

Sécurité alimentaire: le rôle de la pollinisation dans l'amélioration des rendements agricoles

Lucas A. Garibaldi

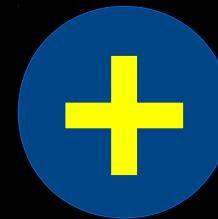
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IRNAD





Crop yield

Conventional intensification

Largeholdings
(landscape simplification)

Agricultural inputs

fertilizers
pesticides
hives

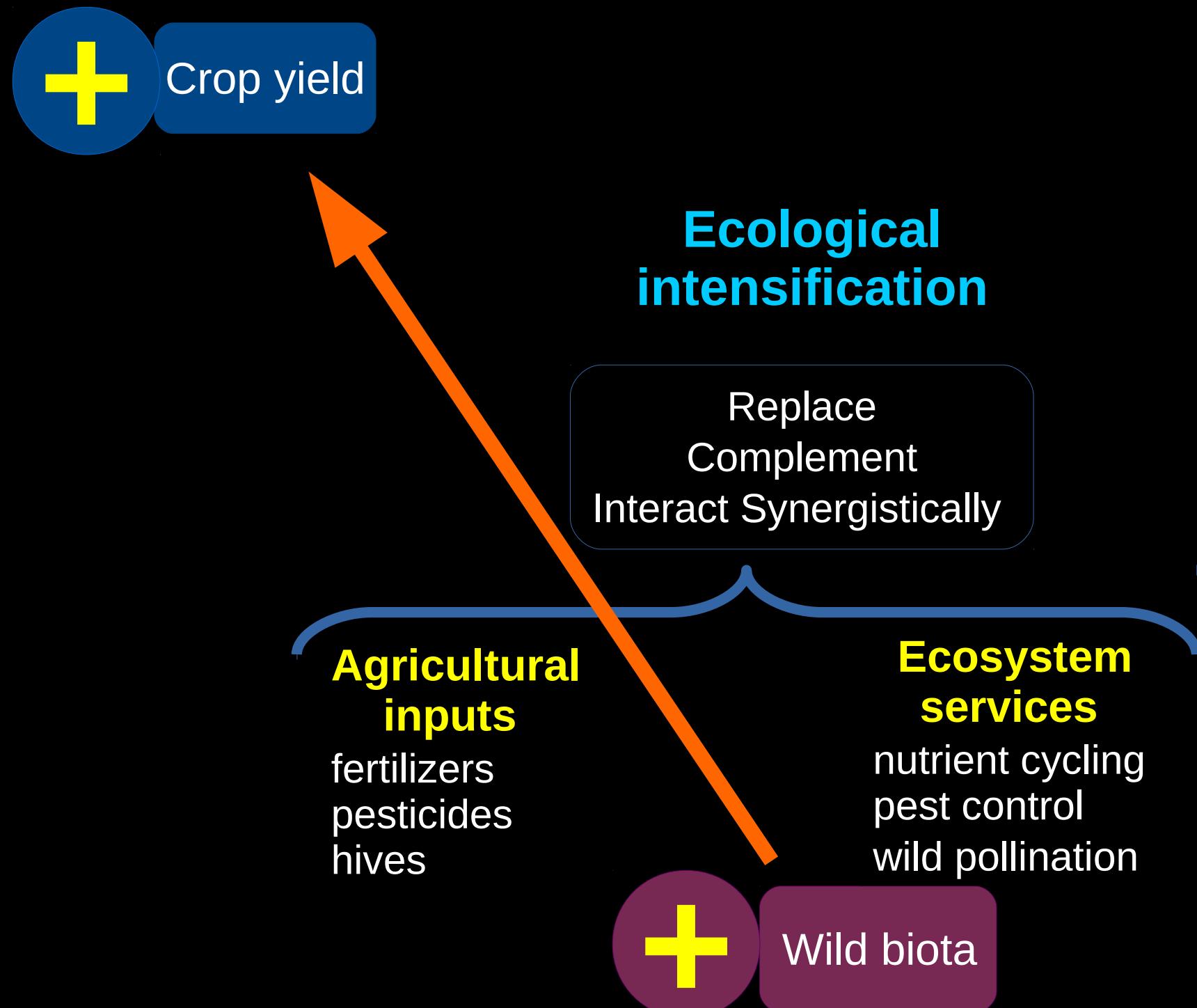
Crop production

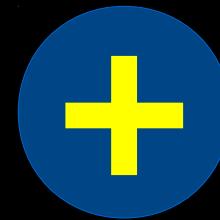


Environment

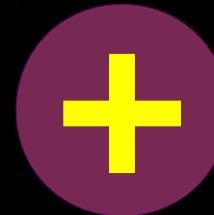
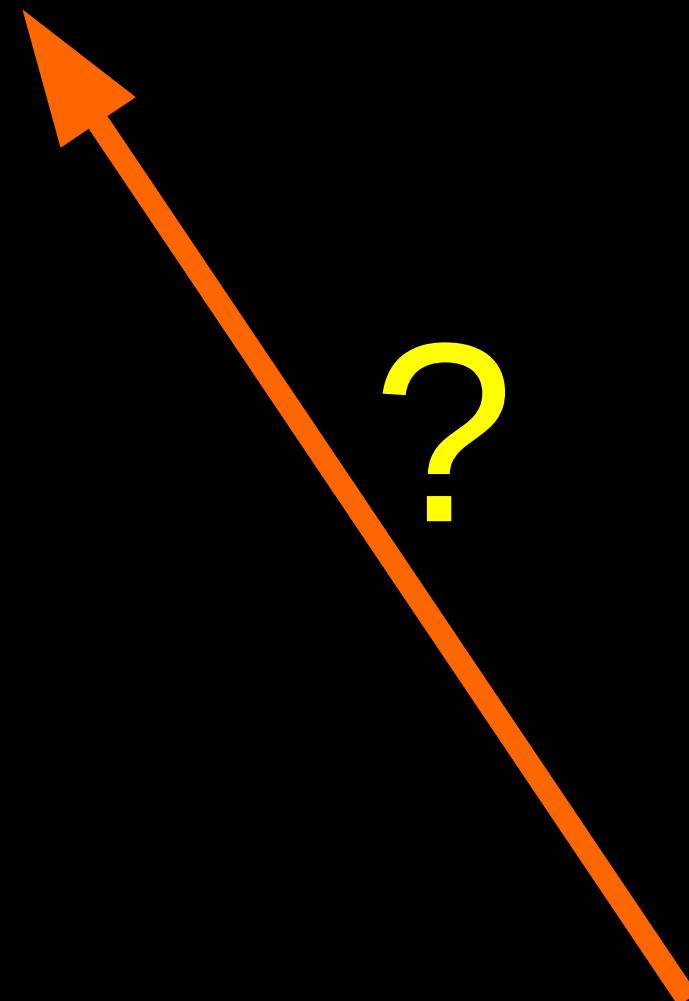


