Keystone Trees for Pollinator and Songbird Conservation

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The worldwide biodiversity crisis:

As many as 1,000,000 species at risk of extinction

PARIS

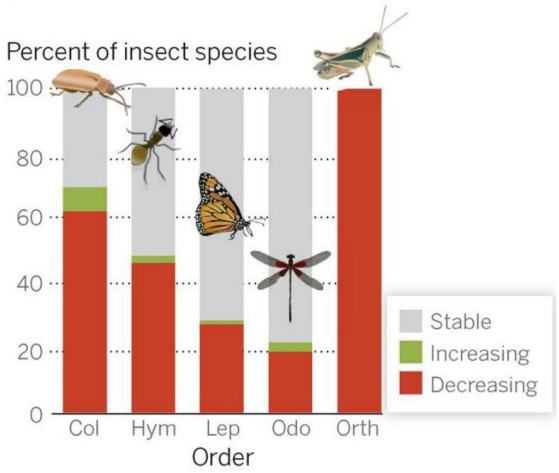
Earth undergoing sixth 'mass extinction' as humans spur 'biological annihilation' of wildlife

The Earth is undergoing a sixth mass extinction, with scientists warning that the "biological annihilation" of wildlife is "more severe than perceived".

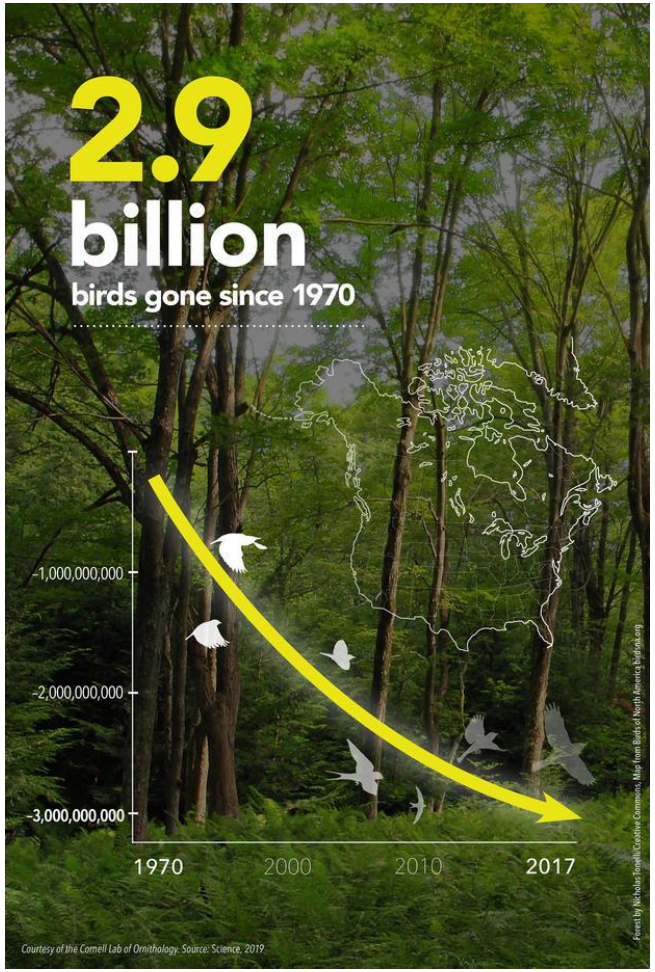
Populations of the African lion dropped 43% since 1993

The Telegraph

IN THE PRESS

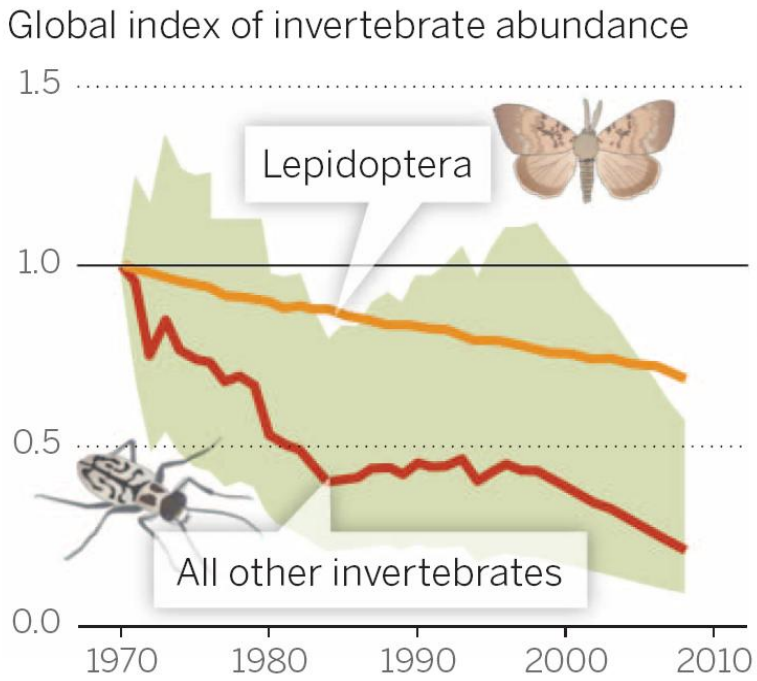


Global index of invertebrate abundance



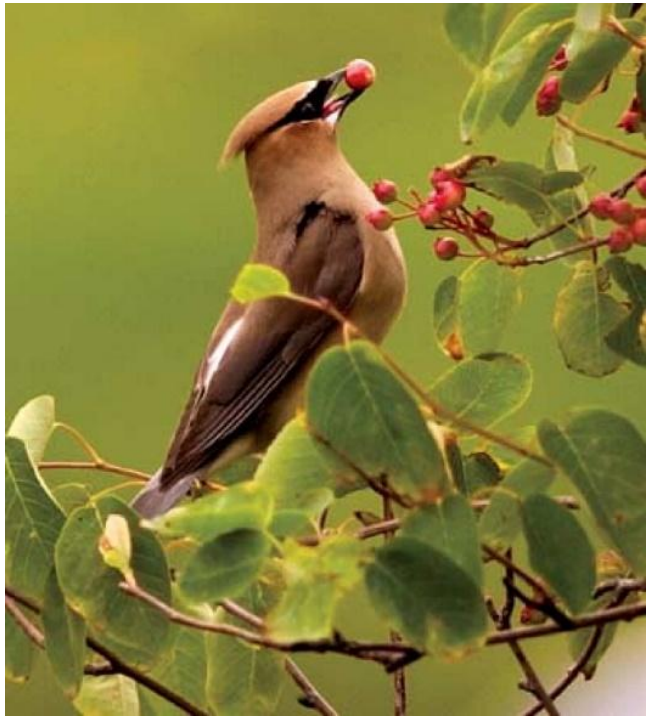
The Insect Apocalypse Is Here

What does it mean for the rest of life on Earth?



“There is a much more insidious kind of extinction: the extinction of ecological interactions”

(Janzen, D.H. 1974)



Ecology and Conservation of Species Interactions in a Changing World

Plant-animal interactions

Applied ecology in urban and agricultural landscapes

Community Ecology of Forest Birds and Insects

For more info: www.desireelnarango.com

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Brooklyn Botanical Garden

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Botanical Garden

Small Planting Decisions Can Make Big Differences…

Informed tree selection can improve your conservation tool kit

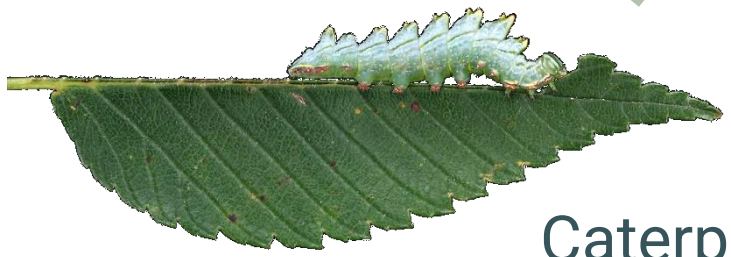
- Aesthetics
- Ease of Care
- Habitat suitability
- Soil, sun, moisture limitations
- Size and Growth Rate
- Climate Resilience
- **Biodiversity Conservation****


Which trees should I plant to support food webs?

Native Plants Support Native Food Webs

Or how to grow a better bird (and insect!) feeder…

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



Caterpillars

Leafhoppers

Beetles

Bees

Photo: S. Jaffe

Forister et al. 2015, PNAS

Native plants support:

- Higher insect diversity
- Higher insect abundance
- More specialized insects
- Higher insect survival & growth

Narango et al. 2017, *Biological Conservation; Narango and Straley 2025 Ecosphere*
Tallamy et al. 2021, *Ecological Entomology*

Native plants support:

Higher insect diversity

Higher insect abundance

More specialized insects

Higher insect survival & growth

>5x more caterpillar species

2-3 times higher caterpillar abundance and biomass

Narango et al. 2017, *Biological Conservation; Narango and Straley 2025 Ecosphere*
Tallamy et al. 2021, *Ecological Entomology*

