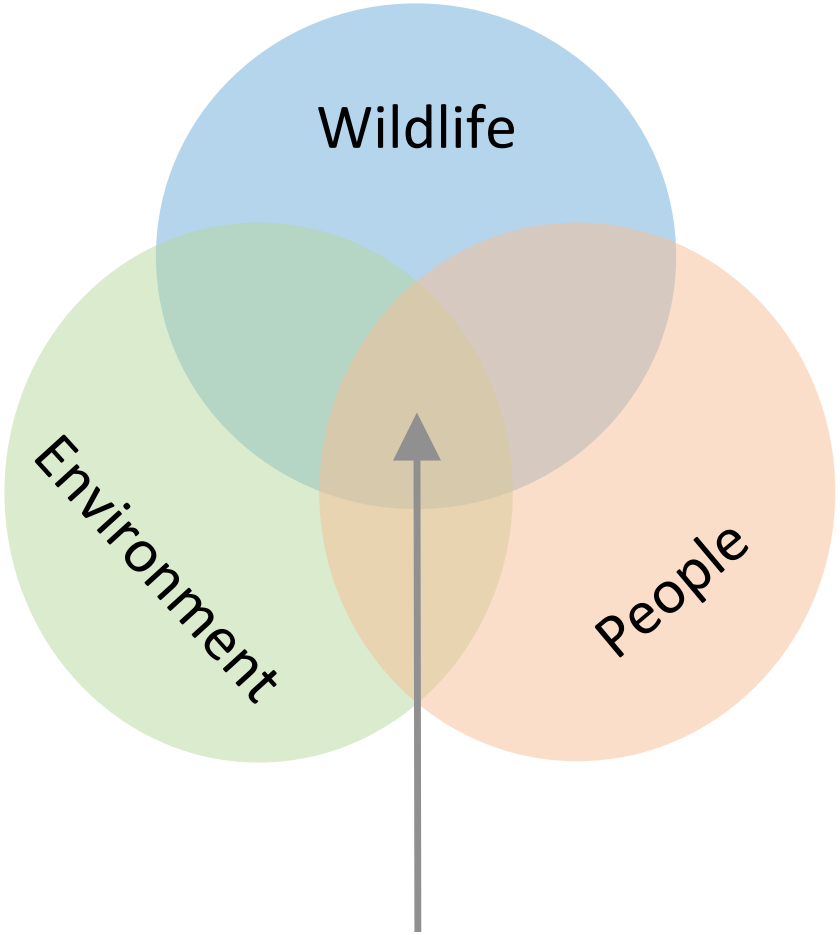
The Chickadee's Guide to Gardening

How to Create Habitat for Birds in Urban Settings

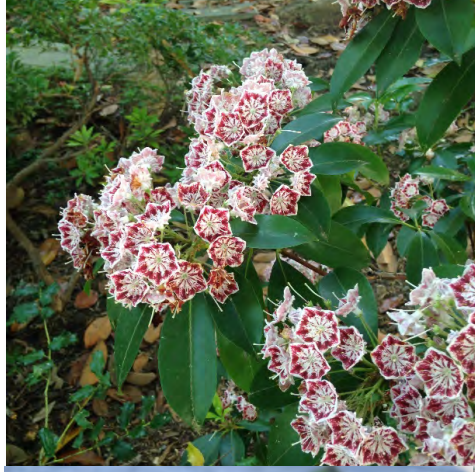
Desirée L. Narango, PhD

UMASS AMHERST

ADVANCED SCIENCE RESEARCH CENTER
THE GRADUATE CENTER
CITY UNIVERSITY OF NEW YORK



Interaction Ecology & Conservation in Human-dominated Systems

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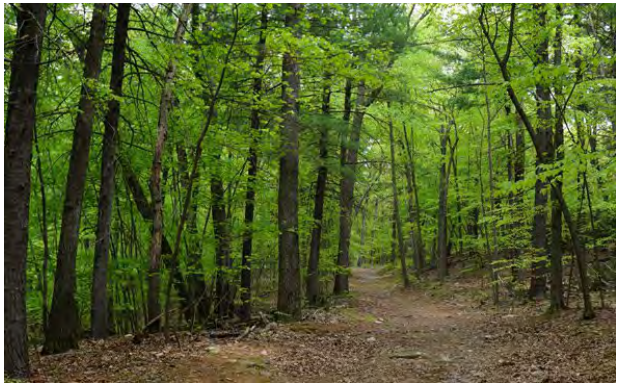




Urban Green Space

Residential Gardens: >50% of urban greenspace

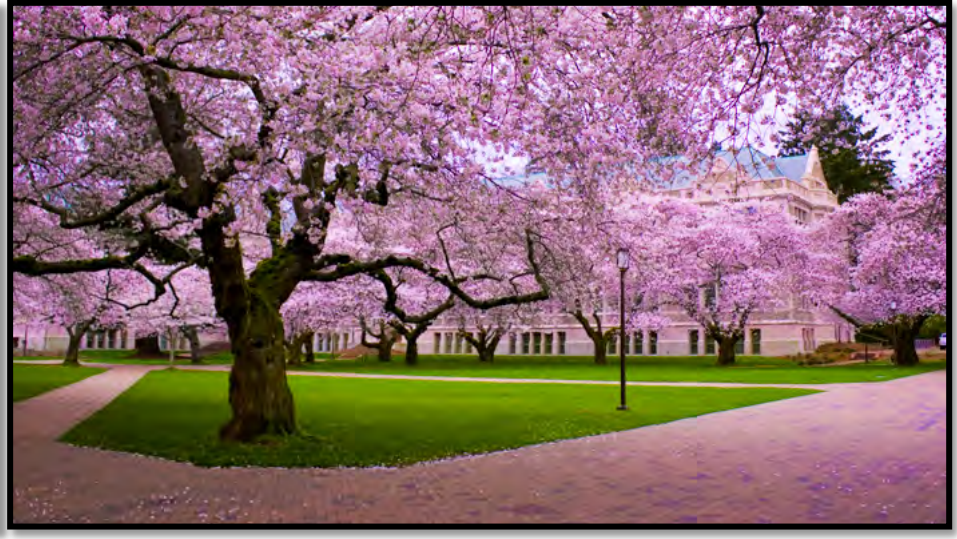
Loram et al. 2017

Dr. Douglas Tallamy
University of Delaware

Dr. Peter Marra
Smithsonian
Migratory Bird Center

Smithsonian Conservation
Biology Institute

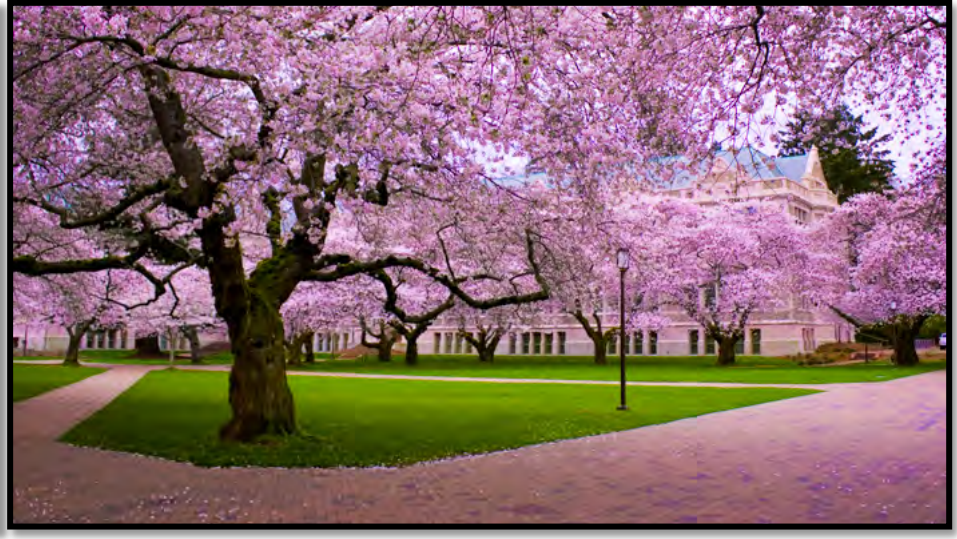
Photos: http://www.ornamental-trees.co.uk/



To plant native or nonnative species?

Goddard et al. TREES 2010

Avolio et al. 2018, Ecological Monographs



Can we strategically plant <u>productive</u> urban trees to improve wildlife habitat?


Why does plant identity matter?

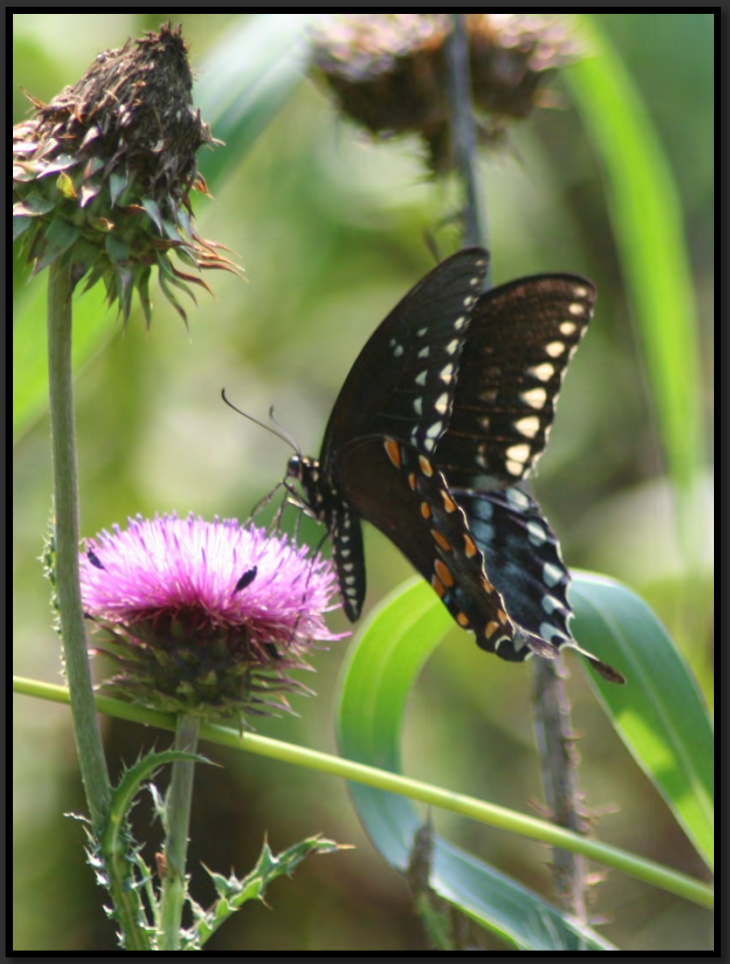
>90% of plant-eating insects are specialists to some degree

Double-toothed Prominent

Photo: S. Jaffe

Hackberry Emperor

Celtis occidentalis
*(*Hackberry)



Spicebush Swallowtail

Lindera benzoin (Spicebush)
Sassafras albidum (Sassafras)

Juniper Hairstreak

Juniperus virginiana
(Red Cedar)

Eastern Tiger Swallowtail

Liriodendron **(Tuliptree)**
Prunus **(Cherry),**
Ptelea **(Hoptree)**
and more

Snowberry Clearwing

Symphoricarpos (Snowberry)
Viburnum
Lonicera (Honeysuckle)

Imperial Moth

Pinus (Pine),
Quercus (Oak),
Acer (Maple),
Liquidambar (Sweet gum)

How many caterpillar species are in Massachusetts?

