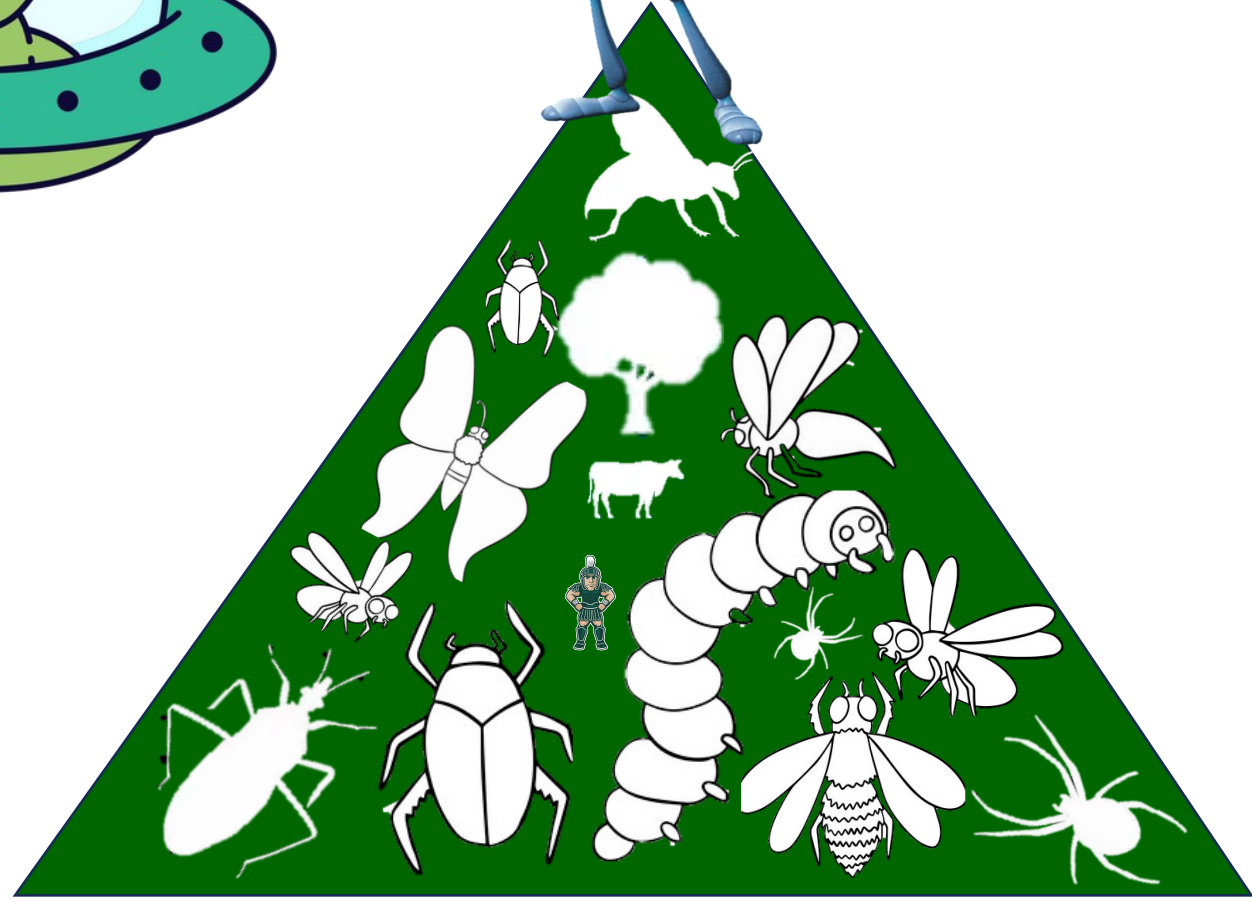


Disappearing Insects

Chris DiFonzo
Field Crops Entomologist
Michigan State University

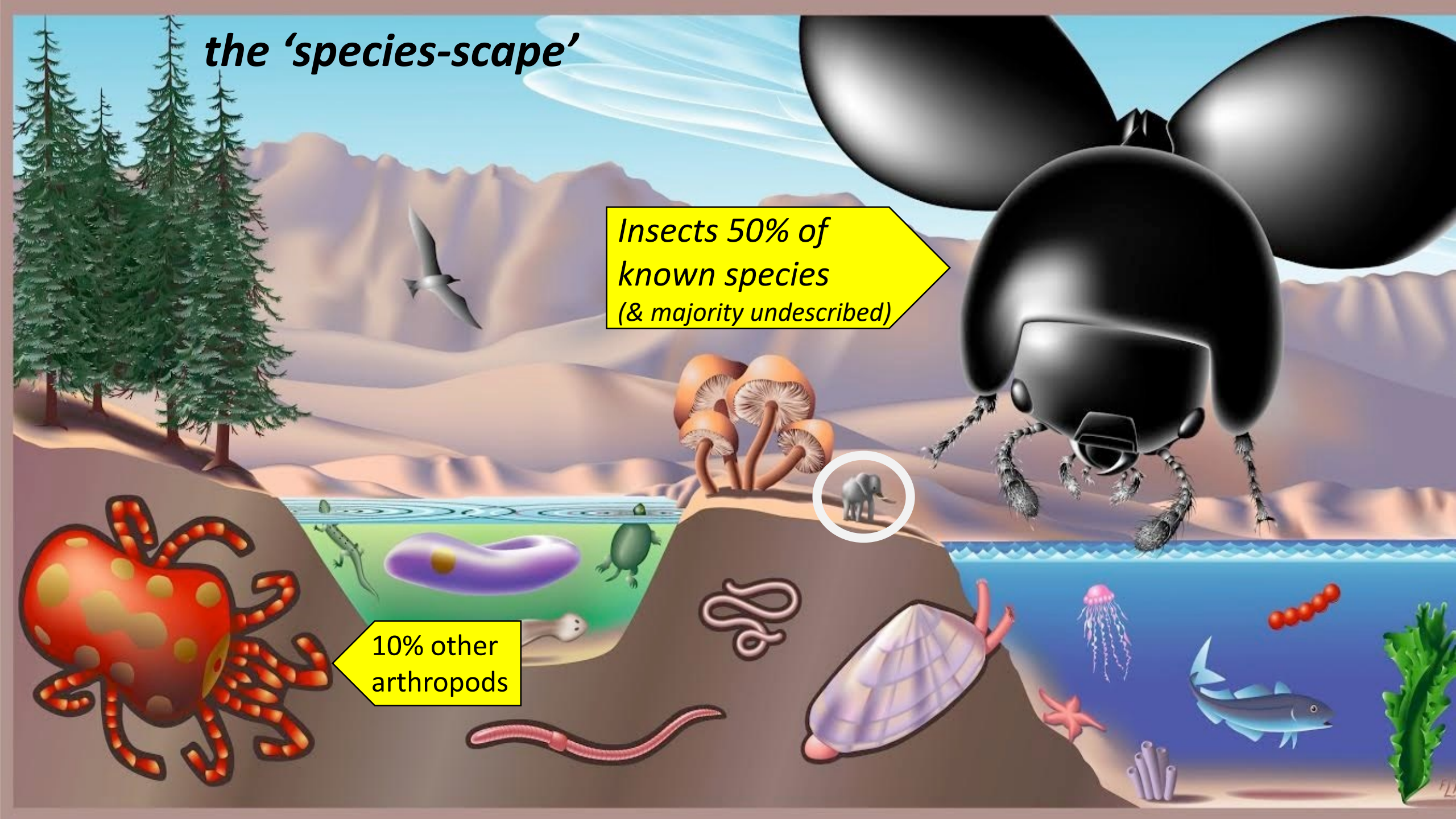




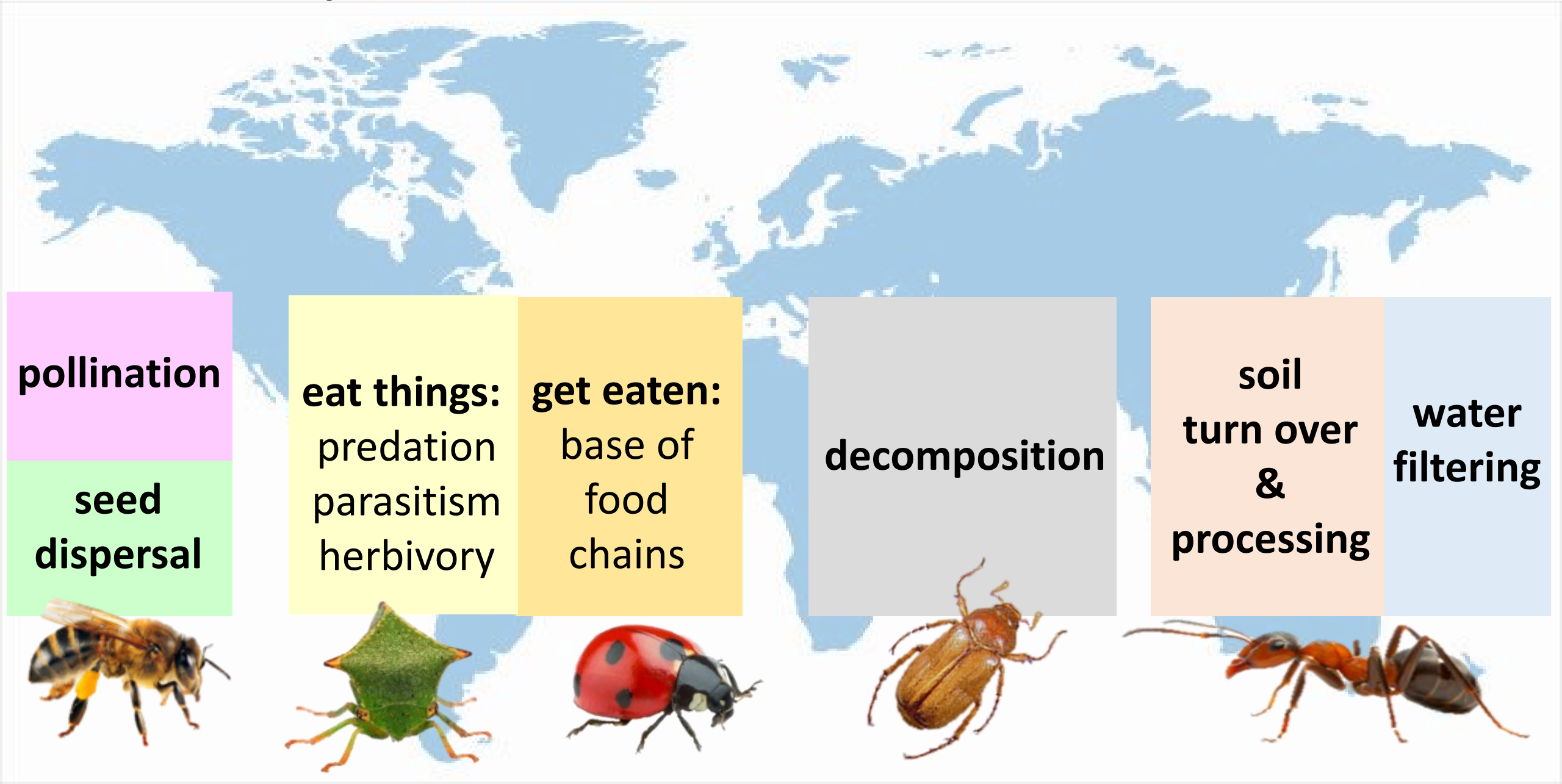
the 'species-scape'

*Insects 50% of
known species
(& majority undescribed)*

*10% other
arthropods*



Key roles of insects in our world



pollination

seed dispersal



eat things:
predation
parasitism
herbivory



get eaten:
base of
food
chains

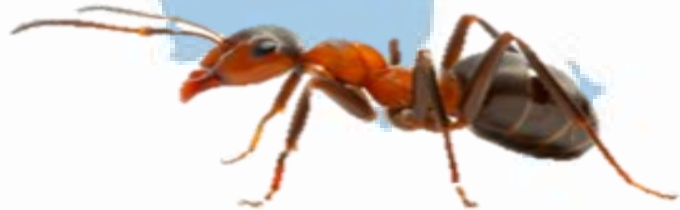


decomposition



**soil
turn over
&
processing**

**water
filtering**





Insect are the...
