

LANDSCAPE CONTEXT INFLUENCES USE OF RESIDENTIAL HABITATS BY NATIVE & EXOTIC LADY BEETLES



TAYLOR · DELGADO DE LA FLOR · PERRY · RILEY · SIVAKOFF · TURO · GARDINER

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LADY BEETLES

- Coccinellidae
- Predators of Aphids, Scales and Mites
- Tend to specialize on one type of prey
- Feed on pollen and nectar when prey rare
- A few feed on plants or fungus
- Many species!

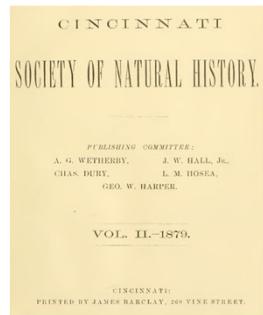


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HISTORIC COMMUNITY - 140 YEARS AGO



COCCINELLIDÆ.

Epilachna borealis, Fab.
Megilla maculata, De G.
Hippodamia convergens, Guer.
13-punctata, Linn.
parenthesis, Say.
Coccinella 9-notata, Hb.
Cyclonedra sanguinea, Linn.
Adalia bipunctata, Linn.
Anatis 13-punctata, Oliv.
Psylllobora 20-maculata, Say.
Chilocorus bivulnerus, Muls.
Brachyacantha ursina, Fab.
10-pustulata, Mels.
4-punctata, Mels.

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100 YEARS LATER...

THE COLEOPTERISTS BULLETIN 32(3), 1978 223
SURVEY OF COLEOPTERA COLLECTED ON THE COMMON MILKWEED, *ASCLEPIAS SYRIACA*, AT ONE SITE IN OHIO

PATRICK J. DAILEY¹, ROBERT C. GRAVES², AND JOHN M. KINGSLOVER³

ABSTRACT

Coleoptera associated with the common milkweed, *Asclepias syriaca* L., were collected daily for 90 consecutive days. Of the 132 species listed, 18 were known to be common (50 or more collections), while the majority of species were considered temporary visitors. The host specific milkweed beetle, *Tetraopes tetrophthalmus*, was the most common beetle collected.



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<i>Casey</i>	1
<i>Scymnus (Pullus) socer</i> LeConte	
<i>Scymnus (Diomus) terminatus</i>	
(Say)	73
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Mulsant	74
<i>Epilachna varivestis</i> Mulsant.	1

5



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INVASIVE ALIEN SPECIES

1987 1998 2006 2009

BIOLOGICAL CONTROL.

Arrival, Establishment, and Habitat Use of the Multicolored Asian Lady Beetle (Coleoptera: Coccinellidae) in a Michigan Landscape

MANUEL COLUNGA-GARCIA AND STUART H. GAGE

235-B Natural Science Building, Department of Entomology, Michigan State University, East Lansing, MI 48824-1115

Diversity and Distributions, (formerly Biol. J.) (2010) 22: 982–994

BIODIVERSITY & DISTRIBUTION Rapid spread of *Harmonia axyridis* in Chile and its effects on local coccinellid biodiversity

Audrey A. Gray^a, Tatia Zavala^a, Helen E. Rey^b, Peter M. J. Brown^a and Gustavo Bazzoli^a

First detection 2008, photo 2013

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NATIVE COCCINELLID DECLINES

E Biogeogr. (2011) 11:113–121
DOI 10.1007/s10640-010-9974-x

SHORT COMMUNICATION

Citizen scientist rediscovers rare nine-spotted lady beetle, *Coccinella novemnotata*, in eastern North America

John E. Lacy · Jordan E. Perlman · E. Richard Hoebeke

Decline in Relative Abundance of *Hippodamia convergens* (Coleoptera: Coccinellidae) in Fall Shoreline Aggregations on Western Lake Superior

Wayne P. Steffens · Ryan P. Laramie

The role of exotic ladybeetles in the decline of native ladybeetle populations: evidence from long-term monitoring

Christine A. Bahal · Manuel Colunga-Garcia · Stuart H. Gage · Douglas A. Landis

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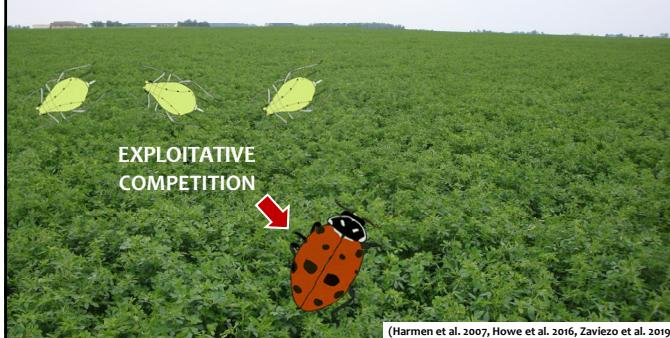
Convergent

