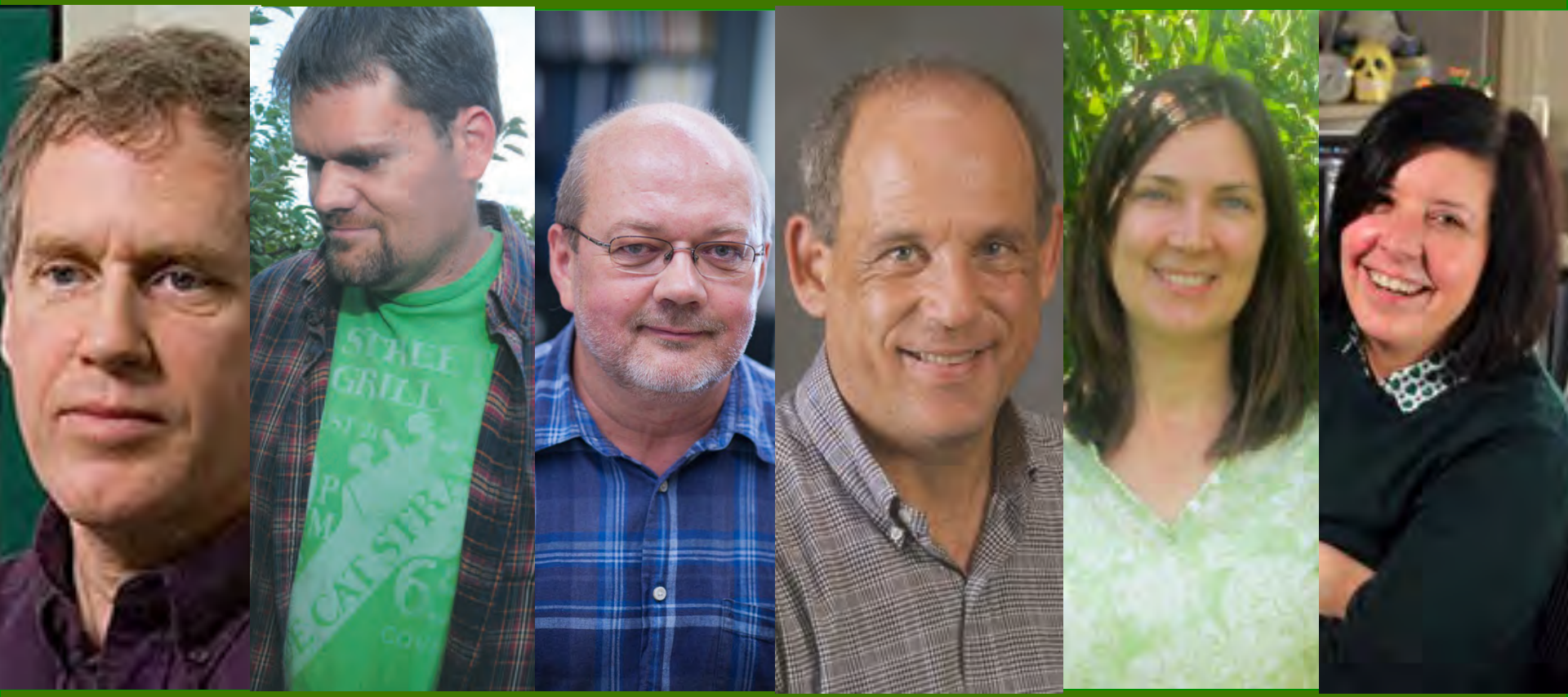
Impact of Areawide Management on

BMSB Populations (Objective 3)



Yong-Lak Park

West Virginia University

Areawide Management

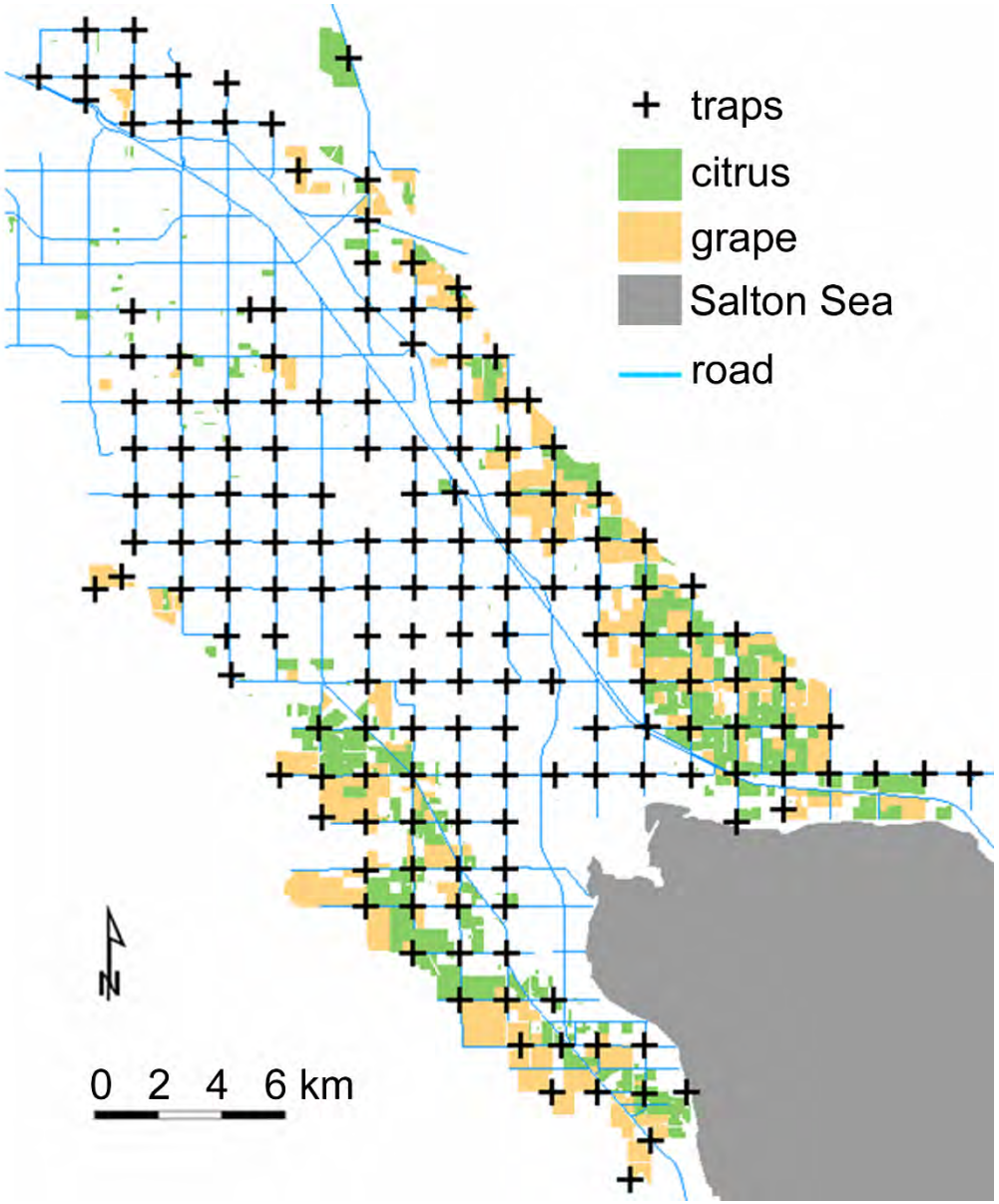
Why areawide management is needed?

- BMSB has wide host range
- BMSB is highly mobile
- Field-by-field BMSB management has limitation

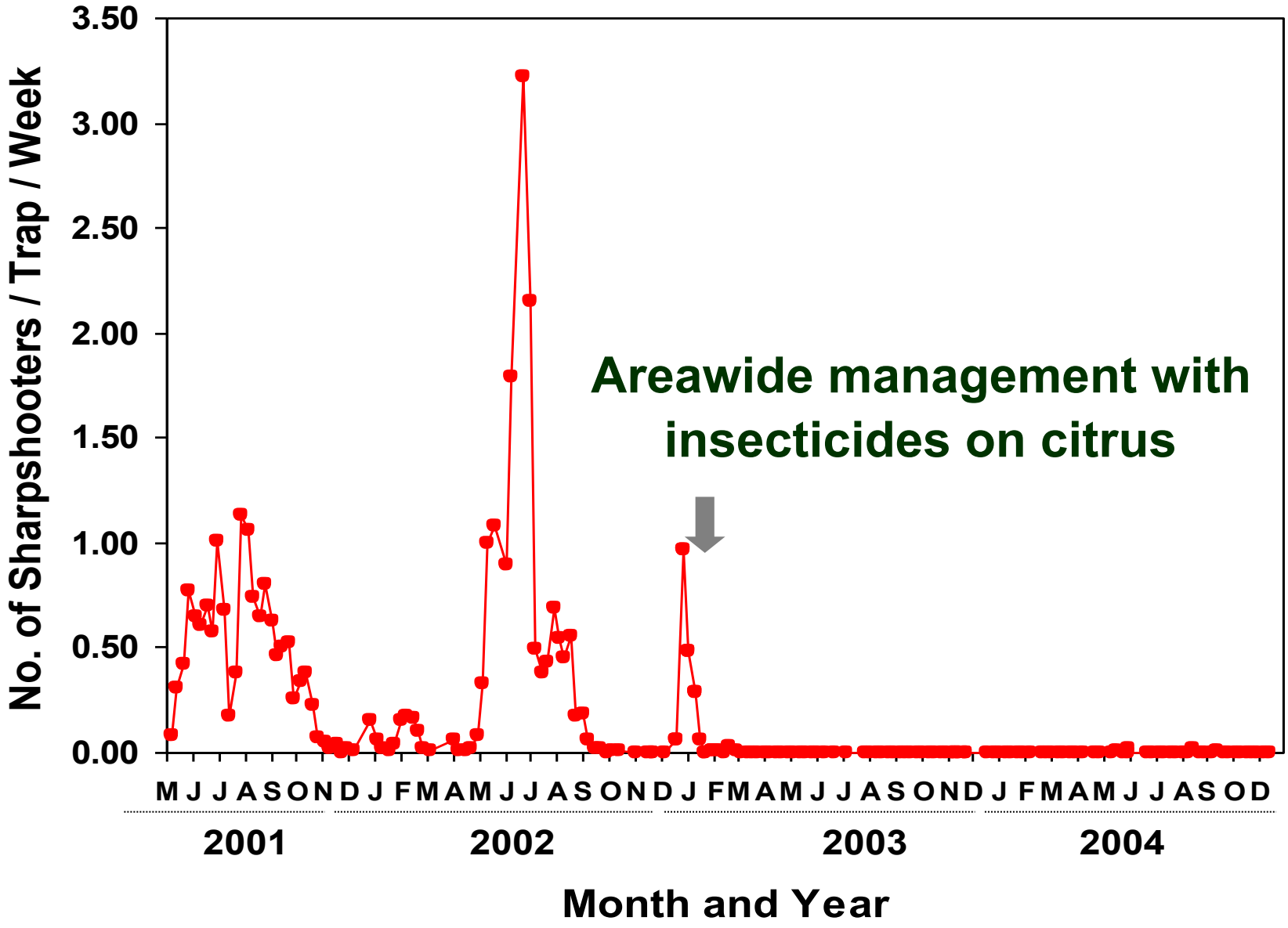
Research question/hypothesis

- Does areawide management work for BMSB?
- Biointensive areawide management

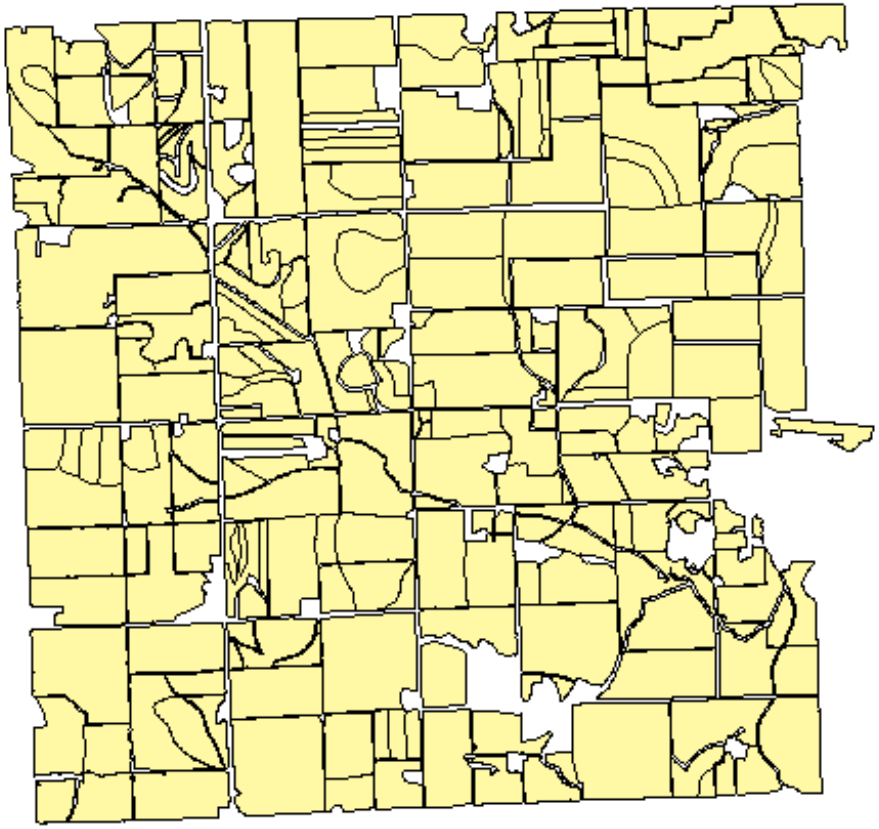
Examples: Glassy-winged Sharpshooter



Examples: Glassy-winged Sharpshooter

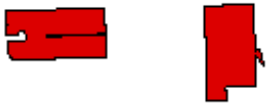


Examples: Corn Rootworm



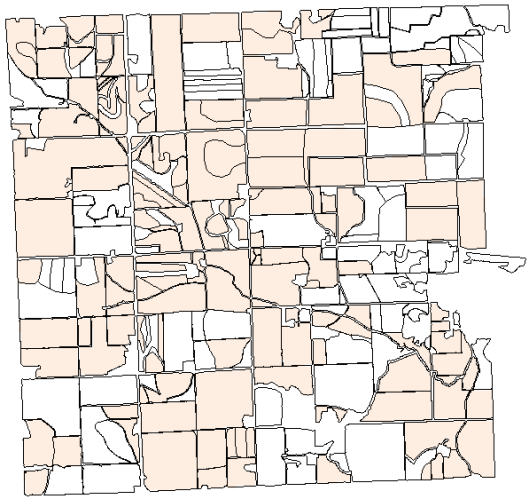
Management site
Semiochemical baits sprayed.

Companion site
Soil insecticide treated.