“little creatures that
run the world”
E.O. Wilson

*If humans suddenly disappeared,
living conditions for most species would improve*

*If insects vanished,
the environment would collapse into chaos*

You live in a world of insects

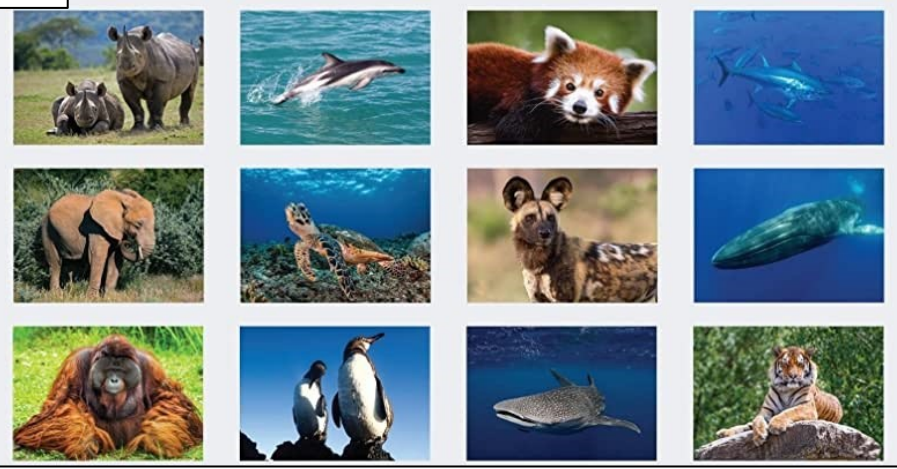


Endangered species

What the public knows...



ENDANGERED ANIMALS 2023



Endangered Species



Measuring reductions in insect populations

Change in
Number



Change in
Diversity



Change in
Biomass



Anecdotal evidence
of changes in
insect abundance

the Windshield Phenomenon

Where have all the bug splats gone?