Nine-spotted

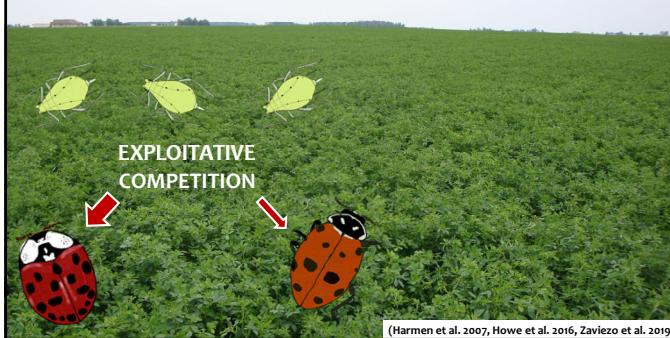
Transverse

Two-spotted

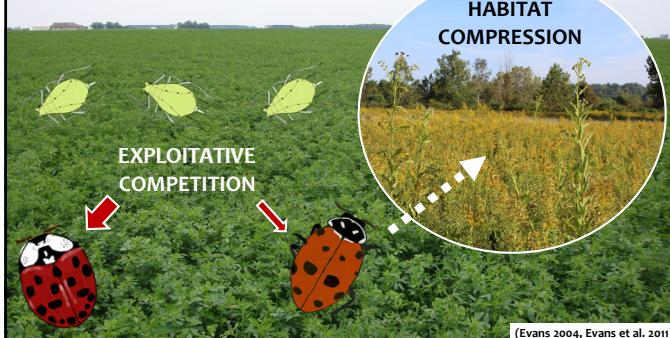
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HYPOTHESIS

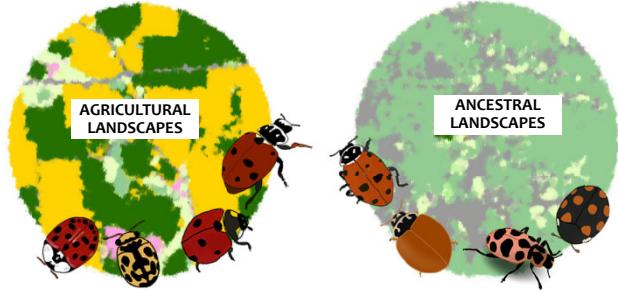
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HYPOTHESIS

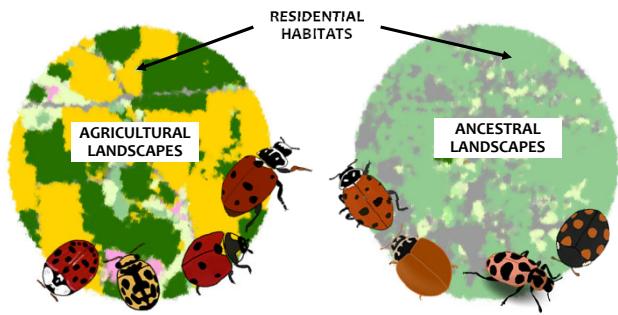
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HYPOTHESIS

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DETECT COMPRESSION AT LANDSCAPE SCALE?

13

DETECT COMPRESSION AT LANDSCAPE SCALE?

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CITIZEN SCIENCE

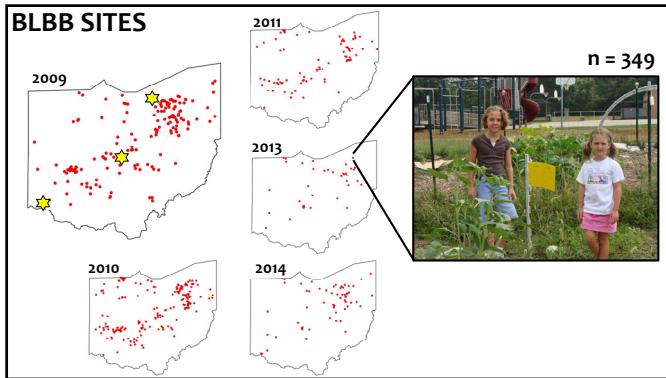
(2009-2014)