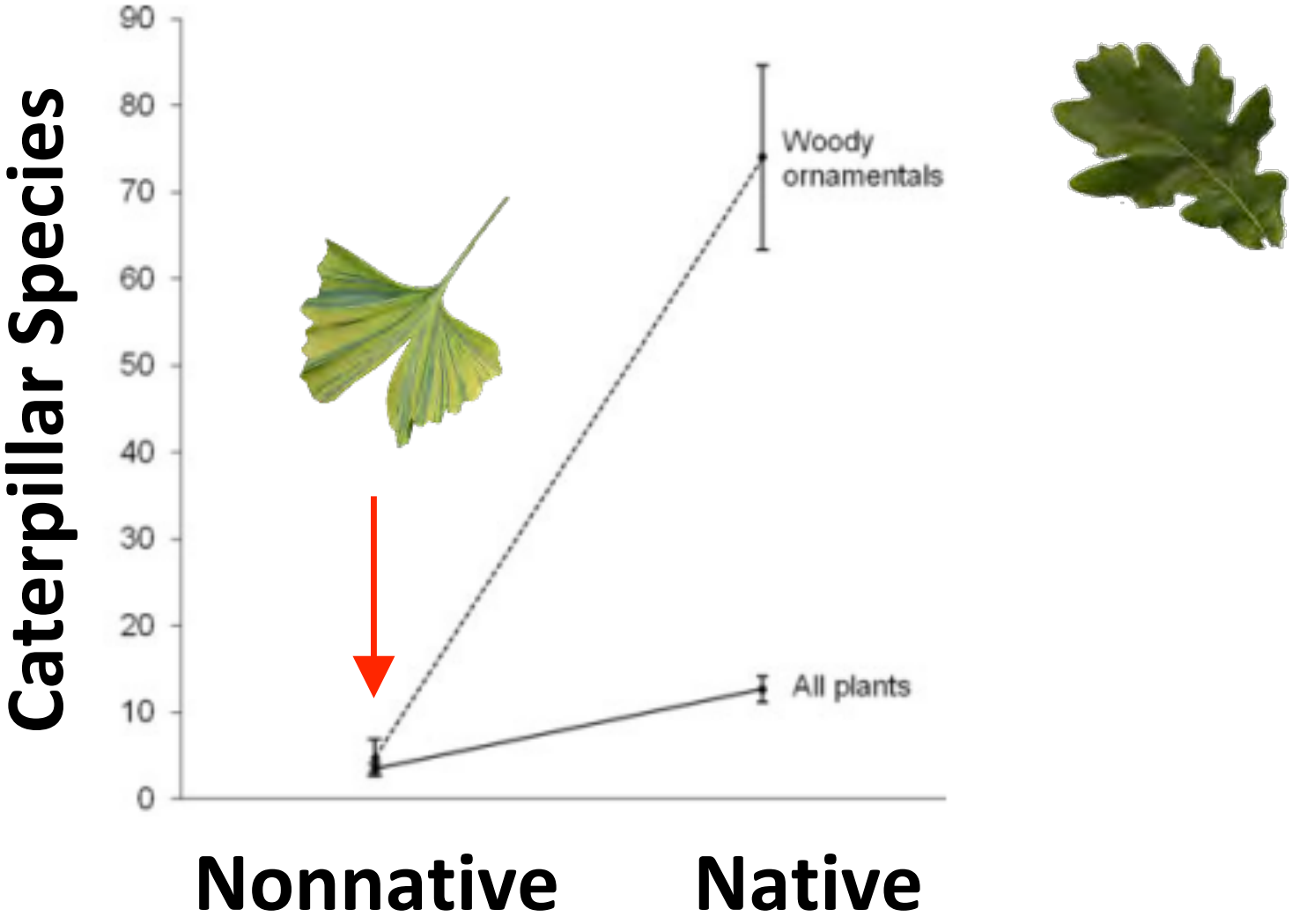
How many caterpillar species are in Massachusetts?

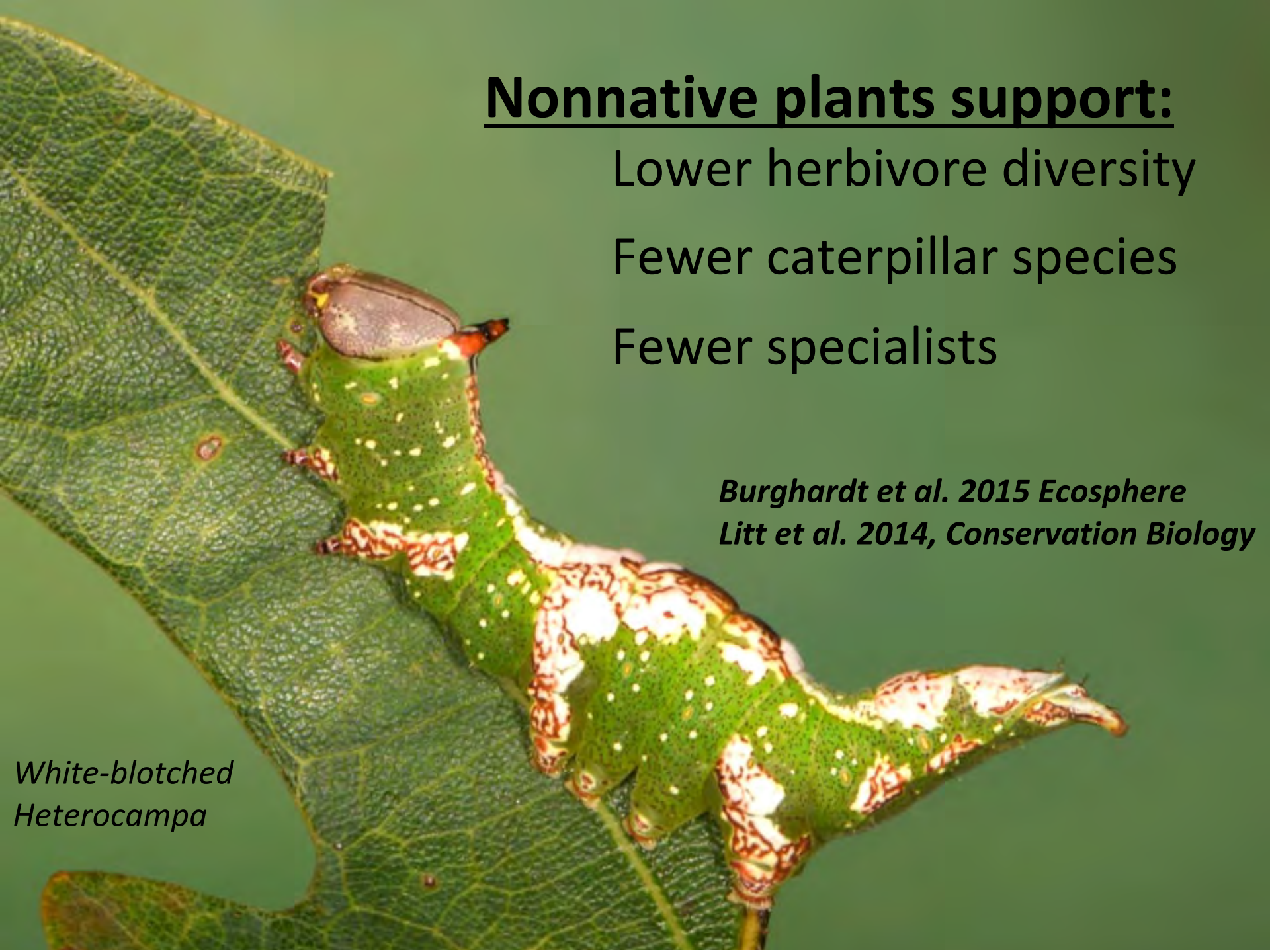
At least 2249!!

26% only feed on 1 plant
70% are <5 plants

Native Woody Plants Support more Caterpillar Diversity than Nonnative

Tallamy and Shropshire, 2009





Nonnative plants support:

Lower herbivore diversity

Fewer caterpillar species

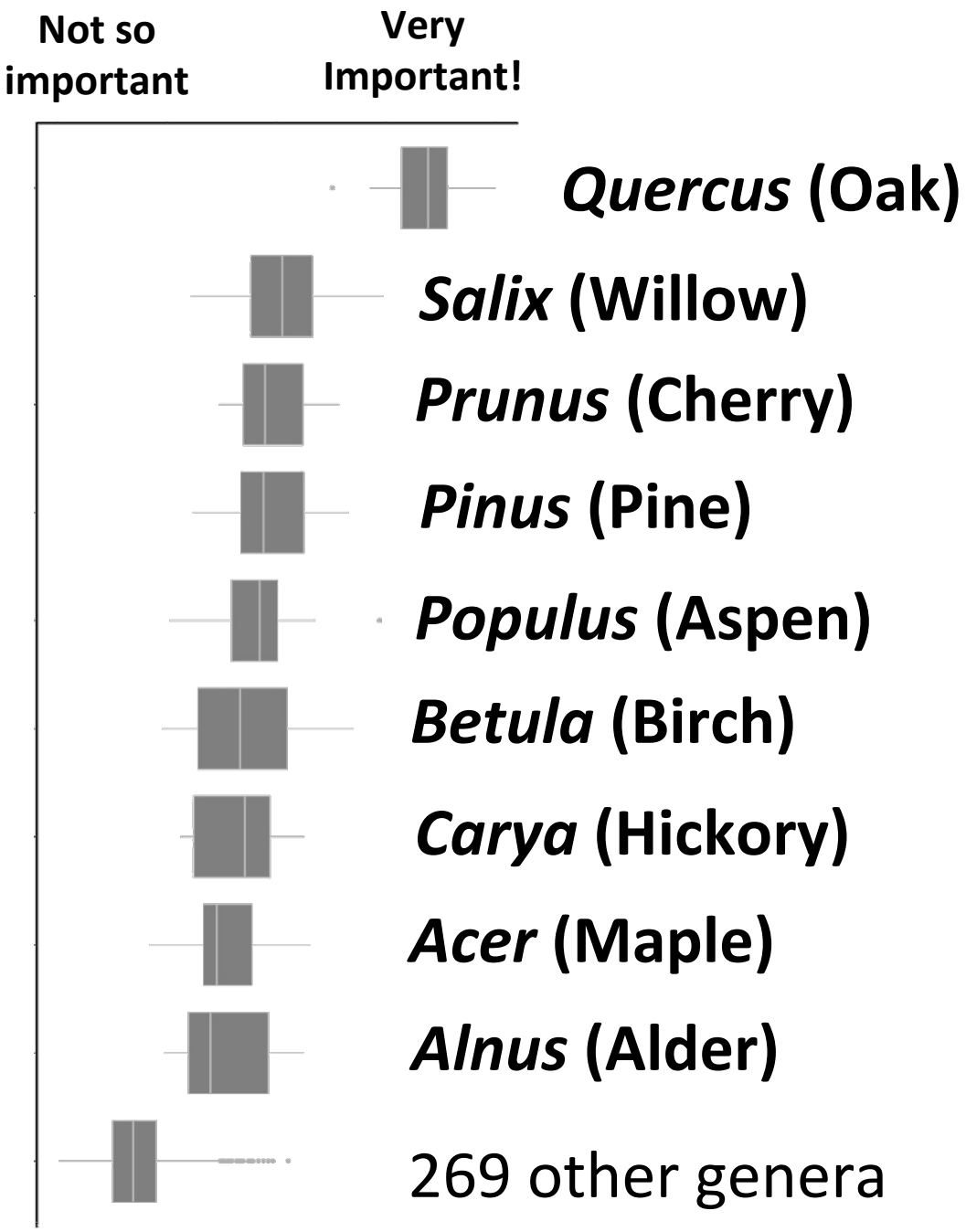
Fewer specialists

Burghardt et al. 2015 Ecosphere
Litt et al. 2014, Conservation Biology

White-blotched Heterocampa

Quercus (Oak) - 477
Prunus (Cherry) - 415
Salix (Willow) - 406
Betula (Birch) - 397
Populus (Aspen) - 338

Ginkgo - 6
Ailanthus - 4
Styrax (Snowbell) - 1
Zelkova - 0
Cryptomeria - 0



Network Analysis:
83 counties,
25 US states

Narango et al. in prep

Are other insects plant specialists?