Herbivores support vast communities of beneficial predators


Alexander Badyaev


© Gary Na




>95% of songbirds eat insects

70% of songbirds eat <u>mostly</u> insects

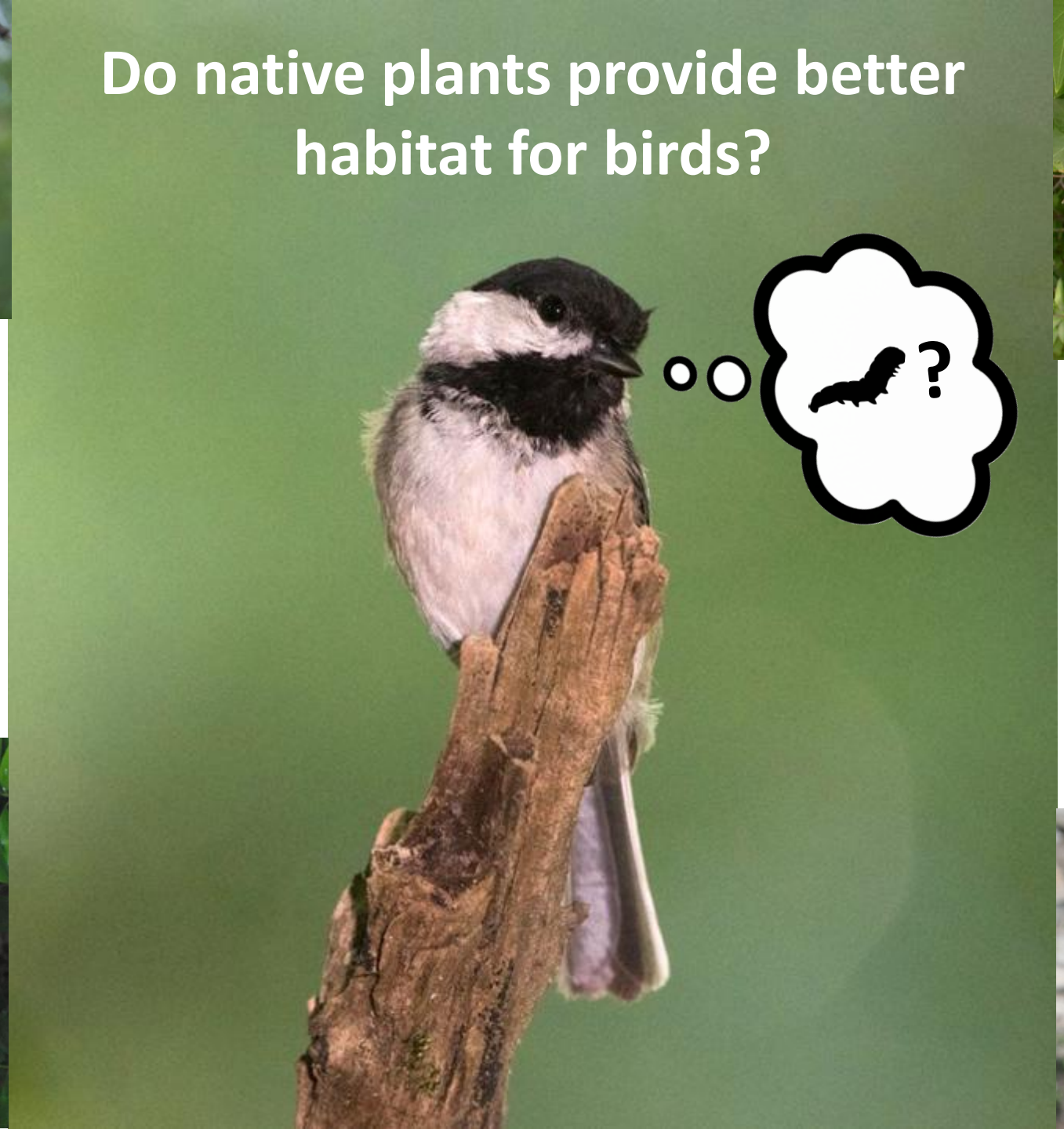






Insects:
An avian superfood
High nutrients, high calories, high predictability

Do native plants provide better habitat for birds?



Chickadees in Washington D.C. Yards…

- **Preferred breeding** in yards with more native plants

Narango et al. 2018 , *Proceedings of the National Academy of Sciences*

Chickadees in Washington D.C. Yards…

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- Consumed more **high quality prey** when native plants were abundant.

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Chickadees in Washington D.C. Yards…

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- Consumed more **high quality prey** when native plants were abundant.
- Nestlings **grew faster** in yards with more native plants.
- Fledged **more young** in yards with more native plants

Narango et al. 2018 , *Proceedings of the National Academy of Sciences*

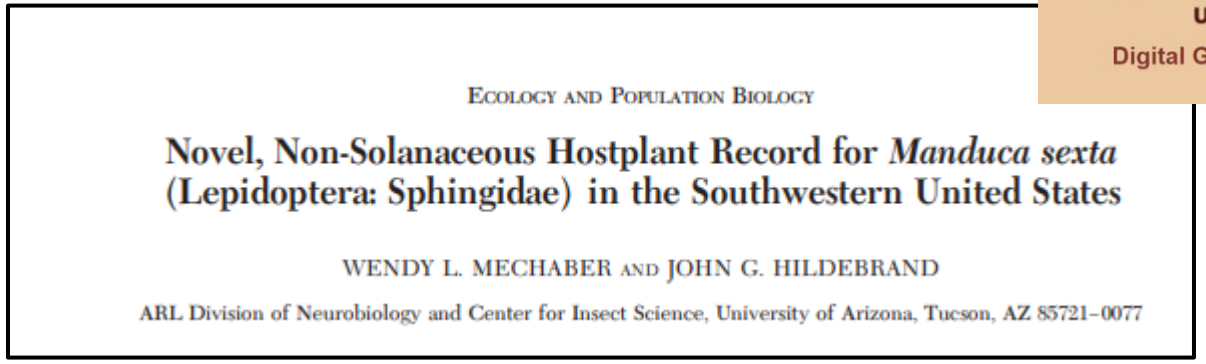

Which tree species should I plant to support food webs?

>100 years, >24k observations by hobbyists, professional and amateur scientists, and backyard entomologists

Kimberley Shropshire

Doug Tallamy

North American
Moth Photographers Group
at the
Mississippi Entomological Museum
at
MISSISSIPPI STATE UNIVERSITY
Digital Guide to Moth Identification