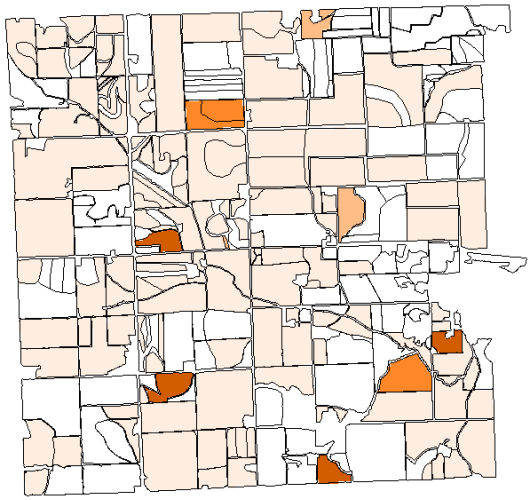


Examples: Corn Rootworm

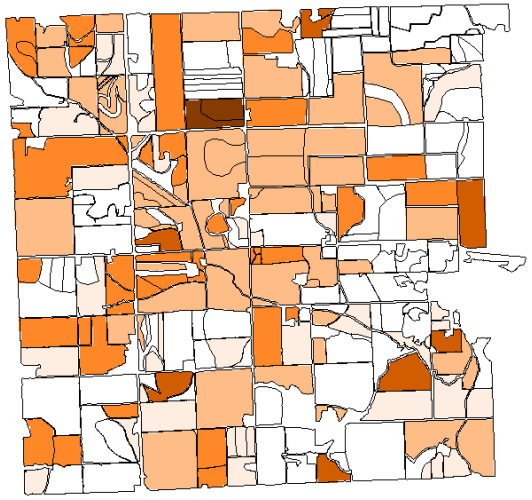
July 1, 1999



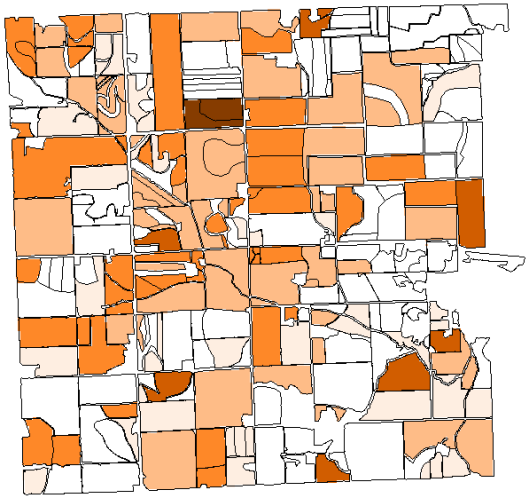
July 22, 1999



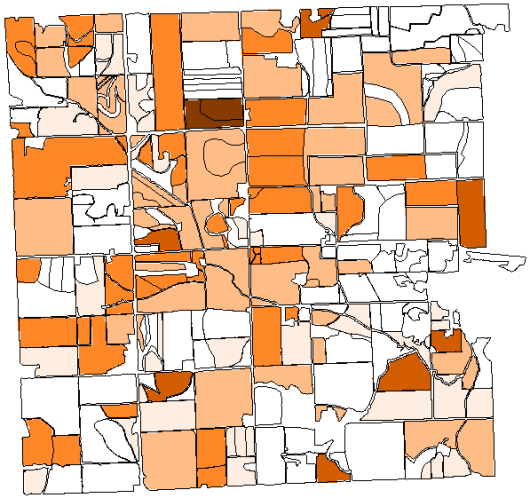
Aug. 12, 1999



Sept. 2, 1999



Sept. 23, 1999



Beetle counts

240-300

180-240

120-180

60-120

0-60

Other Crop

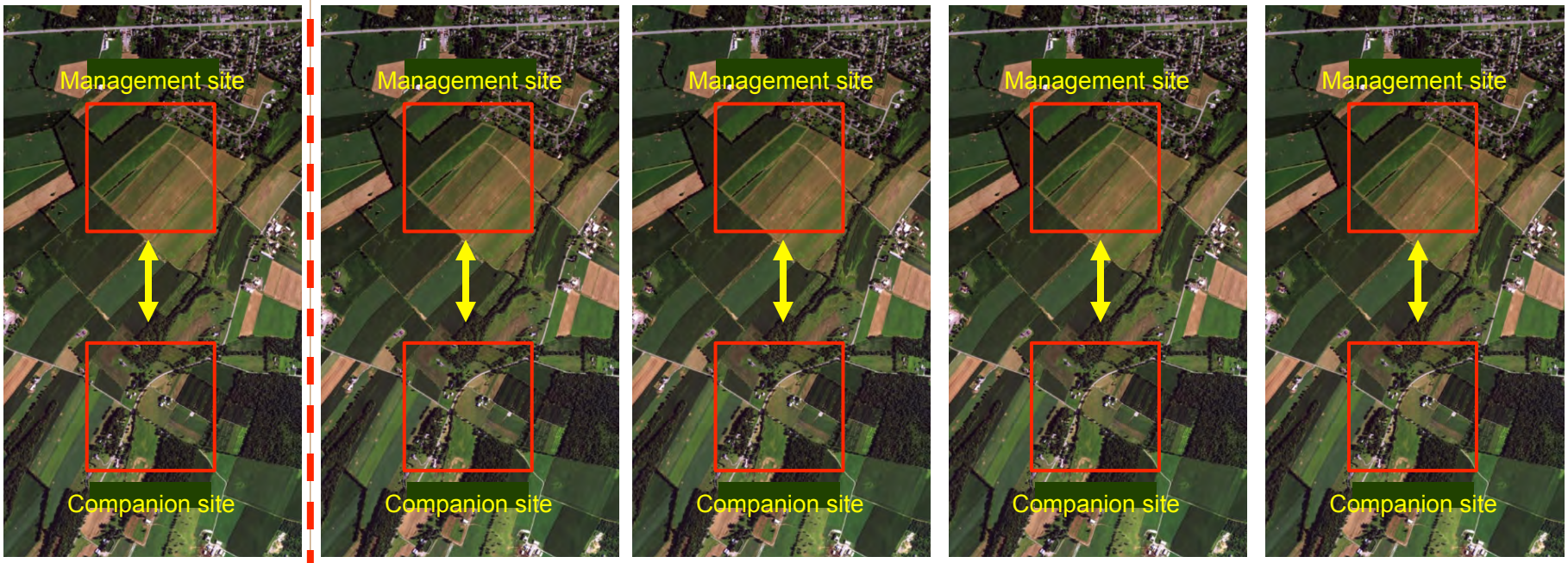
Areawide Management of BMSB

Areawide Management of BMSB

Baseline Data

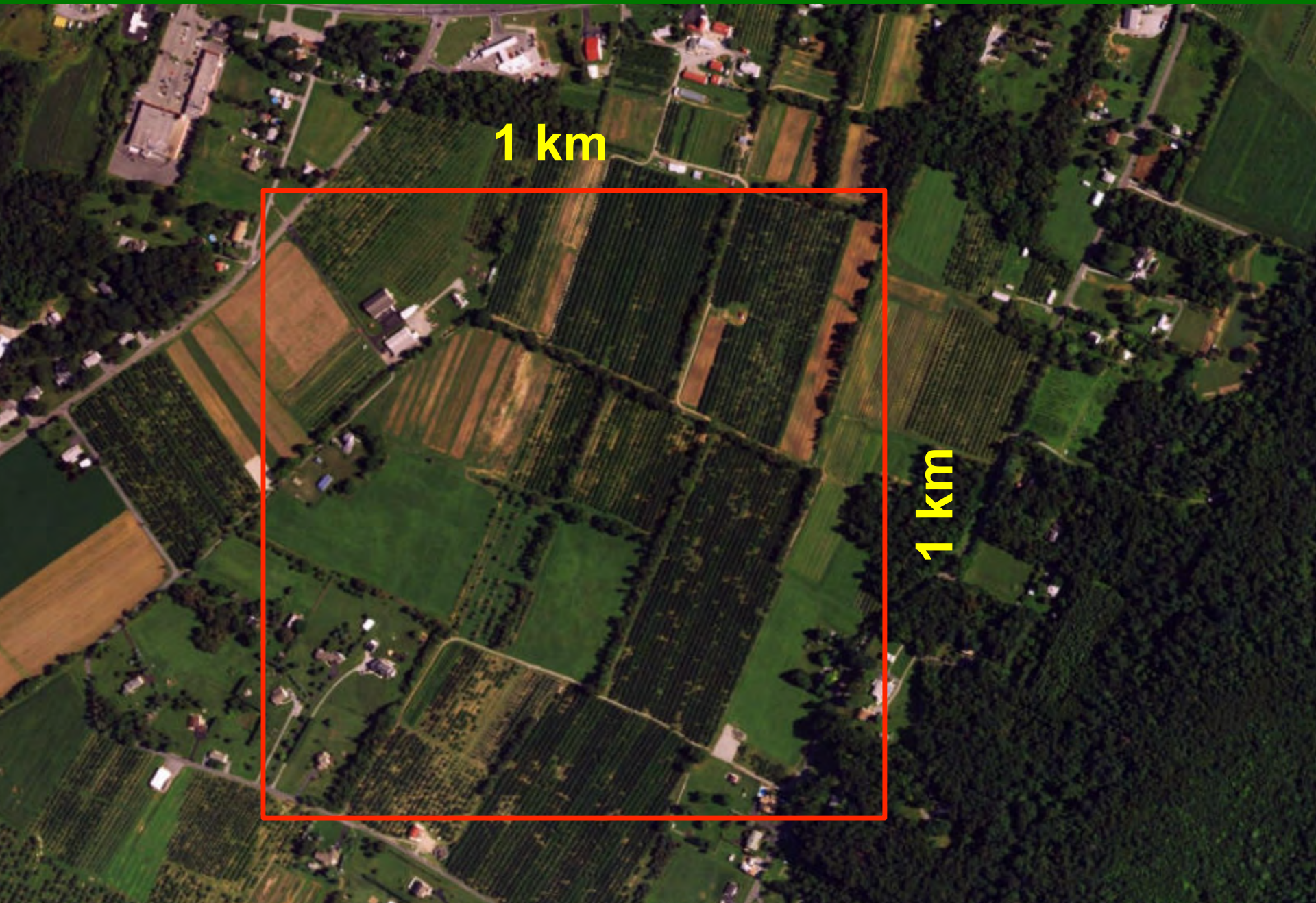
Biointensive Management of BMSB

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

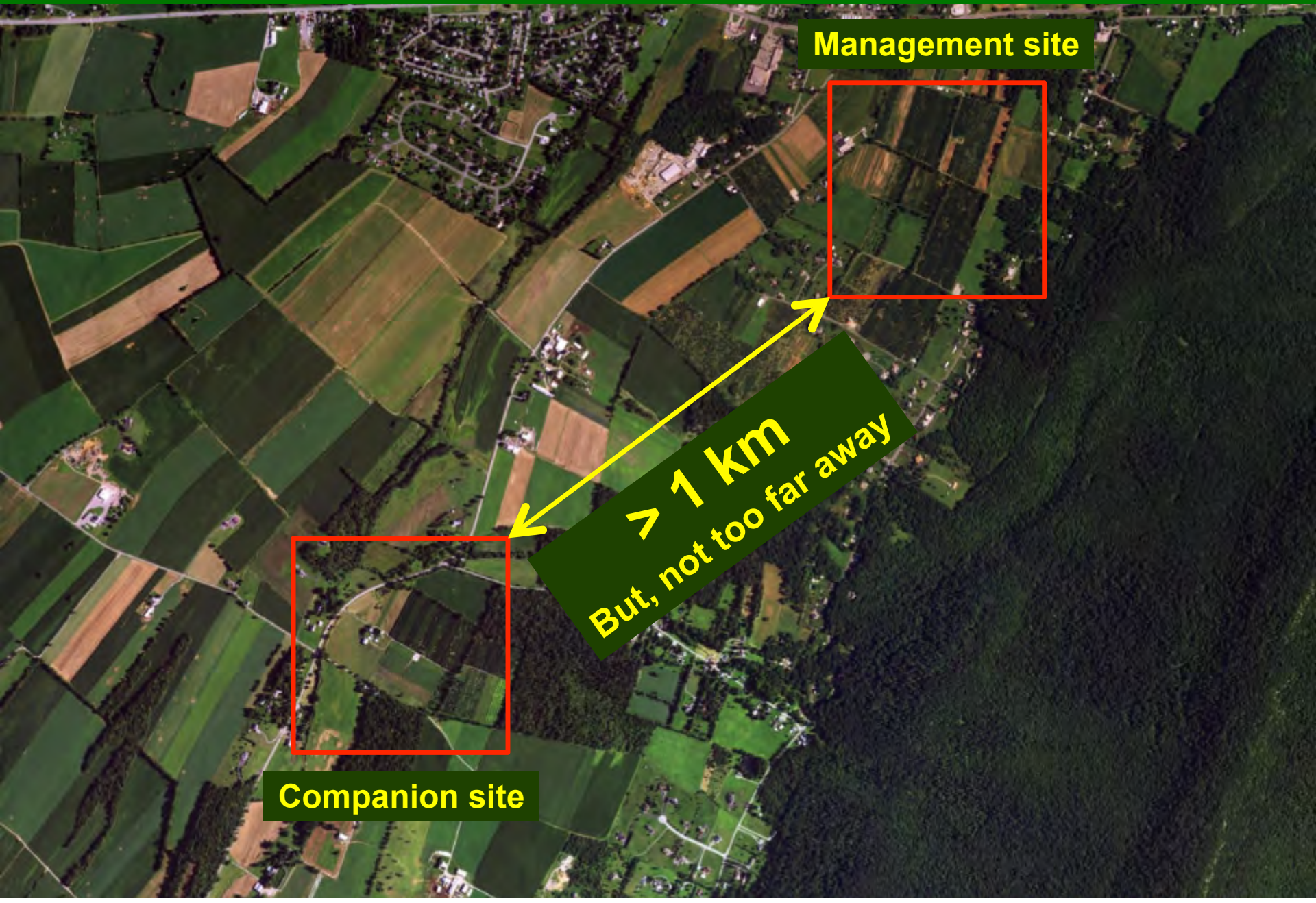


Research Locations

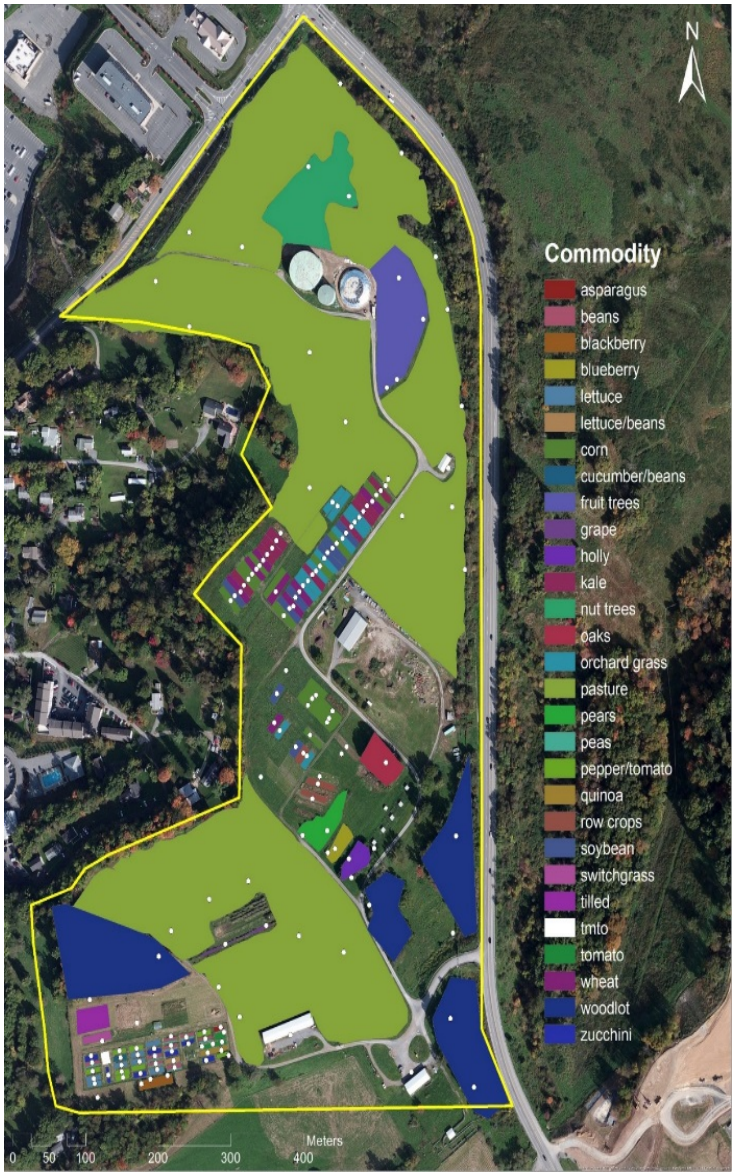
Size of Management and Companion Sites

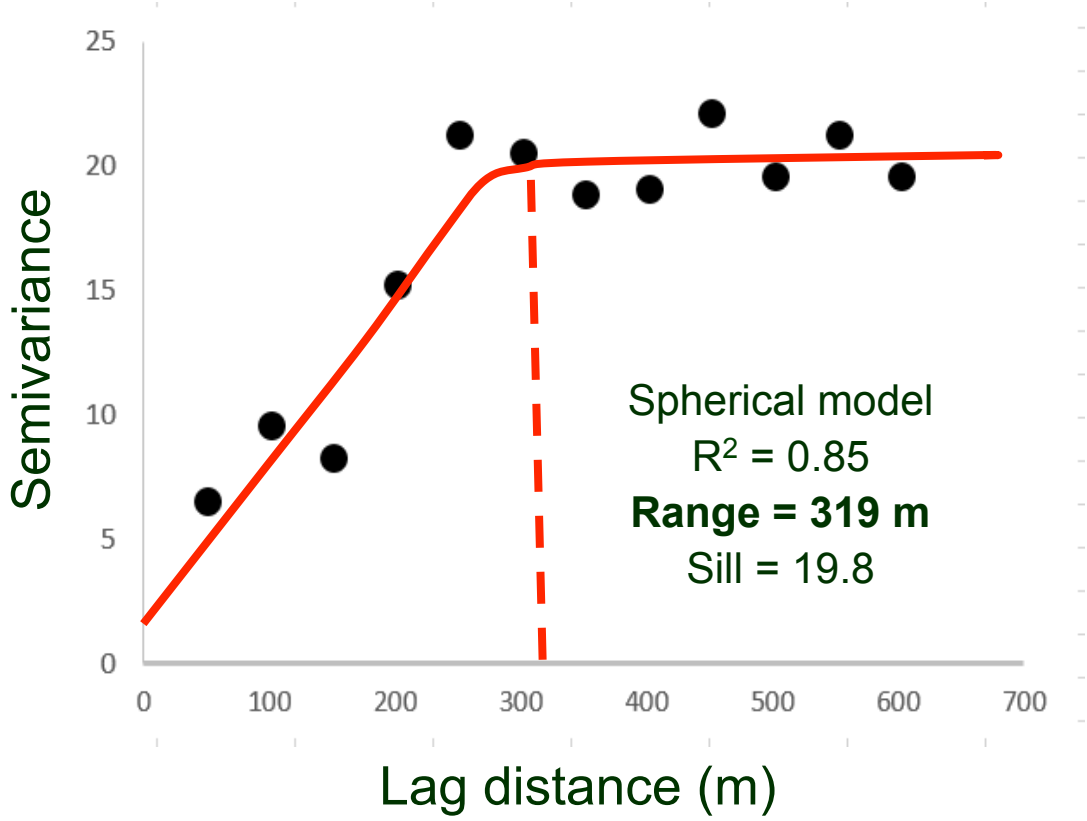


Distance between Management & Companion Sites

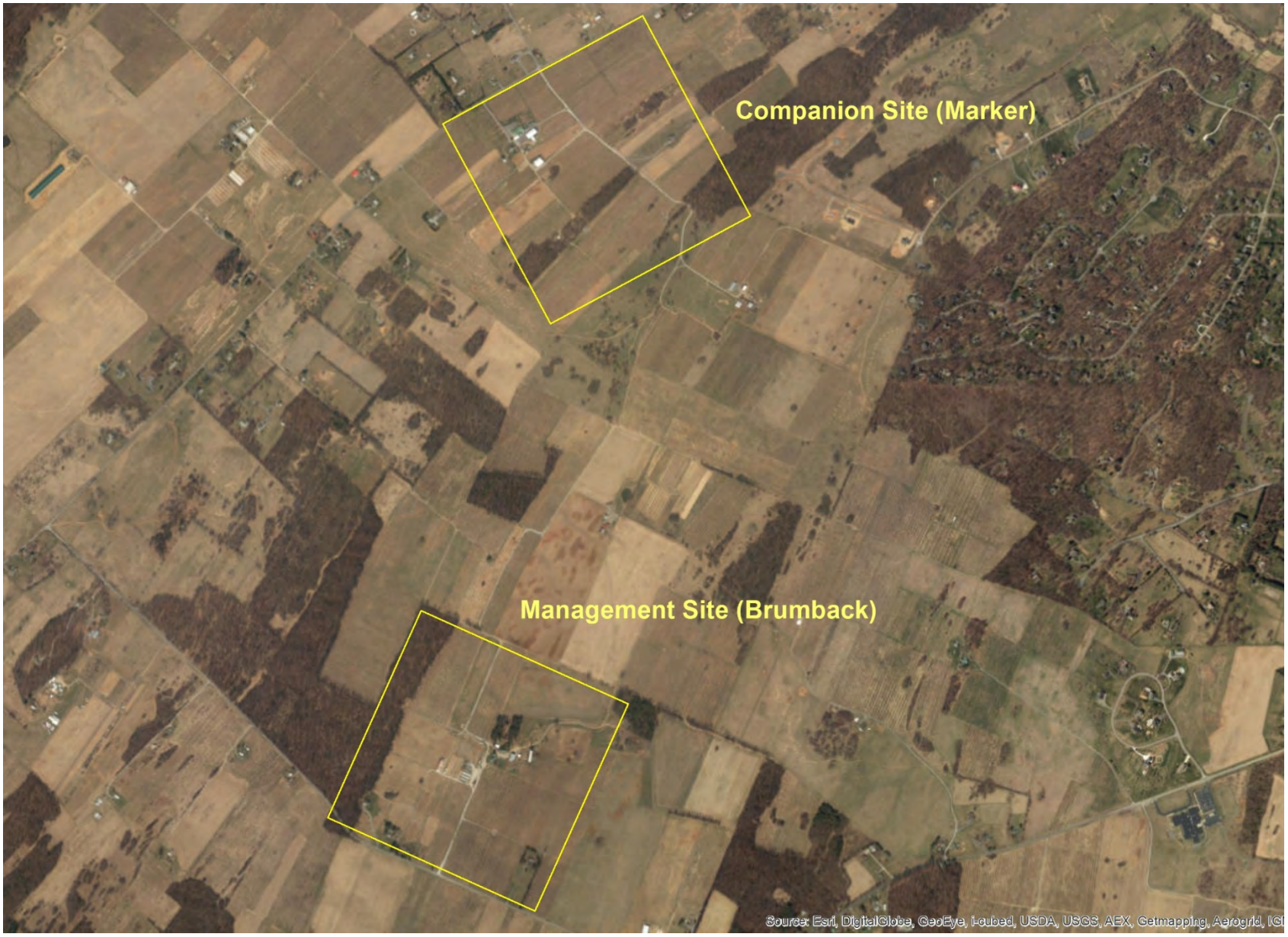


Determination of Distance between Sites





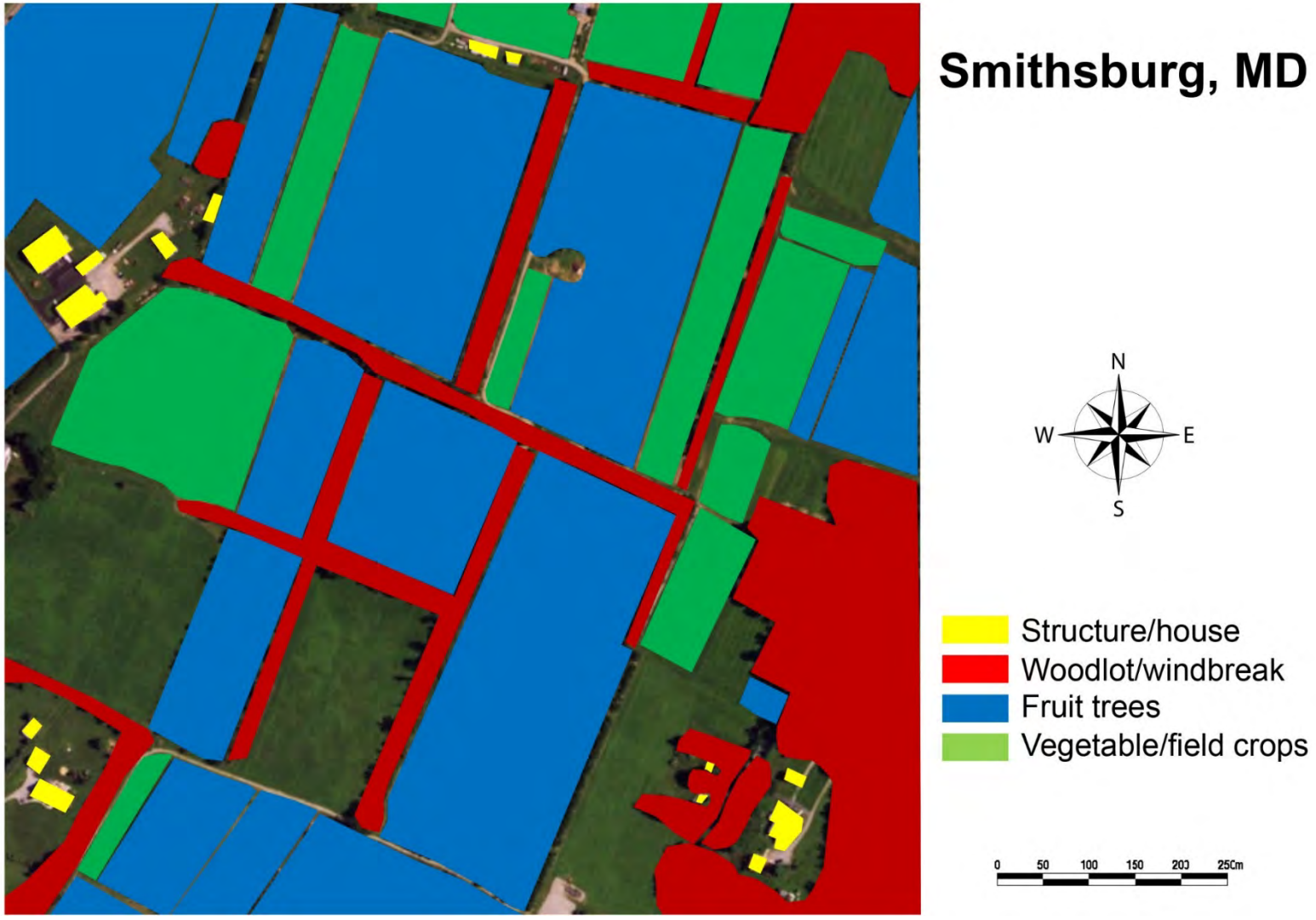
VA Sites


Companion Site (Marker)
Management Site (Brumback)
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGI

PA Sites

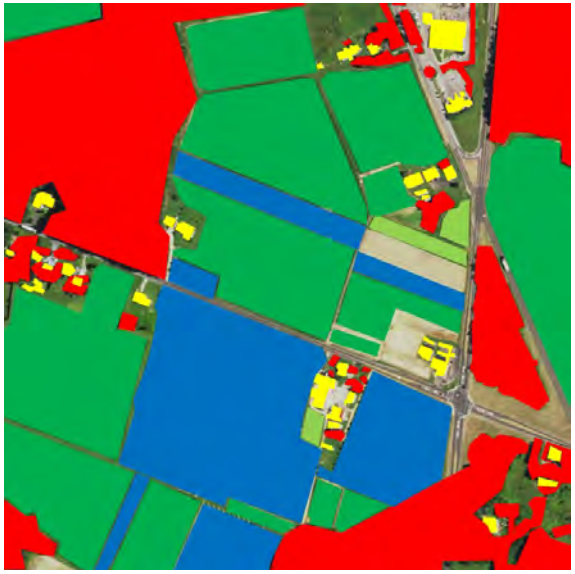
companion
management
N
W
E
S
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

Mapping Landscape Elements



Matching Landscape Elements between Two Sites

Management Site



25.4%	Woodlot	24.7%
17.9%	Fruit trees	17.2%
34.5%	Field crops	35.3%
1.6%	Structure	1.4%
19.7%	Lawn/others	21.4%

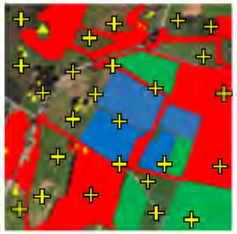
Companion Site

Chi-square test: $\chi 2 = 0.23$; df = 4; P = 0.99

Field Visits

Discussion on Sample Layout

Discussion: sample layout



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sampling			
Estimating BMSB population in each site	Grid or lattice	-Samples cover an entire site -Less biased by the location of landscape elements	-Could be not efficient at all to visit all traps in each site -Some landscape elements may not be sampled (excluded) based on where they are located
	Transect	-When transects are placed along the interface, placing and visiting traps could be easy	-Placing transects along the interface could hinder farm vehicle movement and management -When transect is placed toward a landscape element, accessing to traps could be difficult -May not provide good population estimate in a site (over or underestimate population)
	Stratified by landscape element	-All landscape elements will contain traps	-Depending on the size of each landscape element, over or underestimation of BMSB population may occur -Locating traps in each element can be difficult, depending on its location, shape, and size
	Stratified without considering landscape element	-Provide unbiased estimation of BMSB population in a site	-Depending on where random sample points are located within each landscape element, sampling could be difficult -Samples may not cover all landscape elements
	Completely random	-Provide unbiased estimation of BMSB population in a site	-Depending on where random sample points are located, access to traps could be very difficult -Samples may not cover all landscape elements, specifically for small ones

26

sampling			
