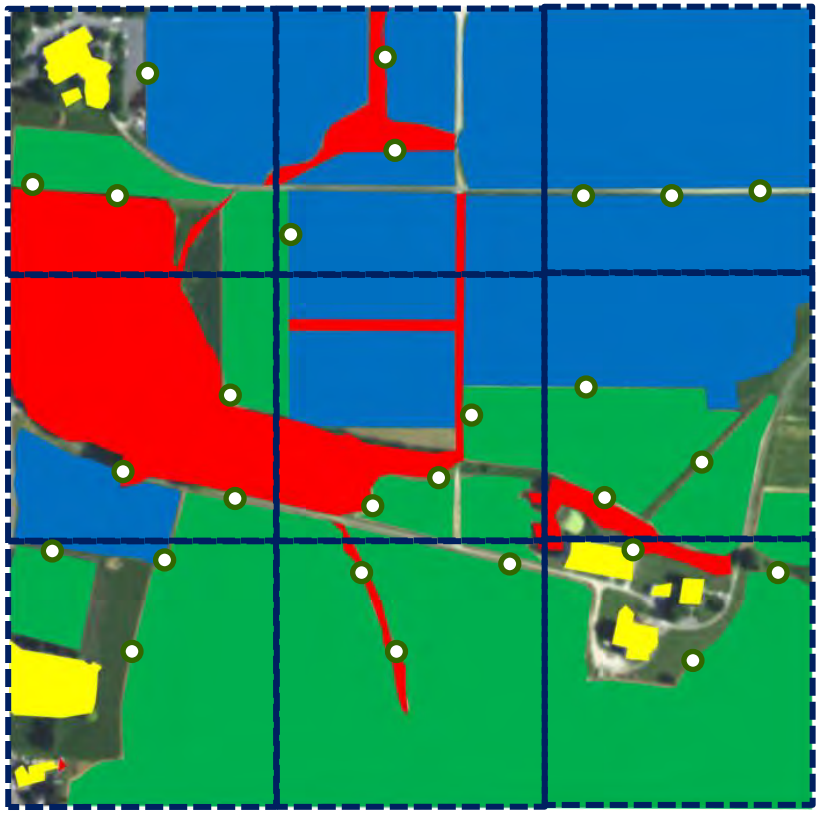
Woodlot/windbreak

Fruit trees

Vegetable/field crops

Interface	Management	Companion
Red-Yellow	1	1
Green-Red	10	10
Green-Green	3	3
Green-Open	2	2
Blue-Green	4	4
Blue-Red	3	3
Blue-Blue	3	3
Blue-Open	1	1