Kent England

- Volunteers install insect “splatometers” on cars

2019 vs 2004
50% fewer splats

*(despite modern cars
hitting more bugs
than older models)*



Denmark, 1997-2017

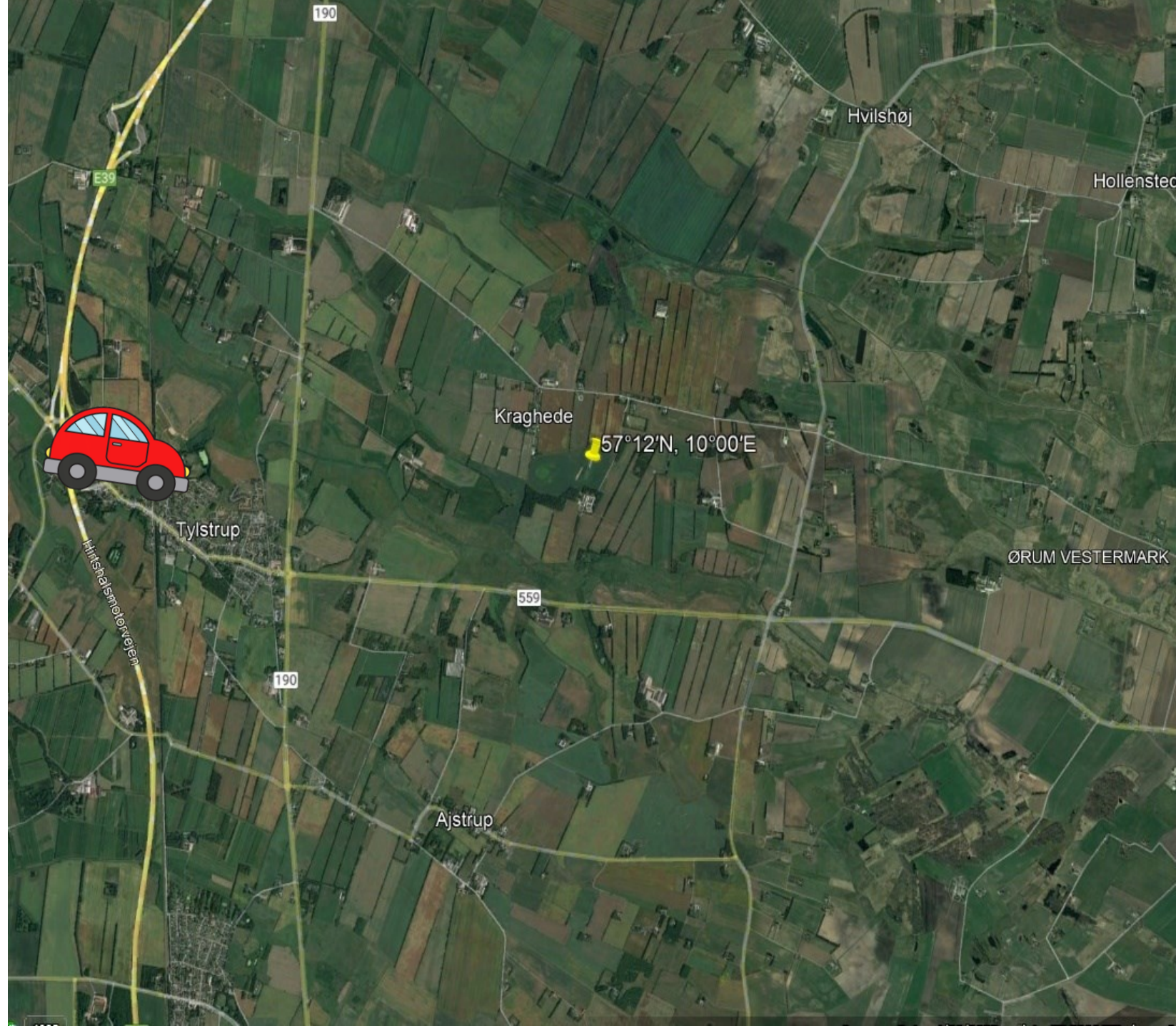
habitat mix didn't change

Researcher drove at fixed speed on fixed transect

- bugs on windshield

Also took:

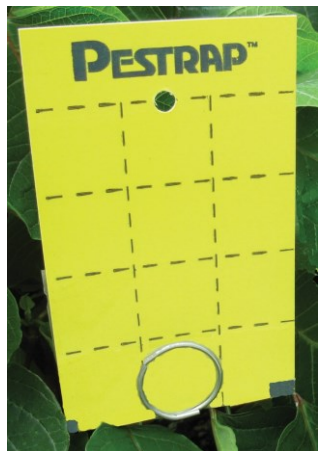
- sweep net samples
- sticky trap samples
- bird feeding rates
- nesting pair counts



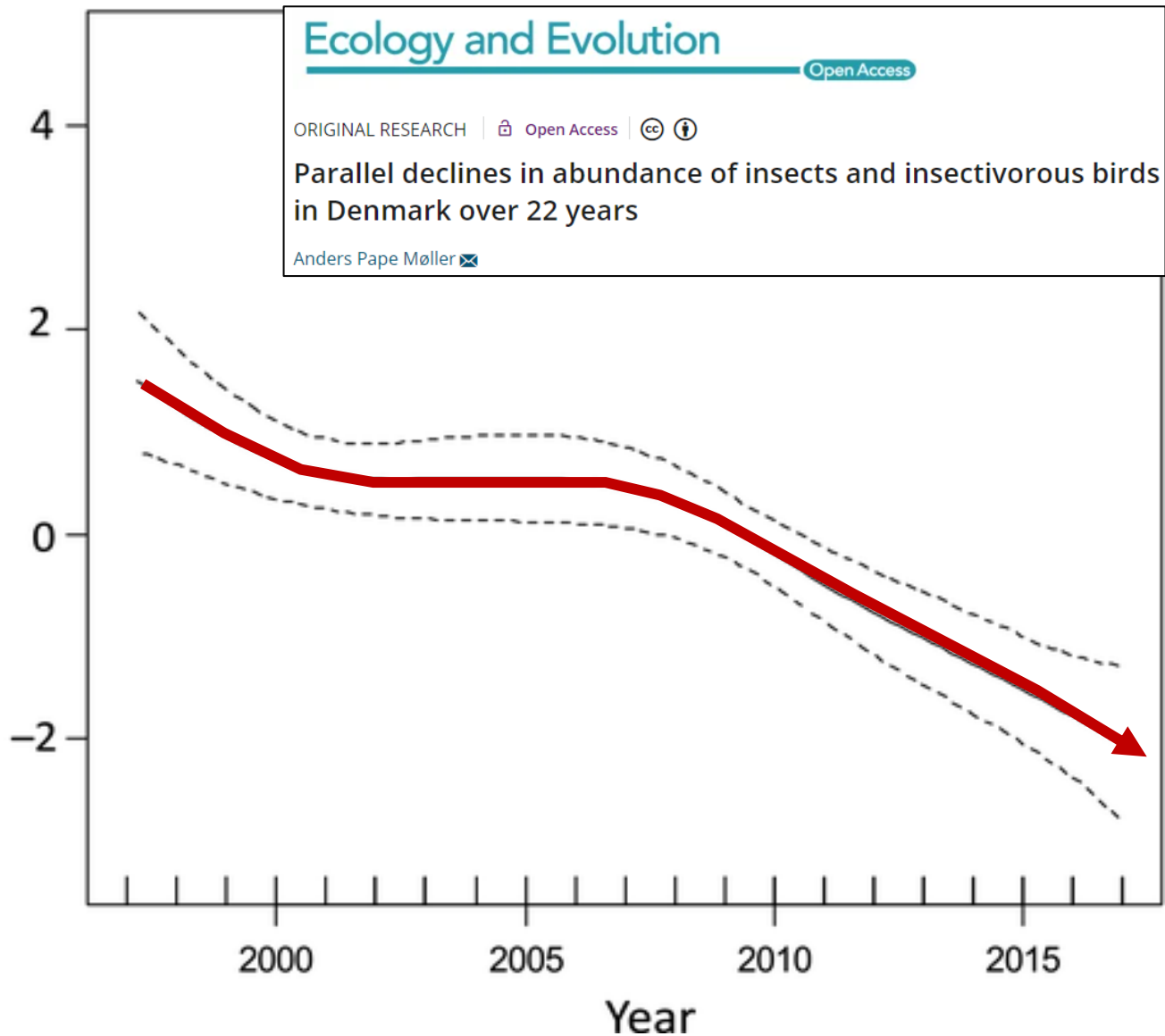
80% reduction in windshield bugs over 20 years



Sweeps, sticky trap, bird feeding rates follow the same curve



Residual number of insects



Broader studies
of abundance and biomass



*Malaise trap
for flying insects*



Amateur society in Germany, collecting insects since 1905

- 1989-2016, sampled nature reserves (**n = 96**)
- trapped flying insects 24/7 from March-Oct; weighed & IDed catch