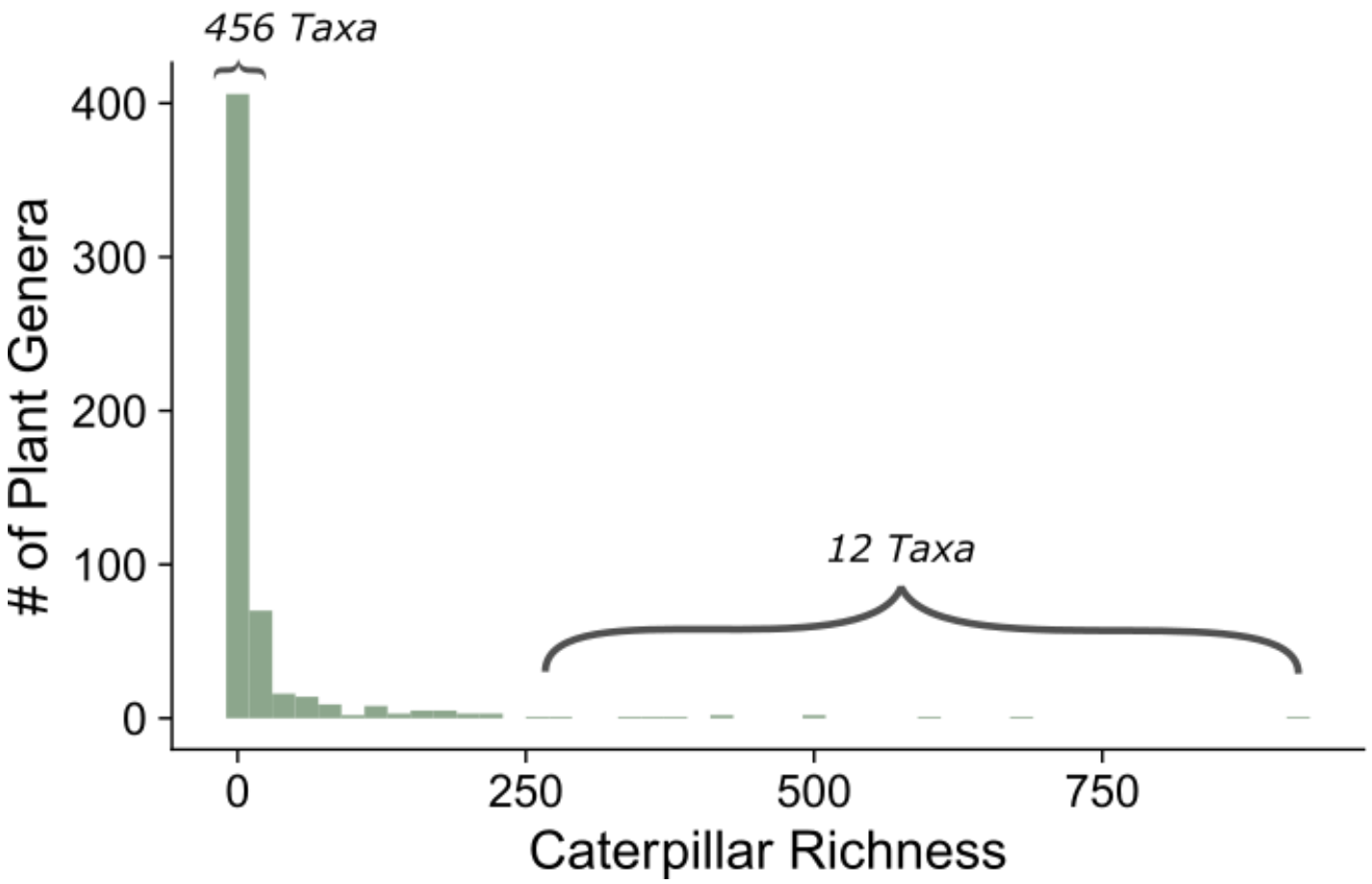
ECOLOGY AND POPULATION BIOLOGY

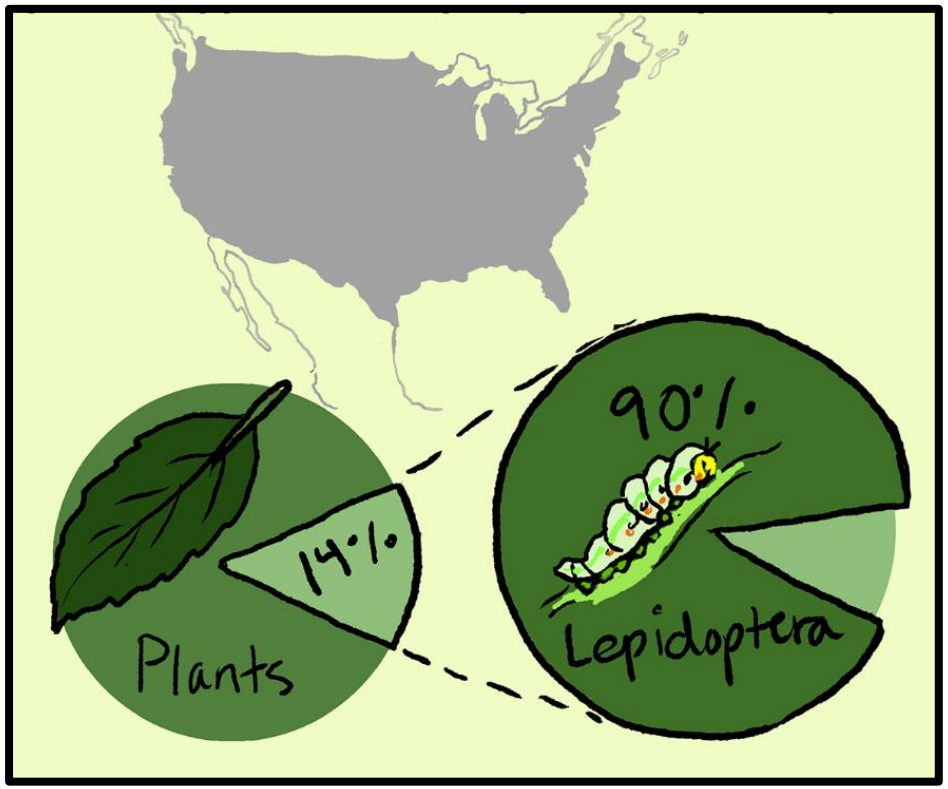
Novel, Non-Solanaceous Hostplant Record for *Manduca sexta* (Lepidoptera: Sphingidae) in the Southwestern United States

WENDY L. MECHABER AND JOHN G. HILDEBRAND

ARL Division of Neurobiology and Center for Insect Science, University of Arizona, Tucson, AZ 85721–0077

Tree-Caterpillar Interactions are consistently skewed



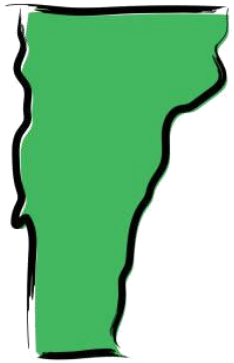


Distribution Analyses
Narango et al. 2020 *Nature Communications*

Vermont/New Hampshire Butterflies and Moths
2200+ species

Native Trees & Shrubs

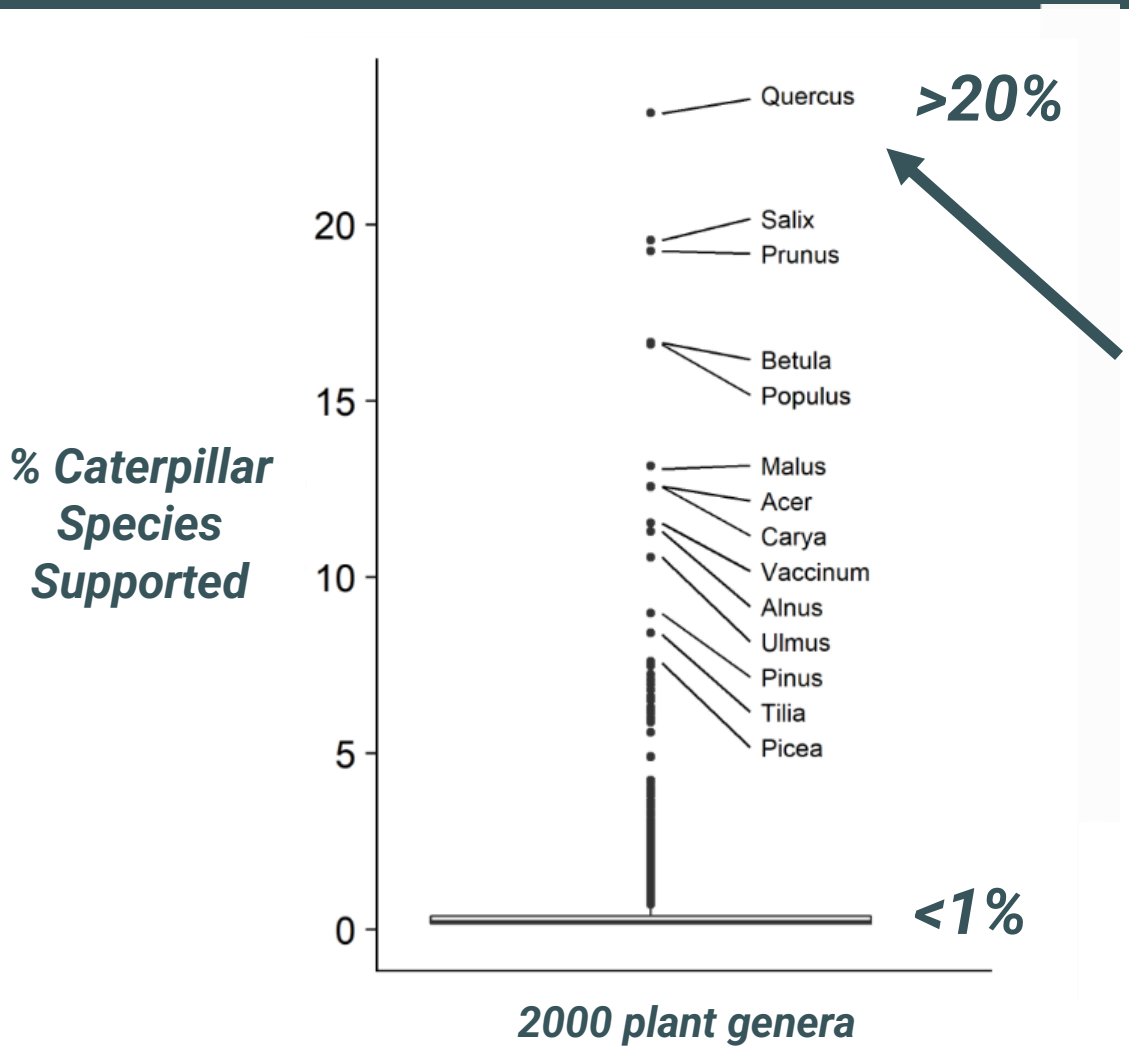
- *Salix* (Willows) – 423 caterpillar species.
- *Prunus* (Cherries) – 414
- *Quercus* (Oaks) – 403
- *Betula* (Birches) – 402
- *Populus* (Aspens) – 361
- *Vaccinium* (Blueberries) – 295

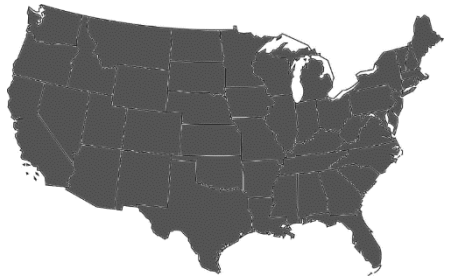


Top Trees!

Narango et al. 2020 *Nature Communications*

Across the country, oaks support on average more caterpillar species than any other tree genus