Are other insects plant specialists?

True Bugs

Beetles

Bees!

>30% of native bees are specialists
(85 specialist species in New England)

Salix (Willows) – 14 species

Cornus (Dogwood) – 4 species

Ilex (Hollies) – 2 species

Cercis (Redbud) – 1 species

Ericaceae
(Rhododendron, Laurel) – 4 species

Cornus florida
Flowering Dogwood

Andrena fragilis
Fragile Dogwood Bee

Native Bee Inventory & Monitoring Lab - USGS

Lots of evidence that birds benefit from trees

PLOS ONE

OPEN ACCESS PEER-REVIEWED

RESEARCH ARTICLE

Street trees reduce the negative effects of urbanization on birds

João Carlos de Castro Pena, Felipe Martello, Milton Cezar Ribeiro, Richard A. Armitage, Robert J. Young, Marcos Rodrigues

Why does plant identity matter?


Birds eat
Insects

How do nonnative plants affect birds in residential landscapes?

How do nonnative plants affect birds in residential landscapes?

Food Availability?

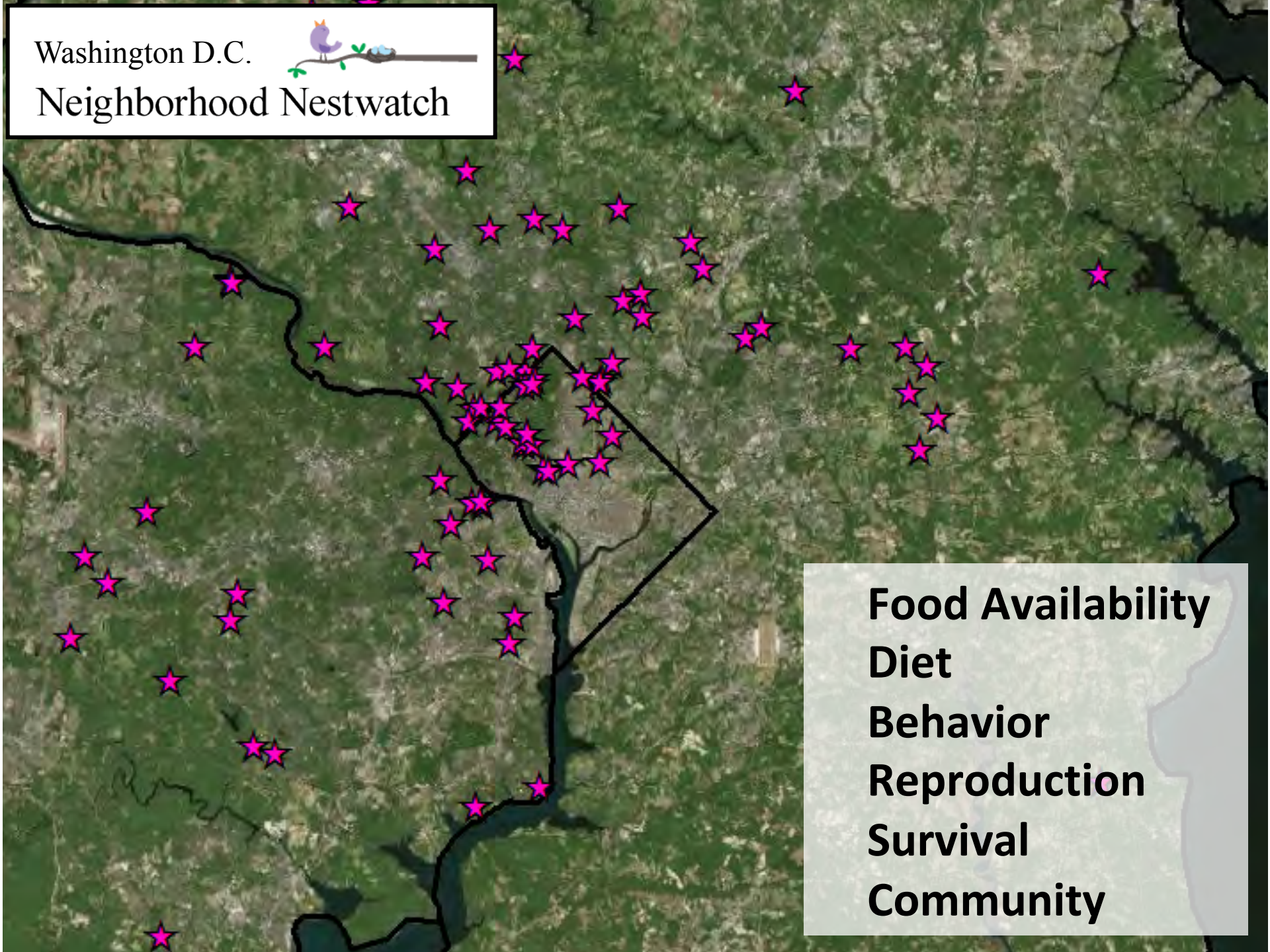
Individual Decisions?

Population consequences?

Habitat Quality?

Smithsonian

Washington D.C.
Neighborhood Nestwatch


Washington D.C.
Neighborhood Nestwatch
Food Availability
Diet
Behavior
Reproduction
Survival
Community

Washington D.C.

Neighborhood Nestwatch

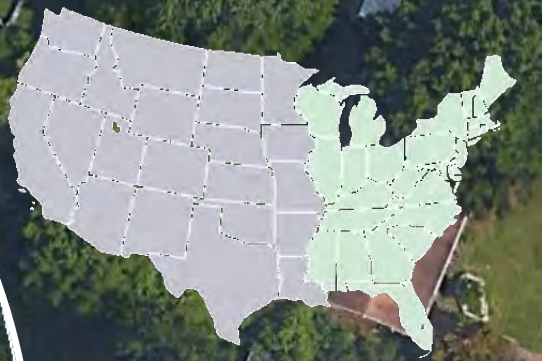
Smithsonian

- 18 years of Urban/Suburban Ecology
- Food Web Project 2013-2016
- >275 yards in DC/MD/VA
- www.neighborhoodnestwatch.weebly.com

Carolina Chickadee

"Bird of Truth"

Modified i-Tree plots
Importance values



36 m

Google earth

iTree: www.itreetools.org

Forest Structure

- Impervious surface / buildings
- Maintained grass
- Shrub density
- Tree density
- Tree height
- Tree species
- Canopy cover
- Tree condition
- Basal area
- Forest area

- Ecosystem Services

Lerman et al. 2014 *Landscape and Urban Planning*

Is All of ‘Subirdia’ the Same?

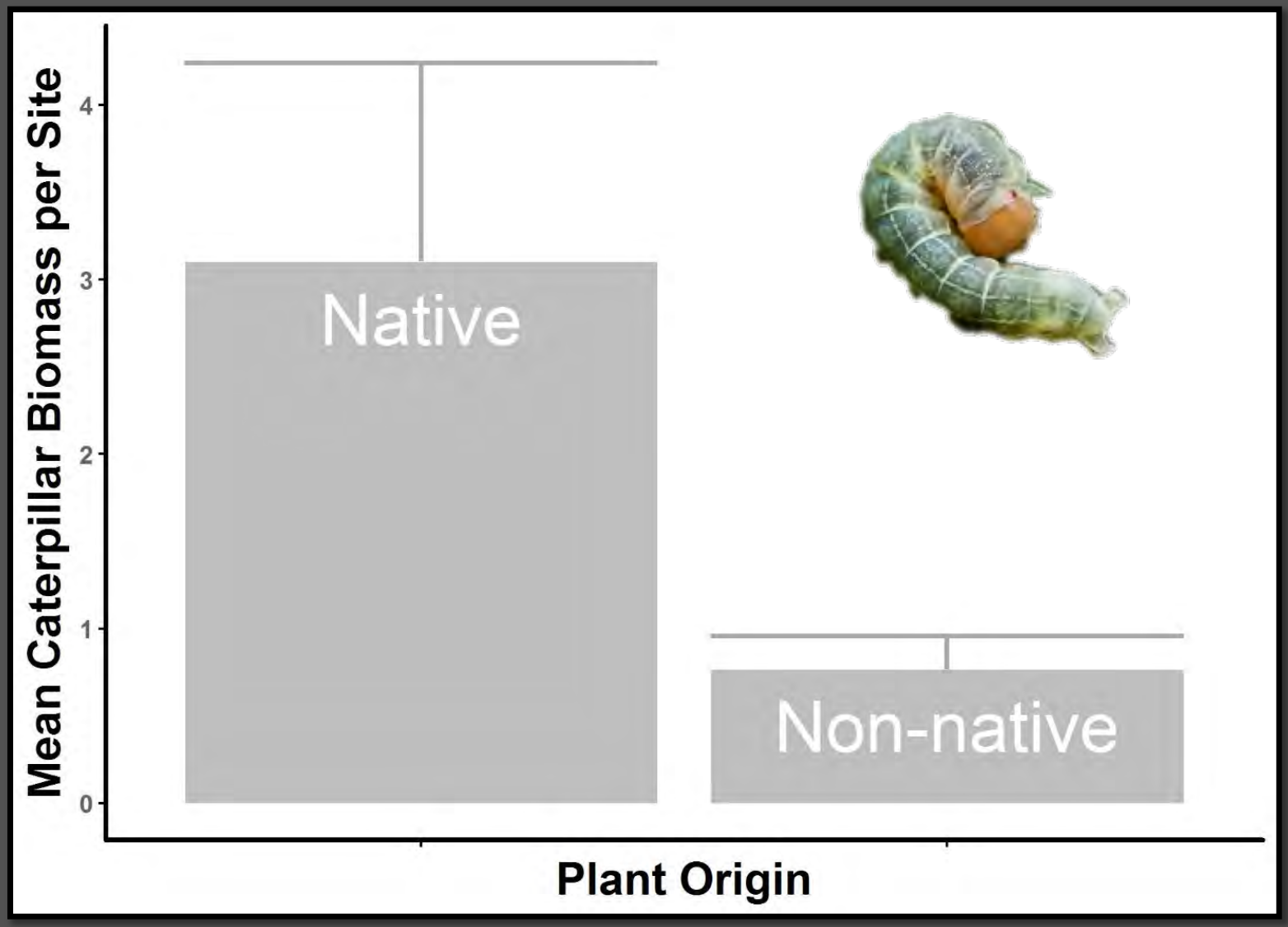
>350 different woody plant species; 74 families