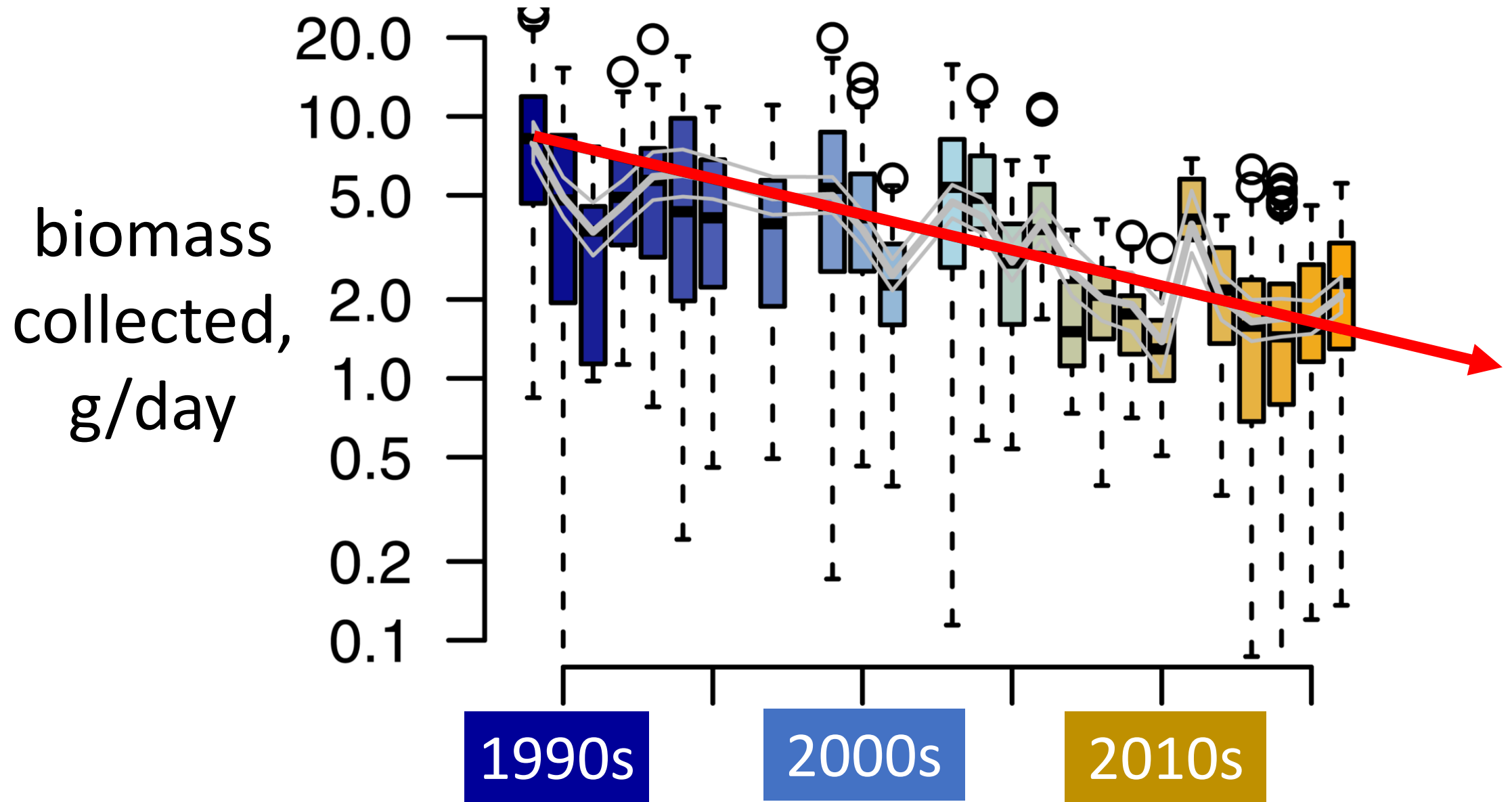


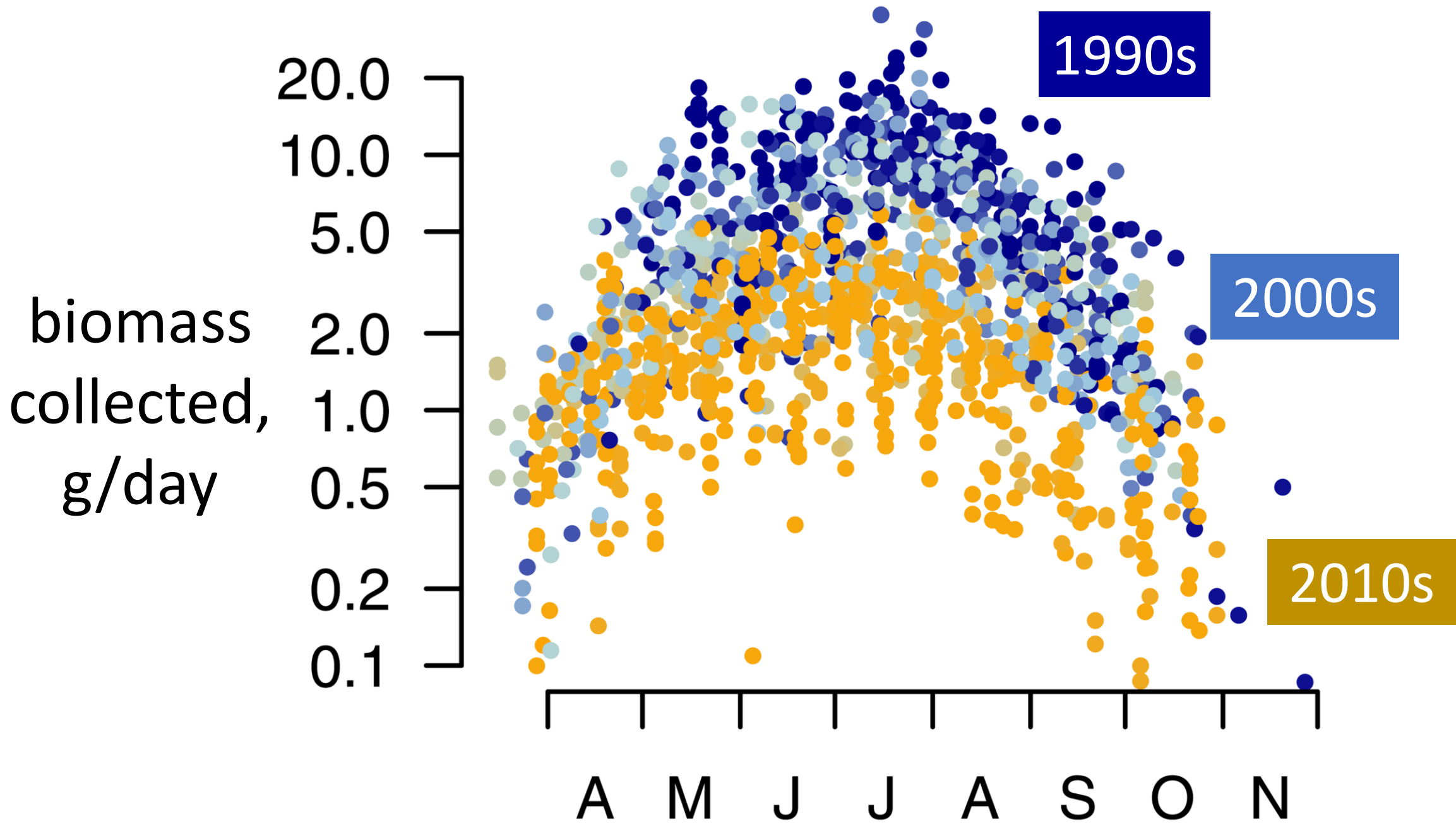
Pic from the Hallman paper...