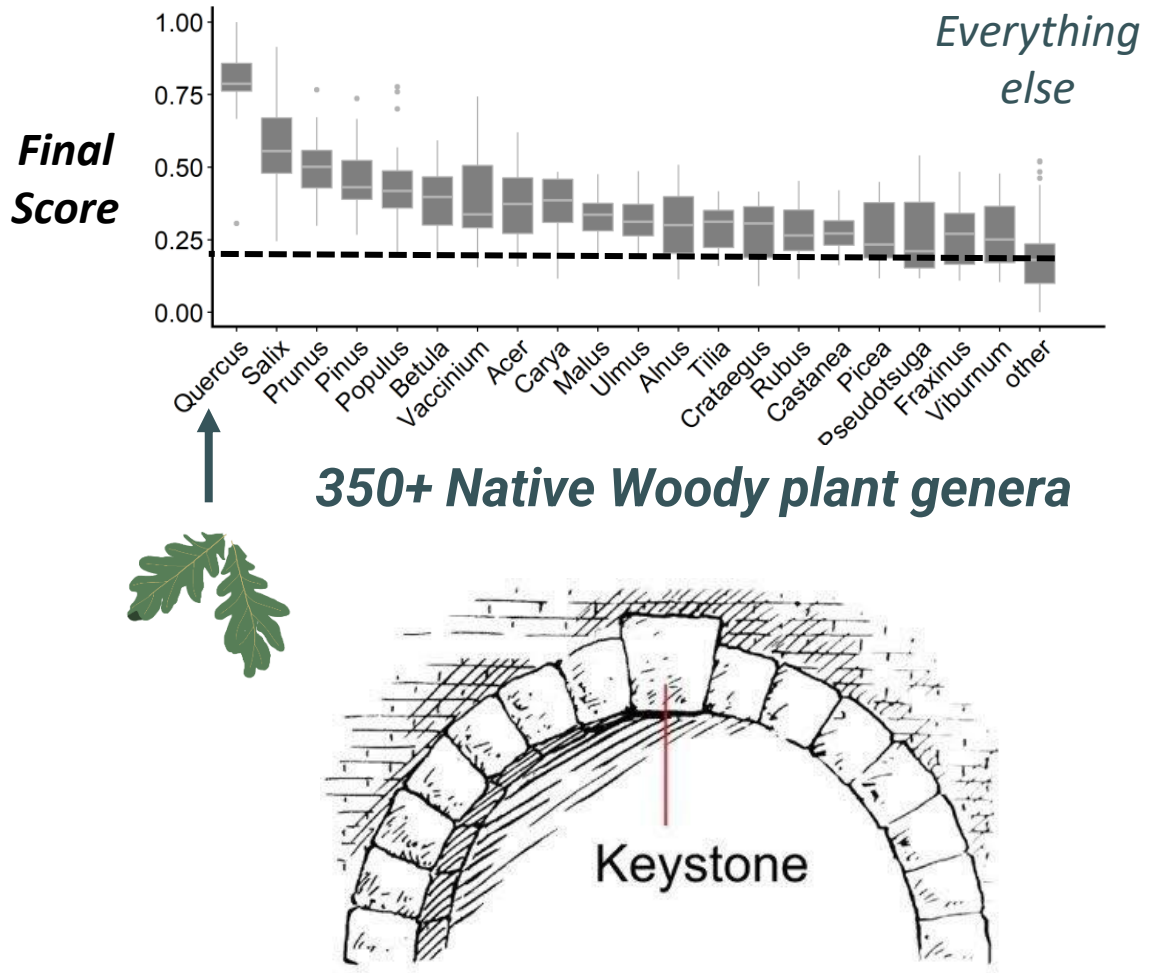
Network Analysis

Narango et al. 2020 *Nature Communications*

Using network ecology to identify restoration targets

Modified methods from Harvey et al. 2017 *J. of Applied Ecology*

20 Tree Genera Contributed Above Average to Plant-Caterpillar Interactions



1. ***Quercus*** **(Oaks)**
2. ***Salix*** **(Willows)**
3. ***Prunus*** **(Cherries and Plums)**
4. ***Pinus*** **(Pines)**
5. ***Populus*** **(Aspens)**
6. *Betula* (Birches)
7. *Vaccinium* (Blueberries)
8. *Acer* (Maples)
9. *Carya* (Hickories)
10. *Malus* (Crabapples)

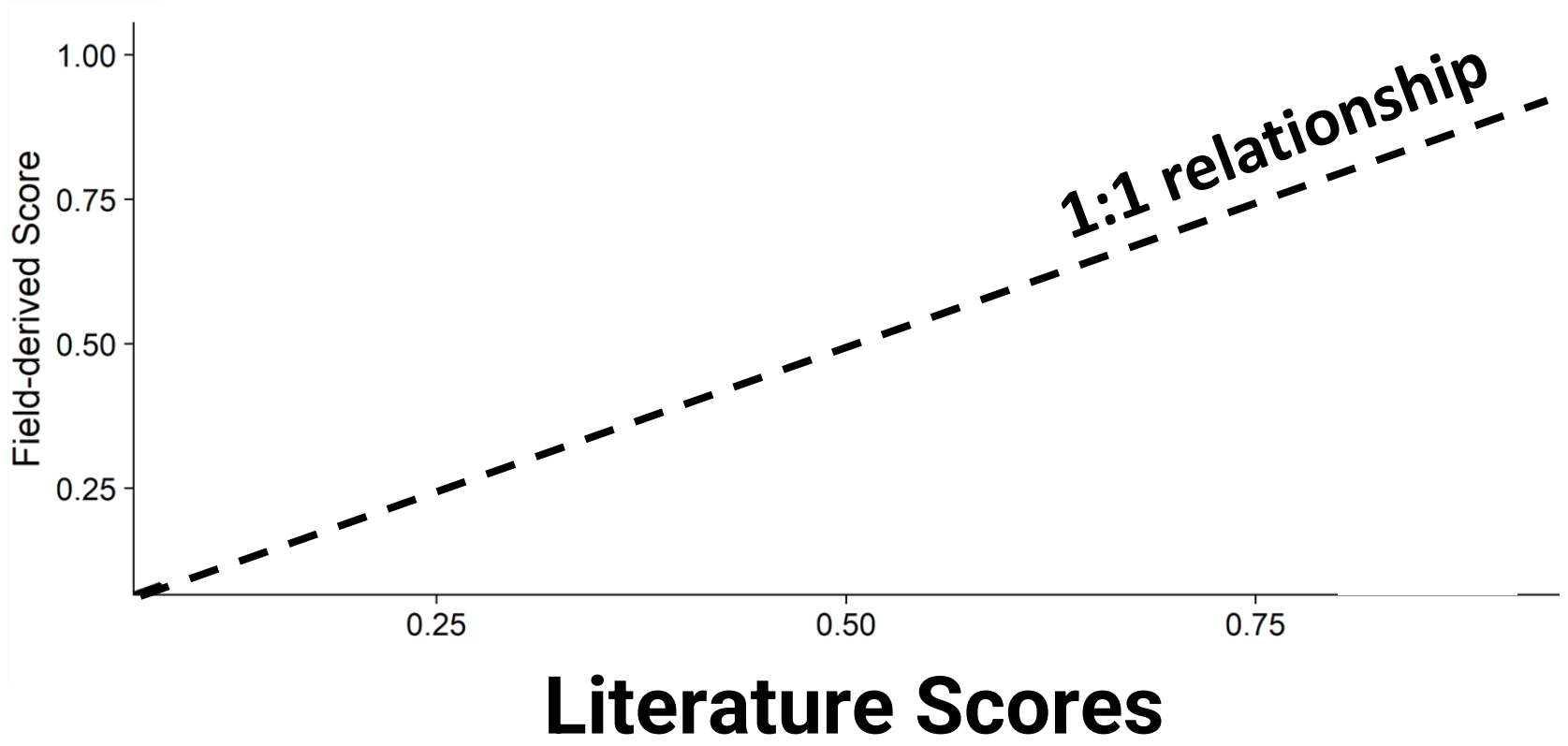
Network Analysis

Narango et al. 2020 *Nature Communications*

Does data synthesis represent real ecosystems?

Field Validation –
Field-Collected Data scores mirror host plant records

Chester County, PA Hedgerows



Narango et al. 2020 *Nature Communications*

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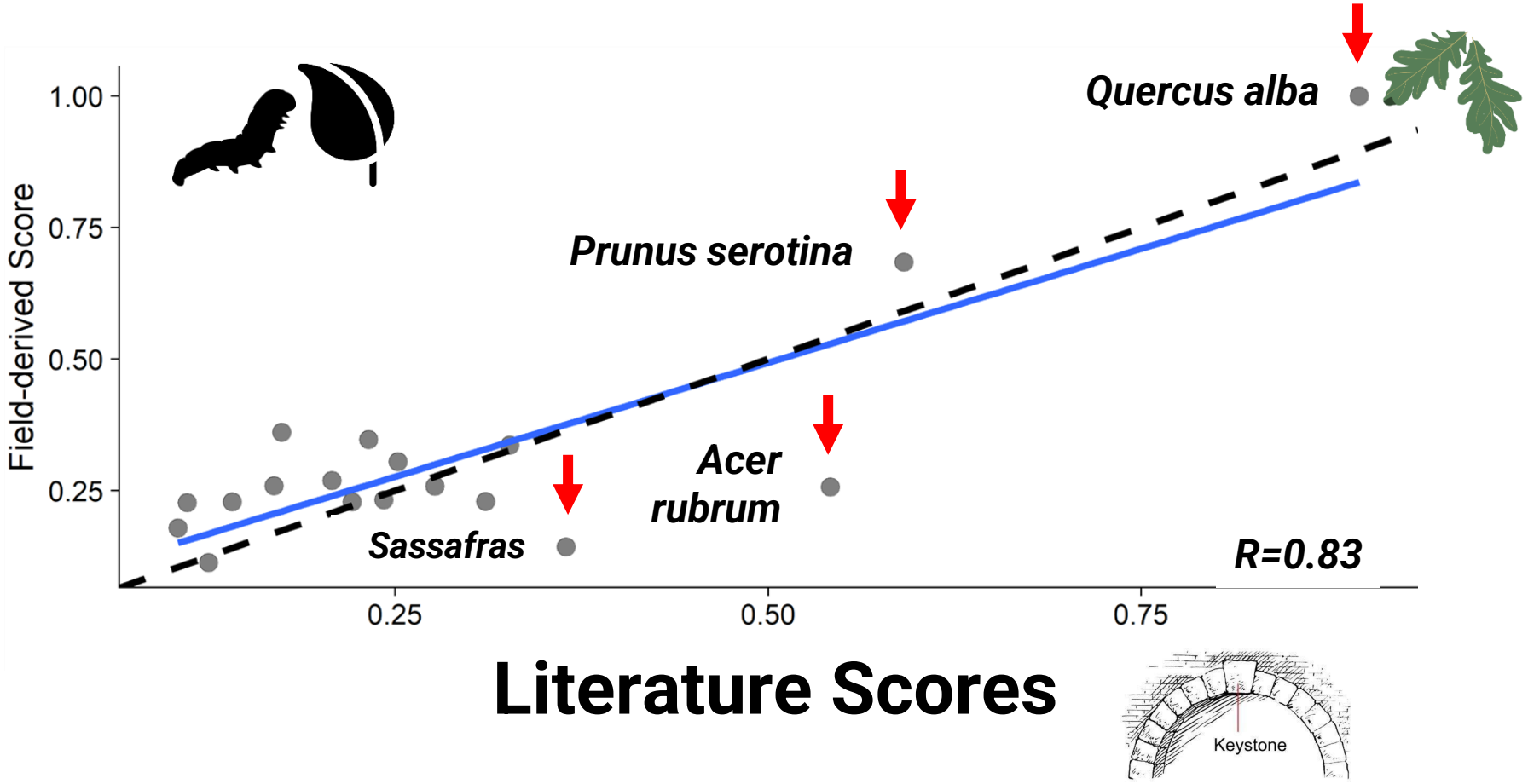
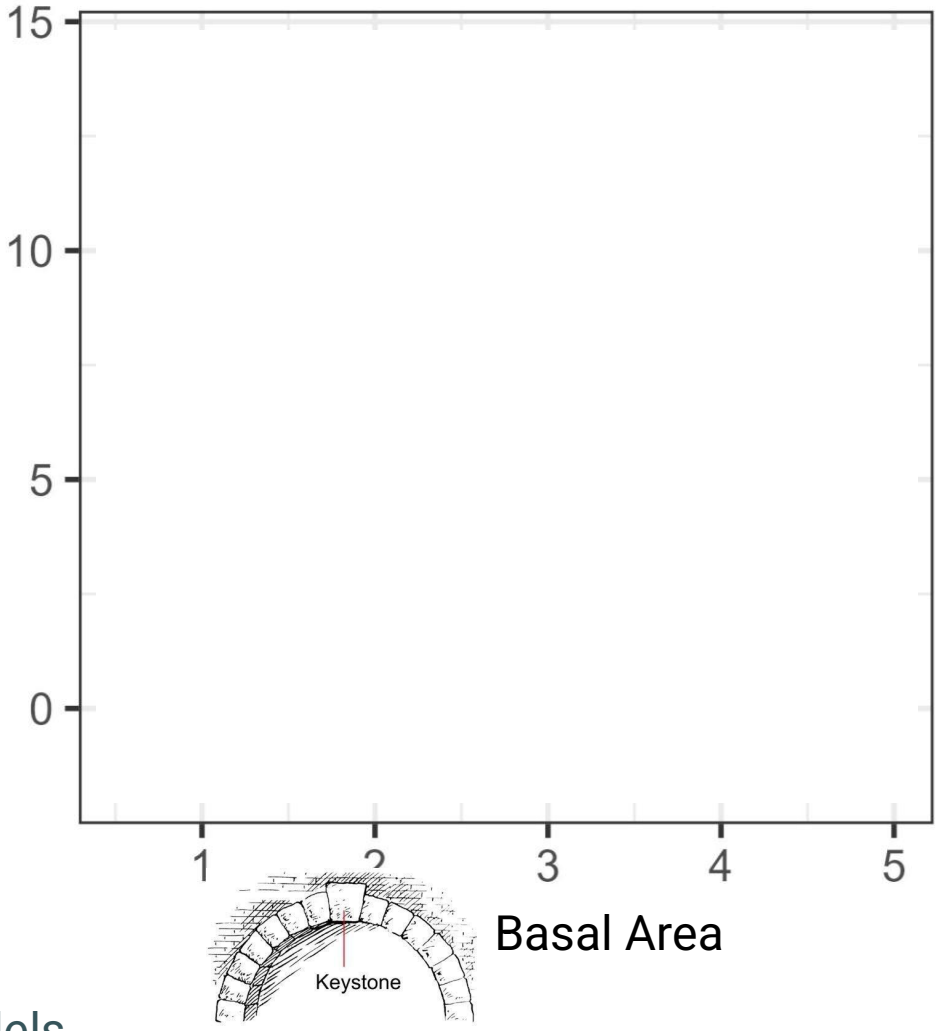