Average diversity: 29 ± 10 woody plant species per site

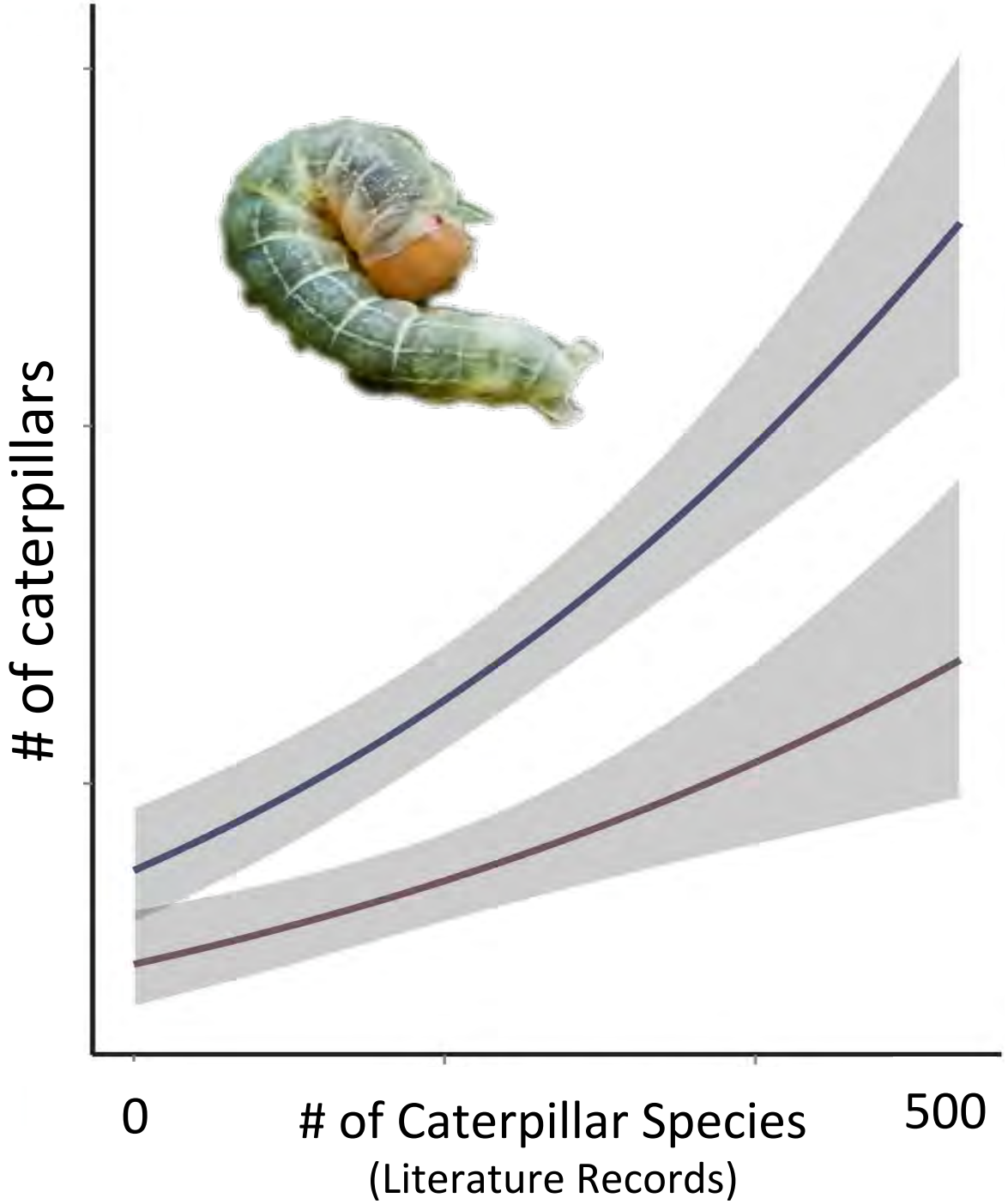
% Nonnative: <1% - 99%

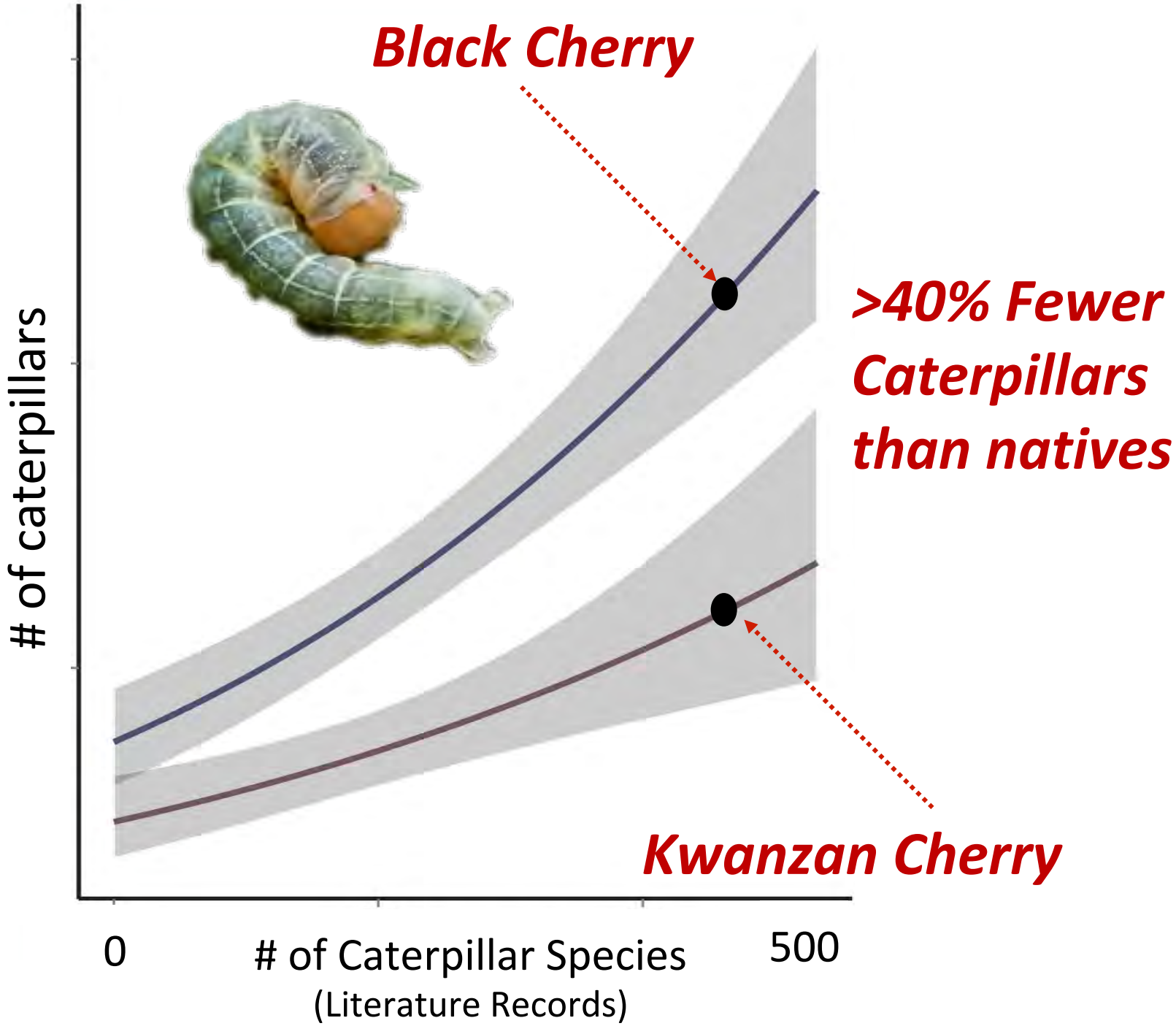
Do native trees have more food for birds?

Narango, et al. 2017, Biological Conservation



Native Trees Have More Caterpillars and Higher Biomass


# of caterpillars
0
# of Caterpillar Species
(Literature Records)
500


Black Cherry
>40% Fewer Caterpillars than natives
Kwanzan Cherry
# of caterpillars
0
# of Caterpillar Species
(Literature Records)
500

Do chickadees prefer native trees?

Narango, et al. 2017, Biological Conservation

Let the chickadees tell us what trees they like!


Nest Location
1: American Elm (*Ulmus americana*)
2. Oaks (*Quercus* sp.)
3. Black Cherry (*Prunus serotina*)
4. Black Locust (*Robinia pseudoacacia)*
5. Black Walnut (*Juglans nigra*)
1
4
5
3
2
2
2
2
2
0
25
50 Meters
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Chickadees Prefer Native Trees for foraging

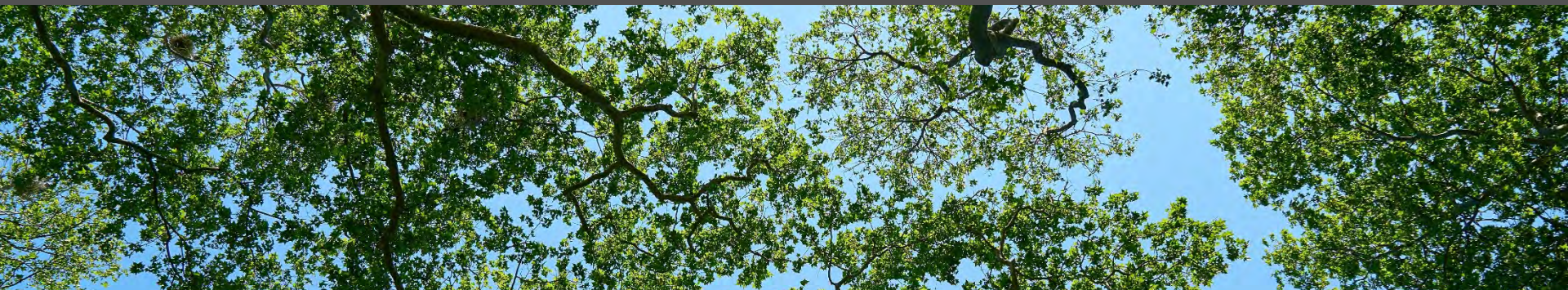
Narango, Tallamy and Marra *2017 Biological Conservation*

Chickadees Prefer Native Trees for foraging

Narango, Tallamy and Marra *2017 Biological Conservation*

Trees that support the most caterpillars, support the most bird foraging

1. Native *Quercus* (Oak) – 557 caterpillar sp.
2. Native *Acer* (Maple) – 297 caterpillar sp.
3. Native *Prunus* (Cherry) – 456 caterpillar sp.
4. Native *Ulmus* (Elm) – 215 caterpillar sp.
5. Native *Carya* (Hickory) –235 caterpillar sp.