Pic from the Hallman paper...

Measurable reduction in biomass over 27 years





Between 1989 to 2016
(only 27 yrs)
75% decline in biomass
of flying insects
= 3% loss per year

FEATURE

The Insect Apocalypse Is Here

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

 PLOS ONE

RESEARCH ARTICLE

More than 75 percent decline over 27 years in
total flying insect biomass in protected areas

Caspar A. Hallmann^{1*}, Martin Sorg², Eelke Jongejans¹, Henk Siepel¹, Nick Hofland¹,
Heinz Schwan², Werner Stenmans², Andreas Müller², Hubert Sumser², Thomas Hörrén²,
Dave Goulson³, Hans de Kroon¹



Trends in abundance & diversity from multiple shorter-term studies

73 studies reviewed

Biological Conservation 232 (2019) 8–27



ELSEVIER

Contents lists available at ScienceDirect

Biological Conservation

journal homepage: www.elsevier.com/locate/biocon

Review

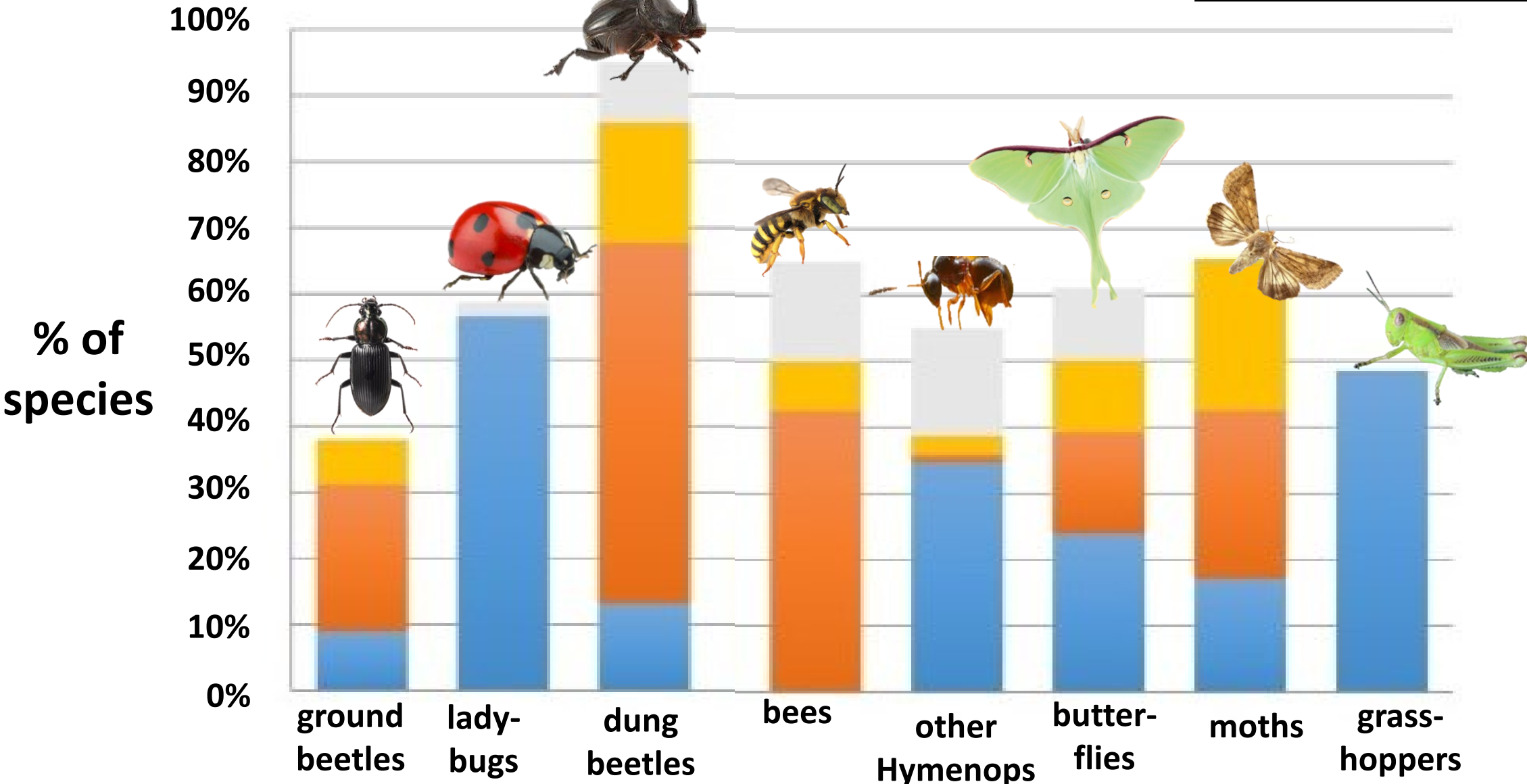
Worldwide decline of the entomofauna: A review of its drivers