GOALS

1. DOCUMENT OHIO LADY BEETLE COMPOSITION IN RESIDENTIAL HABITATS
2. DETERMINE IF ANCESTRAL LANDSCAPE ELEMENTS PROMOTE NATIVE LADY BEETLE ABUNDANCE & RICHNESS



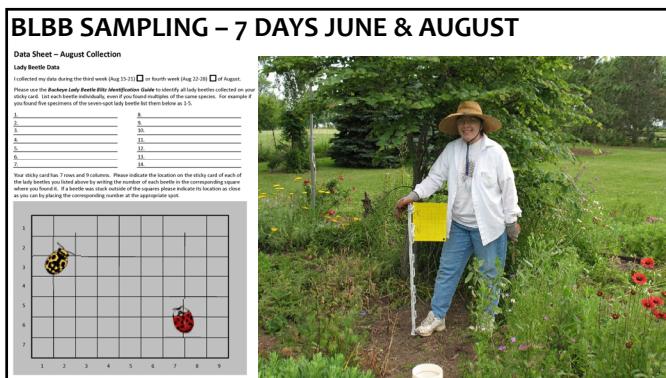
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16



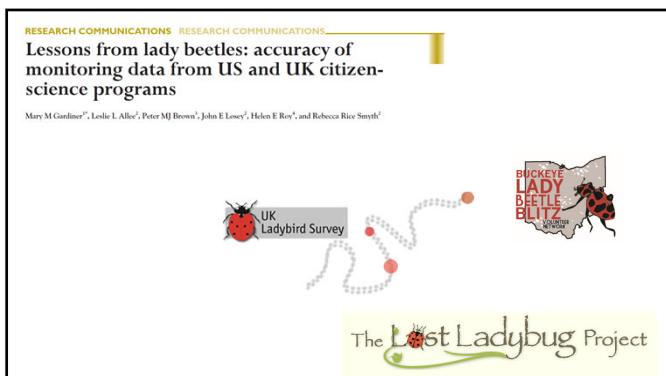
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Our objective
was to compare
the accuracy of
direct versus
verified citizen
science data



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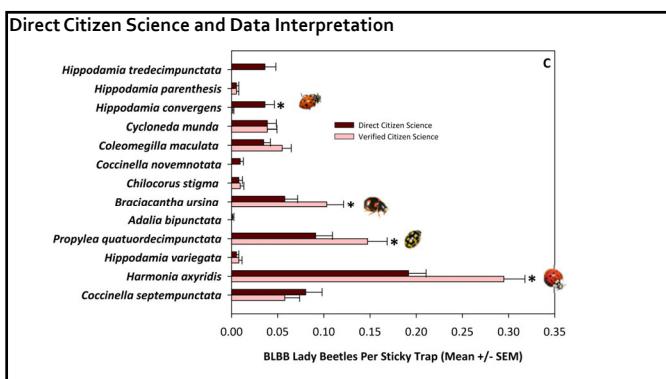
Direct Citizen Scientist Reports

Influences on researcher data interpretation:

- Underestimation of common species
- Overestimation of rare species
- Inflated species richness
- Significantly greater species diversity



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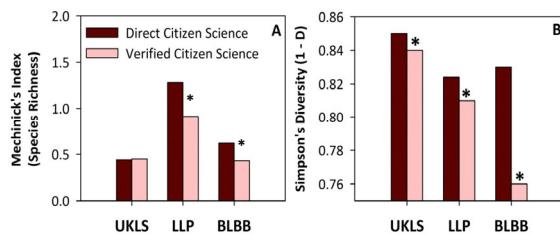


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Direct Citizen Science and Data Interpretation

Inflated species richness

Significantly greater species diversity



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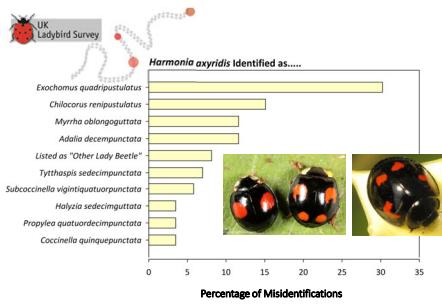
Direct Citizen Science Error: Role of *H. axyridis*

Multicolored Asian Lady Beetle: *Harmonia axyridis*



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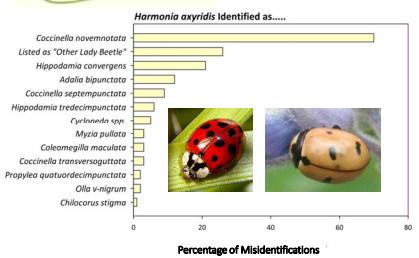
Direct Citizen Science Error: Role of *H. axyridis*