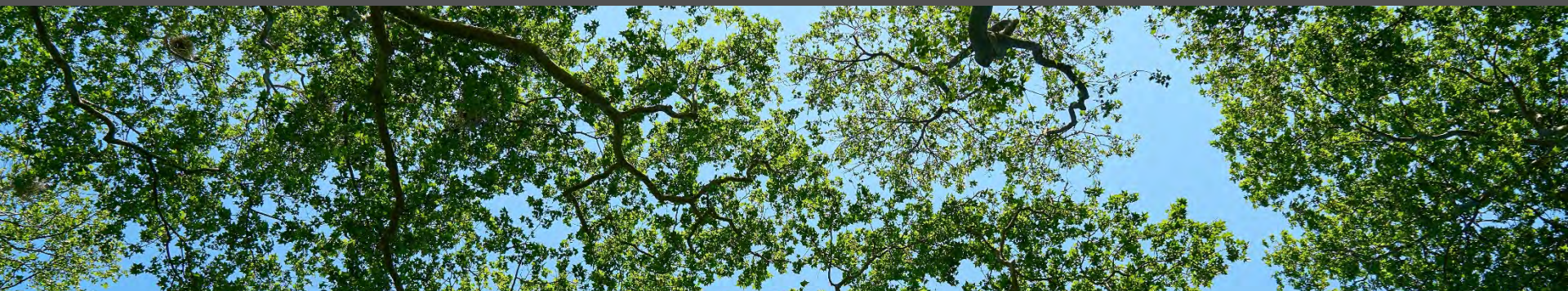


Trees that support the most caterpillars, support the most bird foraging

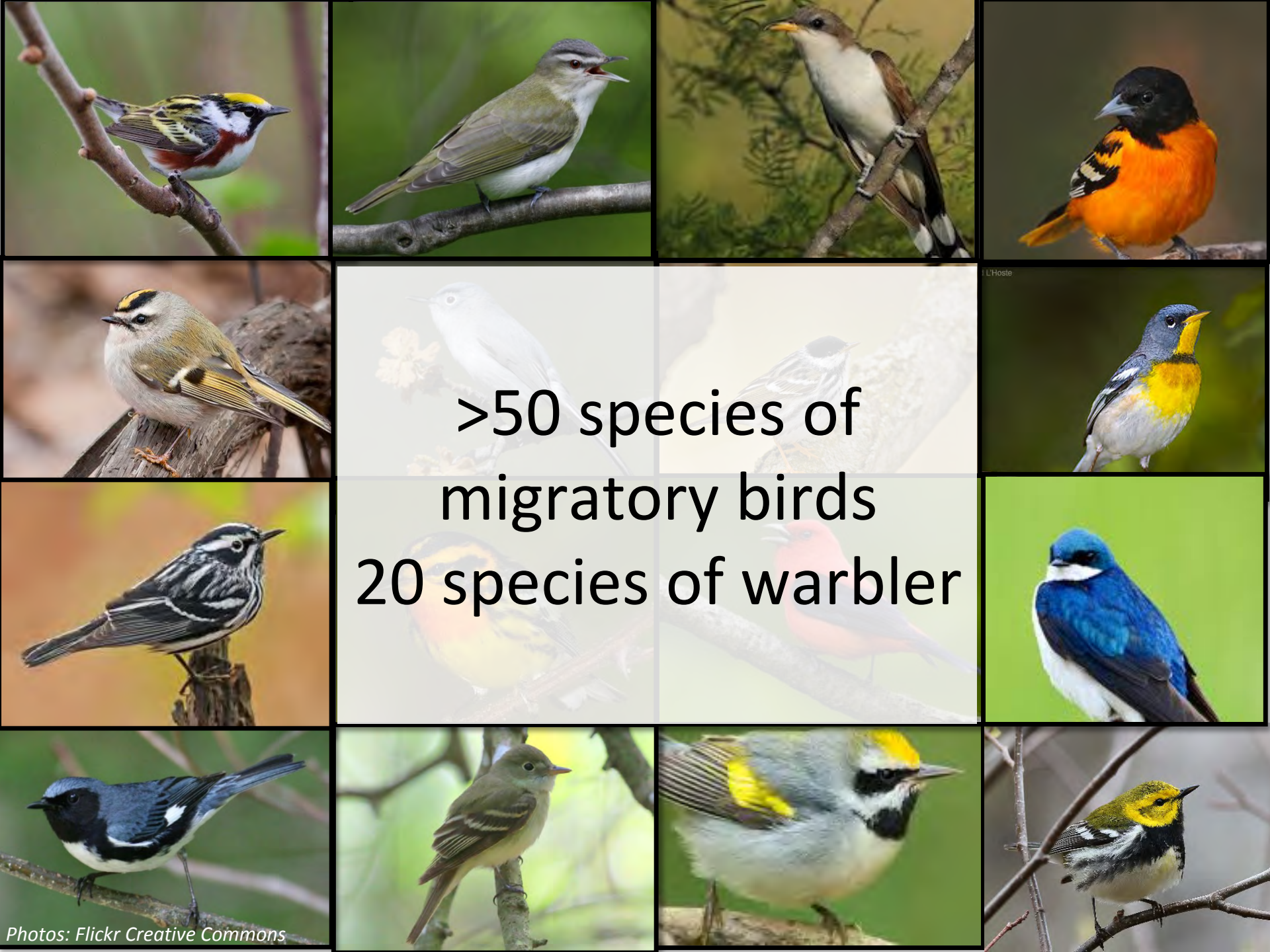
Prunus, 456 spp., Singer et al., 2012, American Naturalist

Betula, 411 spp., Holmes & Robinson, 1981; Oecologia

Quercus, 532 spp., Wood et al., 2012, Forest Ecology Management



Photos: Flickr Creative Commons


>50 species of
migratory birds
20 species of warbler
Photos: Flickr Creative Commons

The Cornell Lab of Ornithology

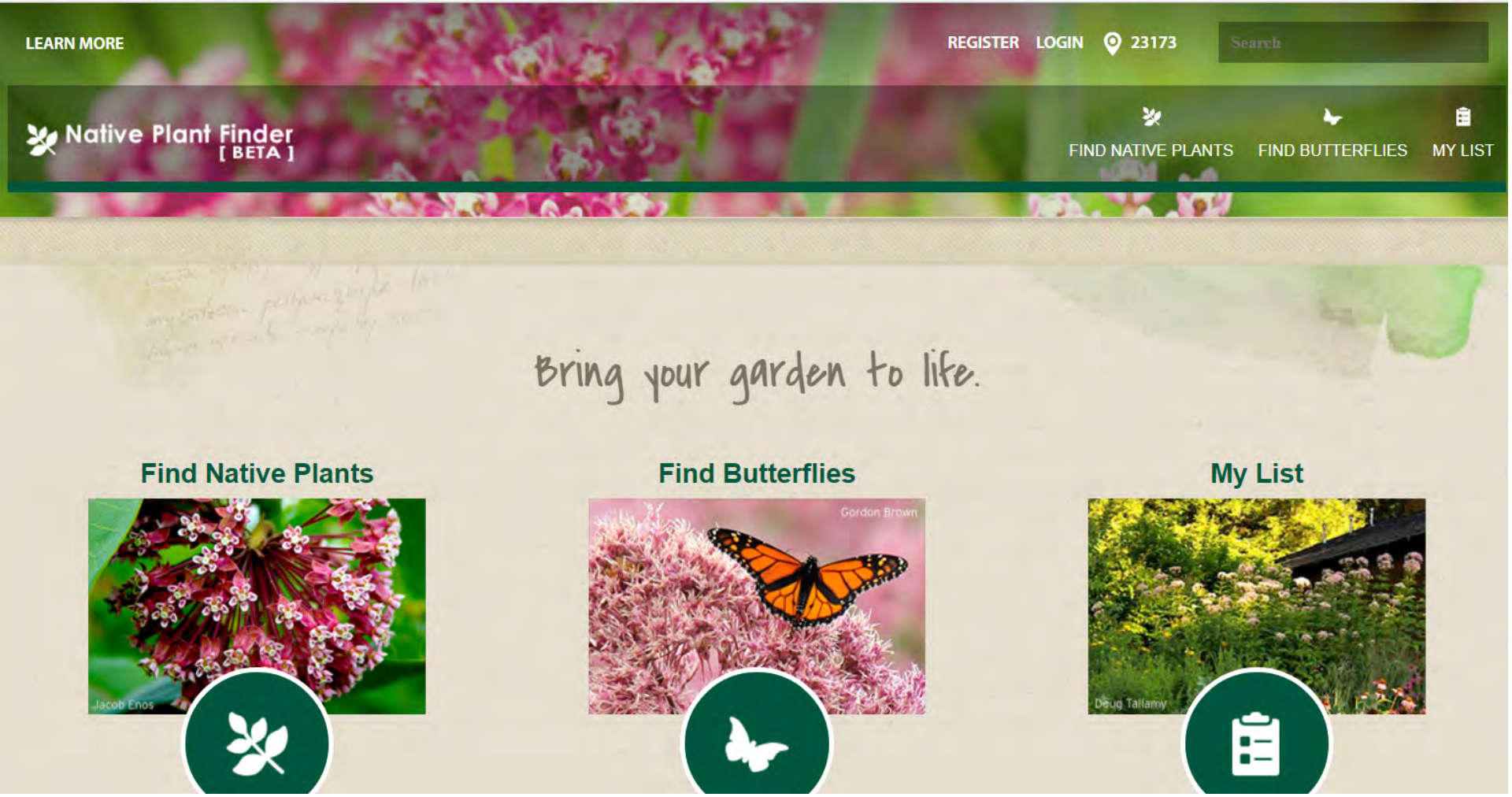
Take Home

Nonnative trees have less insect food

Chickadees strongly prefer native trees for foraging

Caterpillar richness can be a proxy for bird preference

Narango et al. Biological Conservation



https://www.nwf.org/NativePlantFinder

How many caterpillars does it take to make a nest of chickadees?

Photos by D. Tallamy

Lots!

390-570 caterpillars per day (Brewer 1961)

Chickadees feed their young for 16 days before they fledge.


What if they
can't find
that many?

Are there consequences when nonnative trees are abundant?

Narango, et al. 2018, PNAS

How to monitor populations?

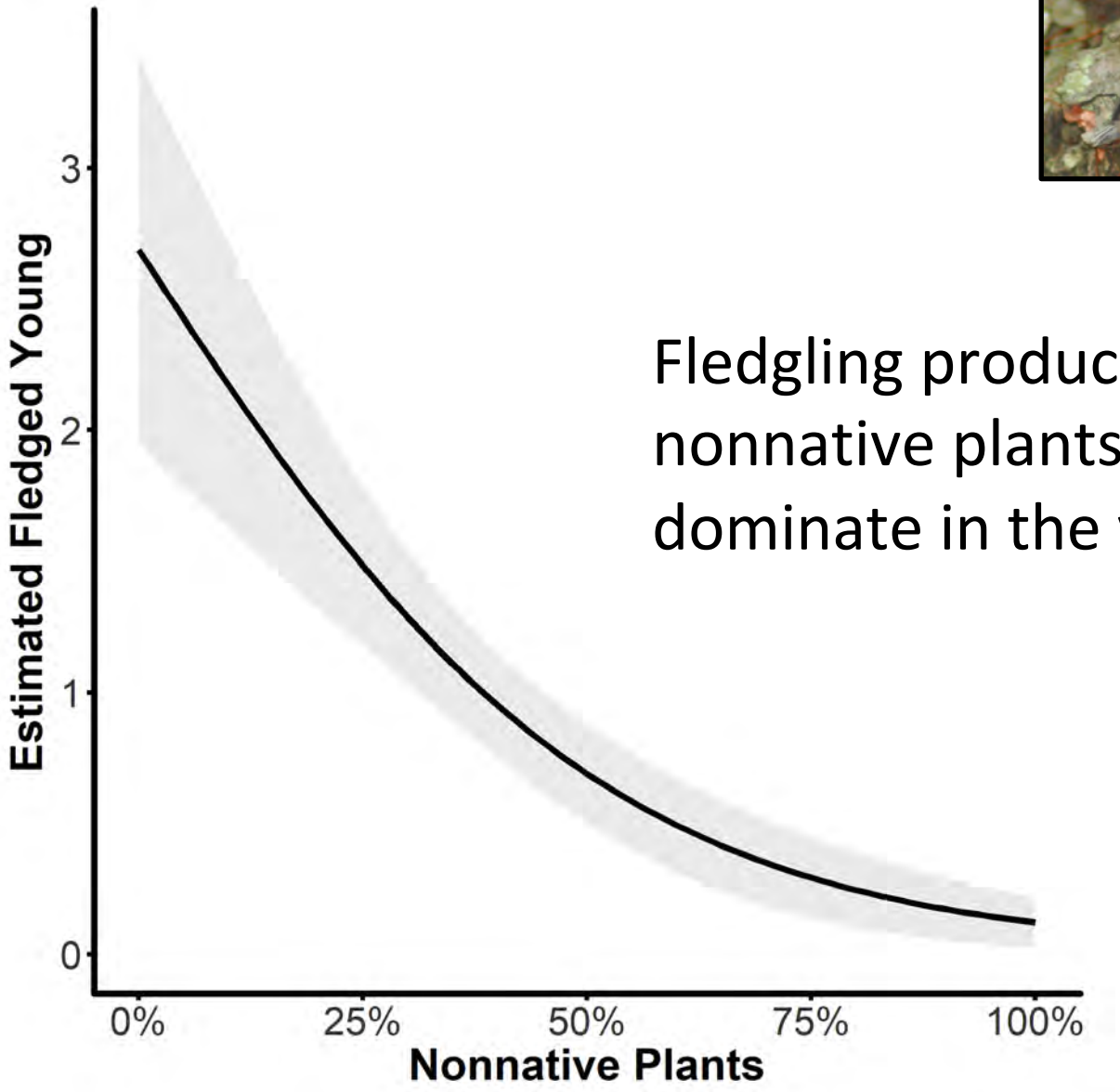
Reproduction +
Adult Survival +
Juvenile Survival

Population growth

Compared to yards landscaped with native trees, yards with nonnative trees…..