Francisco Sánchez-Bayo^{a,*}, Kris A.G. Wyckhuys^{b,c,d}

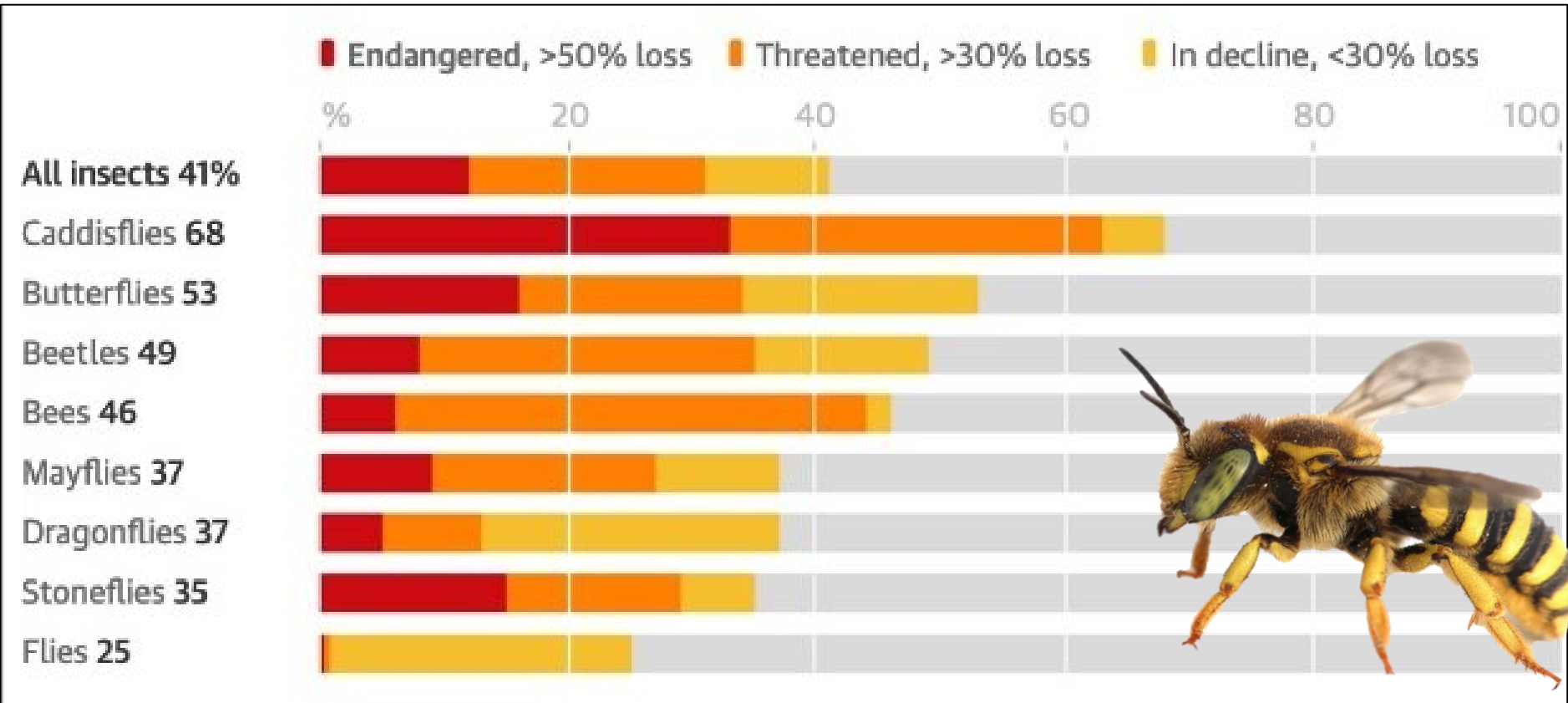
Population declines by insect group

BAR COLORS

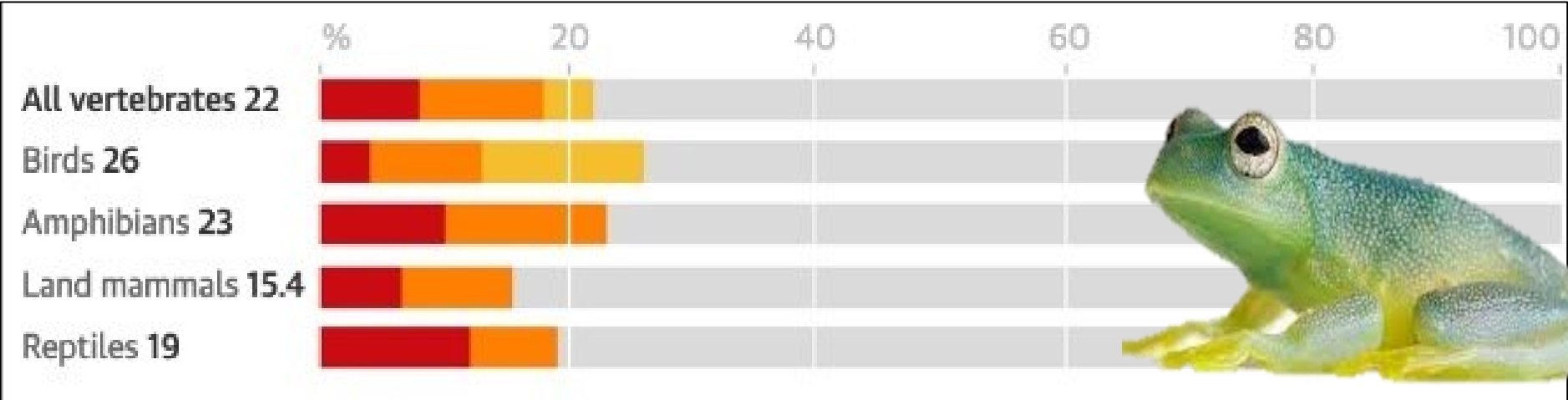
extinct	vulnerable
endangered	declining



41% of insect species have declined over the past decade...



Compared to 22% of vertebrate species



What is driving the Insect Decline?



Habitat change: Urbanization

** habitat loss & fragmentation (esp forest)

** pollution



Habitat change: intensive agriculture

- ** habitat loss & fragmentation
- ** monoculture
- ** pesticides (especially neonicotinoids)
- ** reduction in field edges, tree lines, wood lots



Karner blue



American burying beetle





Artificial light

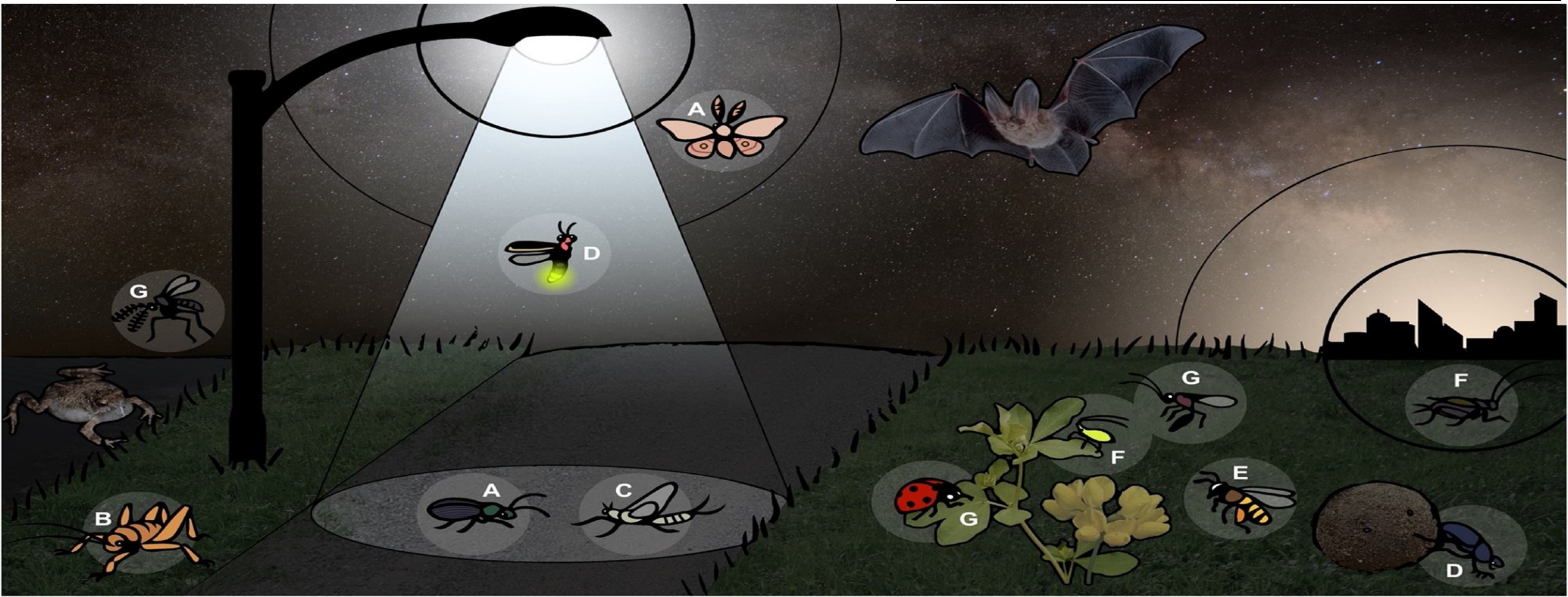


- A fatal attraction
- B avoidance
- C egg laying on surfaces (vs H2O)
- D obscuring natural light
- E change activity patterns
- F change in development time
- G mismatch in timing