Wild biota is being lost



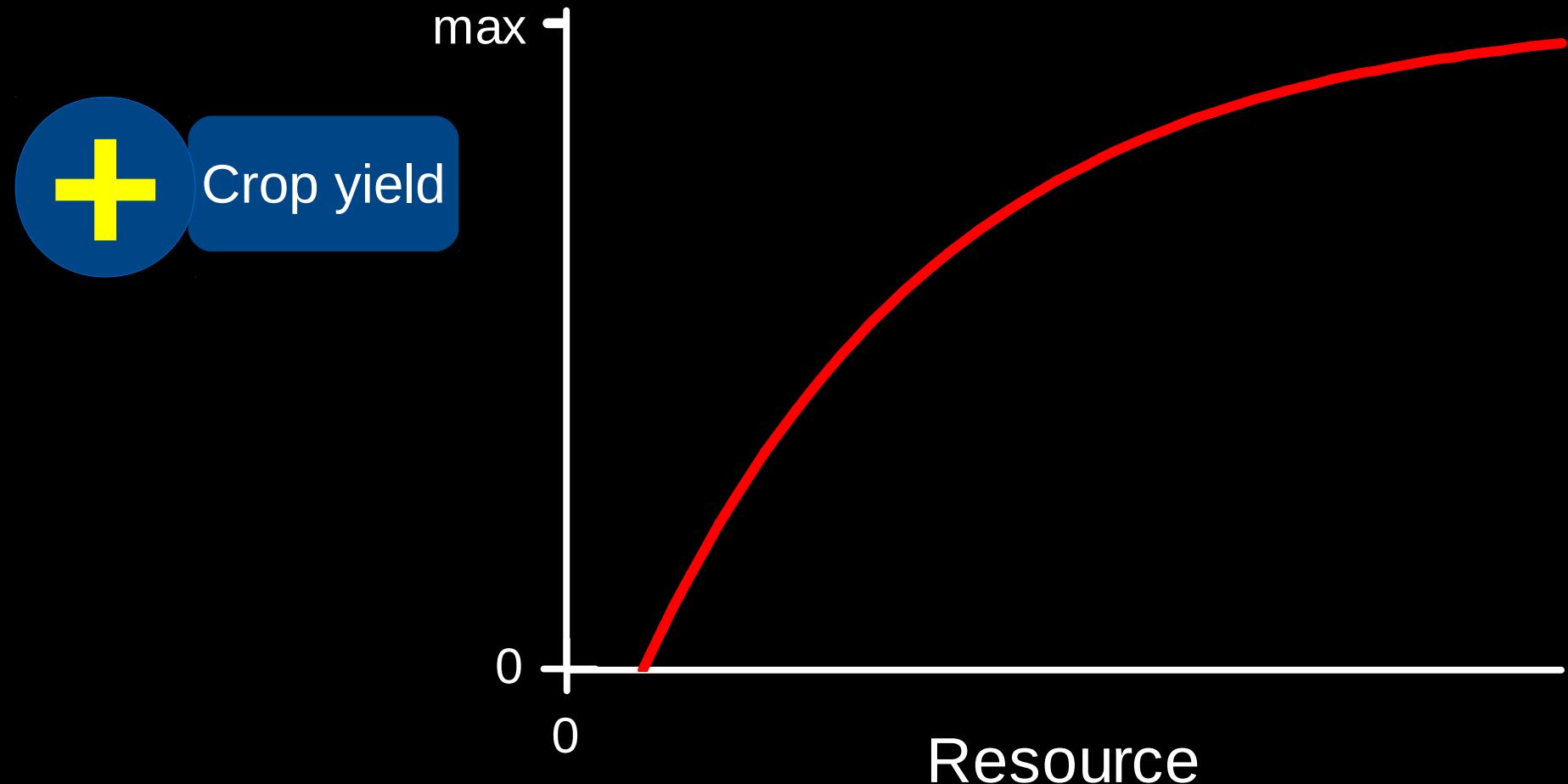


Crop yield



Wild biota

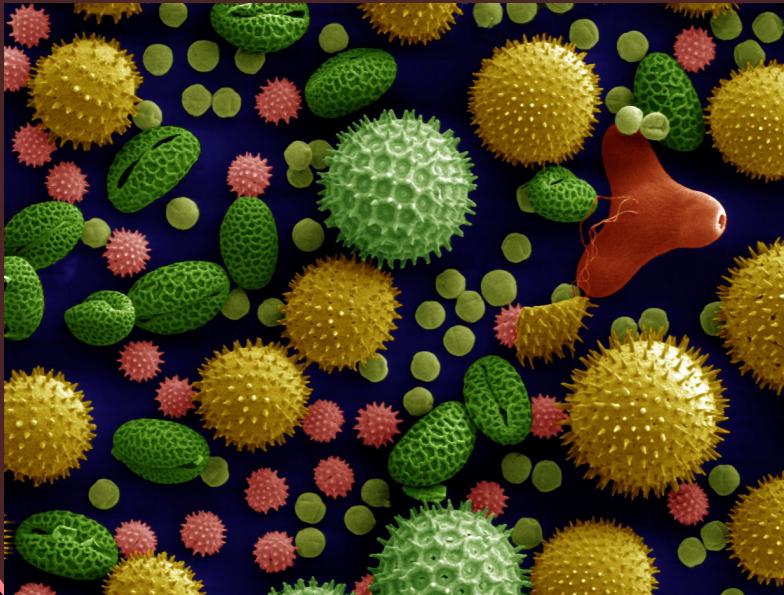
**Ecosystem
services**
nutrient cycling
pest control
wild pollination