- Chickadees were less likely to occupy
- Chickadees were less likely to breed
- They lay (modestly) fewer eggs
- Their nests are less likely to survive
- They fledge fewer young

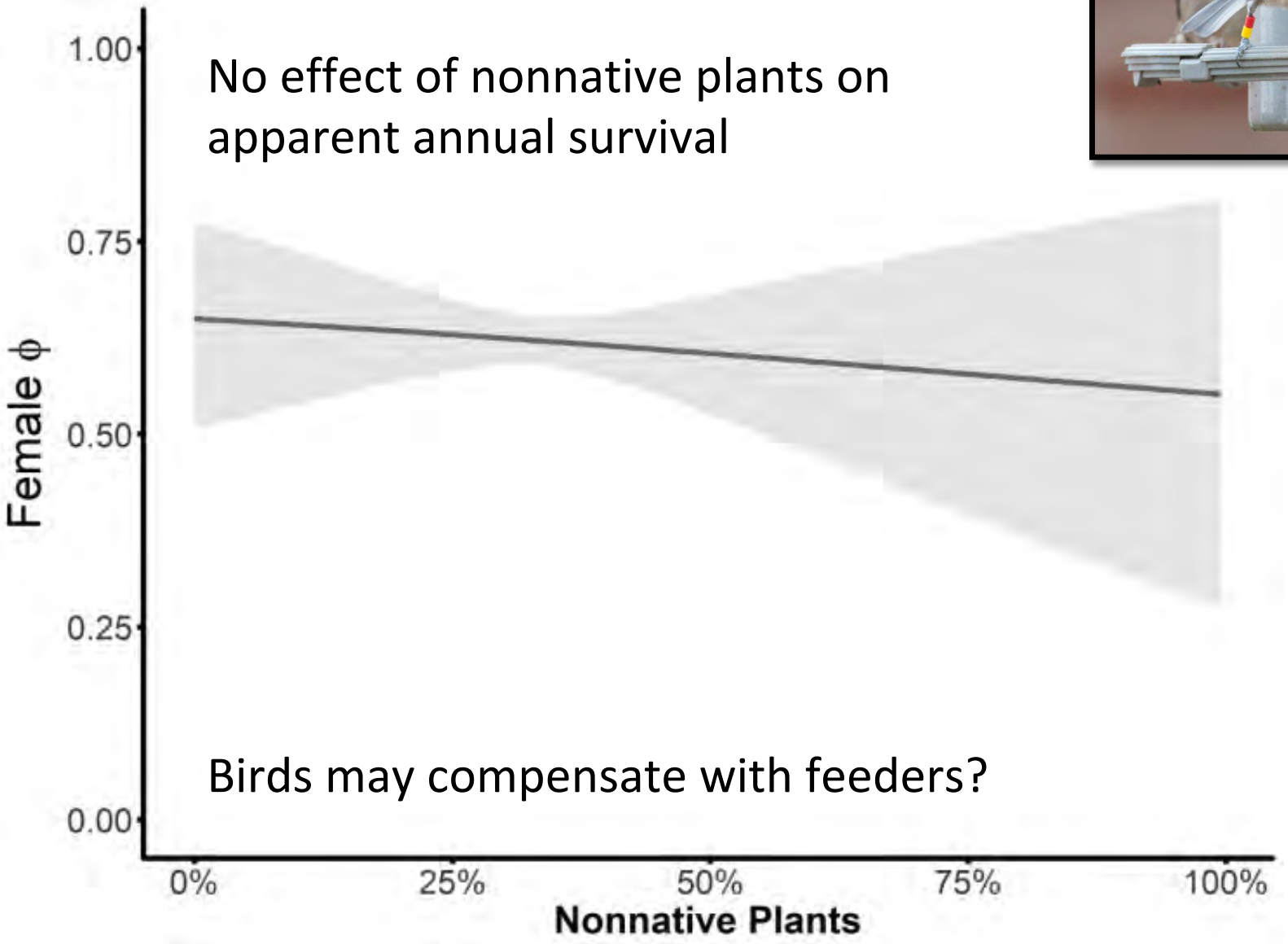
Reproduction



Fledgling production declines as nonnative plants become more dominate in the yard

Adult Survival

No effect of nonnative plants on apparent annual survival

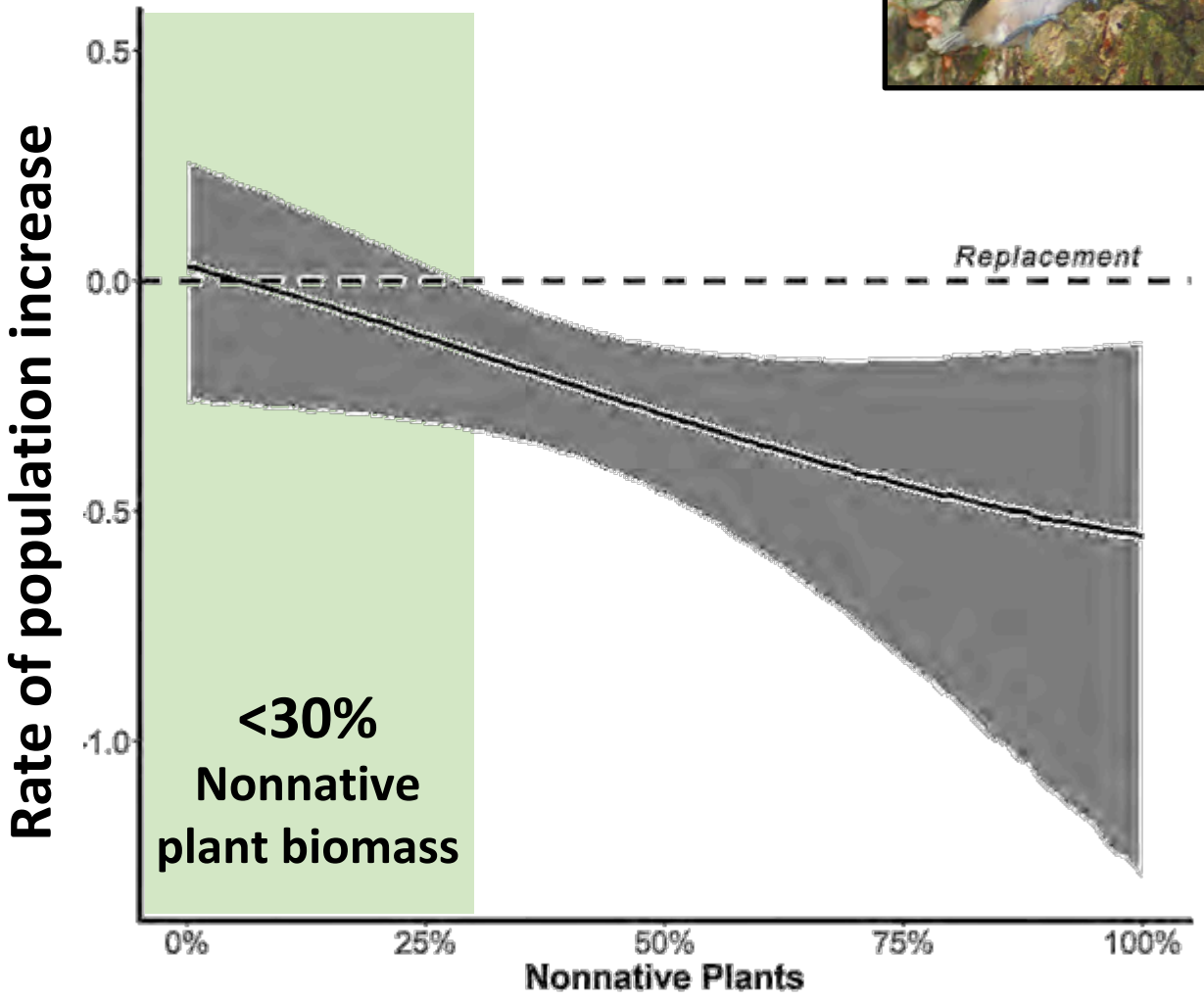


Birds may compensate with feeders?