Management site: PA



2017

Stratified Systematic Sample Layout

trap

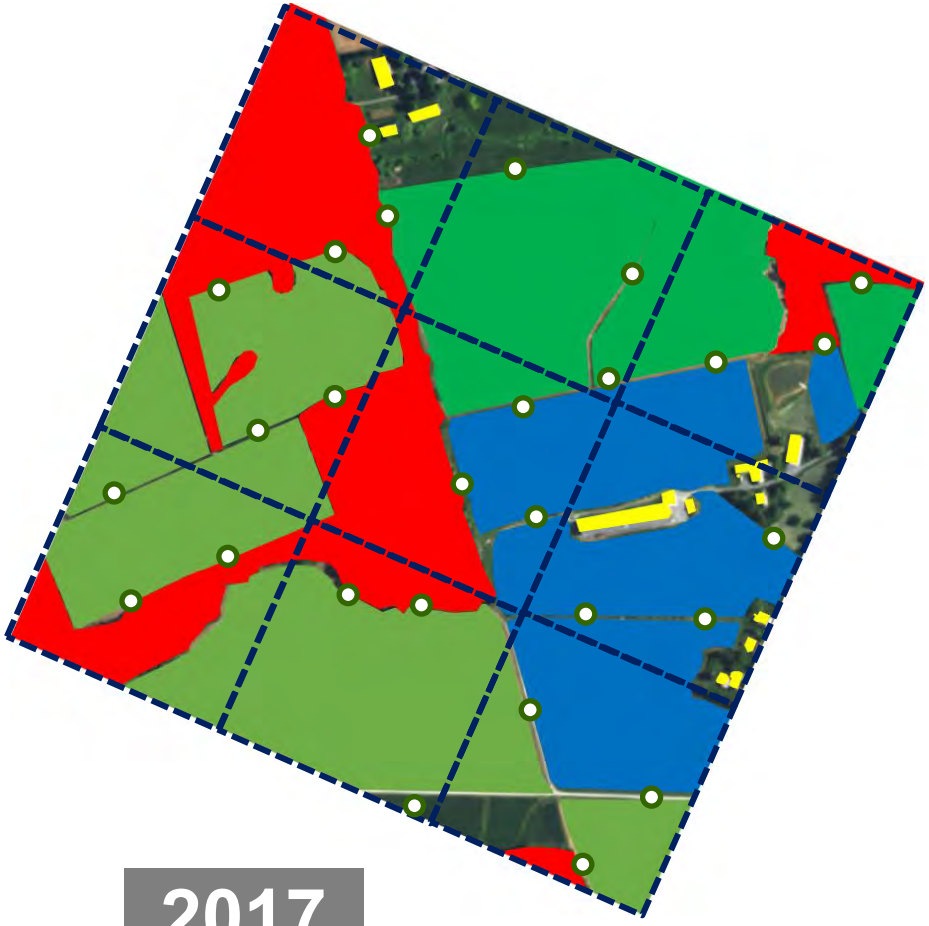
Structure/house

Woodlot/windbreak

Fruit trees

Vegetable/field crops

Companion site: PA

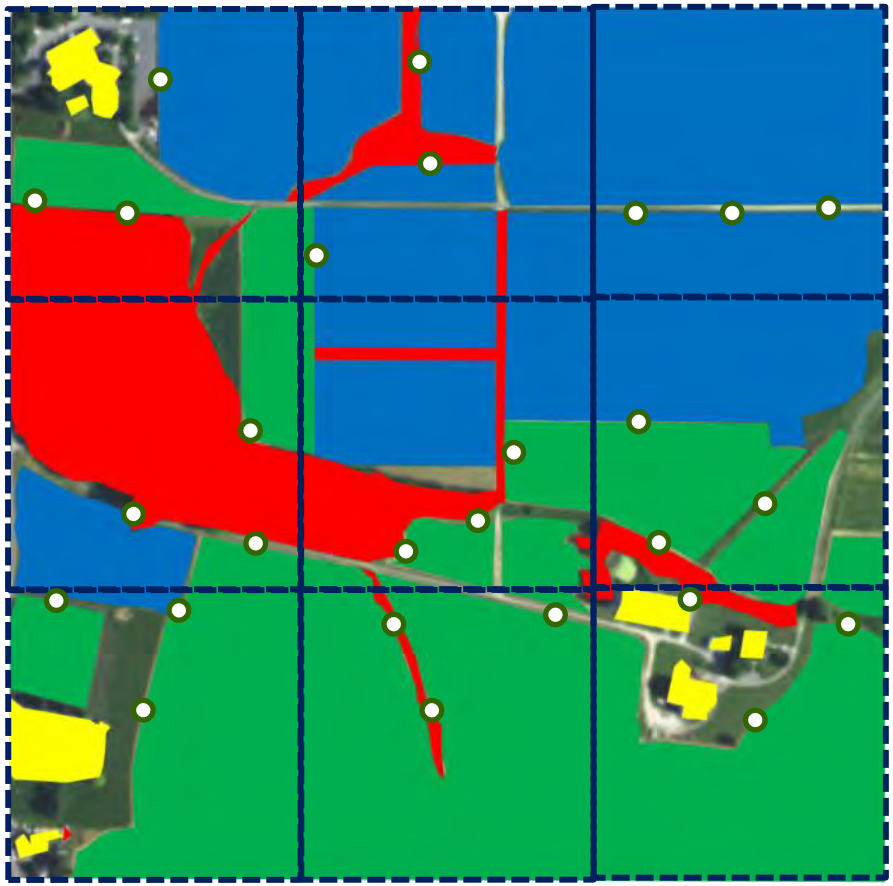


2017

Interface	Management	Companion
Red-Yellow	1	1
Green-Red	10	10
Green-Green	3	3
Green-Open	2	2
Blue-Green	4	4
Blue-Red	3	3
Blue-Blue	3	3
Blue-Open	1	1

BMSB Sampling Protocol

- trap



Trapping

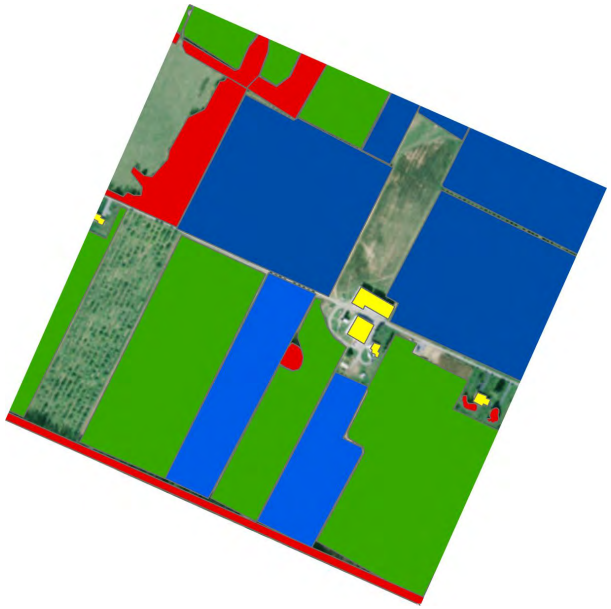
- 27 traps per site
- at least 50 m apart
- May to October
- 14-day interval early and weekly later in the season

Baseline Data
2017 and 2018

WV sites

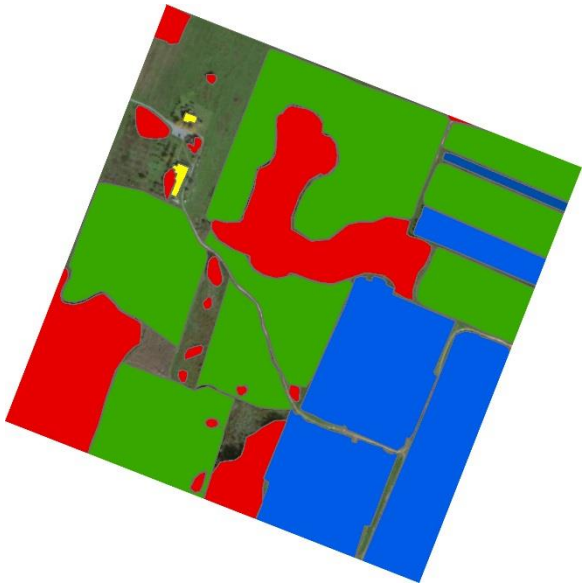
WV Sites

Elliott (Management)



Elliott (Management)		Sharp (Companion)
9%	Woodlot	17%
34%	Fruit trees	24%
37%	Field crops	40%
<1%	Structure	<1%
19%	Lawn/others	19%

Sharp (Companion)



Chi-square test for similarity of landscape element composition
P > 0.05: "No statistical difference"