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Direct Citizen Science Error: Role of *H. axyridis*

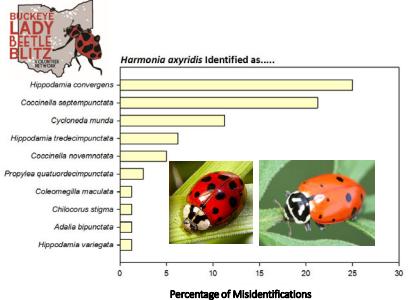
The Lost Ladybug Project



(Gardiner et al. 2012, Frontiers in Ecology and the Environment)

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Direct Citizen Science Error: Role of *H. axyridis*



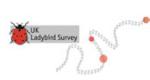
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Conservation Bias?

Native Lady Beetle Species

Ohio has many species of native lady beetles; in this section we will focus on those that have occurred with agricultural habitats. Many native species have declined over time. As a citizen scientist, your efforts will contribute to understanding the extent of this decline and the development of conservation measures.



The Harlequin Ladybird has landed!

A new ladybird has arrived in Britain. But did any ladybird this in the harlequin ladybird, *Harmonia axyridis*, the most invasive ladybird on Earth?

The harlequin ladybird was introduced to North America in the late 1900s and is one of the few non-native ladybird species on the continent. It has already invaded much of north-western Europe, and arrived in Britain in 2004.

There are 40 species of ladybird (*Coccinellidae*) resident in Britain and the recent arrival of the harlequin ladybird has the potential to replace many of these native species. This citizen scientist will monitor its spread across Britain and assess its impact on native ladybirds.

LOST LADYBUG PROJECT

Are you a nine-spotted ladybug?



Spot - and - spot: My name is *Harmonia axyridis*, the introduced harlequin ladybird. All my body parts have been pressed. I come in many different color patterns, with spots and stripes. I am orange with black spots, consistently large and rounded. I was introduced into Britain in 2004 by accident. I am very common. I also spend the winter inside houses.

Spot - and - spot: My name is *Coccinella septempunctata*, the seven-spotted ladybird. I am too long and thin. I am often patchy with orange and red. I have seven dark spots on each wing. Along with spots, most eggs are laid in clusters. I am found in fields, parks, and gardens. You may find me in corn and fruit trees!

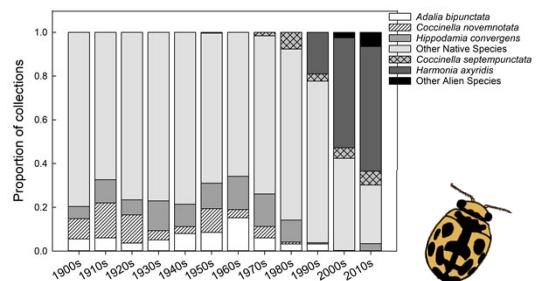
Polymorphic nature of lady beetles

Citizen scientist experience level

Interpretation of training/protocols

Desire to find rare species

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BLBB COMMUNITY

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BLBB COMMUNITY

ORIGINAL RESEARCH Ecology and Evolution WILEY

Community science data suggests that urbanization and forest habitat loss threaten aphidophagous native lady beetles

Mary M. Gardiner¹ | Kayla I. Perry¹ | Christopher B. Riley^{1,2} | Katherine J. Turo¹ | Yvan A. Delgado de la flor^{1,3} | Frances S. Sivakoff⁴

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BLBB COMMUNITY

Psyllobora vigintimaculata (Say)	501
Harmonia axyridis (Pallas)	333
Propylea quatuordecimpunctata (Linnaeus)	162
Hyperaspis undulata (Say)	139
Brachiacantha ursina (Fabricius)	123
Coleomegilla maculata (Degeer)	67
Cycloneda munda (Say)	52
Coccinella septempunctata (Linnaeus)	38
Hippodamia variegata (Goeze)	34
Chilocorus stigma (Say)	14
Hippodamia parenthesis (Say)	4
Hippodamia convergens Guerin	2
Mulsantina picta (Randall)	1

* EXOTIC SPECIES IN BOLD

- MOST ABUNDANT NATIVES FEED ON FUNGI AND SCALES

- EXOTICS 82% OF APHIDOPHAGOUS BEETLES



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BLBB SURVEY CONFIRMED THREATENED TAXA

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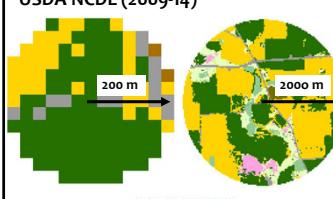