Juvenile Survival

Juvenile Survival

As nonnative plants increase, chickadee population growth declines



Narango, Tallamy and Marra, in press, *PNAS*

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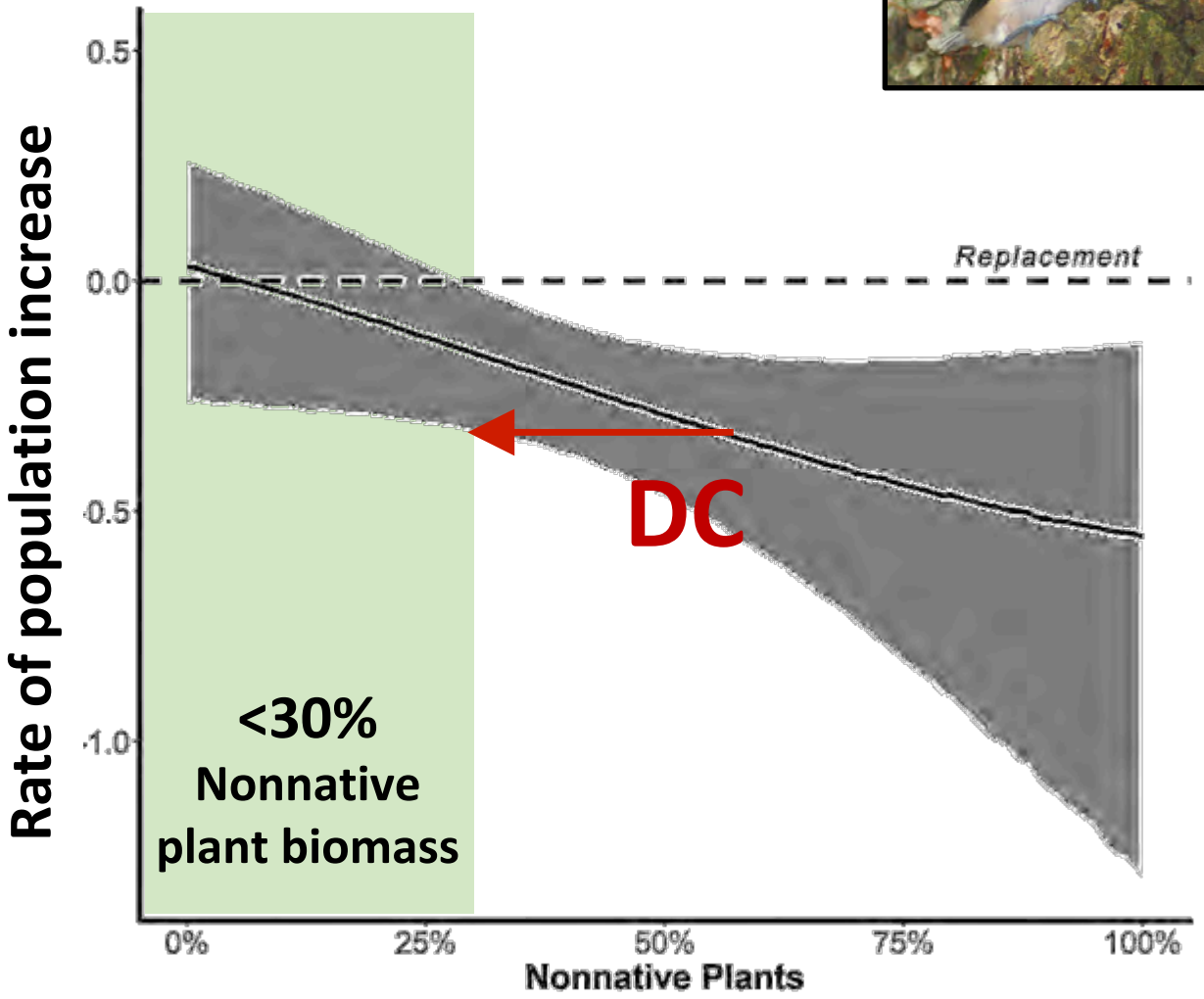

Narango, Tallamy and Marra, in press, *PNAS*

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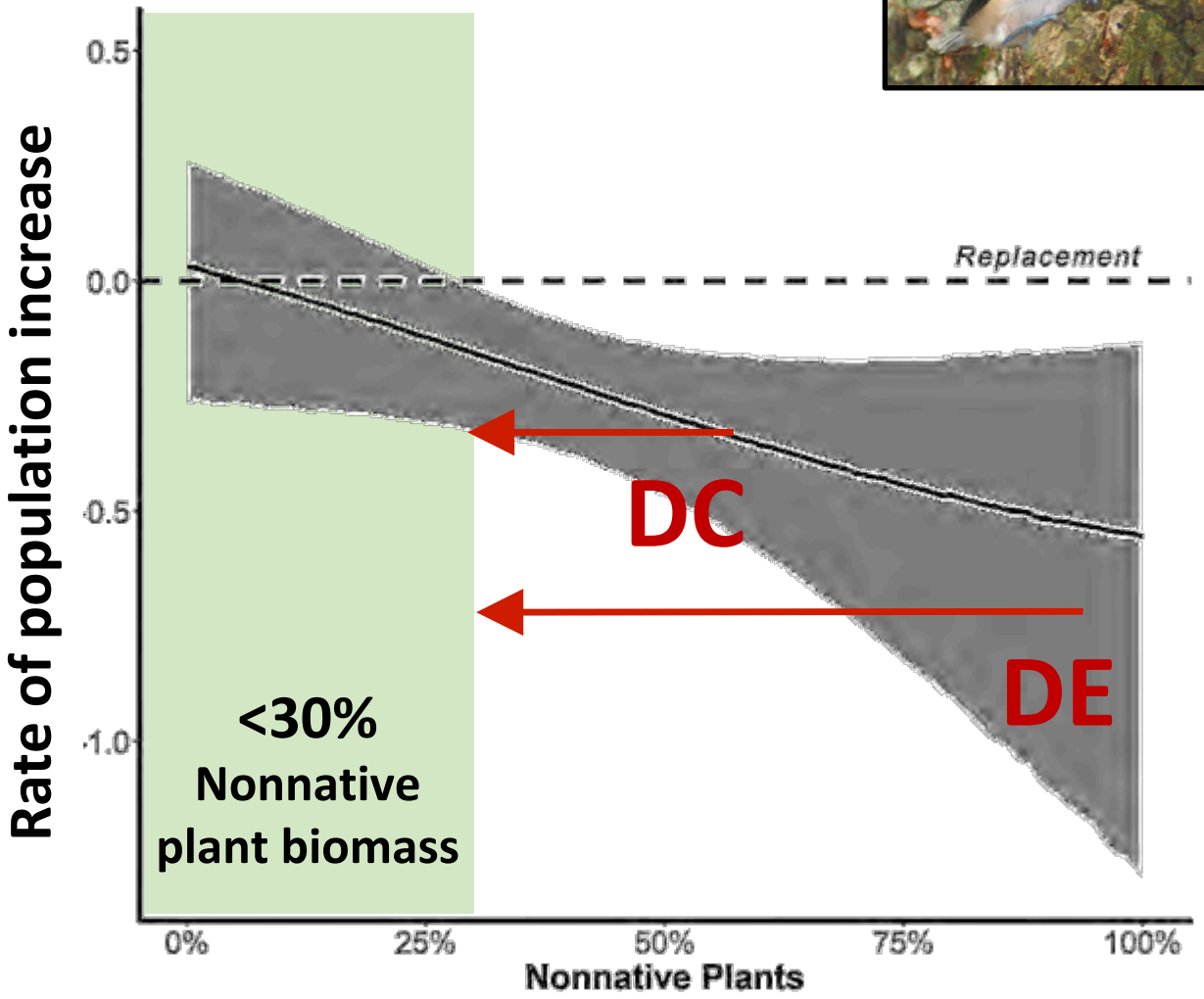


Narango, Tallamy and Marra, 2018, *PNAS*

Take Home

Chickadees breeding in yards with nonnative trees:

Low nesting occupancy

Low reproductive success

Overall reduced population growth

Evidence

To support insect and bird biodiversity, homeowners and urban managers should plant and retain native, insect producing tree species

Urban trees matter!

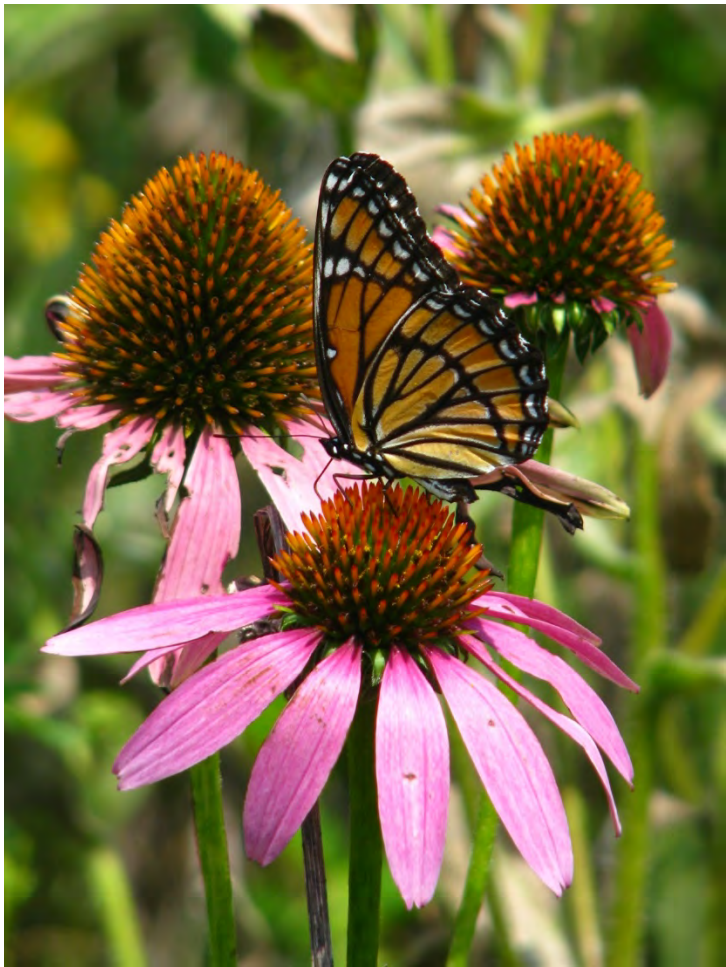
What else can I do to improve bird habitat?

Plant native trees
(and share the info!)

What else can I do to improve bird habitat?

Plant native trees
(and share the info!)

Prioritize ecological interactions to create beautiful, functional, habitat



What else can I do to improve bird habitat?

Plant native trees
(and share the info!)

Prioritize ecological interactions to create beautiful, functional, habitat

Manage trees and shrubs with resources in mind

What else can I do to improve bird habitat?

Species/temporal diversity & structural complexity is important

What else can I do to improve bird habitat?

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Create habitat for all parts of the annual cycle

What else can I do to improve bird habitat?

Species/temporal diversity & structural complexity is important

Create habitat for all parts of the annual cycle

Restore Connectivity

Image: Habitat Network

Thanks!

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@DLNarango

Acknowledgements

Neighborhood Nestwatch Participants

2013-2016 Field Techs and Volunteers

C. Crank, D. Ecker, T. Guida, J. Herbert, C. Jordan, S. Kay, K. Oswald, J. Rajbhandary, K. Snyder, A. Studd-Stojka, T. Wolanin

Kimberley Shropshire, Bob Reitsma

University of Delaware --

Entomology & Wildlife Ecology

Smithsonian Migratory Bird Center

Smithsonian Conservation Biology Institute

Birds have diet flexibility

?

?

How do nonnative trees affect diet and nestlings?

More nonnative plants = More Spiders

Poor condition
Slow feather growth

More native plants = More caterpillars

Good condition
Fast feather growth

Fewer caterpillars =

less high quality food

More visits =

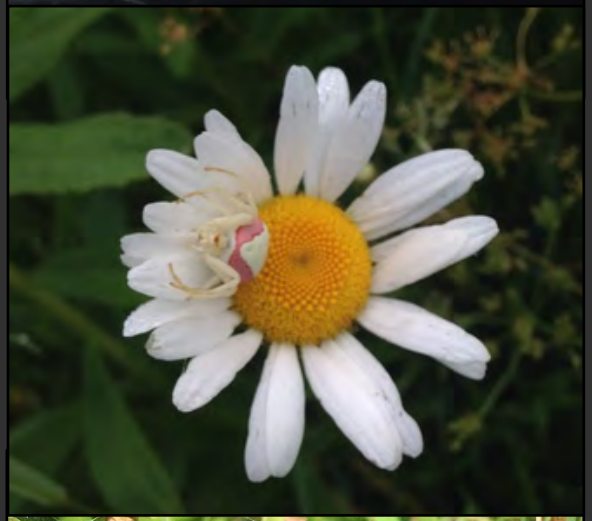
More work for adults

Less food =

poorer condition
& growth

Do nonnative plants limit food for broader consumer communities?

Do nonnative plants limit food for broader consumer communities?