WV: Management Site

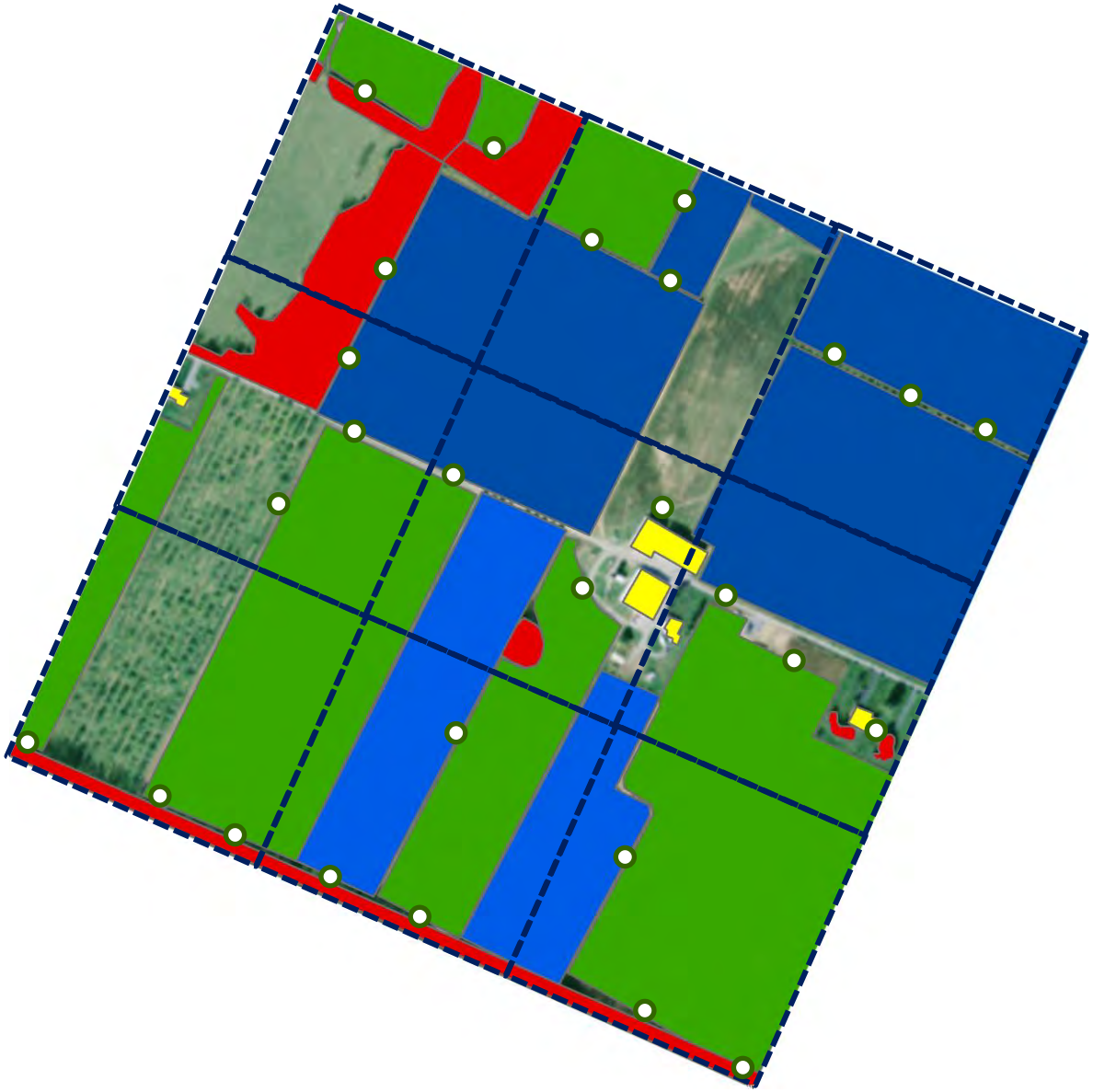
Management

trap

N
W
E
S

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

Interface	Eliott	Sharp
Red-Yellow	1	1
Green-oepn	3	3
Yellow-open	1	1
Green-Red	8	8
Green-Green		1
Blue-Green	7	7
Blue-Red	3	3
Blue-Blue	4	3
Total	27	27