Ecosystem services
nutrient cycling
pest control
wild pollination



Pollen

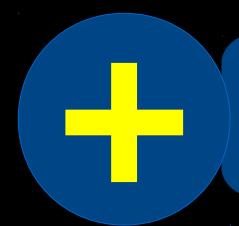


Crop production



Environment





Crop yield

max

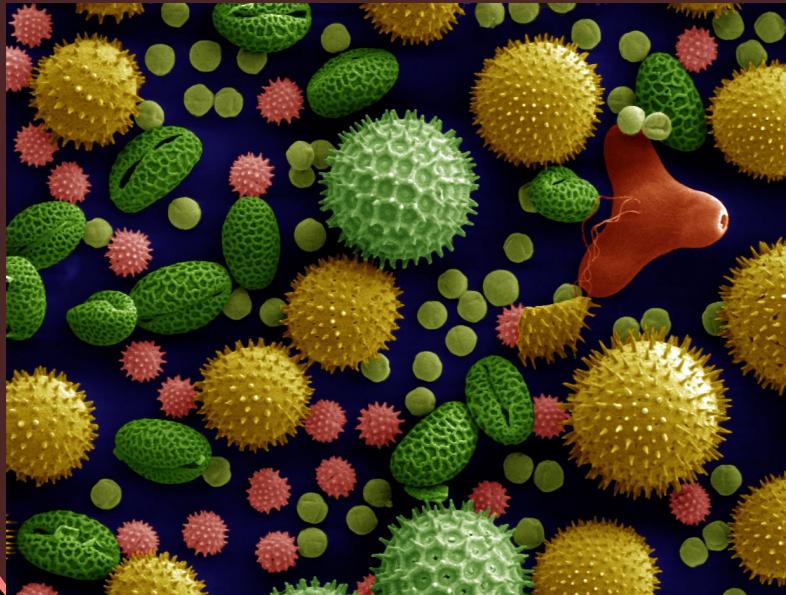
0

0

Pollen



Pollen



Crop production



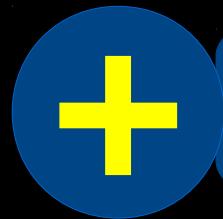
Flower visitors



Environment



max



Crop yield

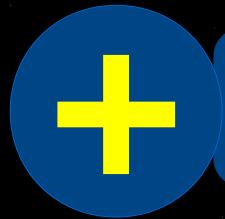
0