Estimating BMSB populations in each landscape element in each site	Overall	We can compare landscape element based BMSB populations between management and companion sites	Assigning the number of samples to each landscape element can be an issue due to various shape, size, and location of the elements
	Random sampling within each landscape element	Less biased BMSB population estimate can be obtained within each landscape element	When an landscape element is large, access to traps could be an issue
	Systematic (grid, lattice, stratified, transect, etc.) within each landscape element	This would be a little bit easier for placing and visiting traps than random layout within each landscape element above	When a landscape element is not large enough or elements are highly fragmented, systematic sample layout may not be work.

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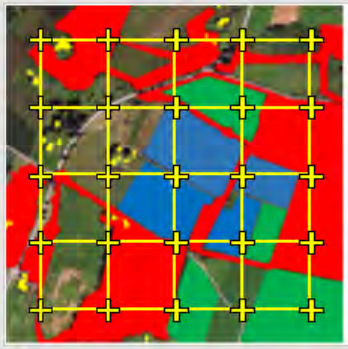
Random

Pros
-Samples cover an entire site
-Less biased by the location of landscape elements

Cons including logistical issues
-Could be not efficient at all to visit all traps in each site
-Some landscape elements may not be sampled (excluded) based on where they are located

28

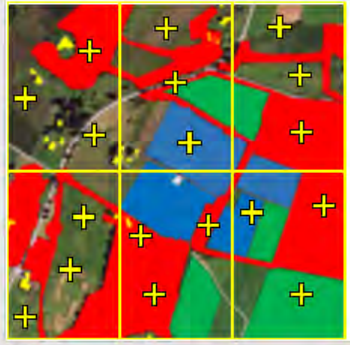


Lattice

Pros
-Samples cover an entire site
-Less biased by the location of landscape elements

Cons including logistical issues
-Could be not efficient at all to visit all traps in each site
-Some landscape elements may not be sampled (excluded) based on where they are located

29



Stratified by area

Pros
-All landscape elements will contain traps

Cons including logistical issues
-Depending on the size of each landscape element, over or underestimation of BMSB population may occur
-Locating traps in each element can be difficult depending on its location, shape, and size

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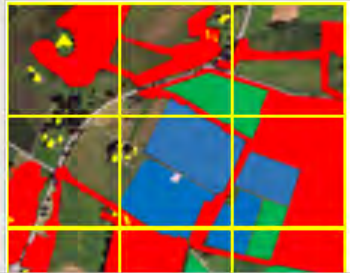
Stratified by landscape element

Pros
-Provide unbiased estimation of BMSB population in a site

Cons including logistical issues
-Depending on where random sample points are located within each landscape element,



Grid

Pros
-Samples cover an entire site
-Less biased by the location of landscape elements

Cons including logistical issues
-Could be not efficient at all to visit all traps in each site

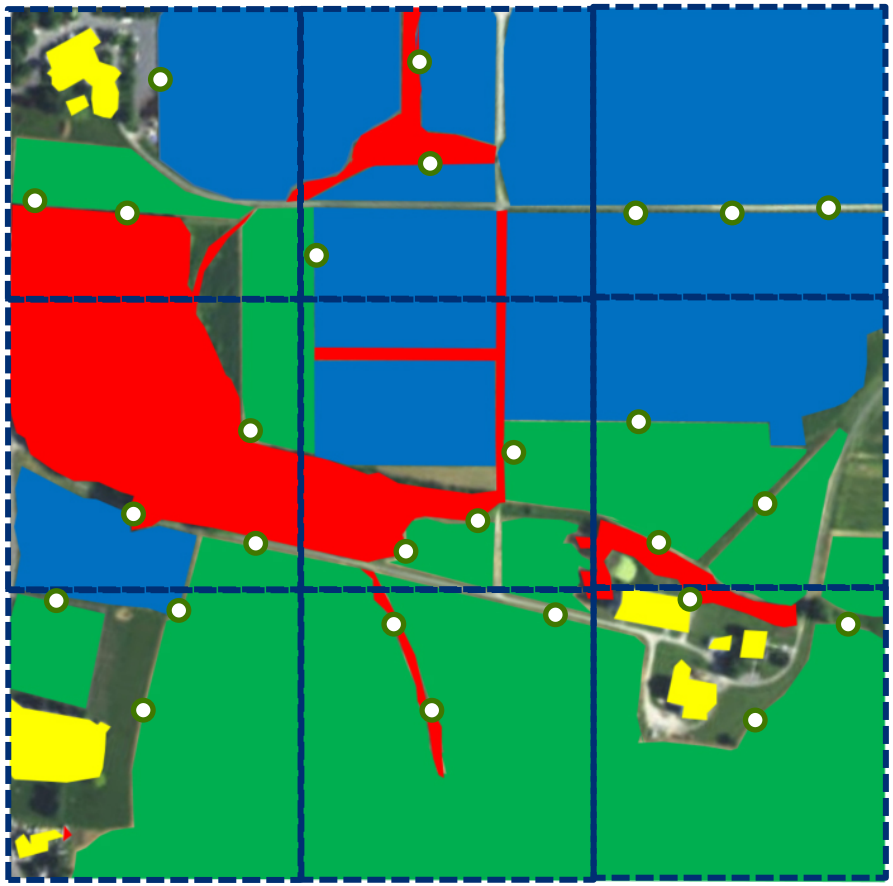
Transect

Pros
-When transects are placed along the interface, placing and visiting traps could be easy

Cons including logistical issues
-Placing transects along the interface could hinder farm vehicle movement and management
-When transect is placed toward a landscape element, accessing to traps

BMSB Sampling Protocol

- trap



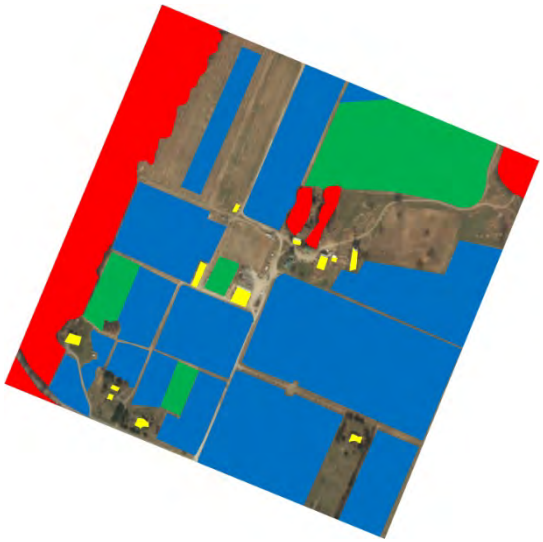
Trapping

- 27 traps per site
- at least 50 m apart
- May to October
- 14-day interval

Finalized Field Layout !!!

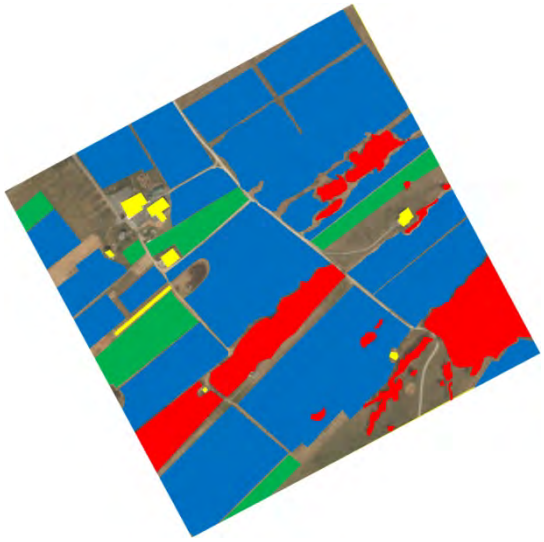
VA Sites

Management (Brumback)



13%	Woodlot	12%
47%	Fruit trees	57%
11%	Field crops	7%
1%	Structure	1%
28%	Lawn/others	23%

Companion (Marker)



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

VA Sites

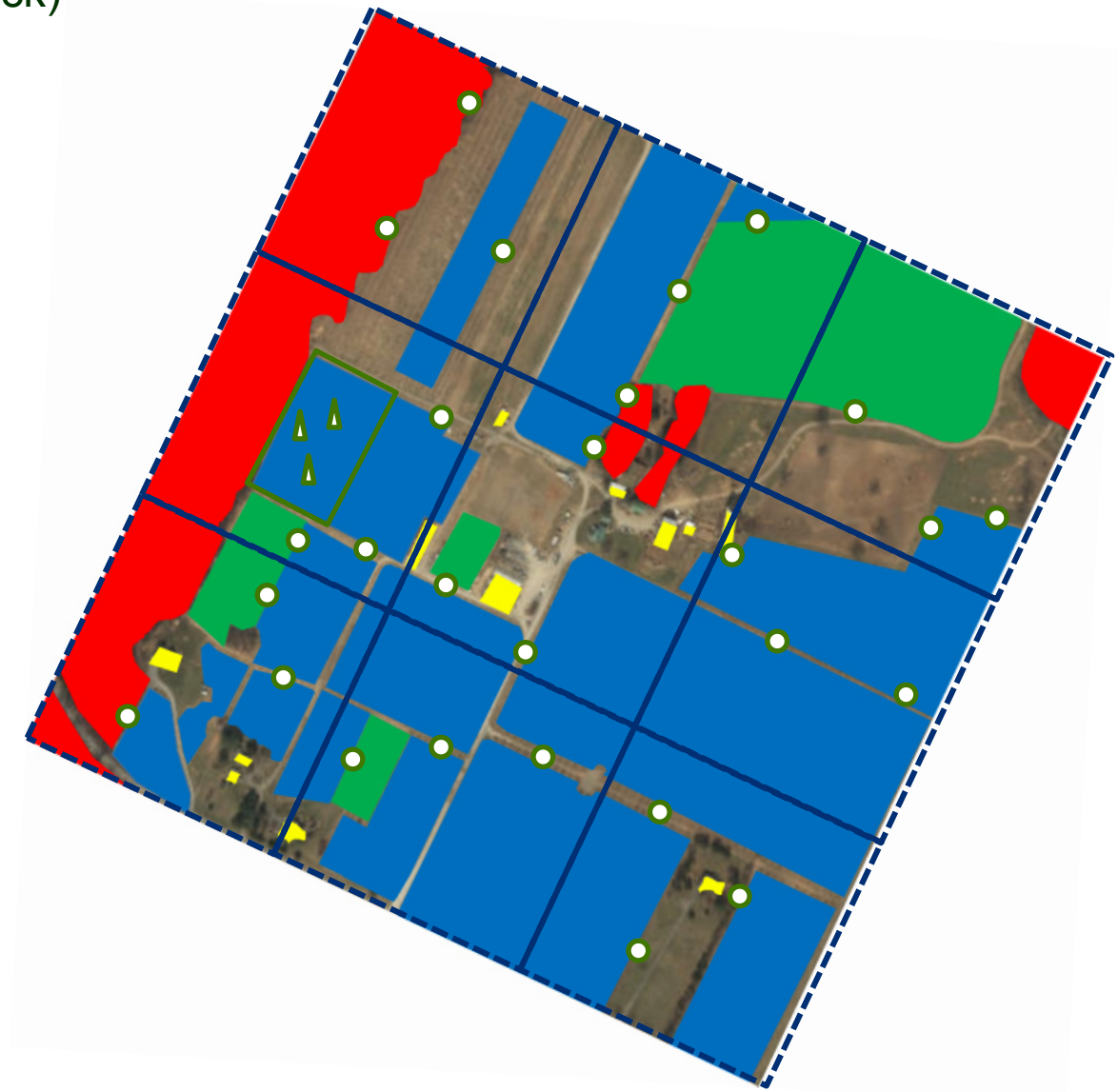
Management site (Brumback)

trap

N
W
E
S

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

Interface	Management	Companion
Blue-Green	6	6
Green-Open	1	1
Blue-Red	3	3
Blue-Open	5	5
Blue-Blue	8	8
Blue-Yellow	2	2
Red-Open	2	2