WV: Companion Site

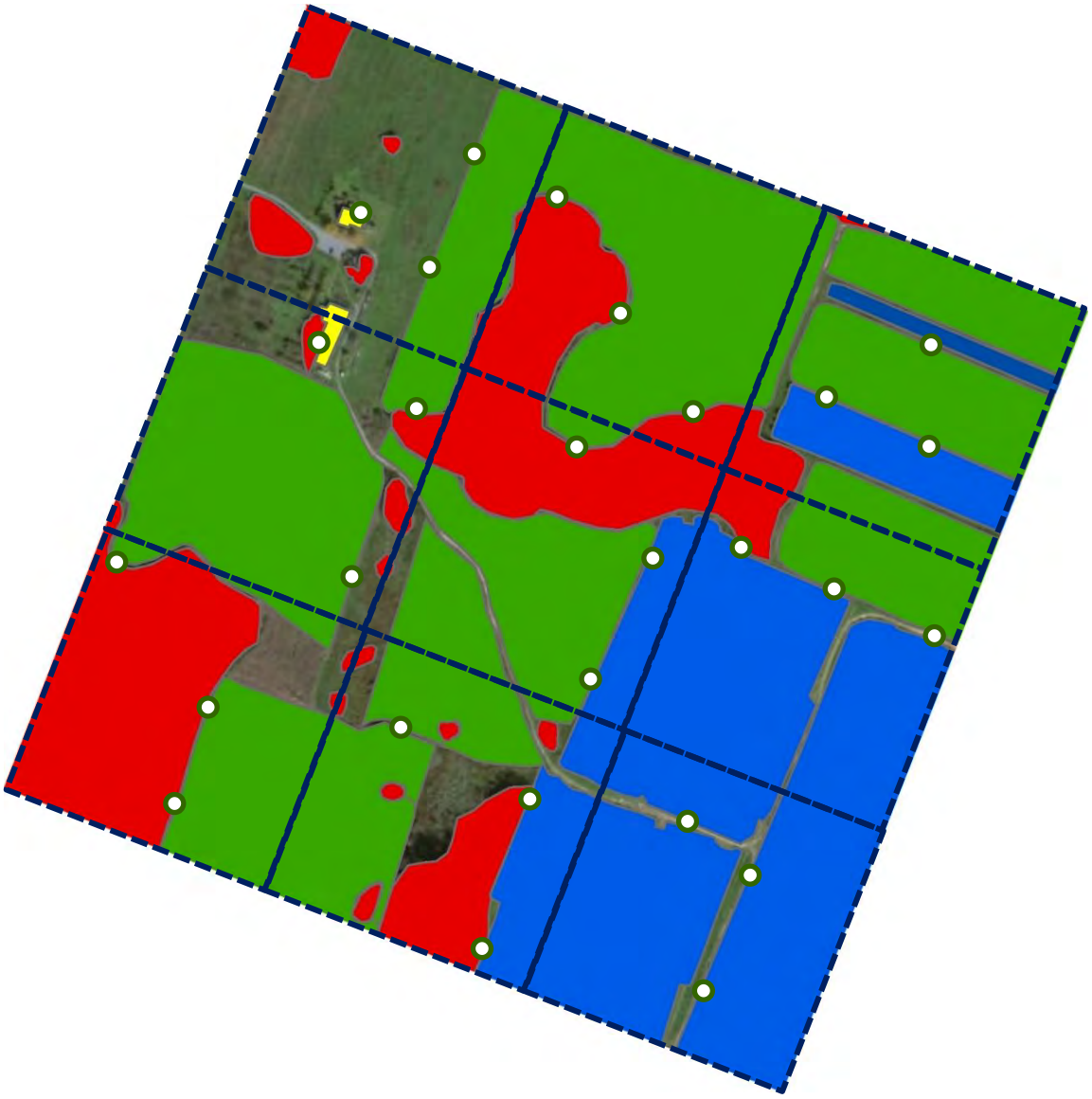
Companion

trap

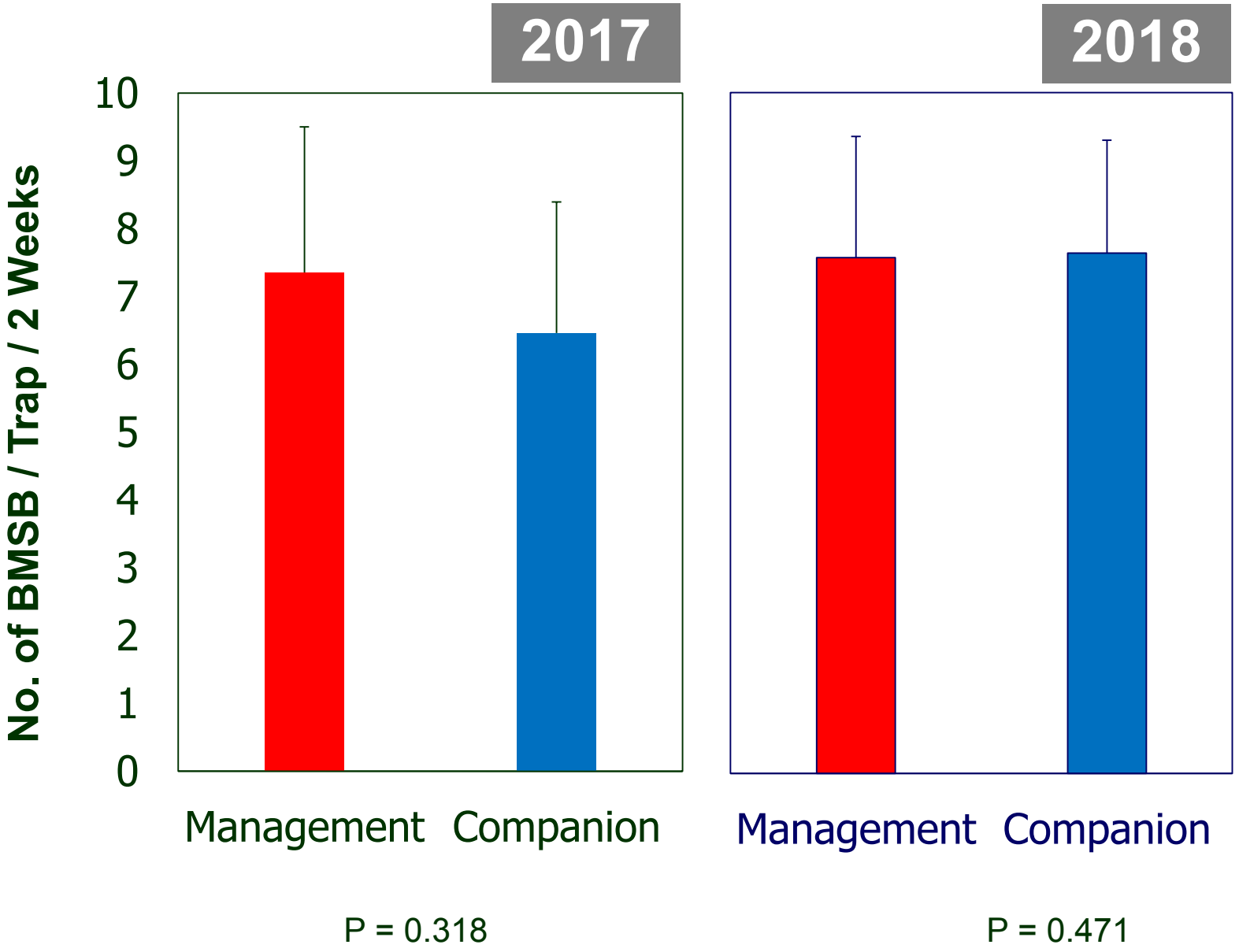
N
W
E
S

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