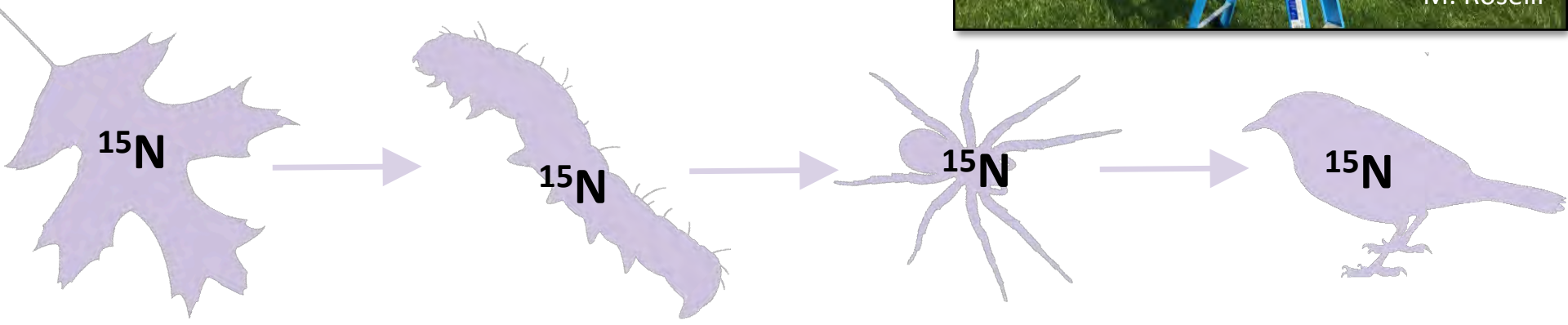
Methods

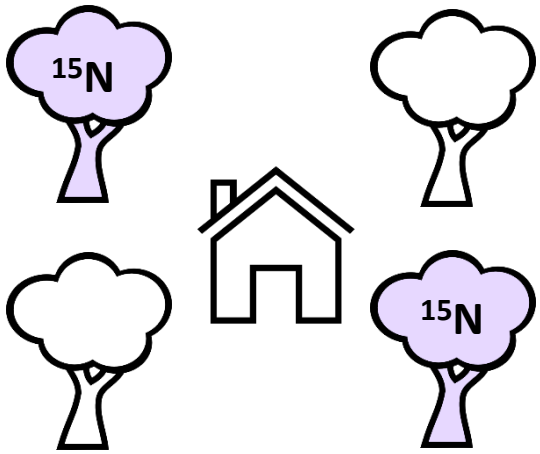
Tracking energy by applying ^{15}N enrichment

99% ^{15}N Single-labeled Ammonium Nitrate

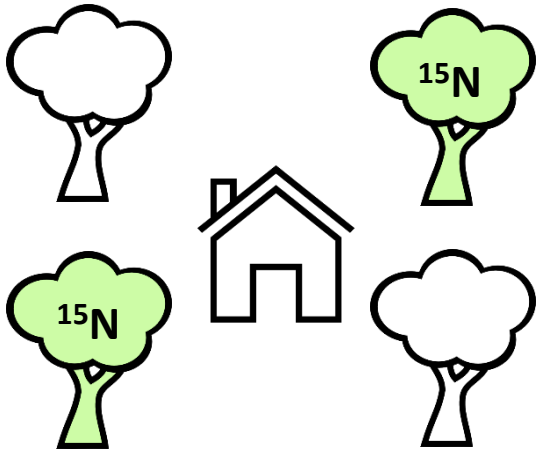
NH_4NO_3

Highly diluted foliar spray





Native plants only



Nonnative plants only

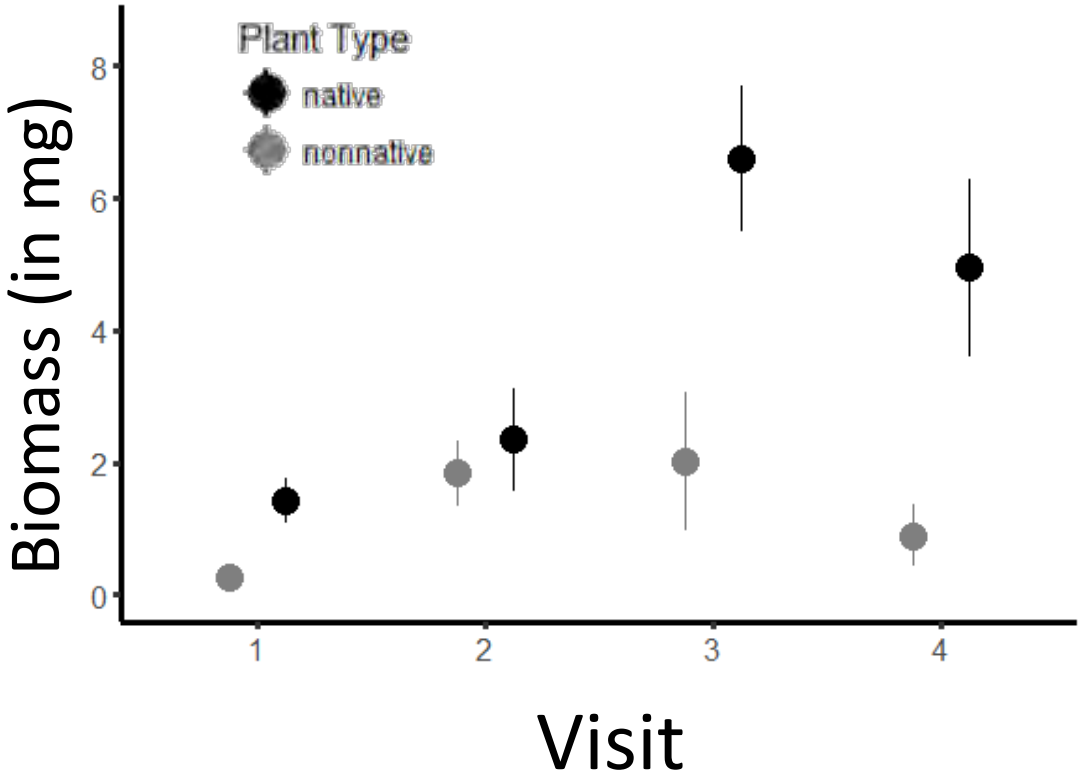
Smithsonian

Washington, D.C.

Neighborhood Nestwatch

12 Native sites
12 Nonnative sites

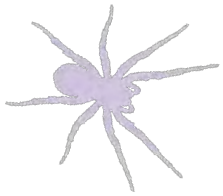
Results – Arthropod Biomass



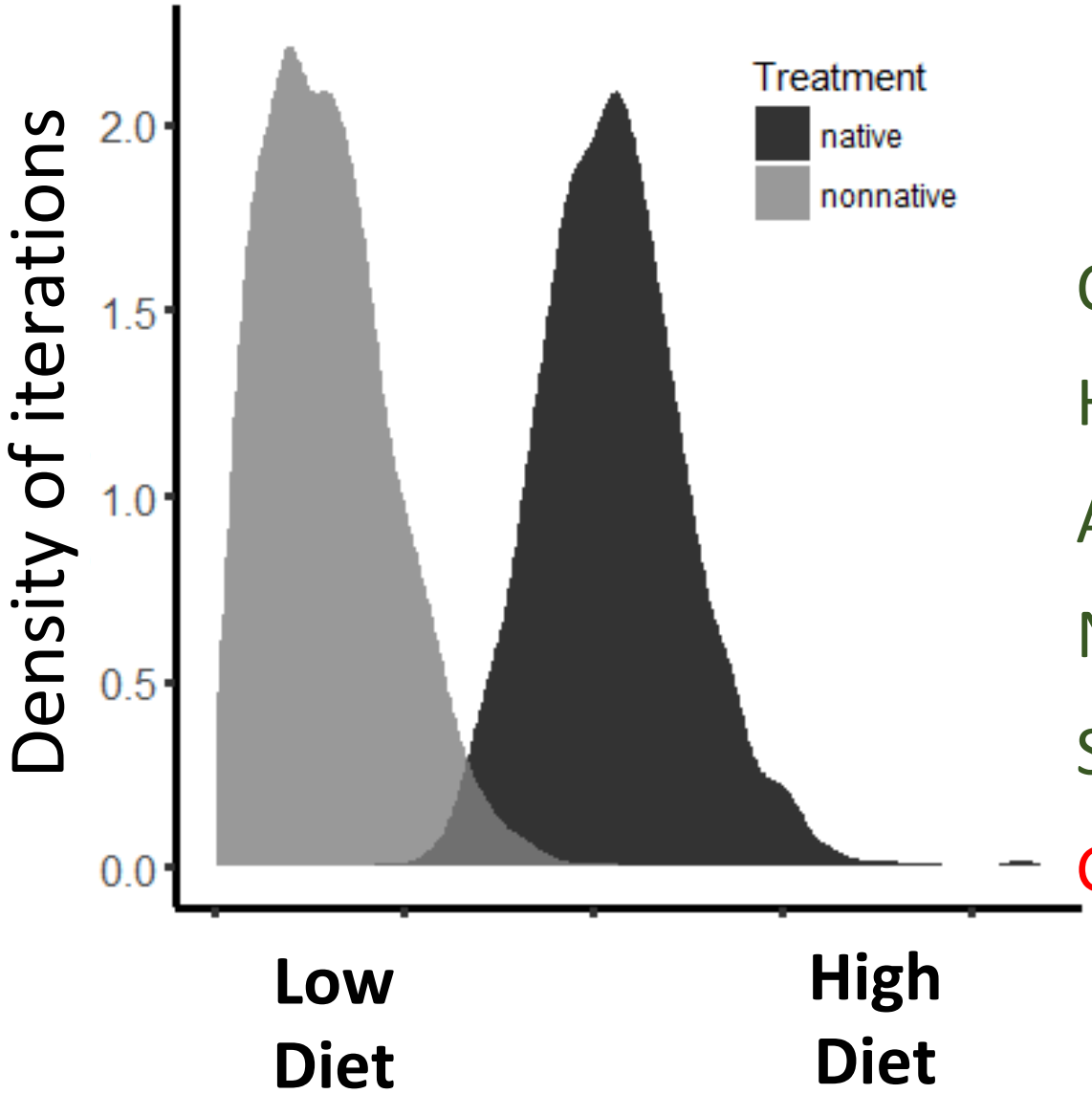
No difference in enrichment

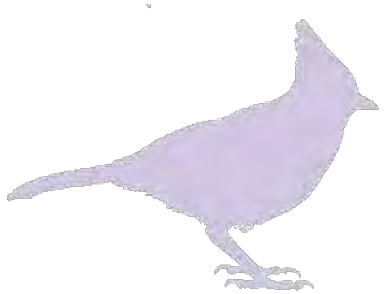
But differences in biomass

- **Caterpillars**
- **spiders**
- **total biomass**



Results – Birds





Carolina Chickadee ✓

House Wren ✓

American Robin ✓

Northern Cardinal ✓

Song Sparrow ✓

Gray Catbird ✗

Take Home

No difference in nitrogen enrichment of spiders, but nonnative plants produced less arthropod biomass

Both obligate and facultative insectivorous birds gained more nitrogen from native plants

Take Home

Nestlings in nonnative yards get lower quality food and grow slower

Nonnative trees transfer less nitrogen to food webs

Do cultivars of native plants have the same ecological value as their parent species?


It depends on the trait that was selected

We looked at six traits

Enhanced fall color
Leaf variegation
Change of growth habit
Disease resistance
Enhanced fruiting
Red or purple leaves

Study supported by Mt Cuba center, Hockessin DE

Only red-leafed cultivars had an effect

(But beware the impact of clones)

Baisden et al. 2018 Hortechnology