VA Sites

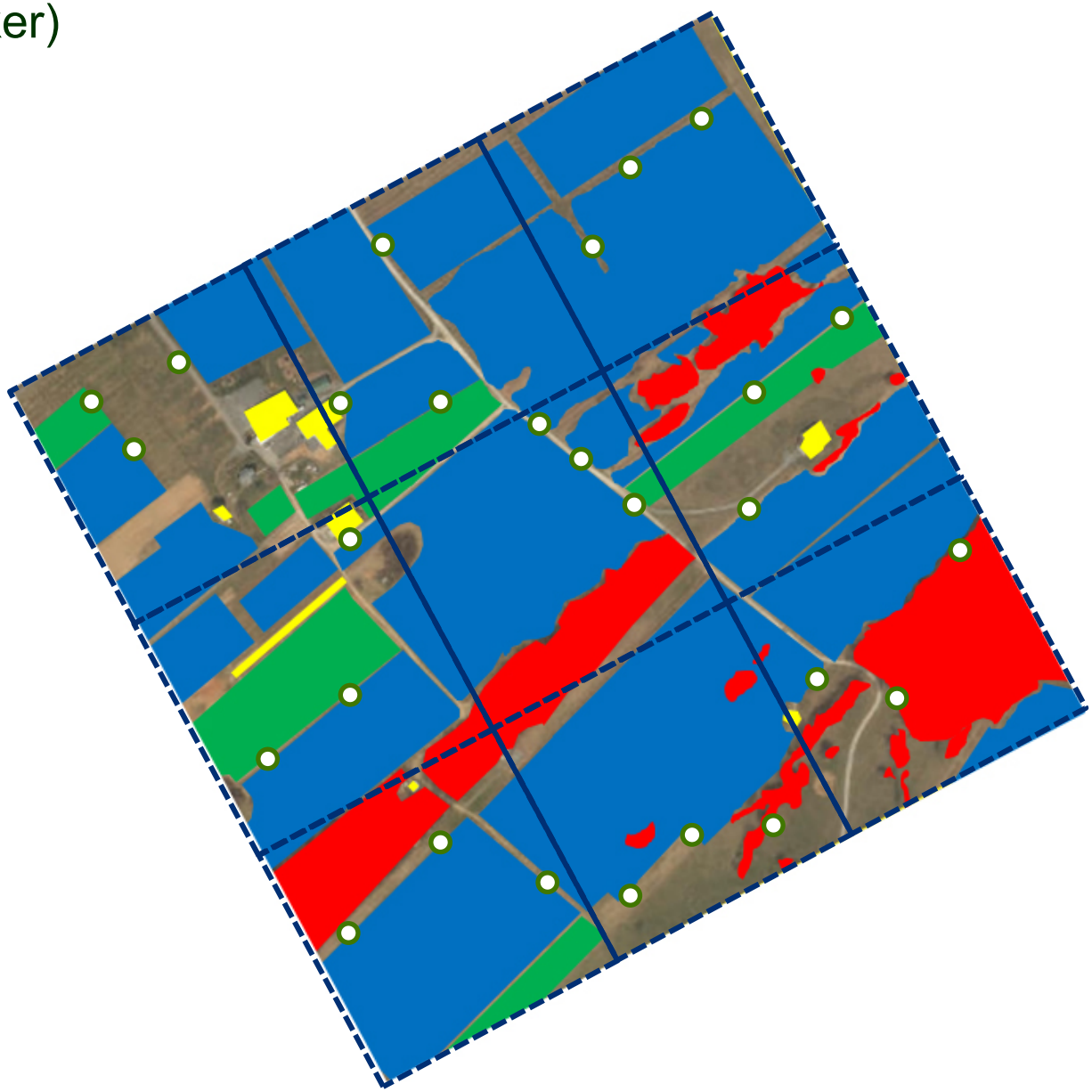
Companion site (Marker)

trap

N
W
E
S

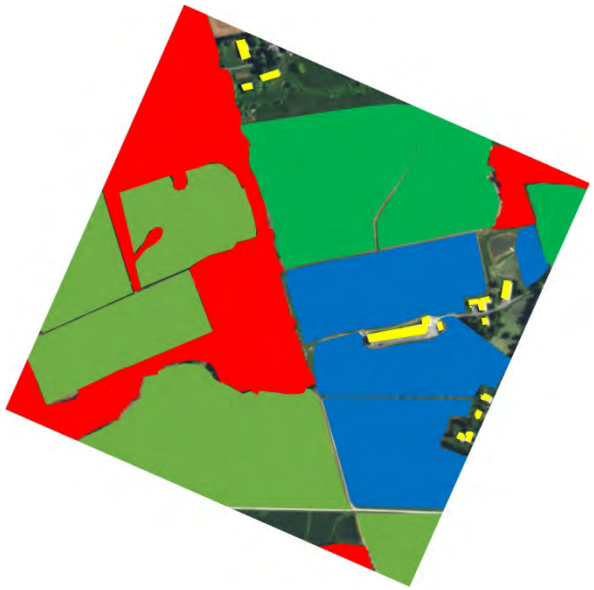
Structure/house
Woodlot/windbreak
Fruit trees
Vegetable/field crops

Interface	Management	Companion
Blue-Green	6	6
Green-Open	1	1
Blue-Red	3	3
Blue-Open	5	5
Blue-Blue	8	8
Blue-Yellow	2	2
Red-Open	2	2



PA Sites

Management



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

Companion

Chi-square test for similarity of landscape element composition

P > 0.05: “No statistical difference”

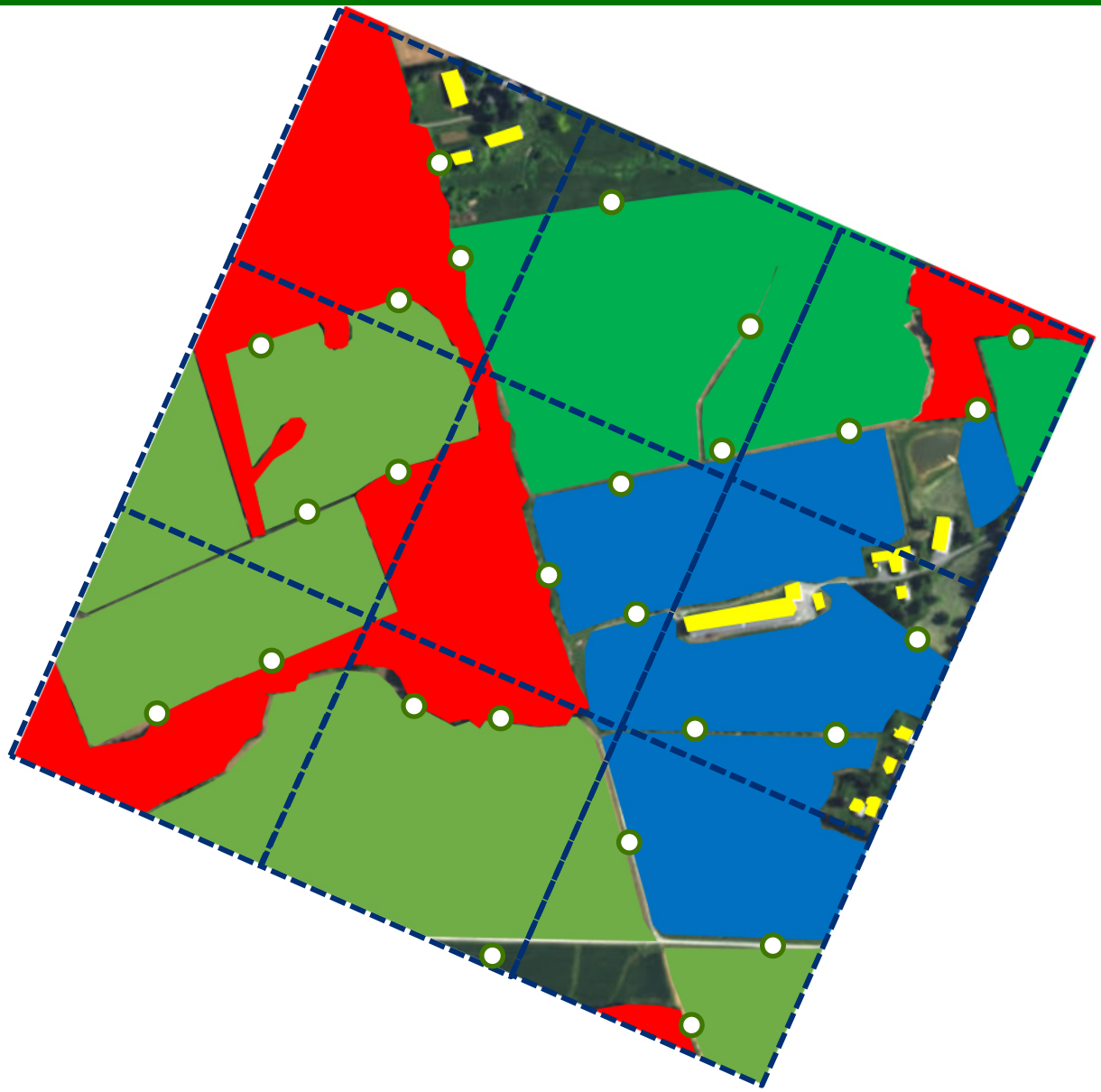
PA Sites

Management Site

trap

N
W
E
S

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

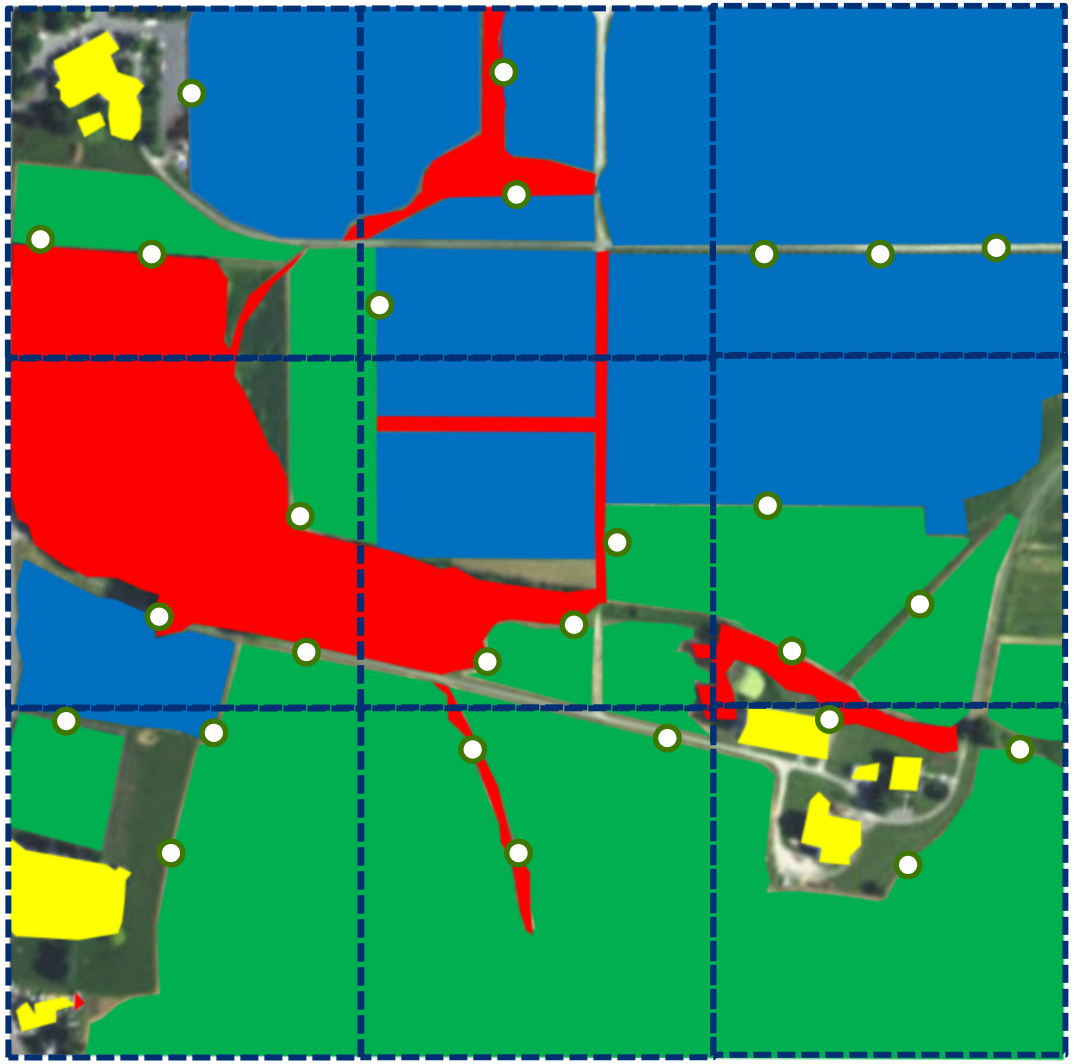
PA Sites

Companion site

trap

N
W
E
S

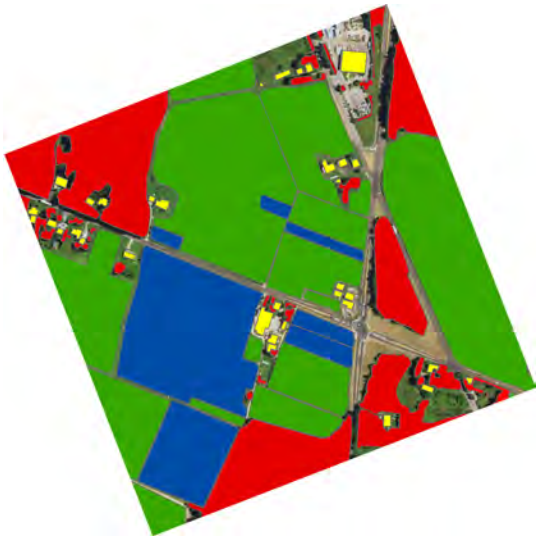
Structure/house
Woodlot/windbreak
Fruit trees
Vegetable/field crops



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

NJ Sites

Management (Bill)



12%	Woodlot	18%
11%	Fruit trees	16%
48%	Field crops	42%
1%	Structure	1%
28%	Lawn/others	24%

Companion (John)

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

NJ Sites

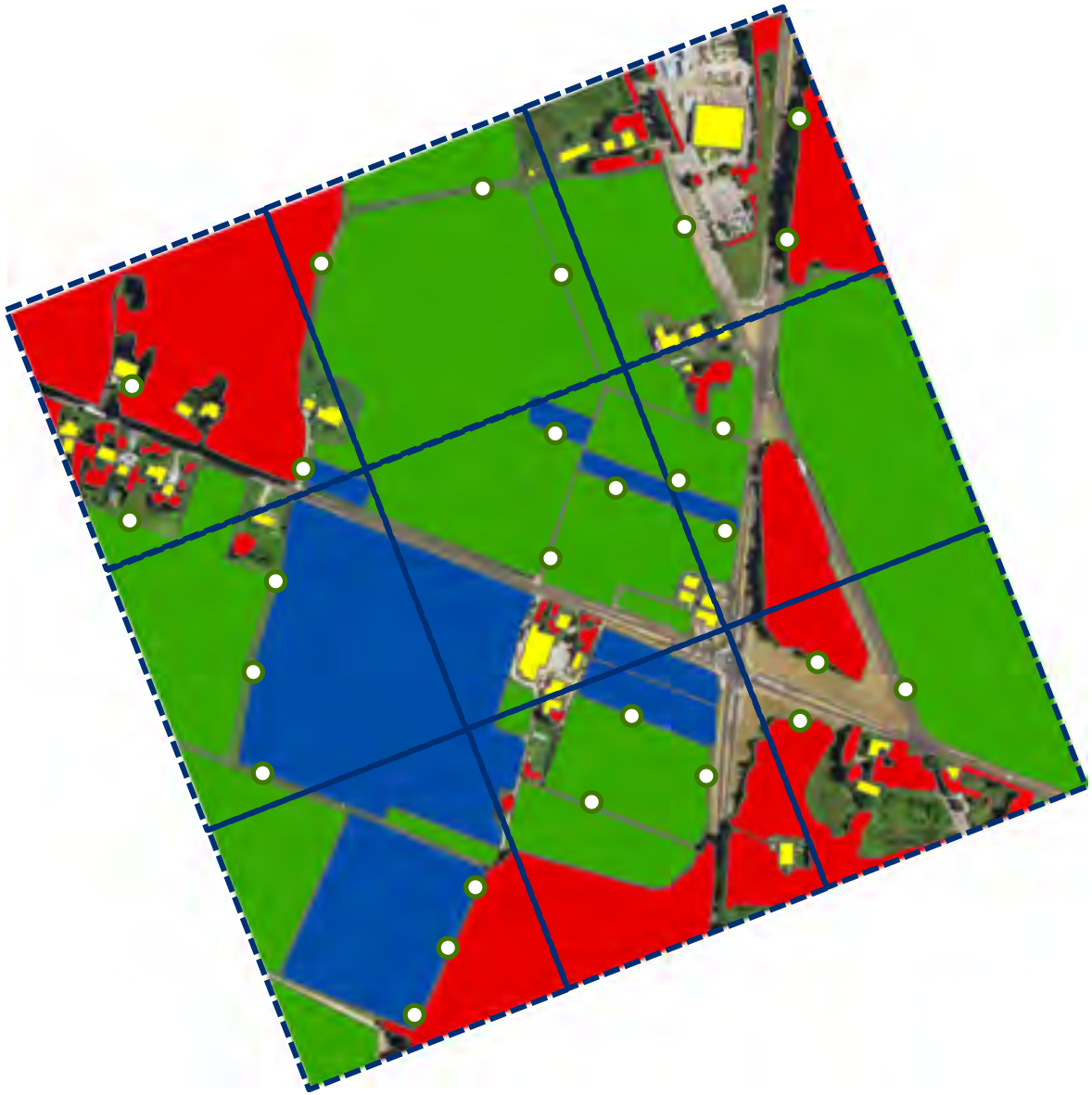
Management Site

trap

N
W
E
S

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

Interface	Bill	John
Blue-Green	9	9
Green-Green	5	5
Green-Open	4	4
Red-Open	4	4
Blue-Red	3	3
Green-Red	1	1
Red-Yellow	1	1