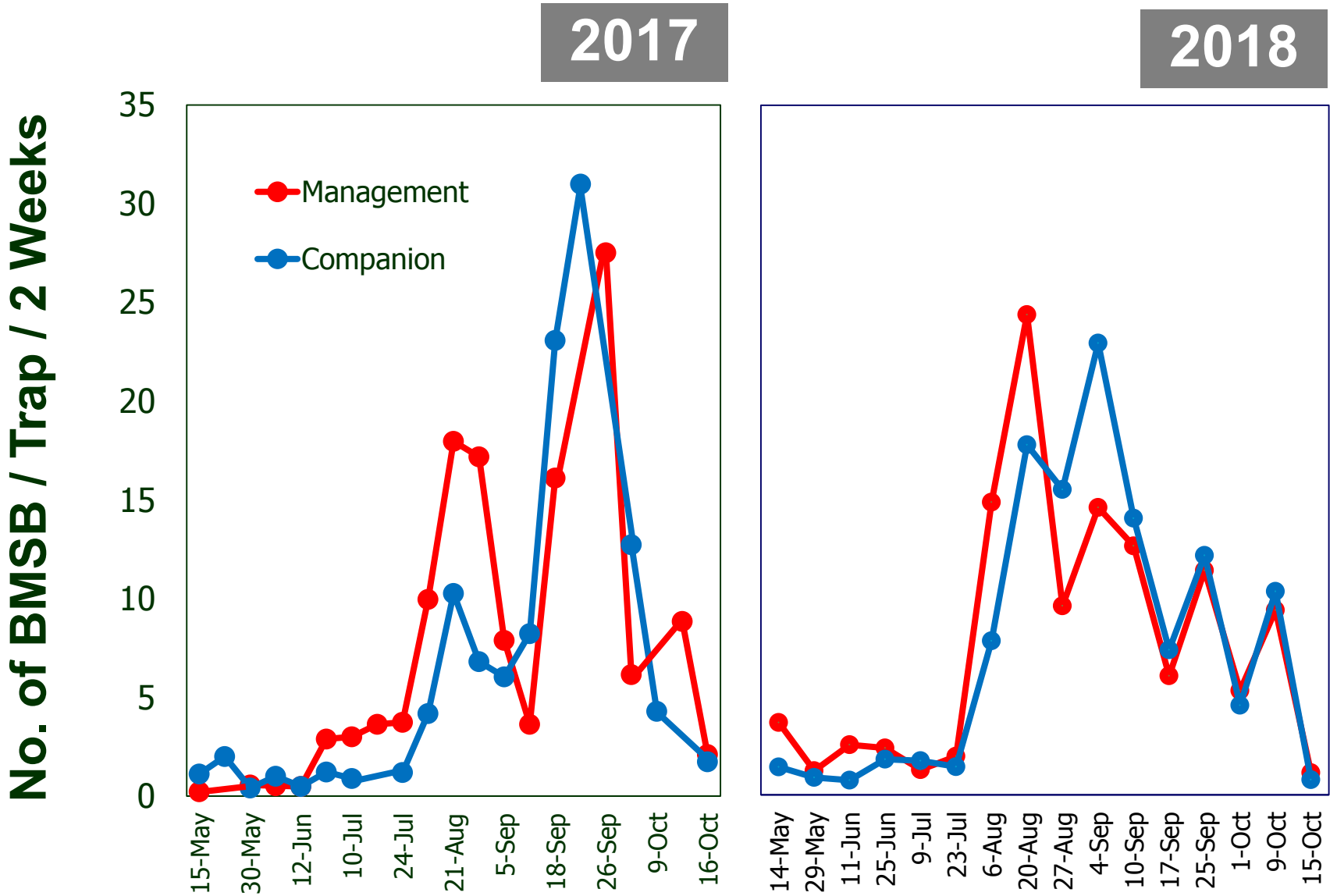
Interface	Elliott	Sharp
Red-Yellow	1	1
Green-oepn	3	3
Yellow-open	1	1
Green-Red	8	8
Green-Green		1
Blue-Green	7	7
Blue-Red	3	3
Blue-Blue	4	3
Total	27	27