Narango et al. 2020 *Nature Communications*

Field Validation –
Moth richness, abundance and biomass increases with keystone trees

Specialist Species Richness



Rural

Suburban

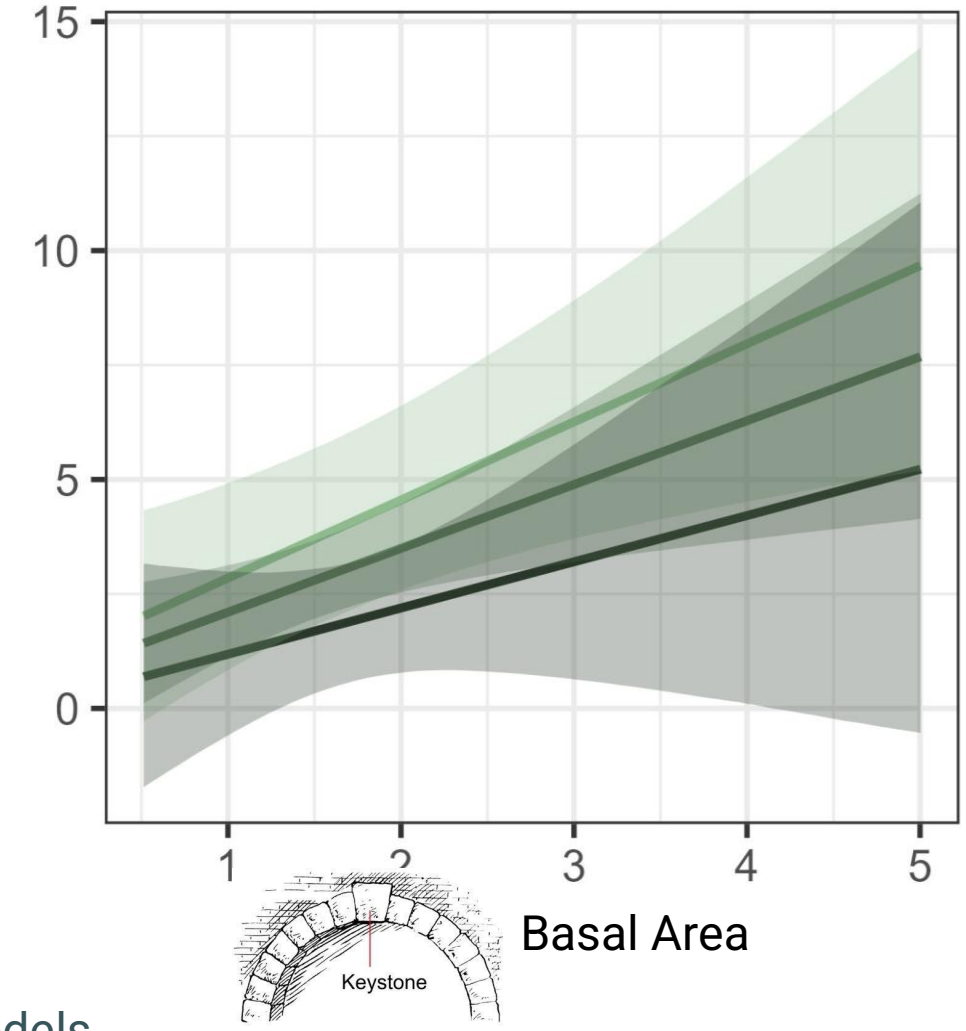
Urban

Bayesian Linear Mixed Models

Narango et al. 2025 *Ecological Solutions and Evidence*

Field Validation –
Moth richness, abundance and biomass increases with keystone trees

Specialist Species Richness



Rural

Suburban

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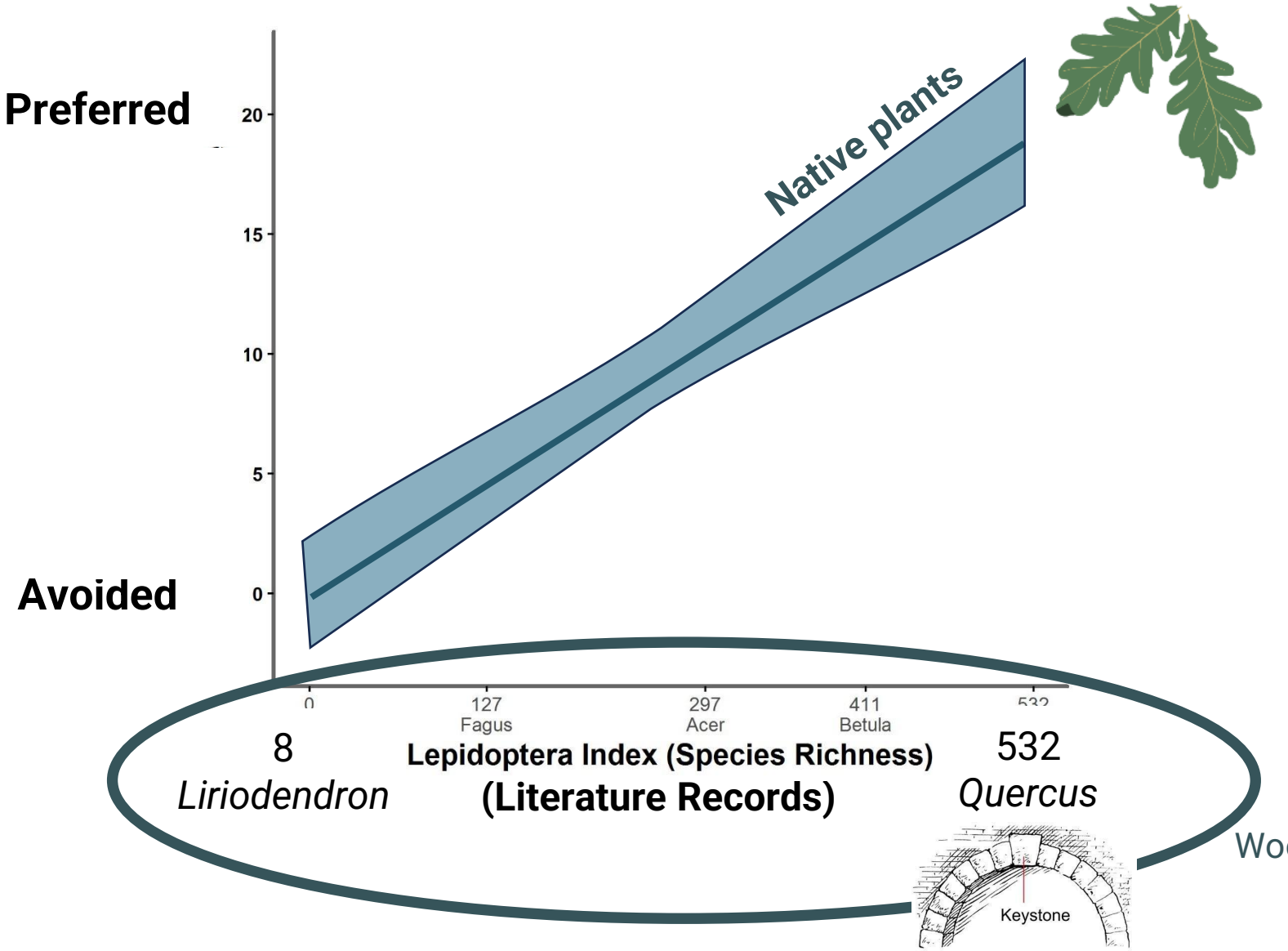
Bayesian Linear Mixed Models
Narango et al. 2025 *Ecological Solutions and Evidence*