NJ Sites

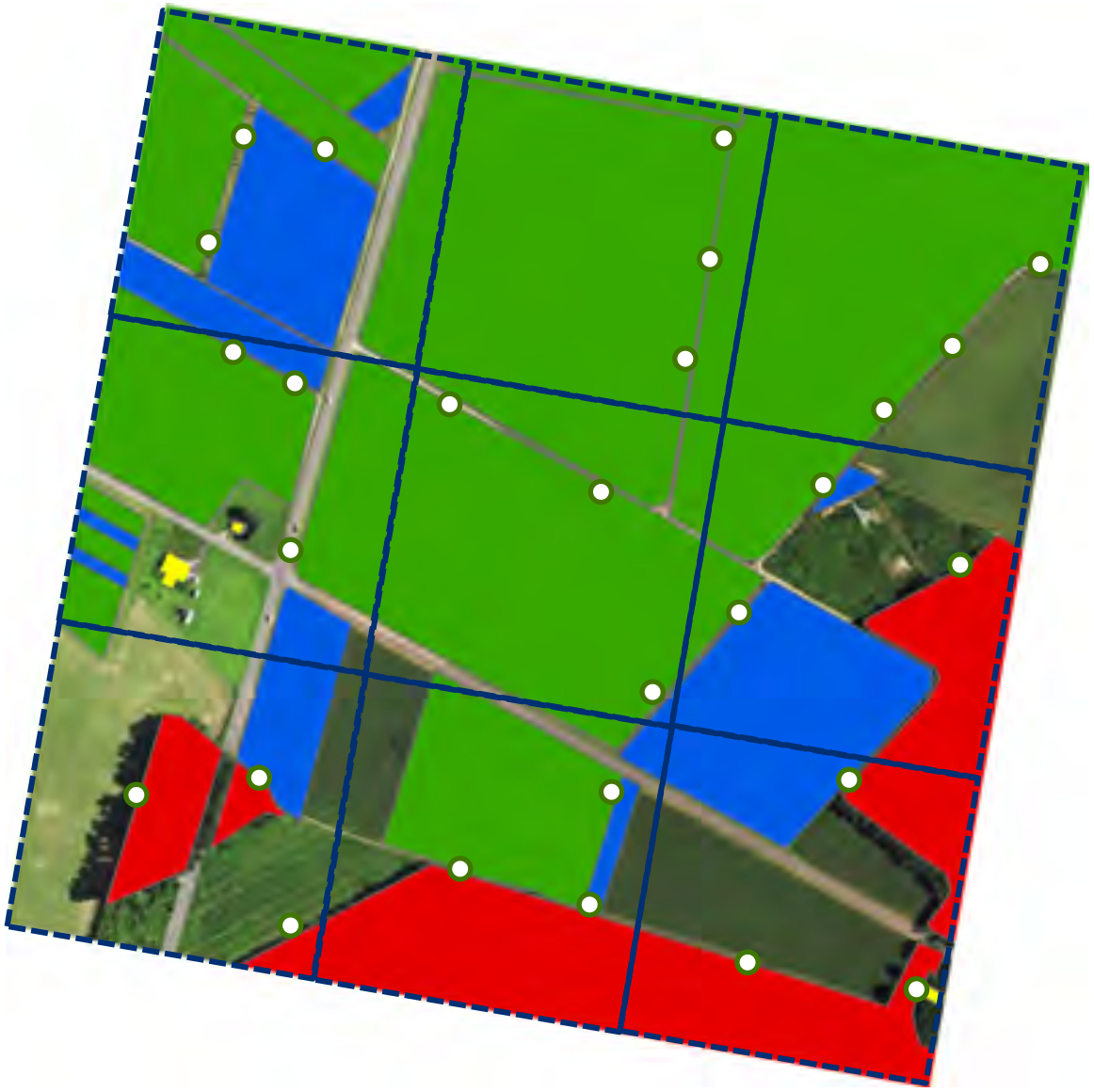
Companion Site

trap

N
W
E
S

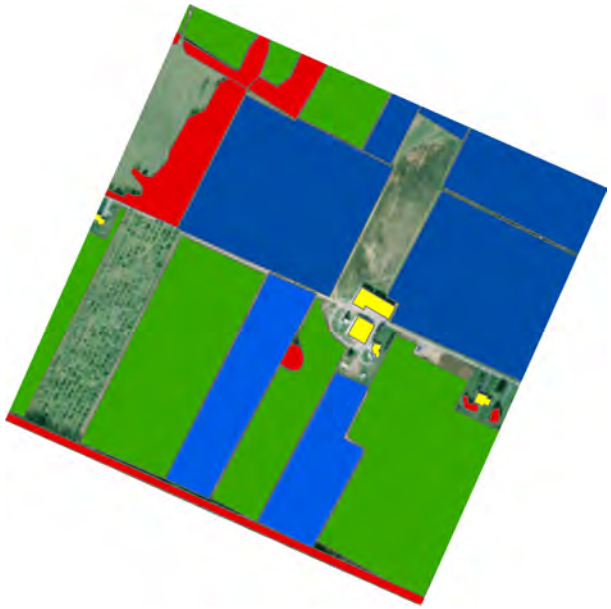
Structure/house
Woodlot/windbreak
Fruit trees
Vegetable/field crops

Interface	Bill	John
Blue-Green	9	9
Green-Green	5	5
Green-Open	4	4
Red-Open	4	4
Blue-Red	3	3
Green-Red	1	1
Red-Yellow	1	1



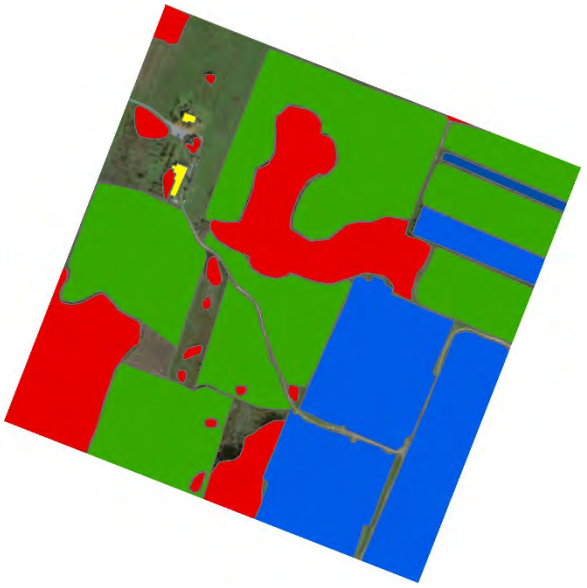
WV Sites

Elliott (Management)



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 Sites

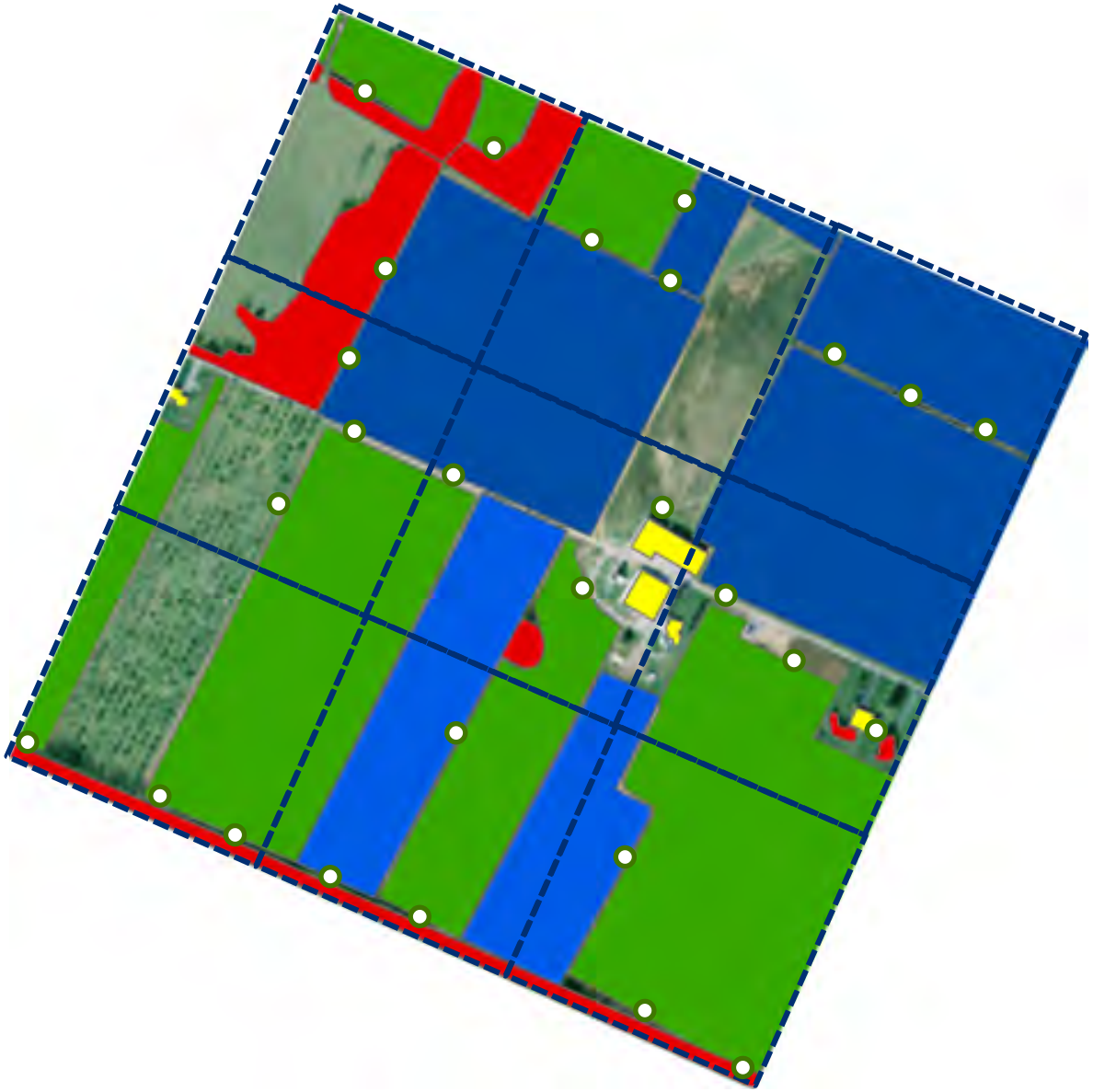
Elliott
(Management)

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 Sites

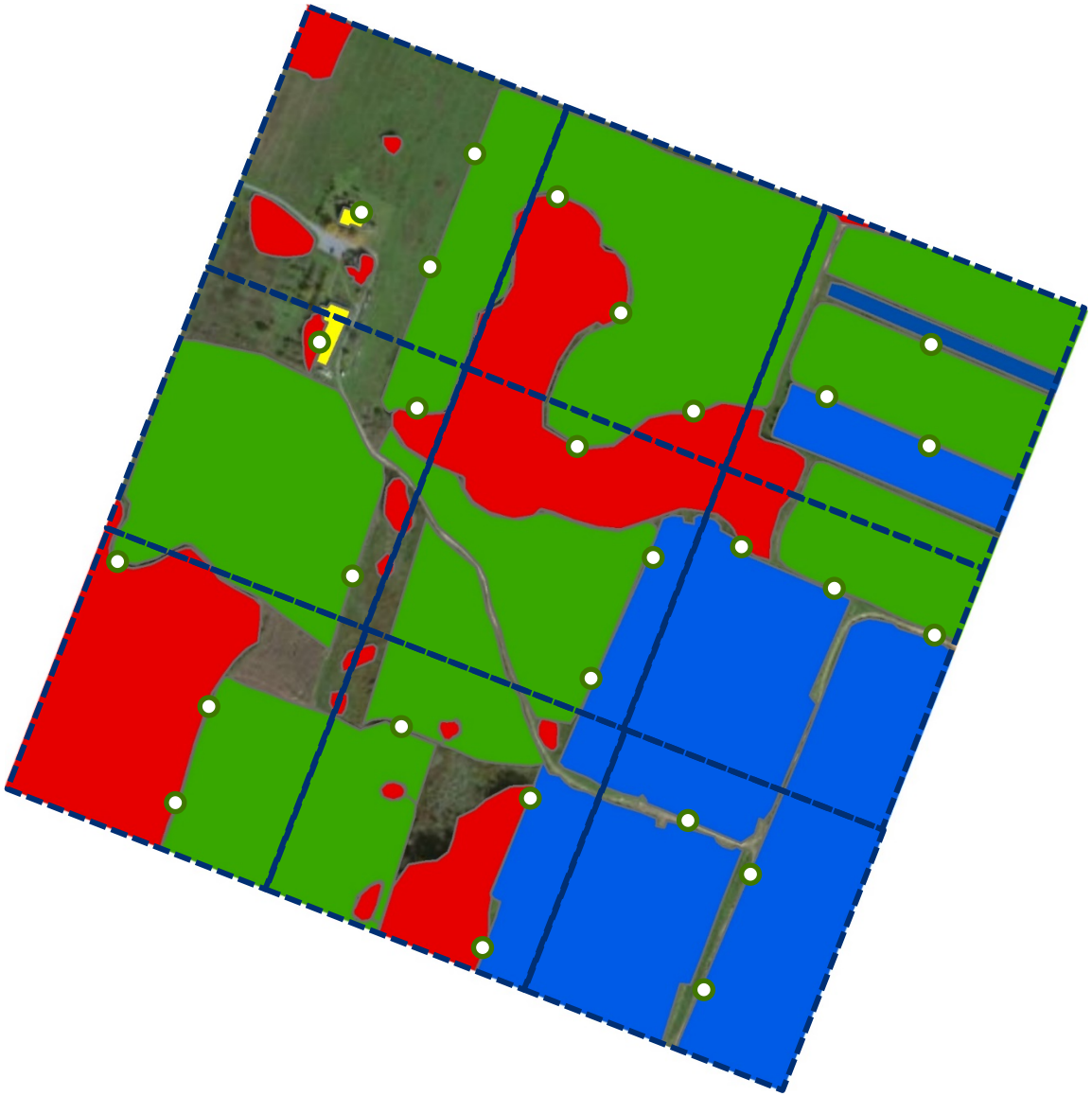
Sharp
(Companion)

trap

N
W
E
S

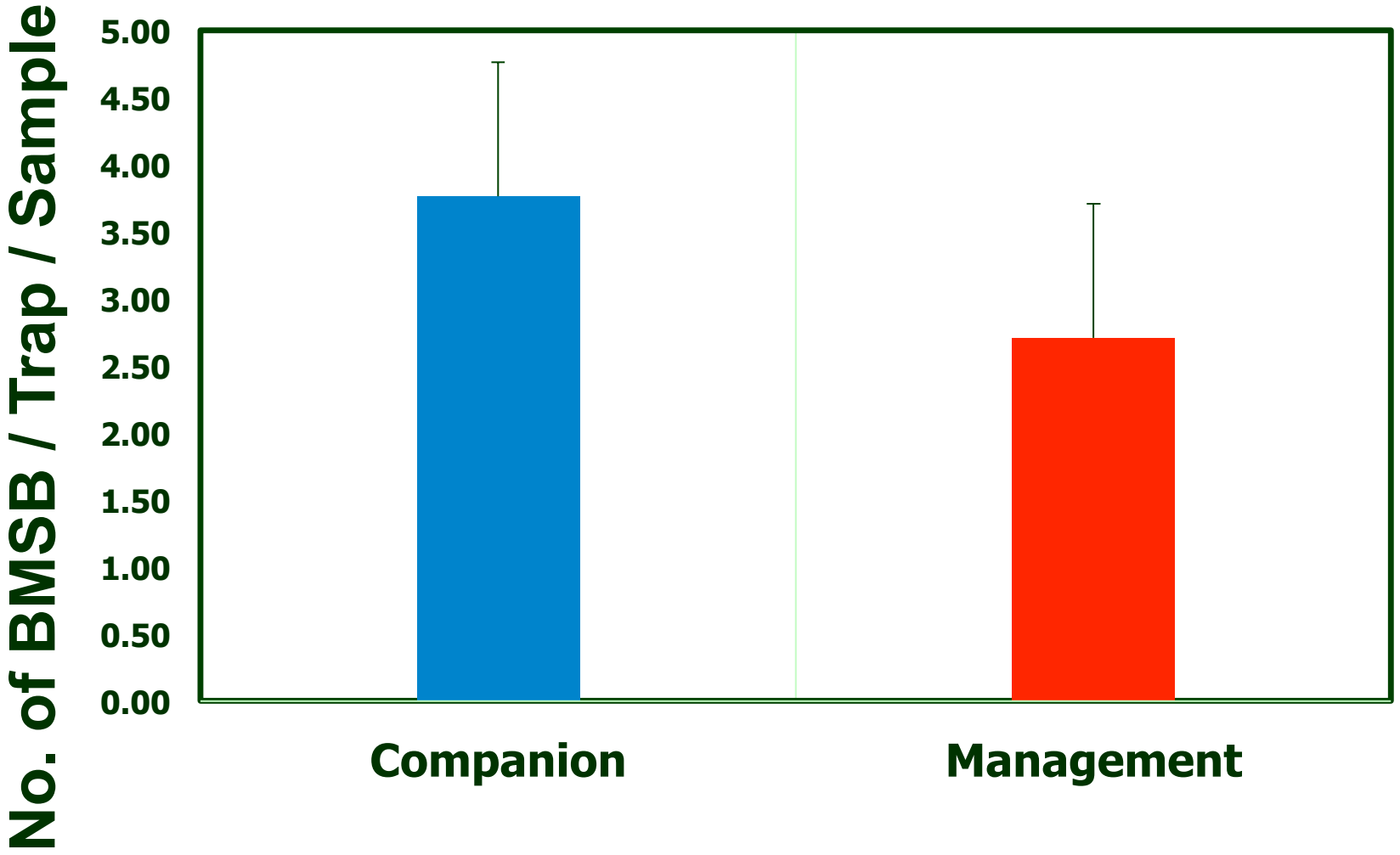
Structure/house
Woodlot/windbreak
Fruit trees
Vegetable/field crops

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



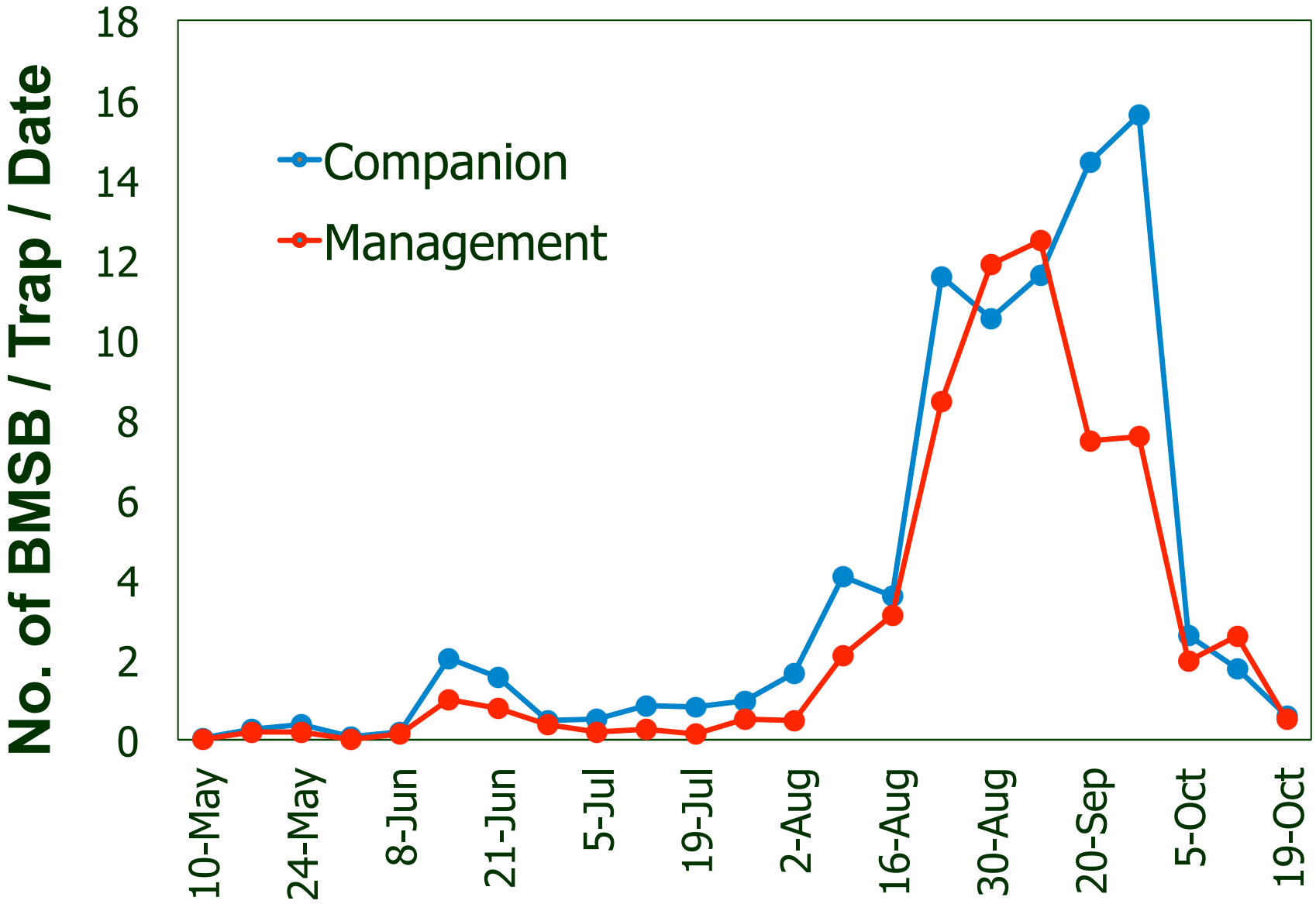
Year 1
Baseline Data !!!