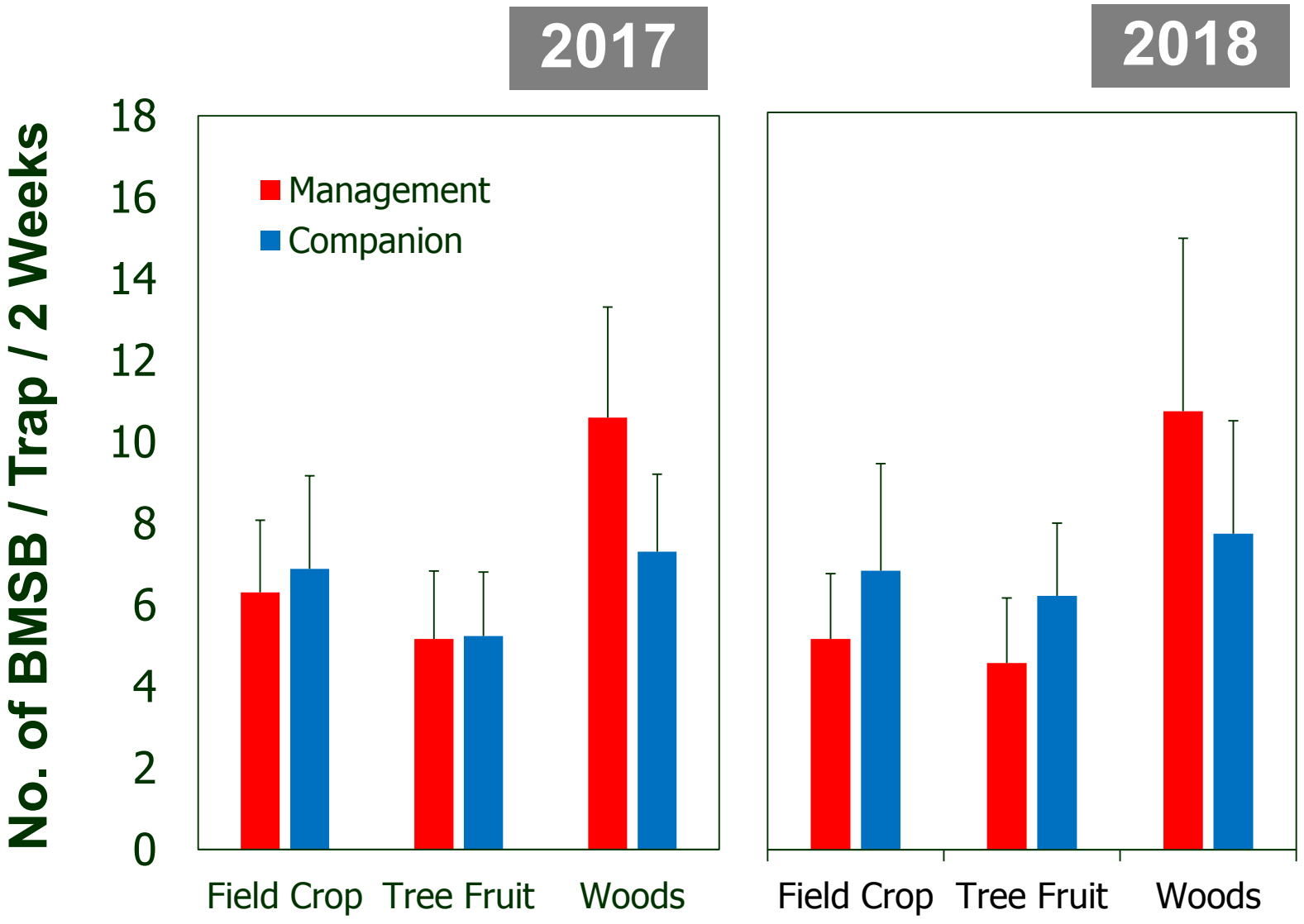
West Virginia



West Virginia



West Virginia



P > 0.05 for all pairwise comparisons between management and companion sites

Spatial Analysis

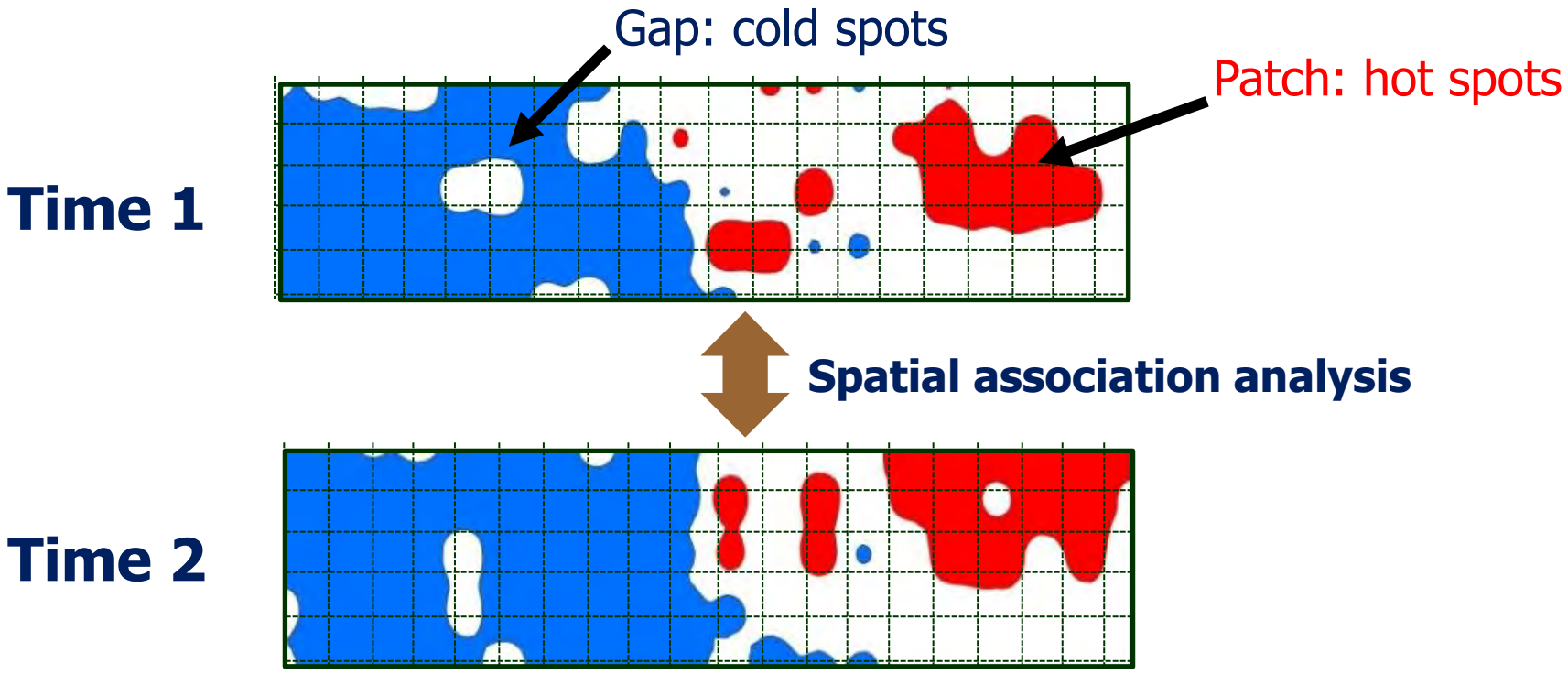
SADIE: Spatial Analysis by Distance IndicEs (Perry et al. 1995)

Measuring and mapping spatial clusters in count data.