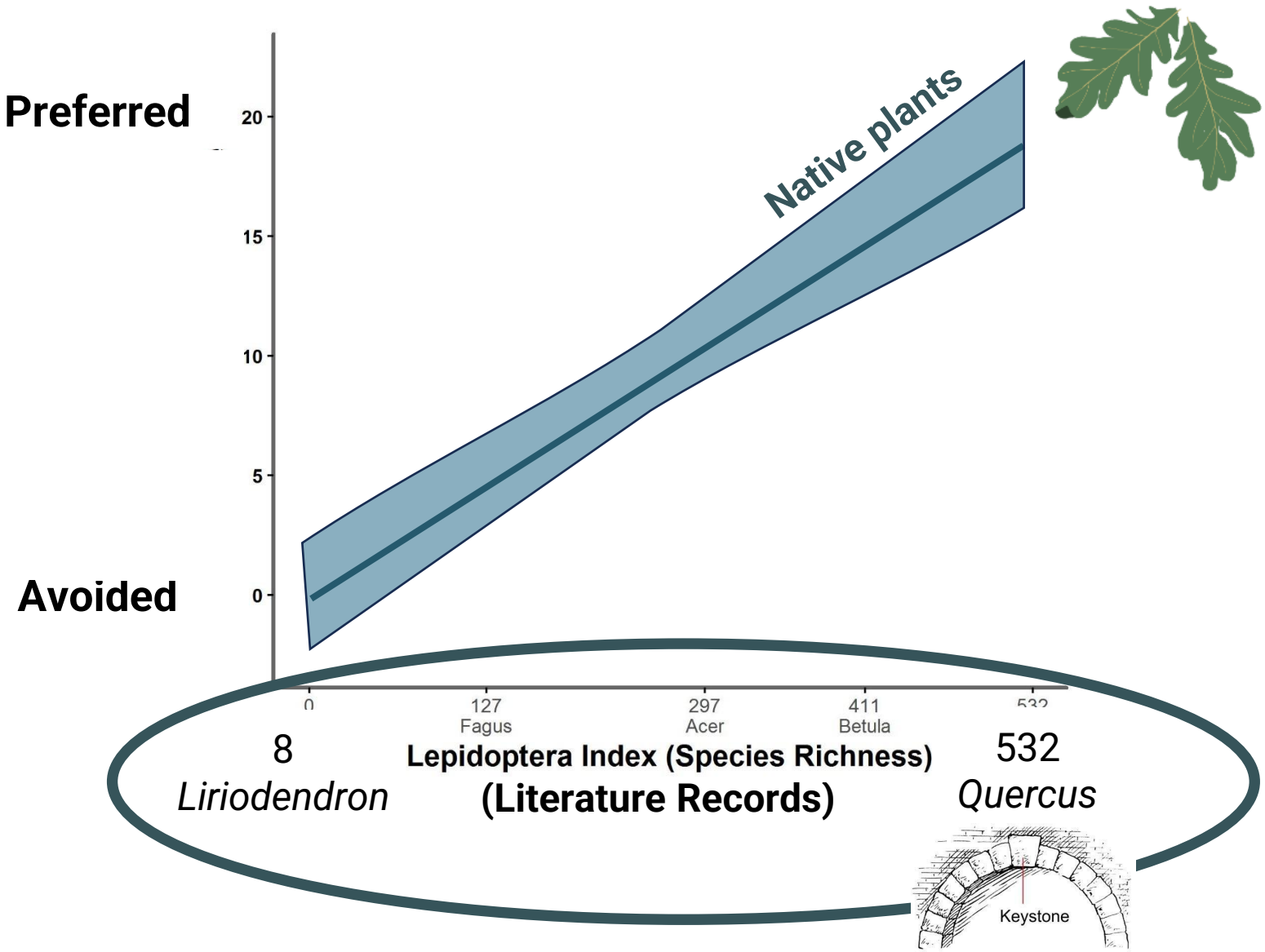

Which Trees
for Birds?

Trees for Caterpillars = Trees for Birds



Wood et al. 2014 Forest Ecology & Management
Narango et al. 2017 *Biological Conservation*
Piel et al. 2021 *Northeastern Naturalist*

Trees for Caterpillars = Trees for Birds



>50 different species of migratory birds

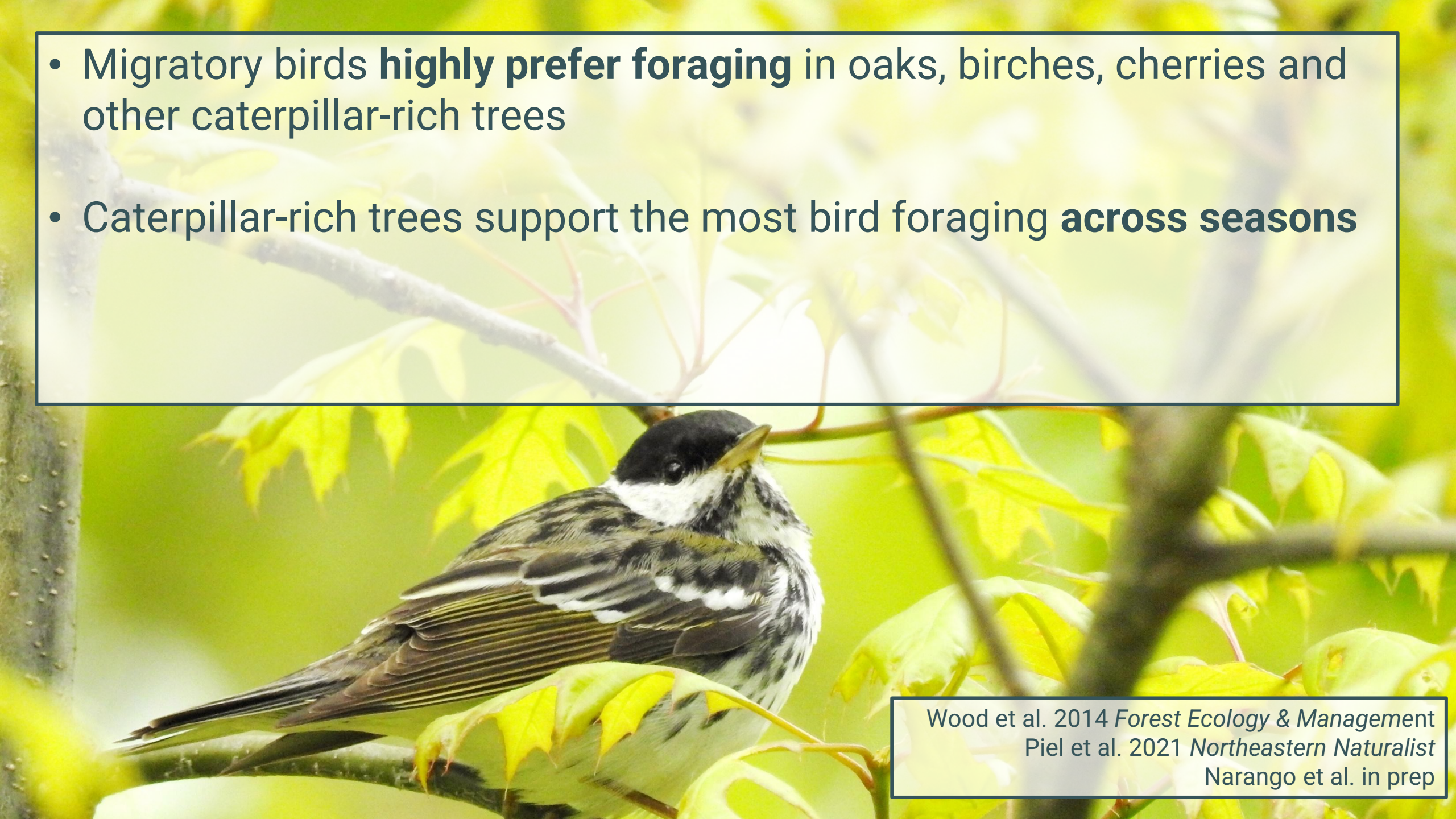
Several species of conservation concern

Narango et al. 2017 *Biological Conservation*

- Migratory birds **highly prefer foraging** in oaks, birches, cherries and other caterpillar-rich trees

Wood et al. 2014 *Forest Ecology & Management*
Piel et al. 2021 *Northeastern Naturalist*
Narango et al. in prep

- Migratory birds **highly prefer foraging** in oaks, birches, cherries and other caterpillar-rich trees
- Caterpillar-rich trees support the most bird foraging **across seasons**



Wood et al. 2014 *Forest Ecology & Management*
Piel et al. 2021 *Northeastern Naturalist*
Narango et al. in prep

- Migratory birds **highly prefer foraging** in oaks, birches, cherries and other caterpillar-rich trees
- Caterpillar-rich trees support the most bird foraging **across seasons**
- Birds refueling for migration are in **better physiological condition** in oak-dominated forests

Wood et al. 2014 *Forest Ecology & Management*
Piel et al. 2021 *Northeastern Naturalist*
Narango et al. in prep


What about
trees for bees?