Pennsylvania

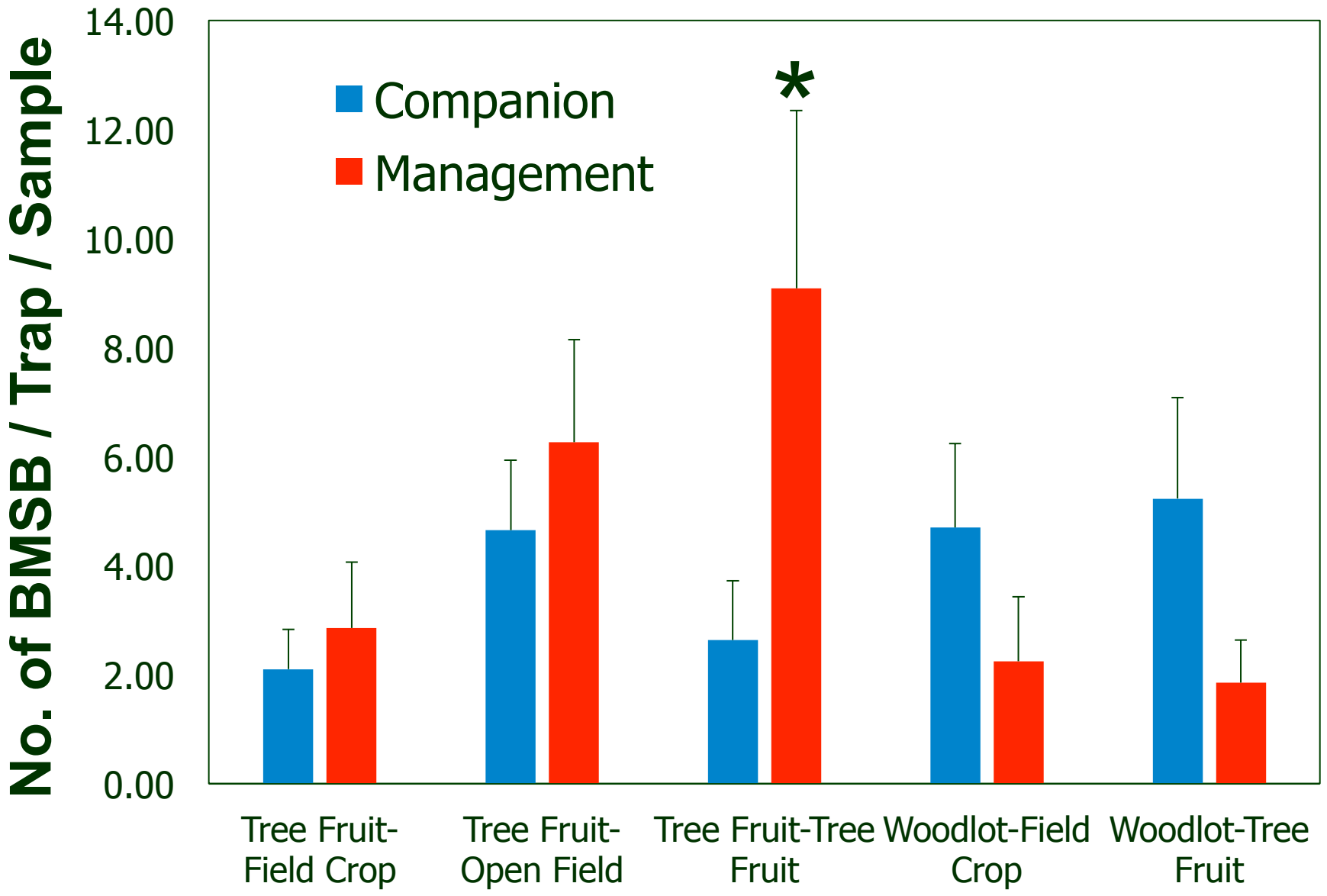


t = 1.837, df = 52, P = 0.072

Pennsylvania



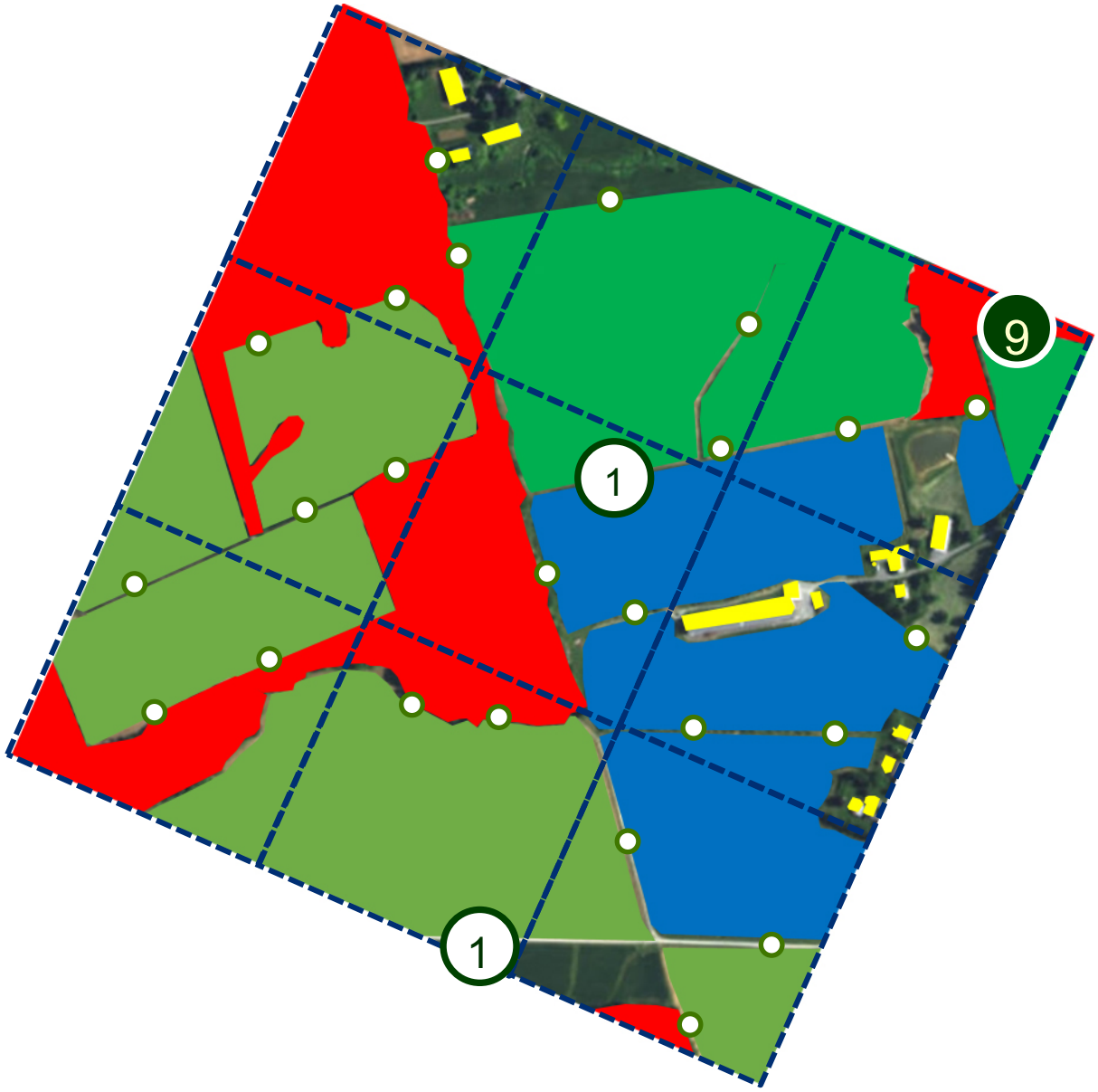
Pennsylvania



Pennsylvania

Companion

- Patch / Hotspot
- Gap / Cold spot



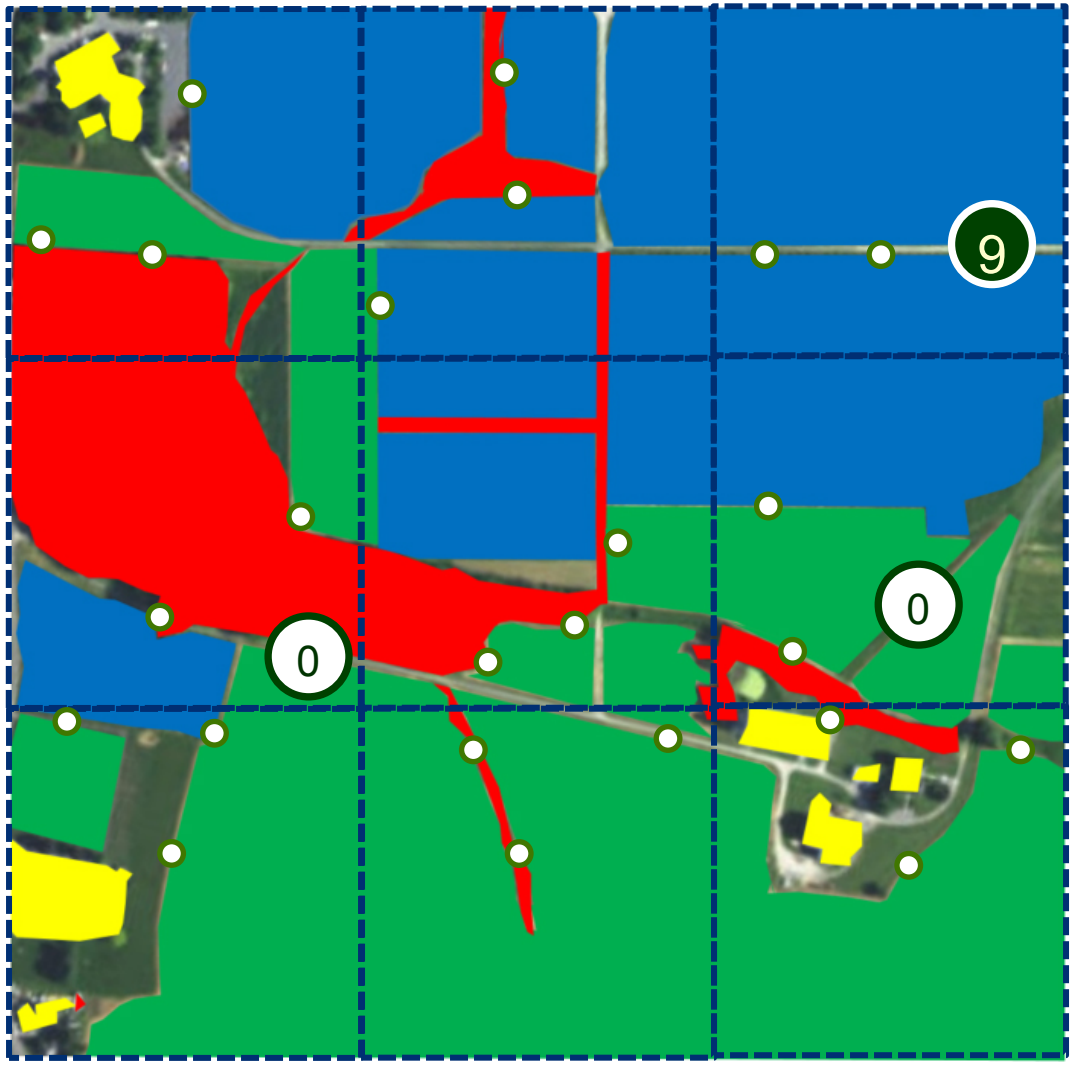
- Structure/house
- Woodlot/windbreak
- Fruit trees
- Vegetable/field crops