Short communication

Light pollution is a driver of insect declines

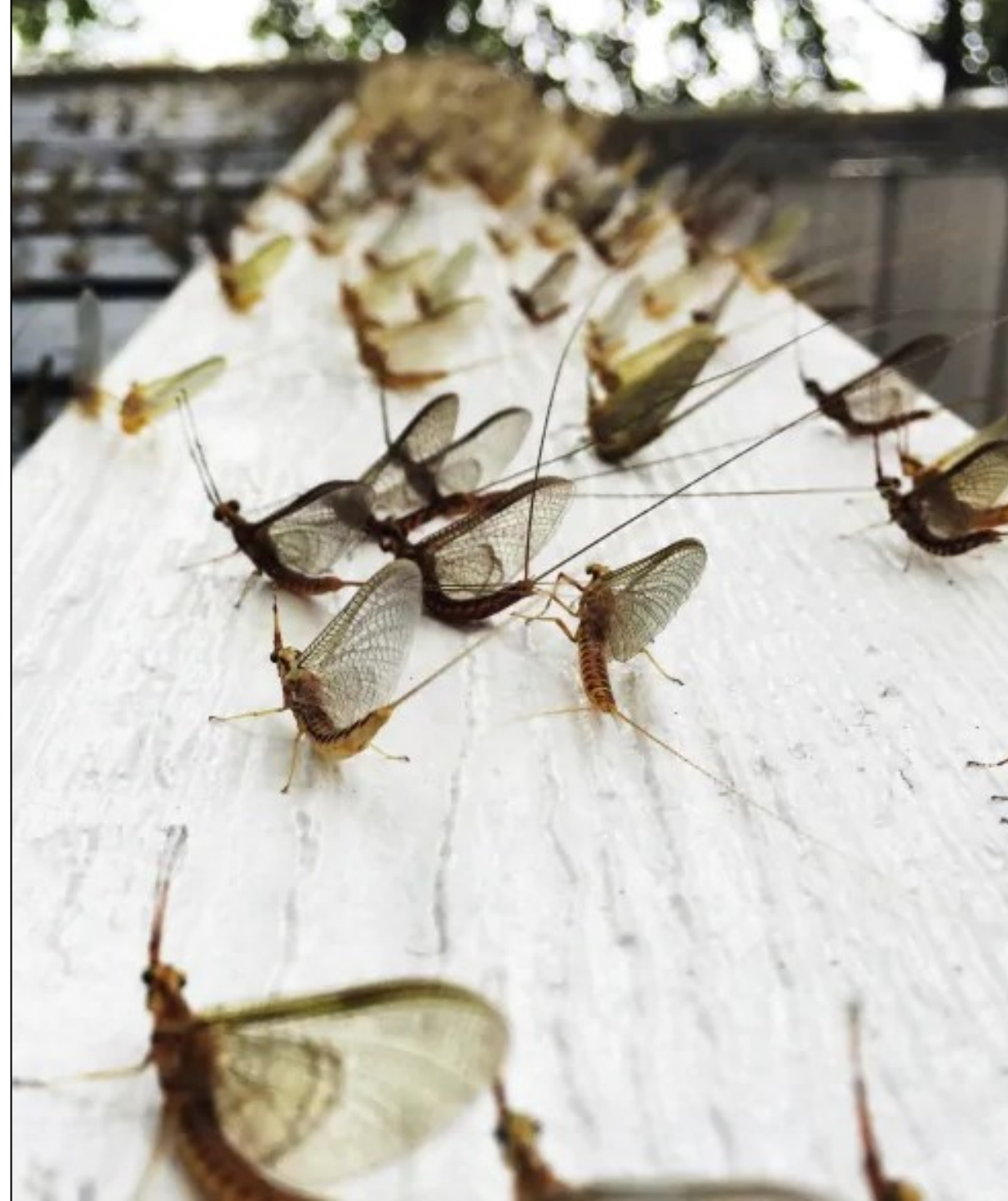
Avalon C.S. Owens ^a, Pr cillia Cochard ^b, Joanna Durrant ^c, Bridgette Farnworth ^d, Elizabeth K. Perkin ^e, Brett Seymoure ^f  



Fireflies



Mayflies



Invasive species

**direct mortality



** habitat change



**competition



NewScientist

Sign in 

Enter search keywords 

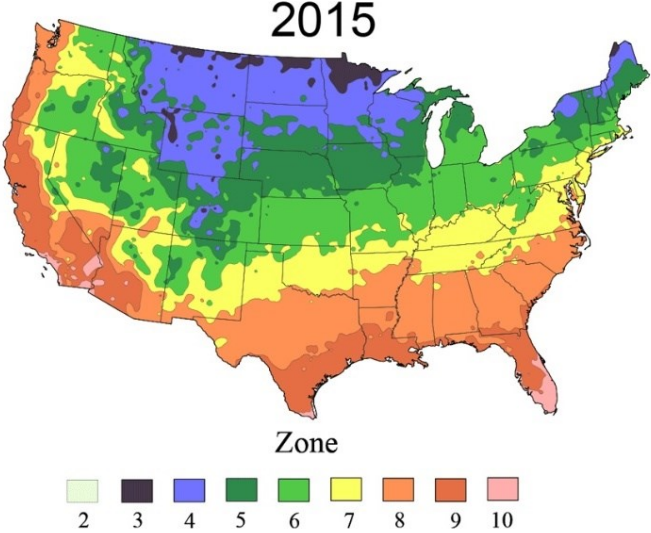
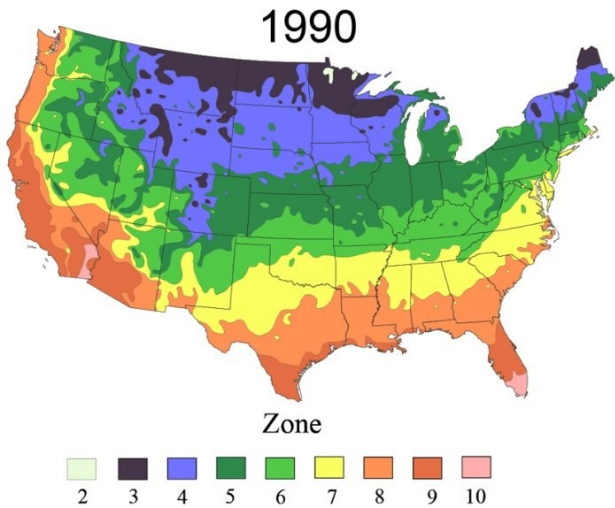
News Features Newsletters Podcasts Video Comment Culture Crosswords | [This week's magazine](#)
Health Space Physics Technology Environment Mind Humans [Life](#) Mathematics Chemistry Earth Society