Trees and Flowers for Specialist Bees

~30% of native bees are specialists
(at least 180 specialist species Eastern US)

Cornus alternifolia
Alternate-leaf Dogwood

Andrena fragilis
Fragile Dogwood Bee

Willows** (Salix***) – 14 sp.
***Blueberries (*Vaccinium*)** – 10 sp.
Dogwoods (Swida) – 4 sp.
Azaleas (Rhododendron) – 1 sp.

*Goldenrods (*Solidago*) – 34 species
*American Asters (*Symphyotrichum)* – 29 species

*** Caterpillar Plants Too!**

Native Bee Inventory & Monitoring Lab - USGS


“When it comes to the sheer amount of resources provided to pollinators in the spring, flowering trees will win out every single time.”
-- Zach Portman

Earliest blooms

High floral abundance

Some evidence of high nutritional quality

Forest-specialized species (1/3 of bees)

Wood et al. 2021 *Entomologia Generalis*
Ulyshen et al. 2023 Biological Reviews

>26k Plant-Bee Records in Vermont

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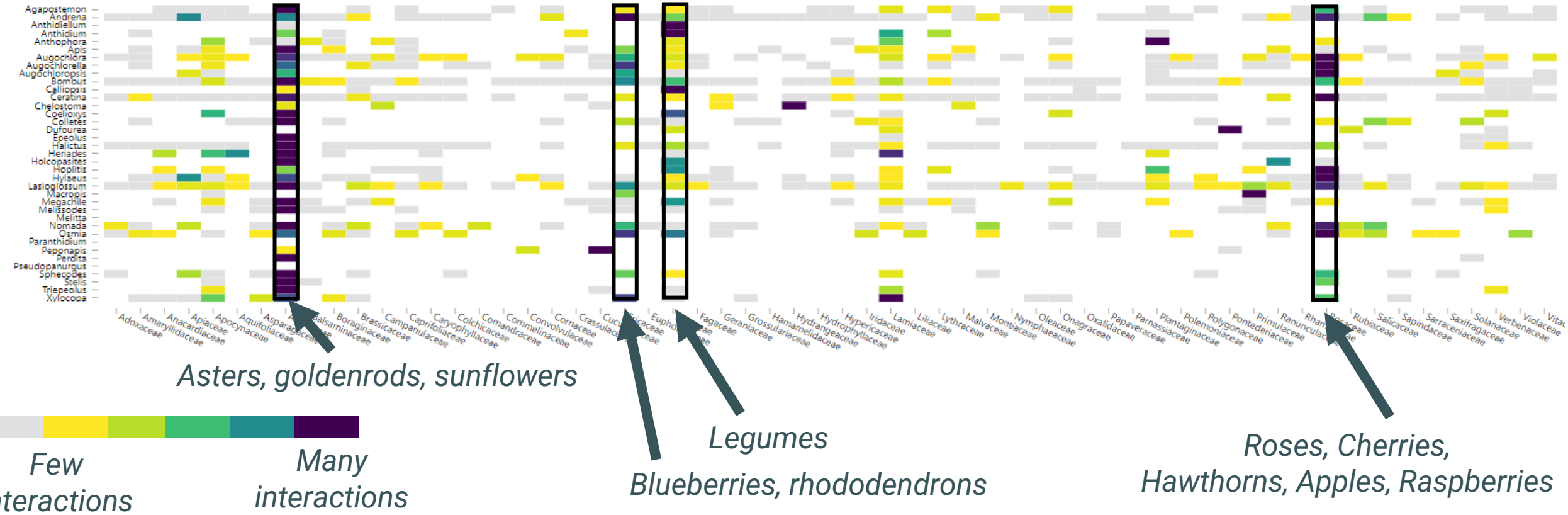
All Bee Genera in Vermont



Early Spring

Salix (Willows)

- Specialist Bees
- 14% all species

Acer (Maples)

- Highly preferred
- Does well in lots of conditions

Early Spring

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Mid-Spring

Cratageus (Hawthorns)

- Highly preferred
- Gorgeous

Prunus (Cherries and Plums)

- Highly preferred
- Fruit for wildlife

Early Spring

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Acer (Maples)
- Highly preferred
- Does well in lots of conditions

Mid-Spring

Cratageus (Hawthorns)
- Highly preferred
- Gorgeous

Prunus (Cherries and Plums)
- Highly preferred
- Fruit for wildlife

Late-Spring

Rubus (Blackberries, Raspberries)
- 40% of species
- Fruit for wildlife

Vaccinium (Blueberries)
- 33% of species
- Bumblebee magnet


EAC
Now what??

Finding native trees and woody plants that fit your criteria

Native Plant Trust

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Search

GO BOTANY | CONSERVING NATIVE PLANTS | FOR YOUR GARDEN | LEARN | VISIT | SUPPORT | RESOURCES + PRESS | ABOUT US

Additional Information

- About Ecoregions, Cultivars and More

Search for plants by name using "quick search," or narrow your results based on plant type, flower color, New England Level 3 ecoregion, exposure, moisture, bloom season, and even cultivation status. Specify whether to show results that meet *all* or *any* of your search criteria by toggling the box at the bottom of the page. You can also use our search tool to access information about the full range of plants sold at Garden in the Woods and Nasami Farm.

Check out our Important Definitions page to learn more about ecoregions, cultivation status, and why certain plants are included in this database.

Note: This site is still under development, and is being regularly updated and improved to make it a more comprehensive resource. To alert us of site functionality problems, please contact mkenney@nativeplanttrust.org.

Quick Search

Plant Type/Program:

ANY TYPE
Edible
Fern
Grasses, Sedges, and Rushes
Groundcover
Ornamental Grass
Perennial
Shrub
Tree
Vine/Liana

Flower Color:

ANY TYPE
Blue
Green
Insignificant
Maroon
Non-Flowering
Orange
Pink
Purple
Red

Ctrl-click (Mac users ⌘-

Height:

Inches

Spread:

Inches

Identify native keystone trees and woody shrubs for your region

Get on the MAP! HOMEGROWN NATIONAL PARK
HNPark.org

Trees and Shrubs List

9.2 Temperate Prairies

American Plum
(Prunus americana)

LIGHT: Full Sun, Partial Sun
WATER: Low, Average
HEIGHT: 15 - 25 ft
SPREAD: 15 - 25 ft

This tree is a great choice for shrub borders, hedges, screens, or erosion control. It has toothed leaves, five petaled white flowers in spring, and produces edible red plums.

Black Cherry
(Prunus serotina)

LIGHT: Full Sun, Partial Sun
WATER: Average
HEIGHT: 50 - 80 ft
SPREAD: 30 - 60 ft

This plant has glossy green leaves with pointed tips, has fragrant white flowers in the spring, and produces berries that can be used in jams and jellies. Is tolerant of dry soil.

** Not native to western half of ecoregion*

Bur Oak
(Quercus macrocarpa)

LIGHT: Full Sun
WATER: Average
HEIGHT: 60 - 80 ft
SPREAD: 60 - 80 ft

This species has leathery dark green leaves with 5-9 lobes, 12 inches long that turn yellow to golden brown in the fall. It also has yellow-green catkins in the spring and brown oval acorns.

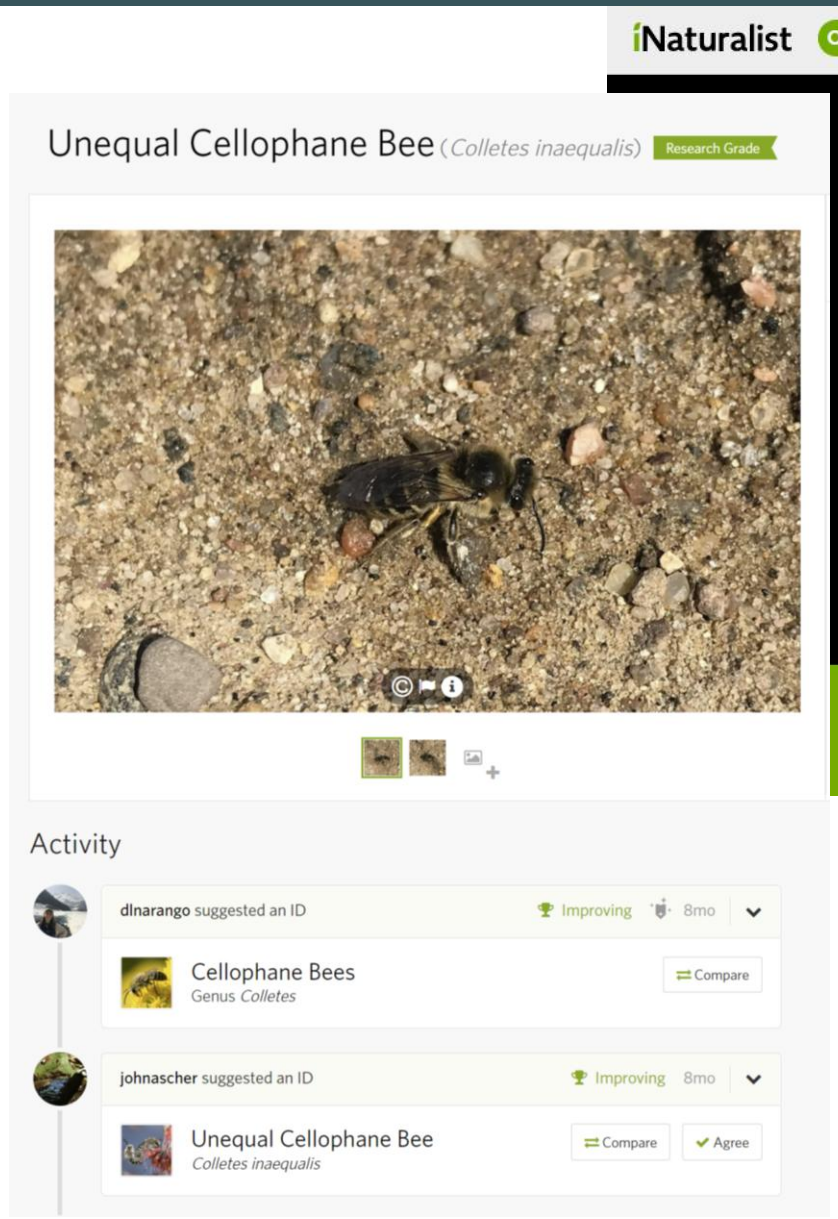
Chokecherry
(Prunus virginiana)