Pennsylvania

Management

Patch / Hotspot

Gap / Cold spot



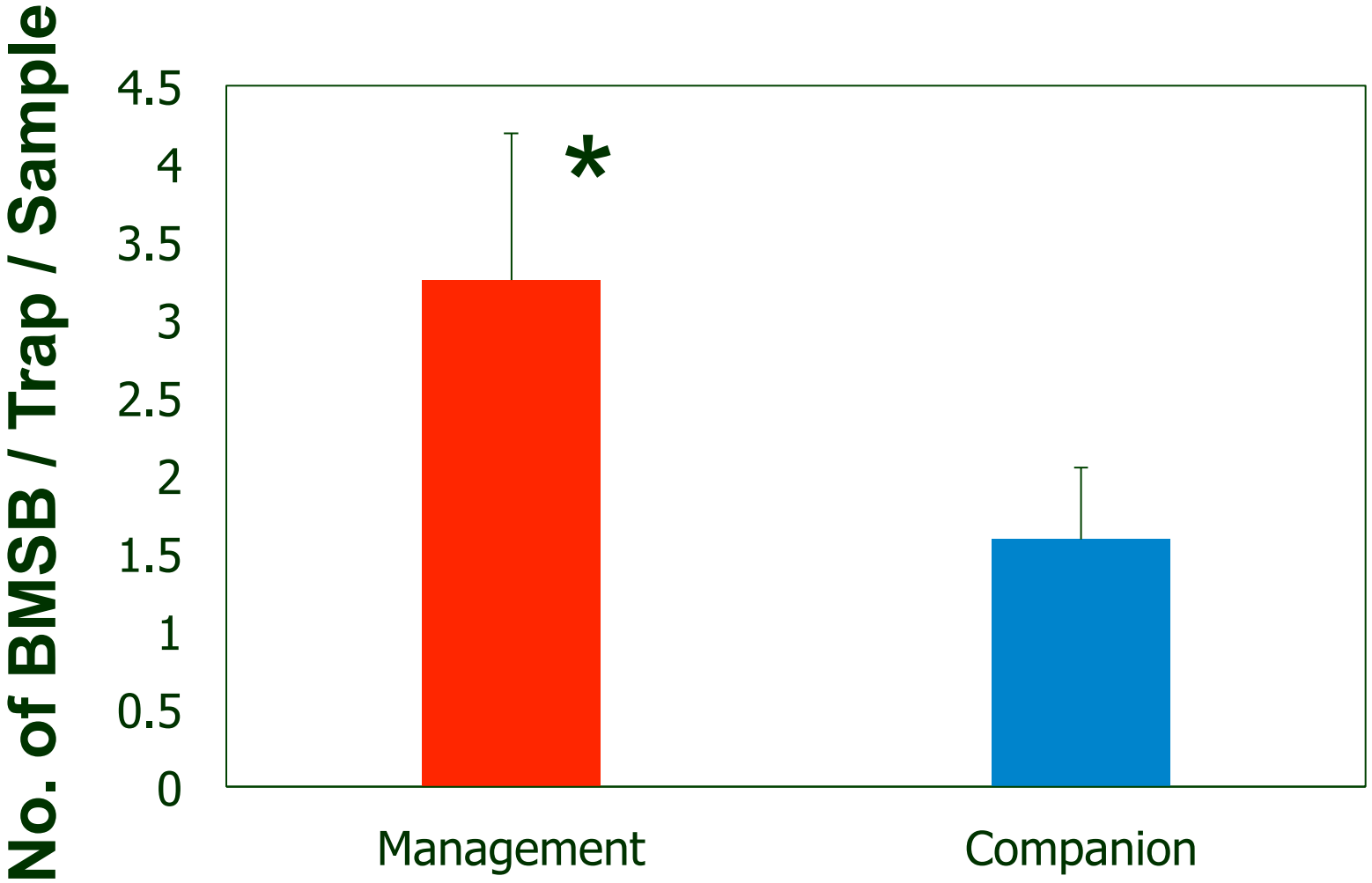
Structure/house

Woodlot/windbreak

Fruit trees

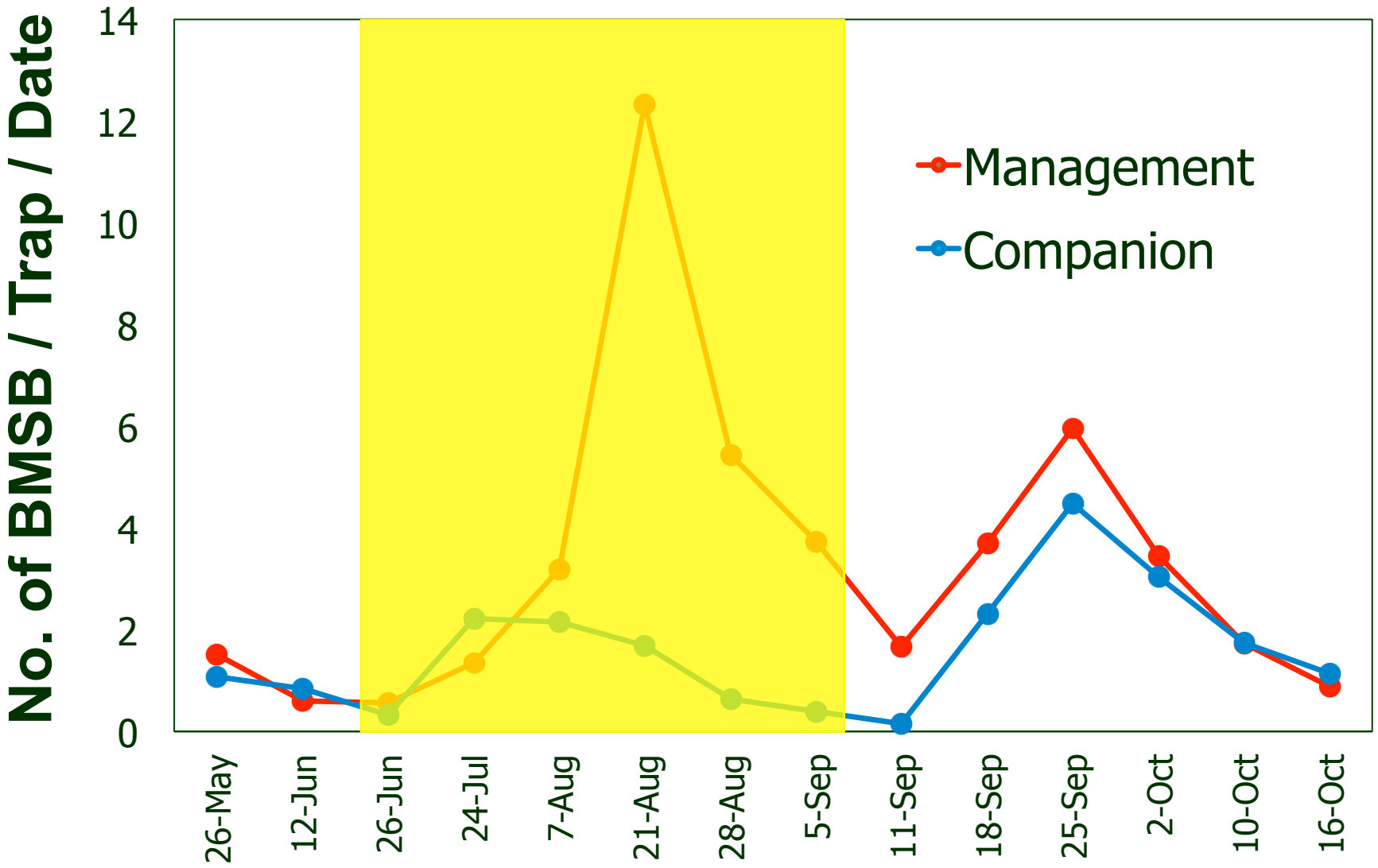
Vegetable/field crops

Virginia

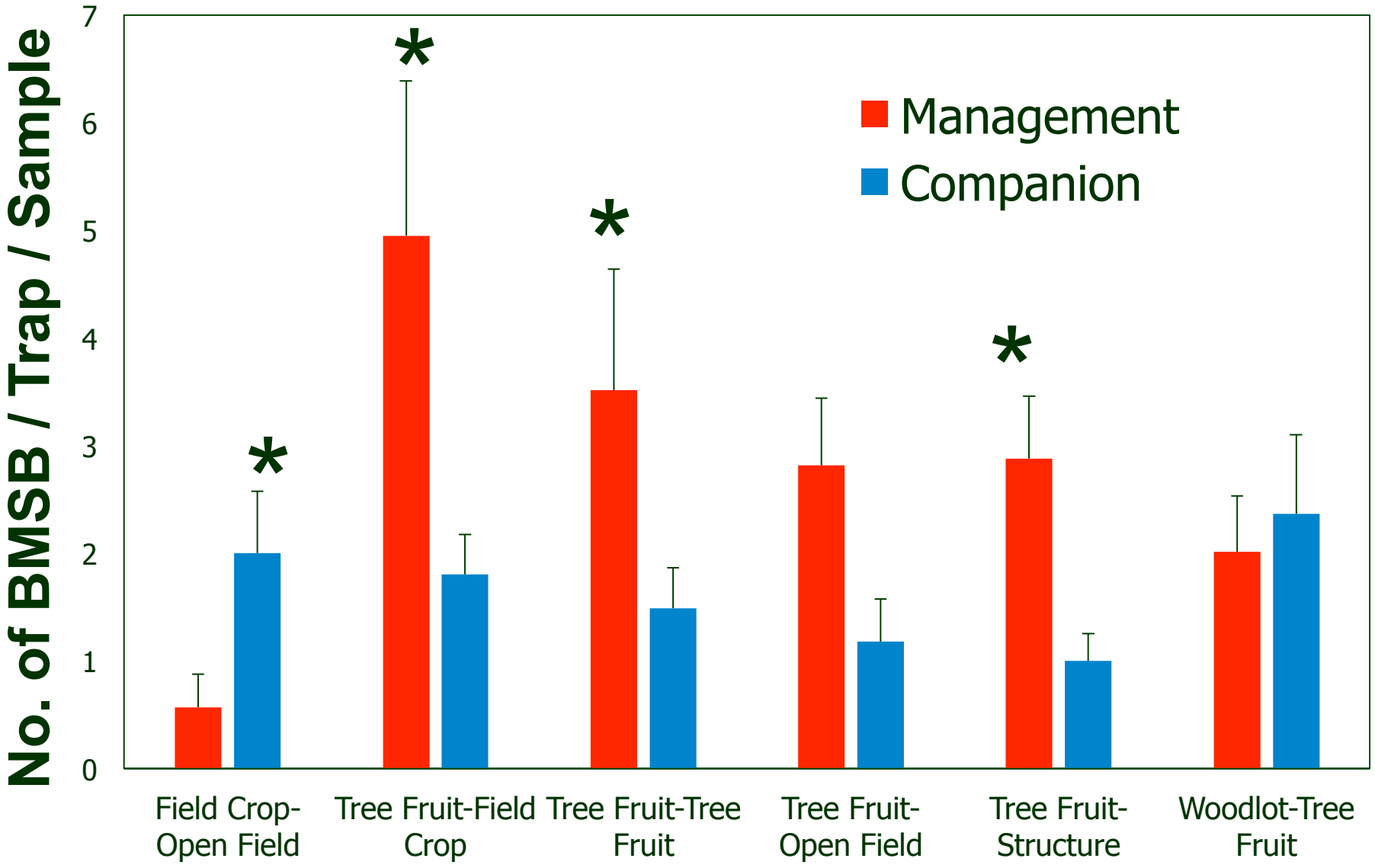


$t = 3.720$, df = 52, $P < 0.001$

Virginia


No. of BMSB / Trap / Date
14
12
10
8
6
4
2
0
26-May
12-Jun
26-Jun
24-Jul
7-Aug
21-Aug
28-Aug
5-Sep
11-Sep
18-Sep
25-Sep
2-Oct
10-Oct
16-Oct
Management
Companion

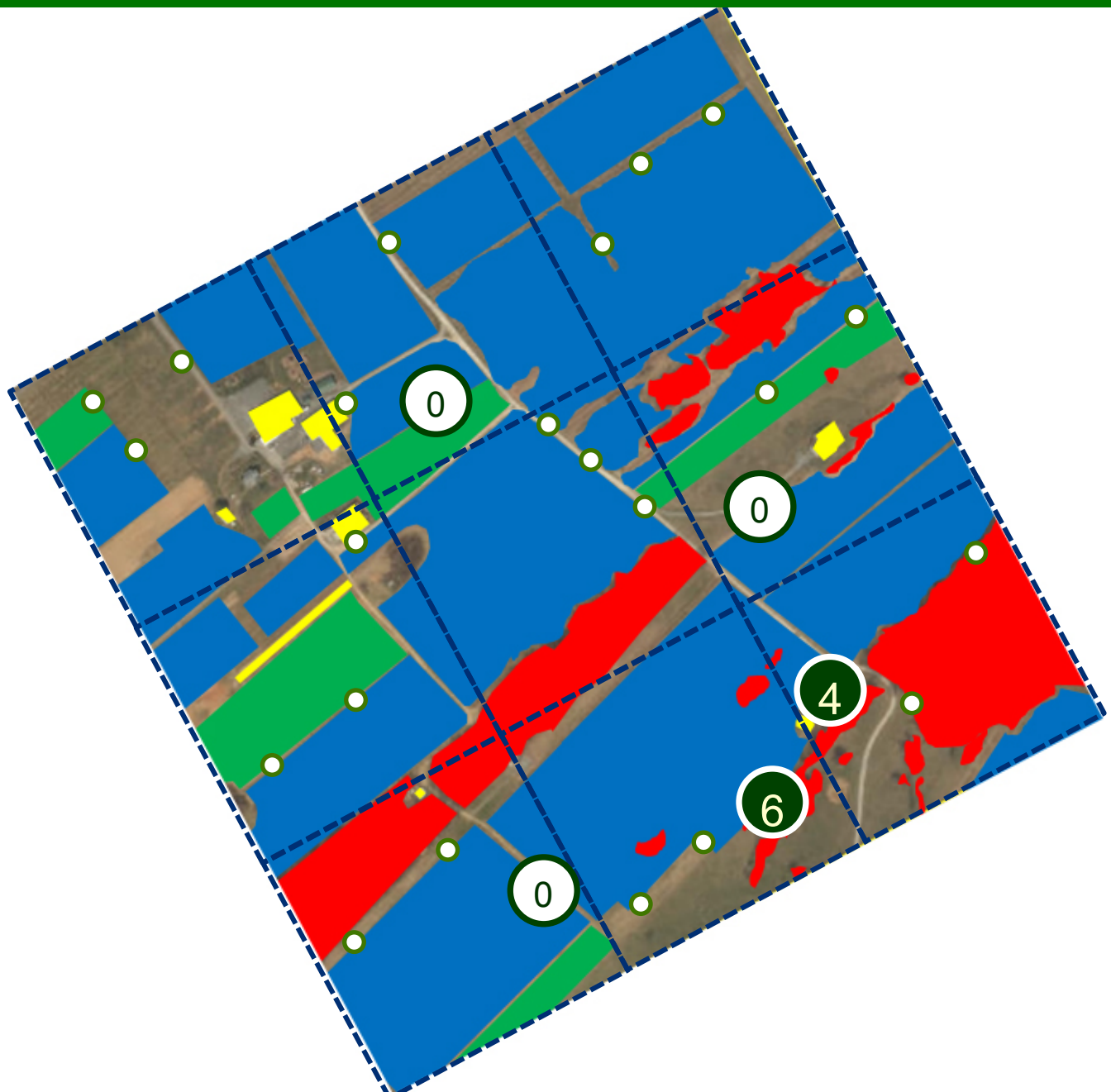
Virginia


No. of BMSB / Trap / Sample
0
1
2
3
4
5
6
7
Management
Companion
*
*
*
Field Crop-Open Field
Tree Fruit-Field Crop
Tree Fruit-Tree Fruit
Tree Fruit-Open Field
Tree Fruit-Structure
Woodlot-Tree Fruit

Virginia

Companion

- Patch / Hotspot
- Gap / Cold spot

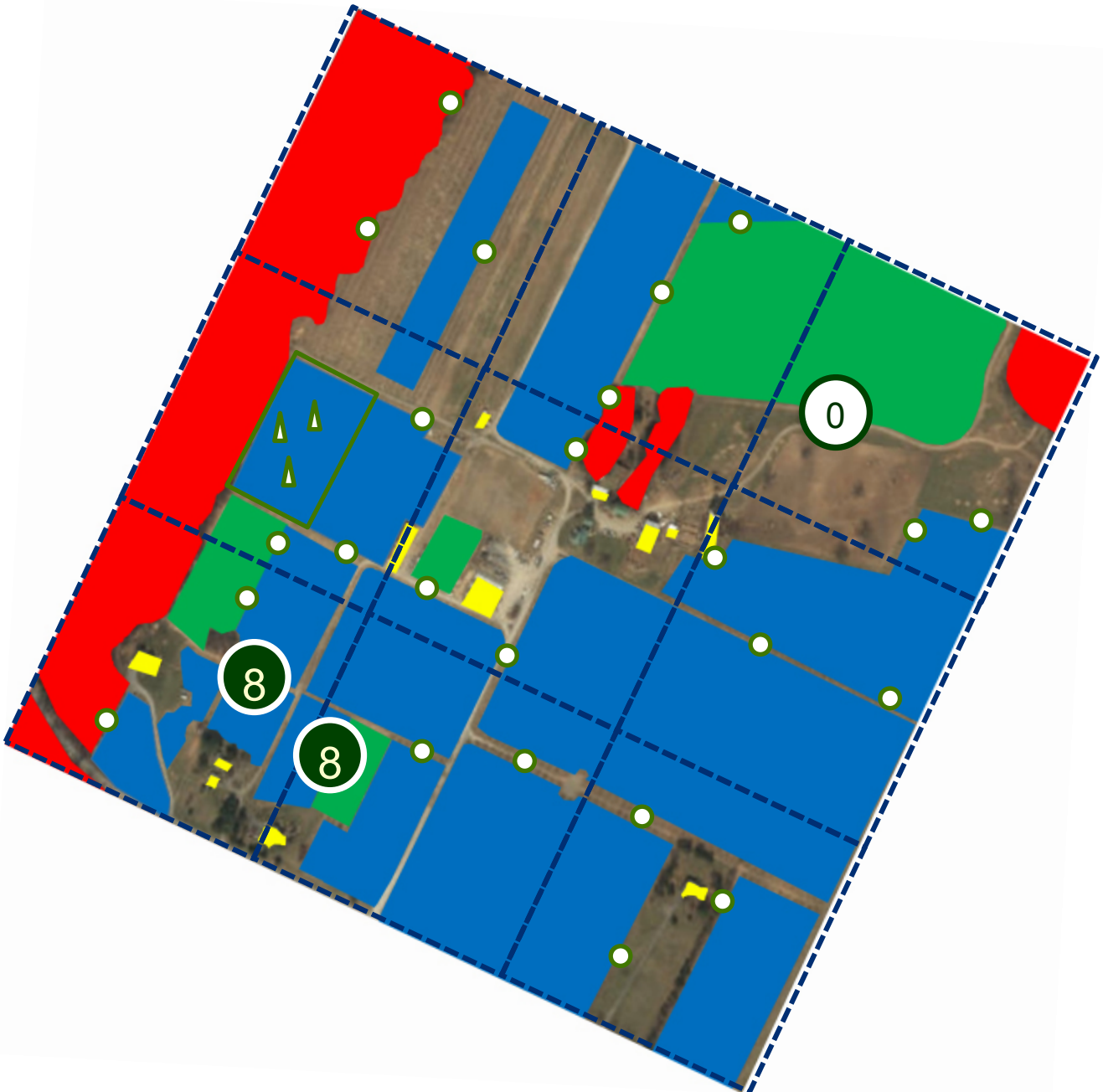


- Structure/house
- Woodlot/windbreak
- Fruit trees
- Vegetable/field crops

Virginia

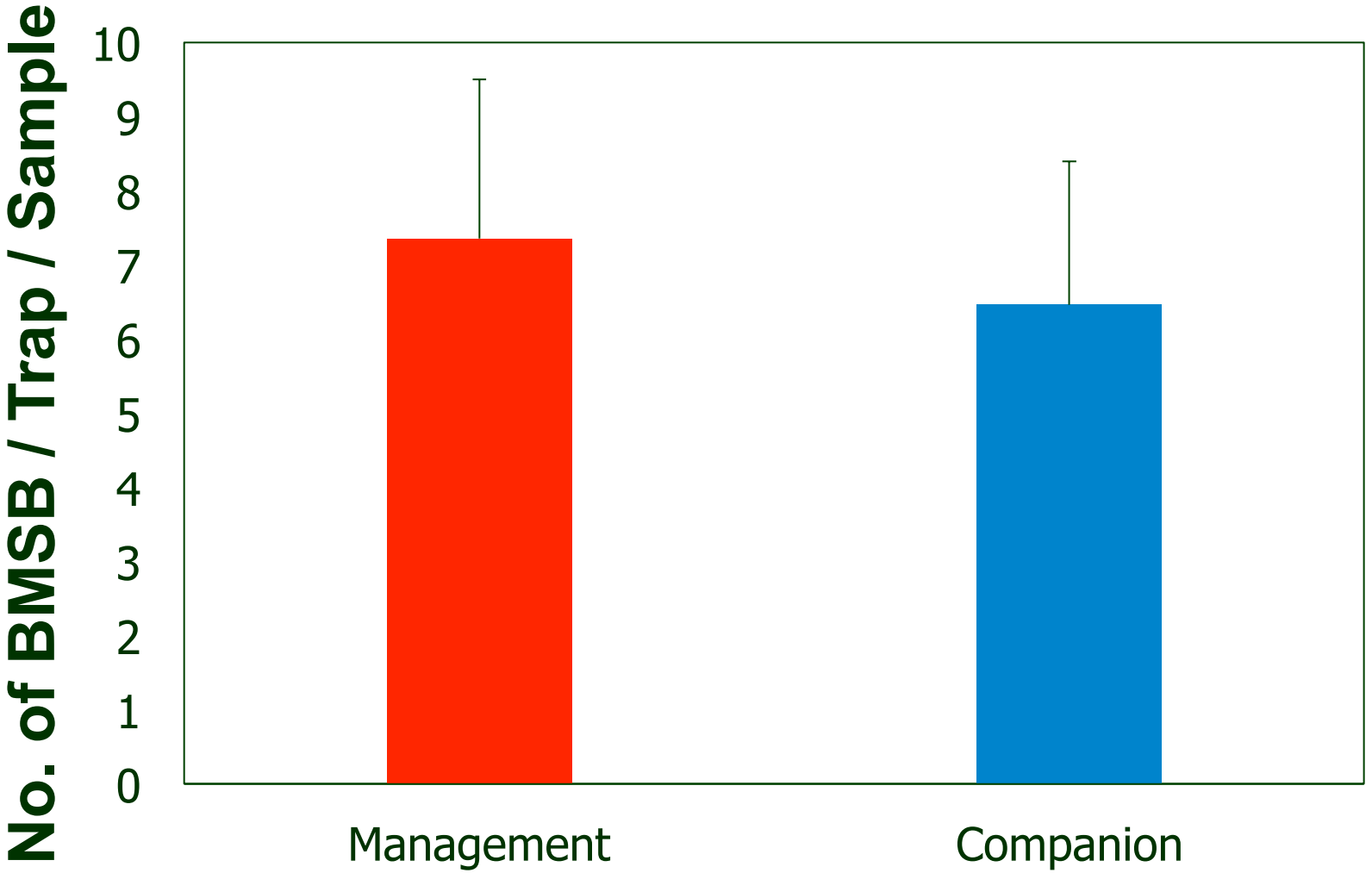
Management

- Patch / Hotspot
- Gap / Cold spot



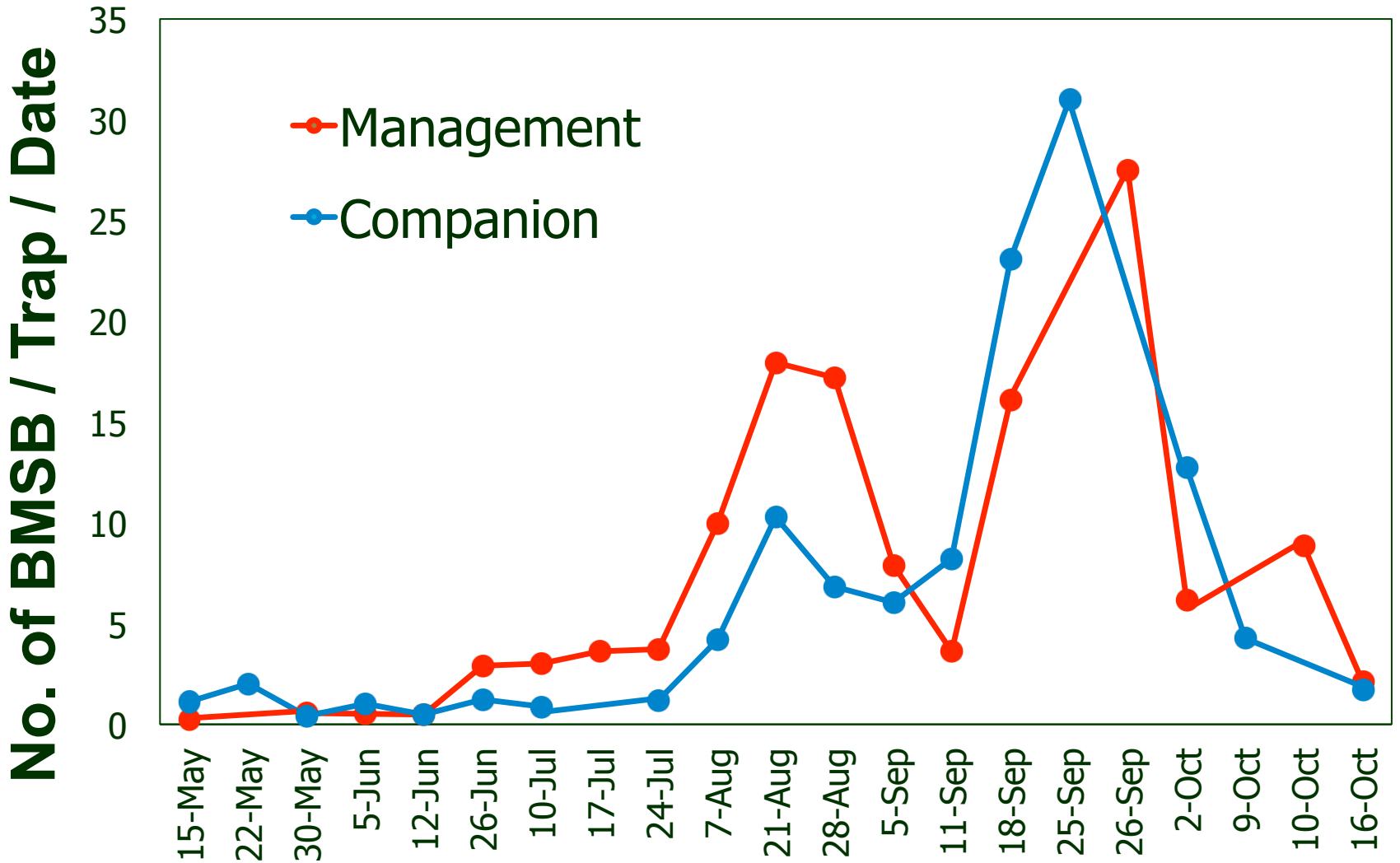
- Structure/house
- Woodlot/windbreak
- Fruit trees
- Vegetable/field crops