Two forms of spatial cluster

Patch: a region of relatively large counts close to one another

Gap: a region of relatively small counts close to one another



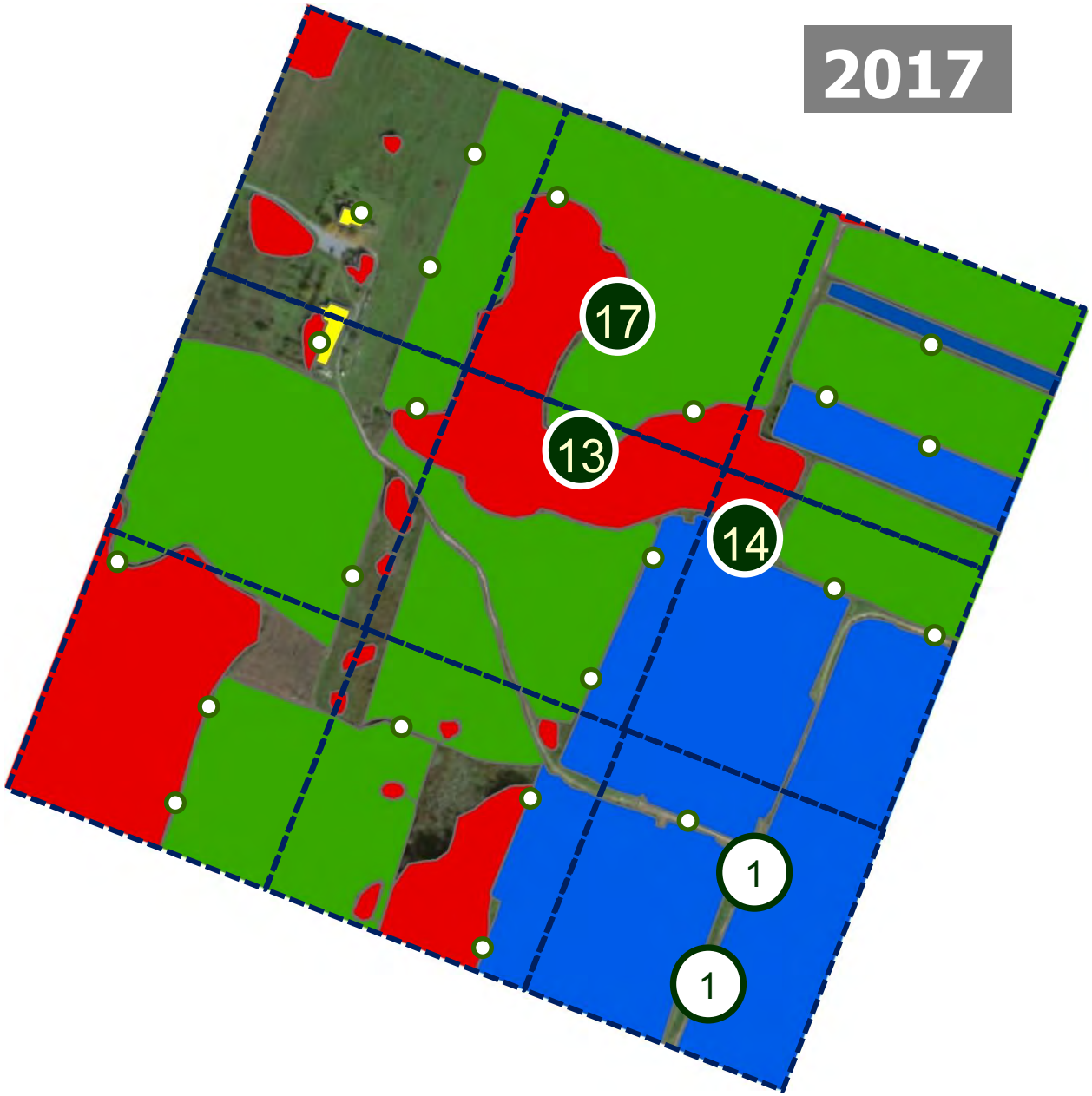
West Virginia

Companion

Patch / Hotspot

Gap / Cold spot

2017



Structure/house

Woodlot/windbreak

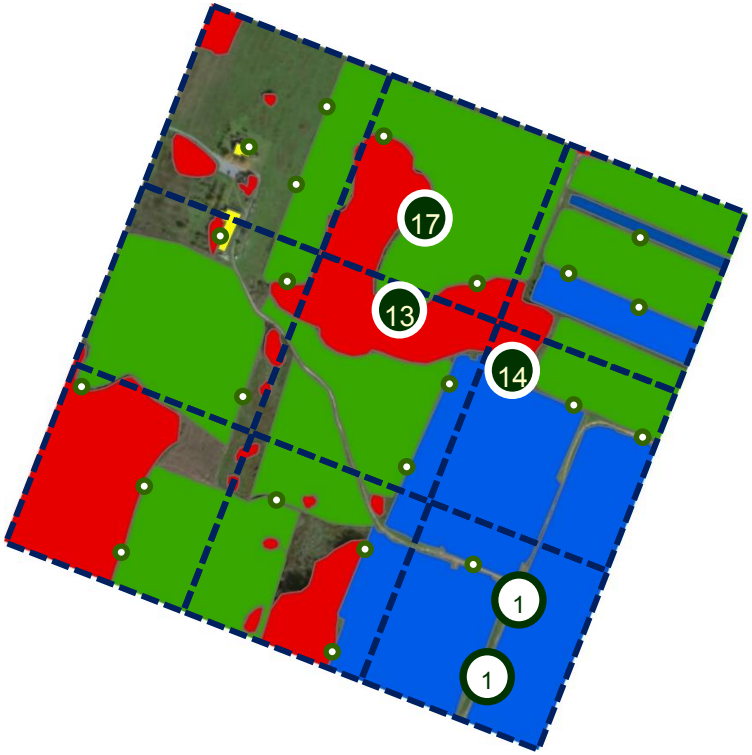
Fruit trees

Vegetable/field crops

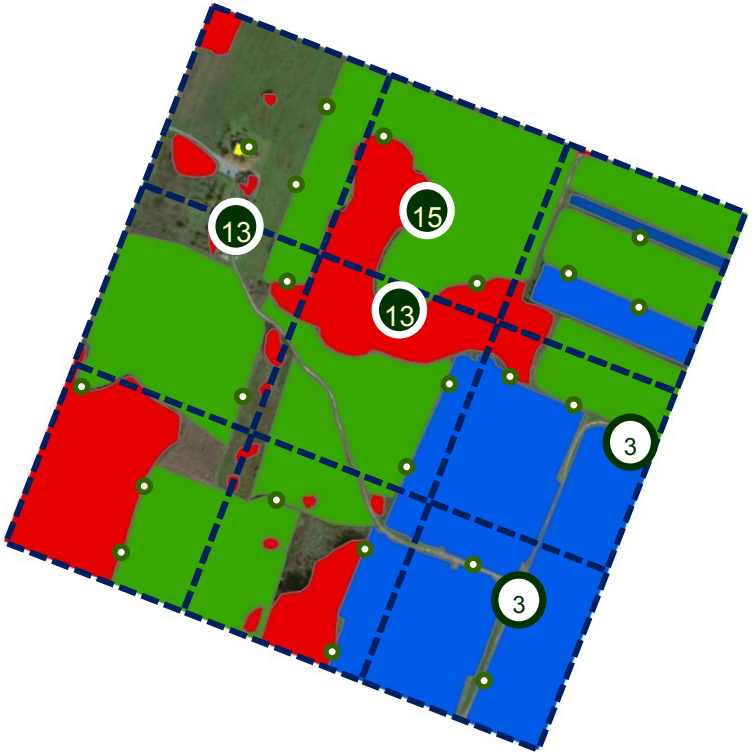
West Virginia

Companion

2017



2018



Structure/house

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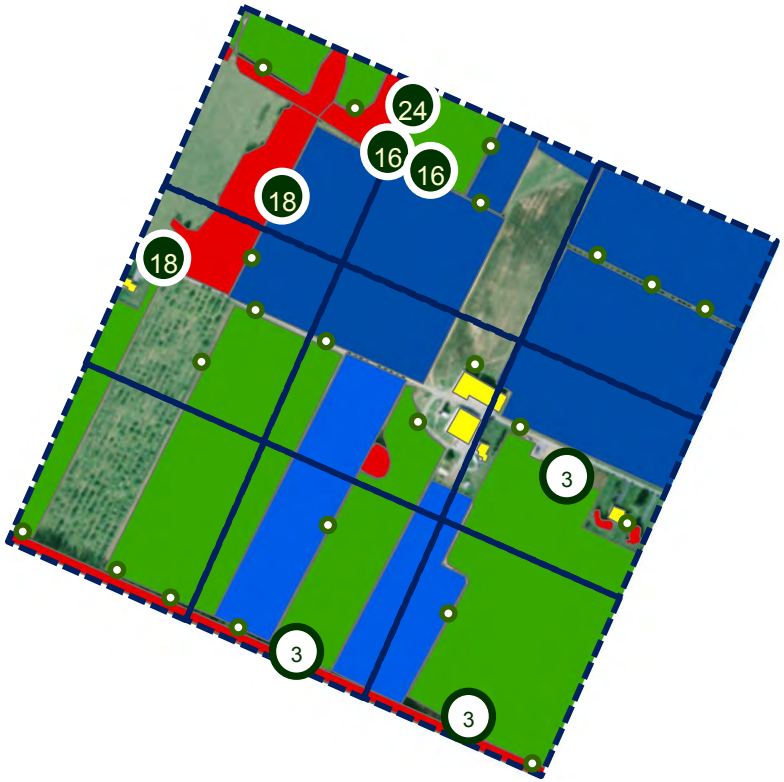
Patch / Hotspot

Gap / Cold spot