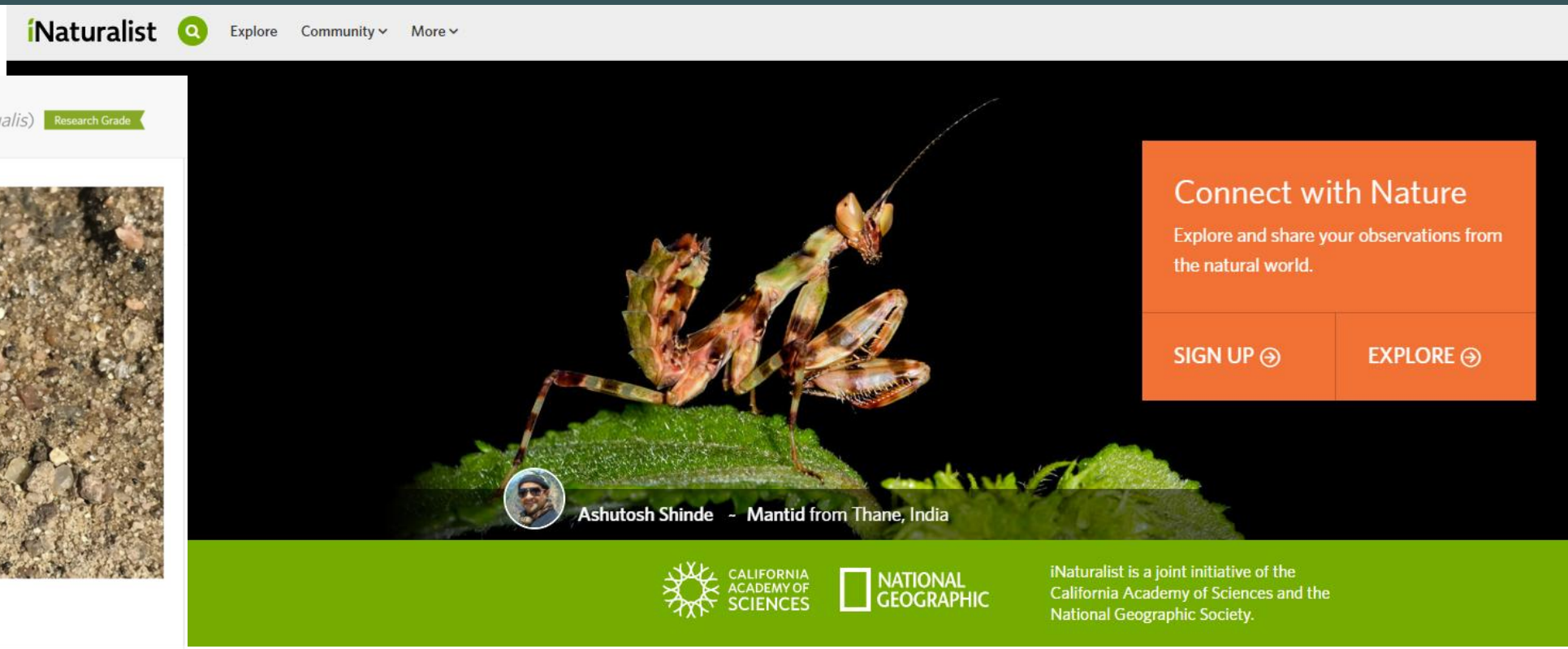
LIGHT: Full Sun, Partial Sun
WATER: Low, Average
HEIGHT: 20 - 30 ft
SPREAD: 15 - 20 ft

This plant is tolerant to drought, and dry, rocky, or clay soil. It is a great choice for beds, borders, hedges, screens, and open woodland gardens. It produces white flowers and edible berries.

** Not native to southern parts of ecoregion*

Meet your neighbors!





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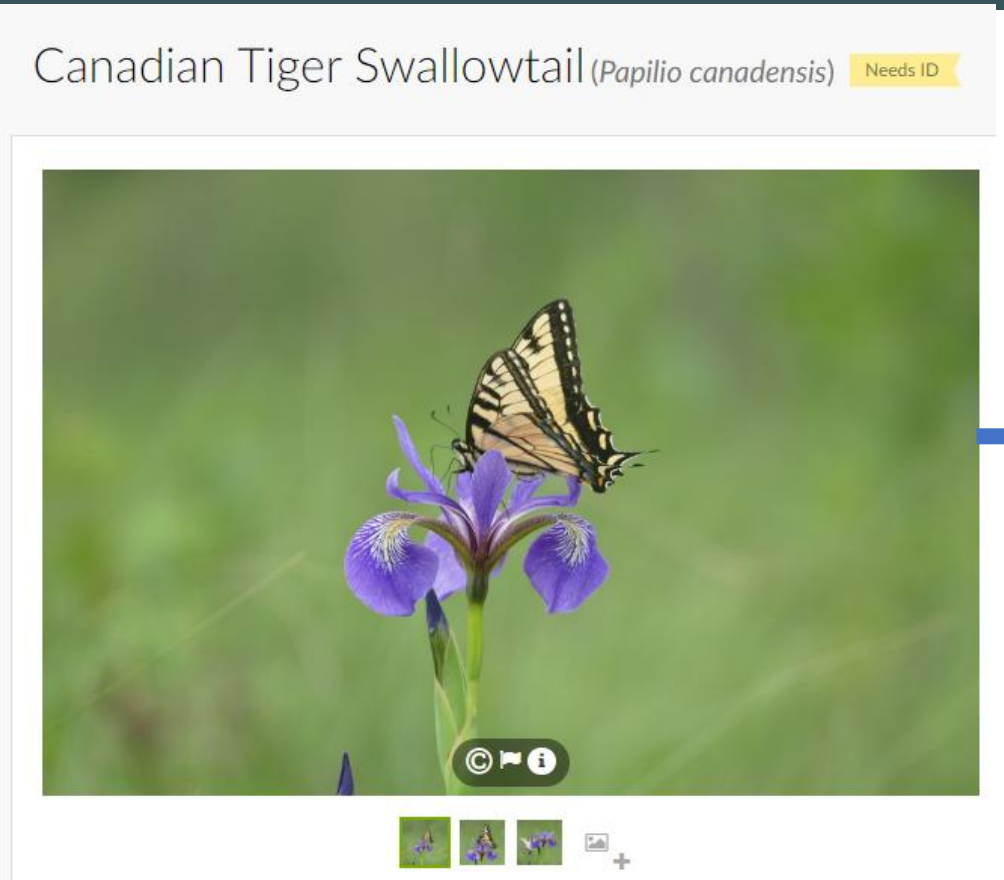
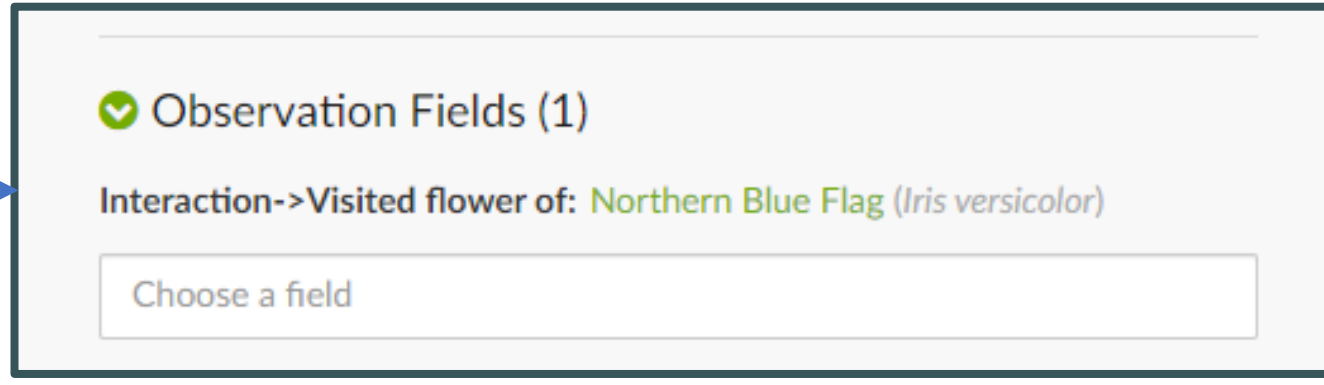
www.inaturalist.org

Document Plant-insect interactions!





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Help VCE learn about species interactions!

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Pollinator Interactions on Plants (PIP Project)

Stats

Totals

187170
Observations »

2163
Species »

10926
People »

Most Observations

bugeyedbernie	12186 observations
allisonbf	7494 observations
susanhewitt	7082 observations
xris	6702 observations
mpelikan	3744 observations

Most Species

bugeyedbernie	358 species
mpelikan	332 species
erikamitchell	297 species
adamkohl	290 species
scoutingforplants	255 species

Most Observed Species

Common Eastern Bumble Bee	14761 observations
Western Honey Bee	7467 observations
Brown-belted Bumble Bee	4594 observations
Monarch	4181 observations
Two-spotted Bumble Bee	3039 observations

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Take Home

- Birds and insects have coevolved relationships with native plants.
- Keystone native plants are critical for supporting healthy insect and bird communities.
- Community-collected data helps guide real conservation decisions.

Thanks!

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@DLNarango

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