Columnist Life

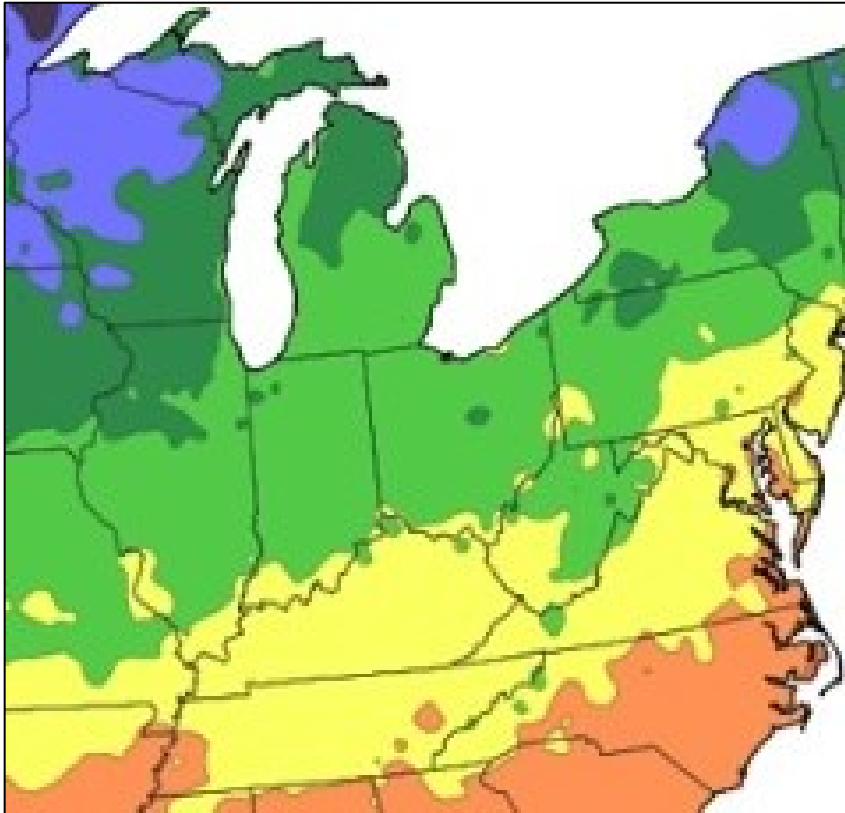
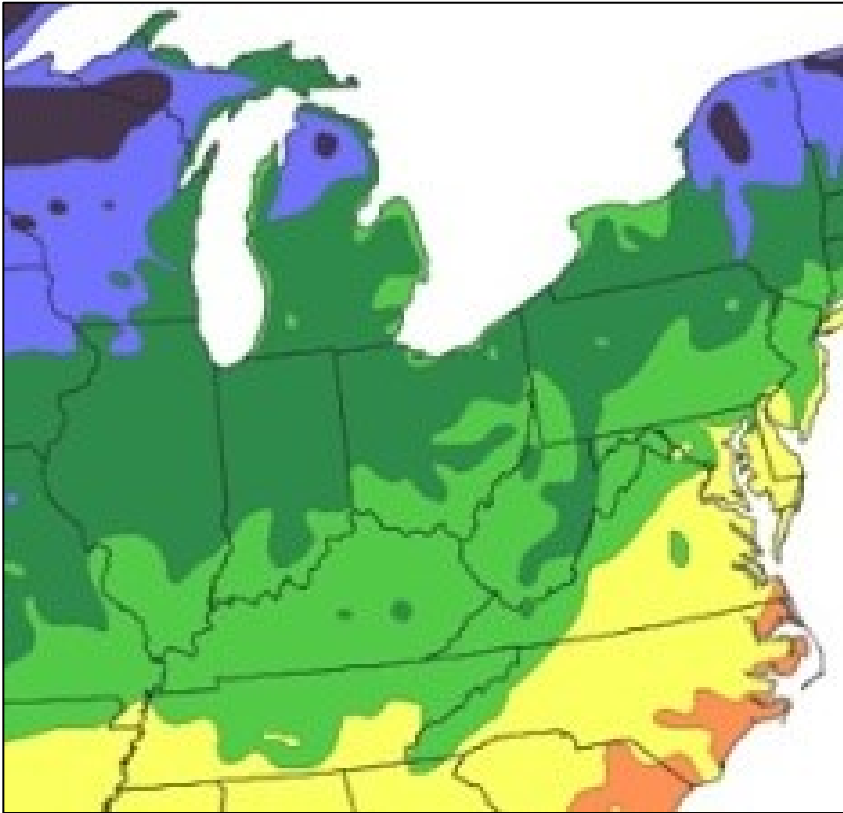
The urban beekeeping boom is hurting wild pollinator species

Climate change

- ** temperature rise
- ** variation in rainfall



*USDA
Hardiness Zones
moving north
at 13 miles
per decade*



**graphs from
Yale Enviro360*



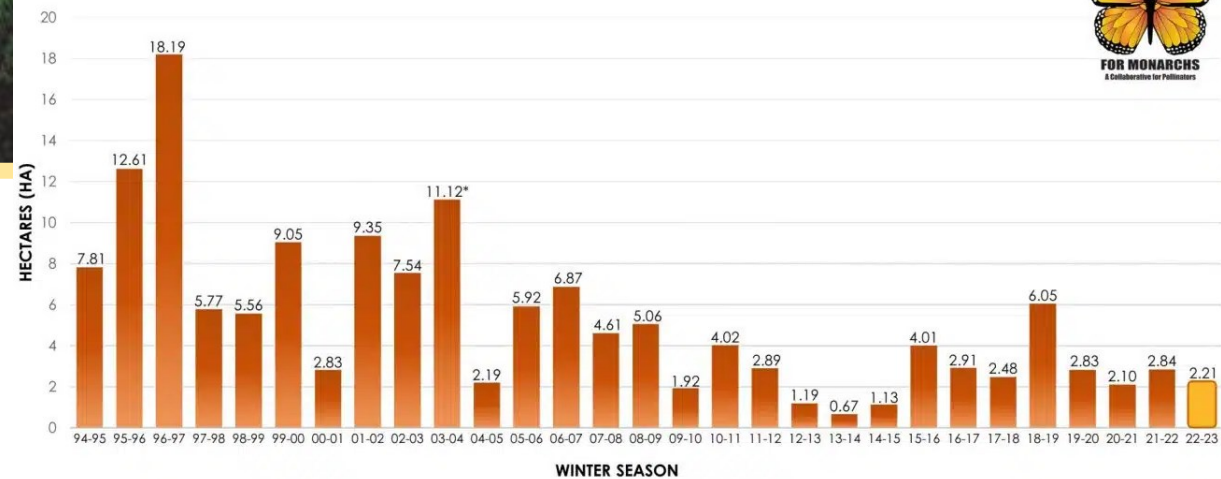
Multiscale seasonal factors drive the size of winter monarch colonies


Sarah P. Saunders  , Leslie Ries, Naresh Neupane, , and Elise F. Zipkin [Authors Info & Affiliations](#)

Edited by May R. Berenbaum, University of Illinois at Urbana-Champaign, Urbana, IL, and approved February 15, 2019 (received for review 4, 2018)

March 18, 2019 | 116 (17) 8609-8614 | <https://doi.org/10.1073/pnas.1805114116>

Total Area Occupied by Monarchs at Overwintering Sites in Mexico 2022-2023





*None of this
applies to
farming*

I'm running
a business,
not a nature
preserve

Who cares
about
butterflies?

I want
fewer bugs
in my
crops!

Natural ecosystems are being affected by insect declines

pollination

**seed
dispersal**



eat things:
predation
parasitism
herbivory



get eaten:
base of
food
chains



decomposition



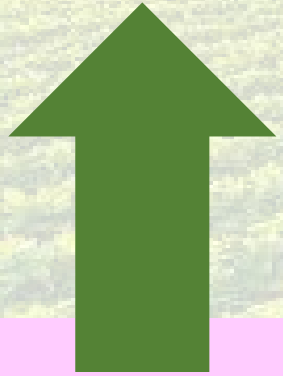
**soil
turn over
&
processing**



**water
filtering**

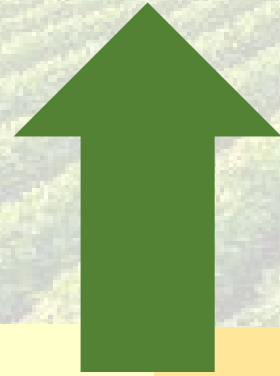
Impact of insects to agriculture

***yield potential**



pollination

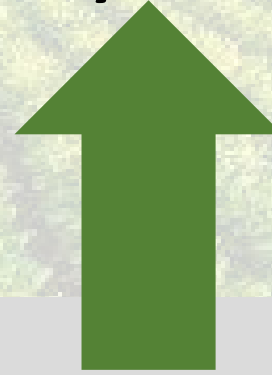
*** biological control**



eat things:
predation
parasitism
herbivory

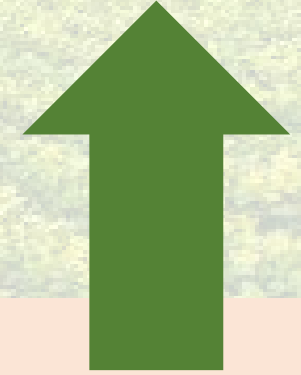
get eaten:
base of
food
chains

*** residue breakdown**
*** nutrient cycling**
*** fertility**



decomposition

*** healthy & productive soil**



**soil
turn over
&
processing**

Small things you can do to help insects

- keep & maintain tree lines, field edges, woods



- use cover crops
- spray on thresholds
- Less lighting (& yellow vs white)

Its not just about tigers, its about tiger moths