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LANDSCAPE ANALYSIS

USDA NCDL (2009-14)



RESPONSE VARIABLES:

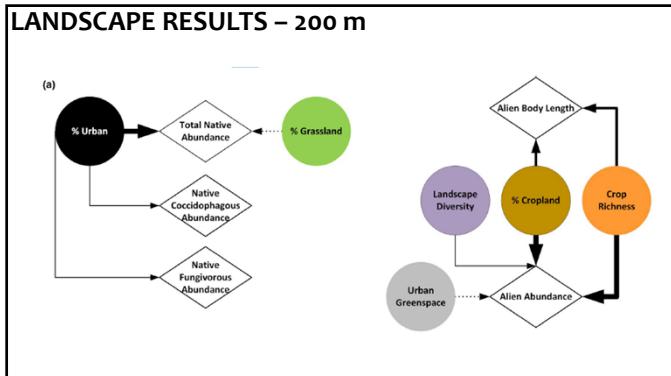
EXOTIC ABUNDANCE
NATIVE ABUNDANCE (APHID, SCALE, FUNGUS)
NATIVE RICHNESS
NATIVE EVENNESS

PREDICTOR VARIABLES:

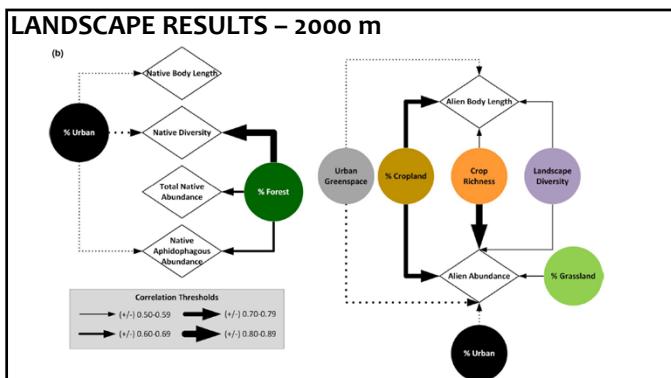
CROPLAND
CROPLAND RICHNESS
FOREST
GRASSLAND
DEVELOPED URBAN
URBAN OPENSPACE
LANDSCAPE DIVERSITY

PARTIAL LEAST SQUARES CORRELATION ANALYSIS

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SUMMARY

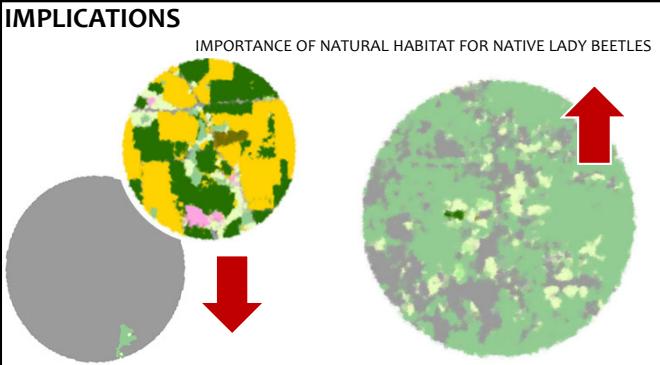


- 9 NATIVE SPECIES FOUND IN RESIDENTIAL HABITATS
- NATIVES REPRESENTED 41% OF PREDATORY SPECIES
- **EVIDENCE OF HABITAT COMPRESSION:**
- EXOTICS DOMINATE IN AGRICULTURAL LANDSCAPES
- NATIVES POSITIVELY INFLUENCED BY ANCESTRAL HABITATS, NEGATIVELY INFLUENCED BY URBANIZATION

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IMPLICATIONS

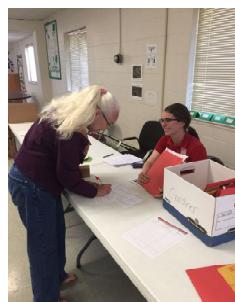
IMPORTANCE OF NATURAL HABITAT FOR NATIVE LADY BEETLES



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CONSERVATION ACTIONS

- AVOID PESTICIDES
- MAINTAIN FLOWERING PLANTS SEASON LONG
- OPEN FLOWERS and EXTRAFLORAL NECTAR
- FOREST PATCHES AND TREE PLANTING



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ACKNOWLEDGEMENTS

BLBB VOLUNTEERS

BLBB RESEARCH TEAM

VERIFICATION:

Hilary Edgington, Bethany Hunt, Chelsea Gordon

LANDSCAPE: Reid Wilson

ART: Emily Syplot



FUNDING

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OSU IPM Program

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