West Virginia

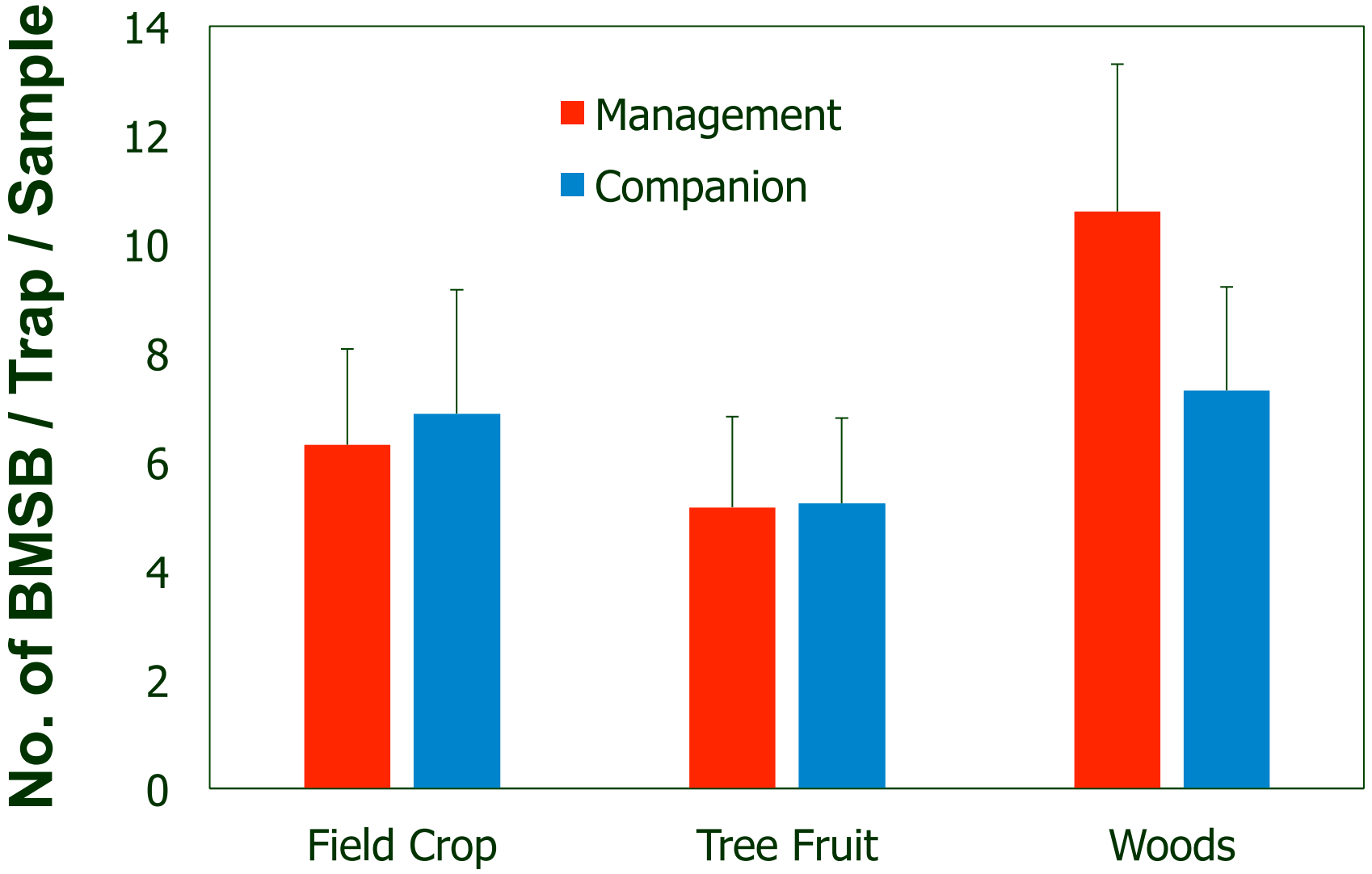


t = 1.008, df = 52, P = 0.318

West Virginia



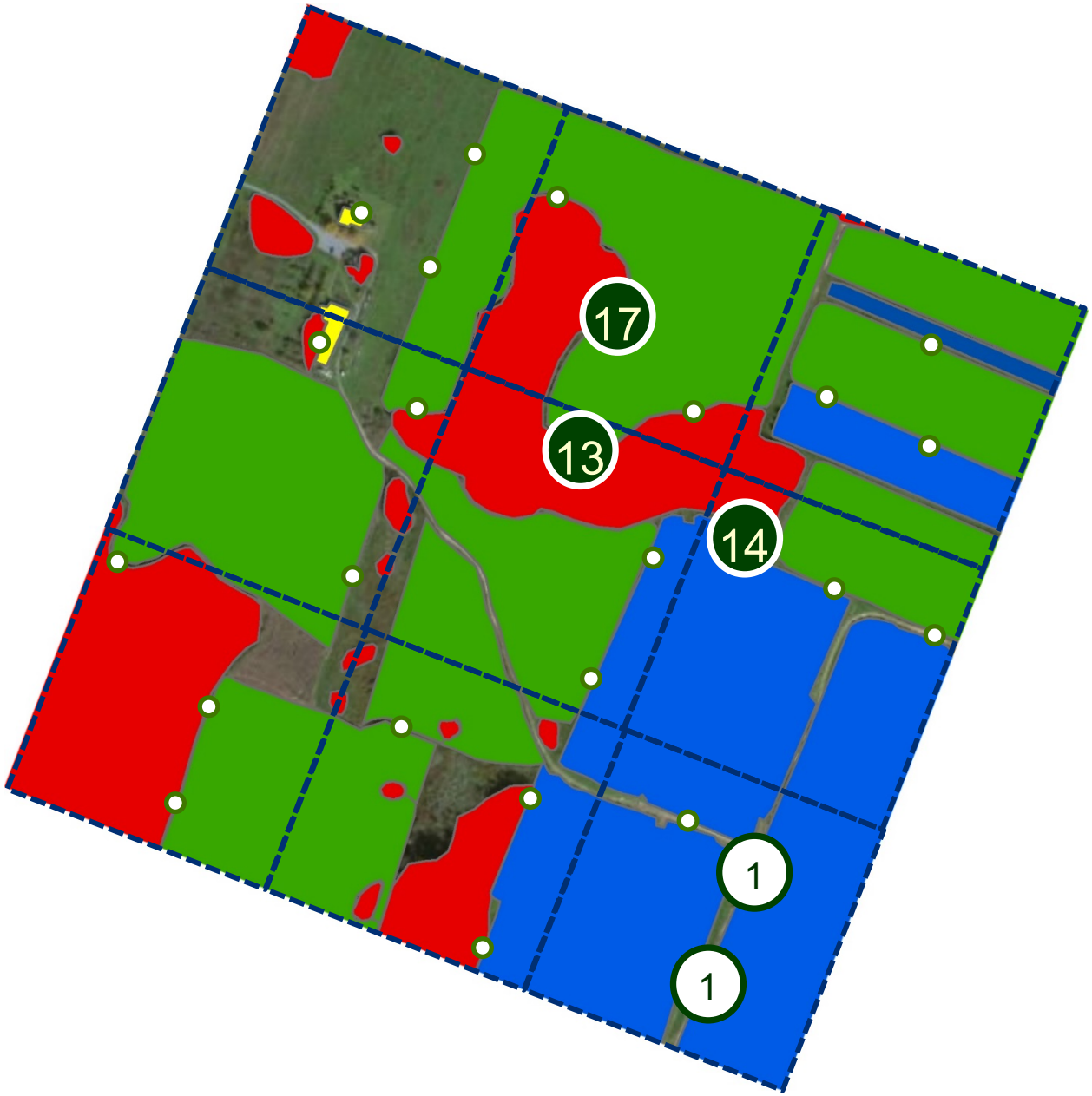
West Virginia



West Virginia

Companion

- Patch / Hotspot
- Gap / Cold spot

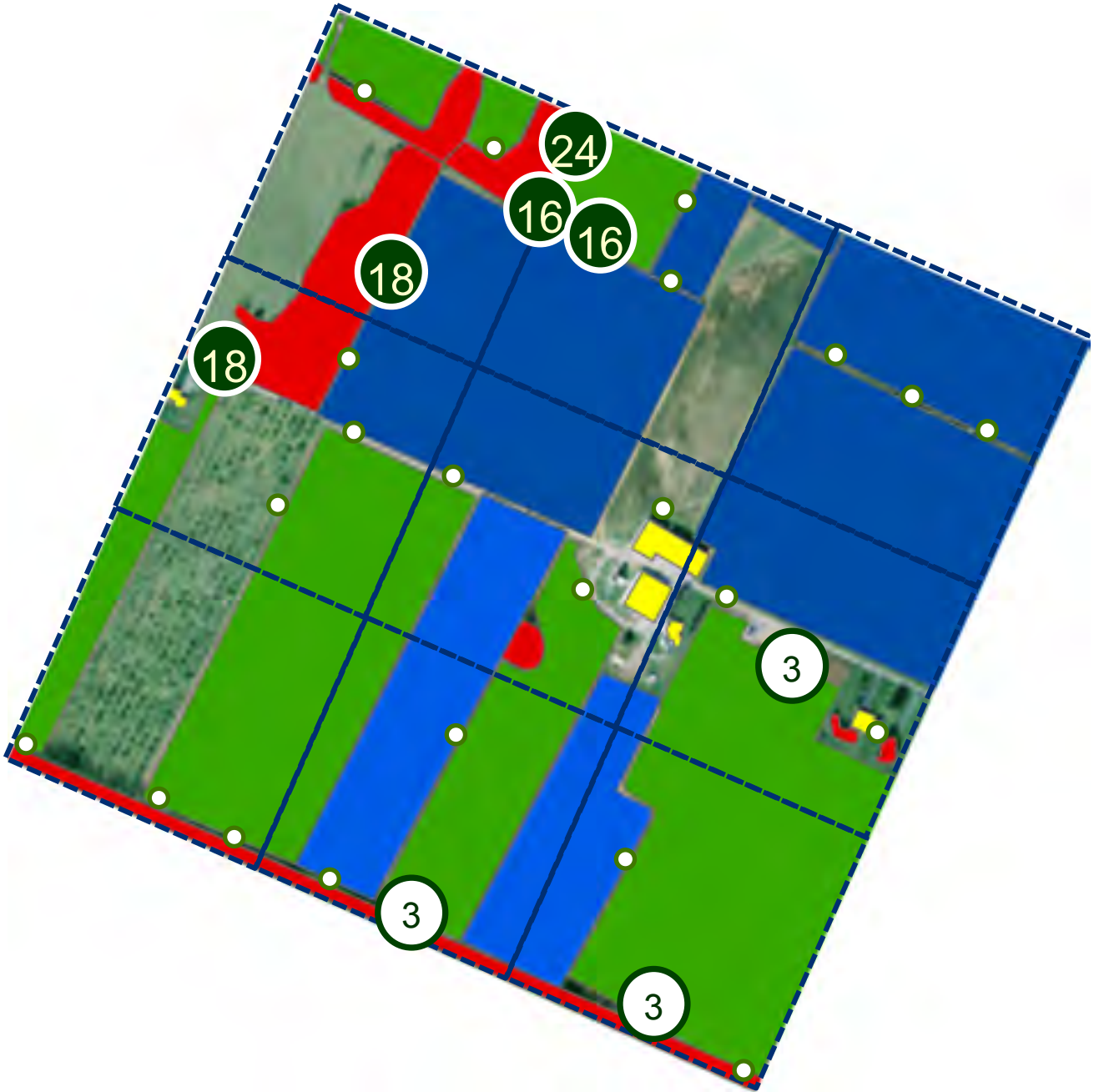


- Structure/house
- Woodlot/windbreak
- Fruit trees
- Vegetable/field crops

West Virginia

Management

- Patch / Hotspot
- Gap / Cold spot



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

New Jersey

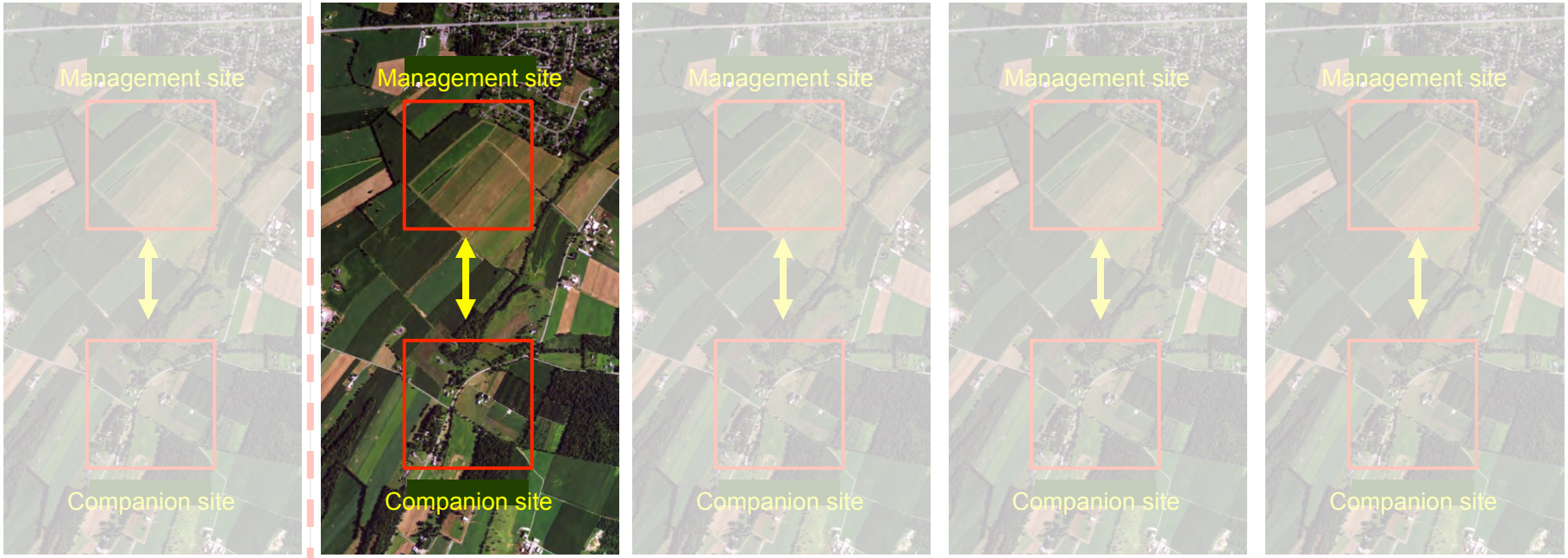
Coming soon

What's Next?

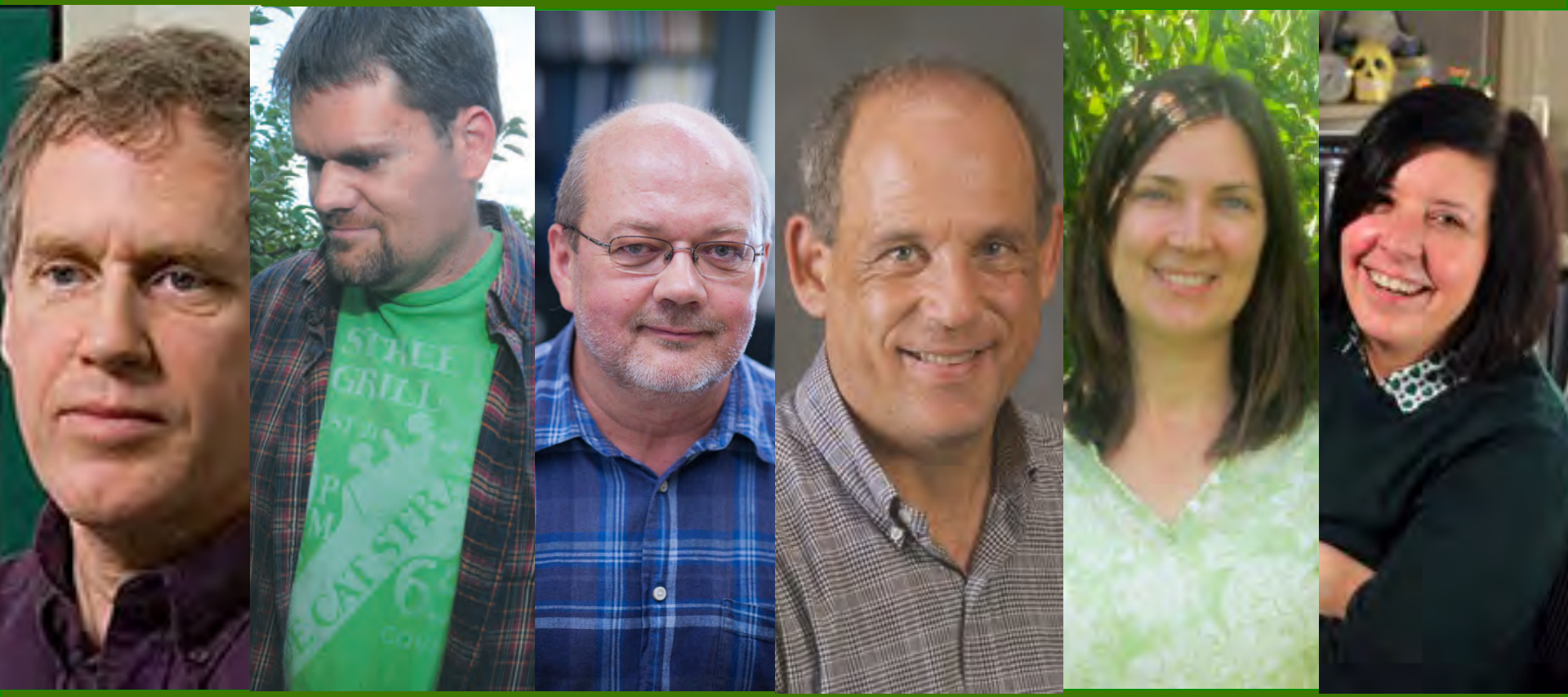
Baseline Data

Biointensive Management of BMSB

Year 1	Year 2	Year 3	Year 4	Year 5



Questions



or Comments?