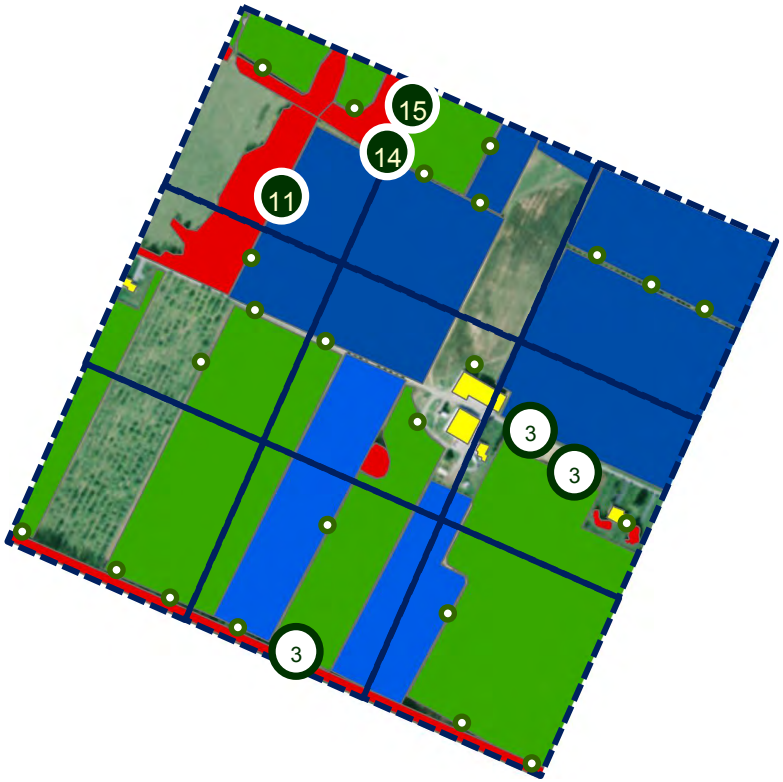
West Virginia

Management

2017



2018



Structure/house

Woodlot/windbreak

Fruit trees

Vegetable/field crops

Patch / Hotspot

Gap / Cold spot

Next Steps

Continue monitoring at 4 Areawide and Companion sites.

Begin to implement biointensive management tactics at Areawide site. Examples include:

a. Releases of *Trissolcus japonicus*.

b. Threshold-based monitoring.

c. Attract and kill.

d. Border sprays.

Measure changes in BMSB and natural enemy relative densities and/or presence over time and grower willingness to adopt and/or support biointensive management tactics.

Areawide Outcomes