0

Pollen

Flower visitors



Wild biota



Crop yield

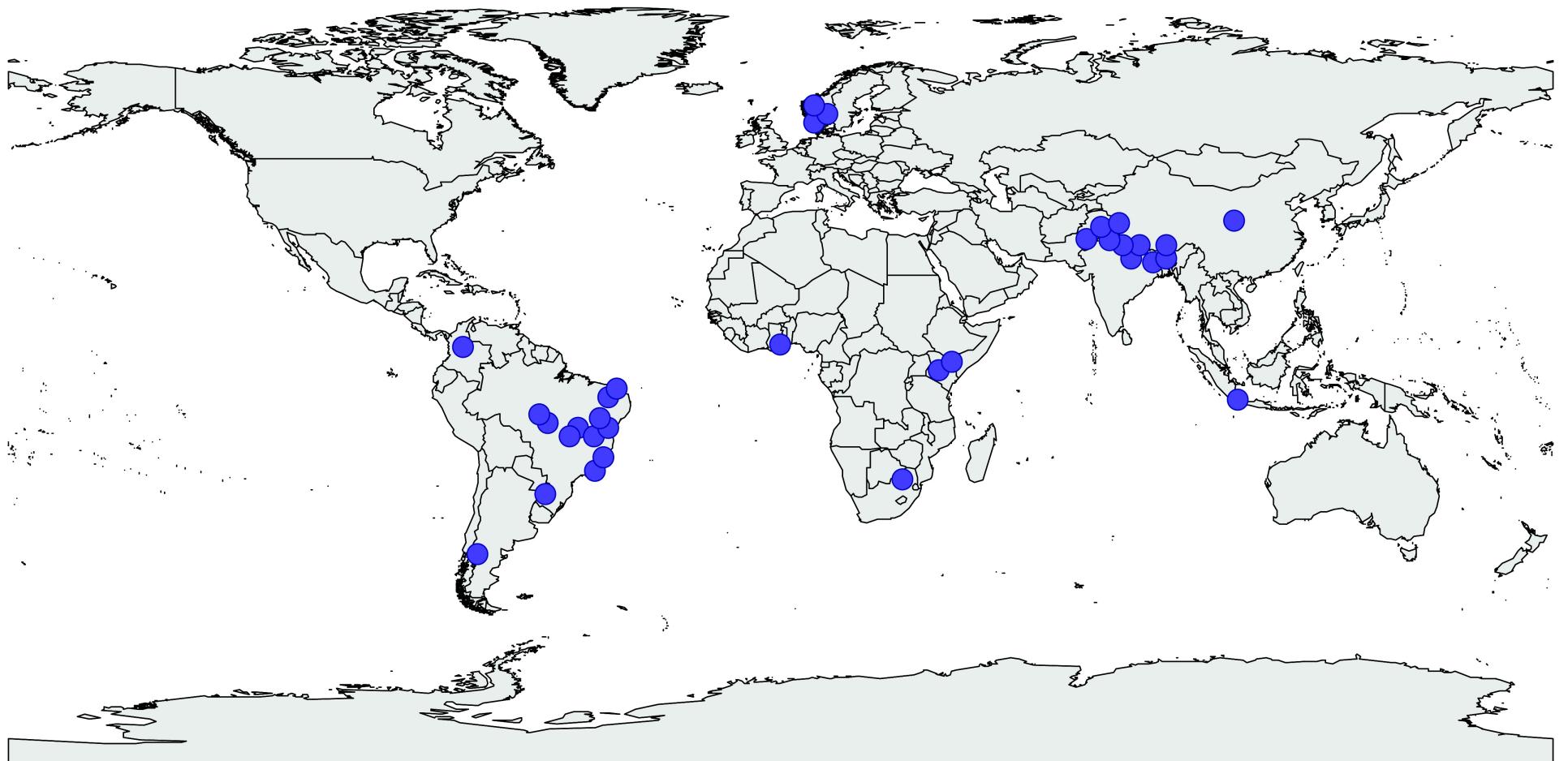
max

0
0

Pollen

Flower visitors





344 fields

33 crop systems

5-year period (2010-2014)



EXTENSION OF KNOWLEDGE BASE

ADAPTIVE MANAGEMENT

CAPACITY BUILDING

MAINSTREAMING



PROTOCOL TO DETECT AND ASSESS POLLINATION DEFICITS IN CROPS: A HANDBOOK FOR ITS USE



Smallholdings



Largeholdings

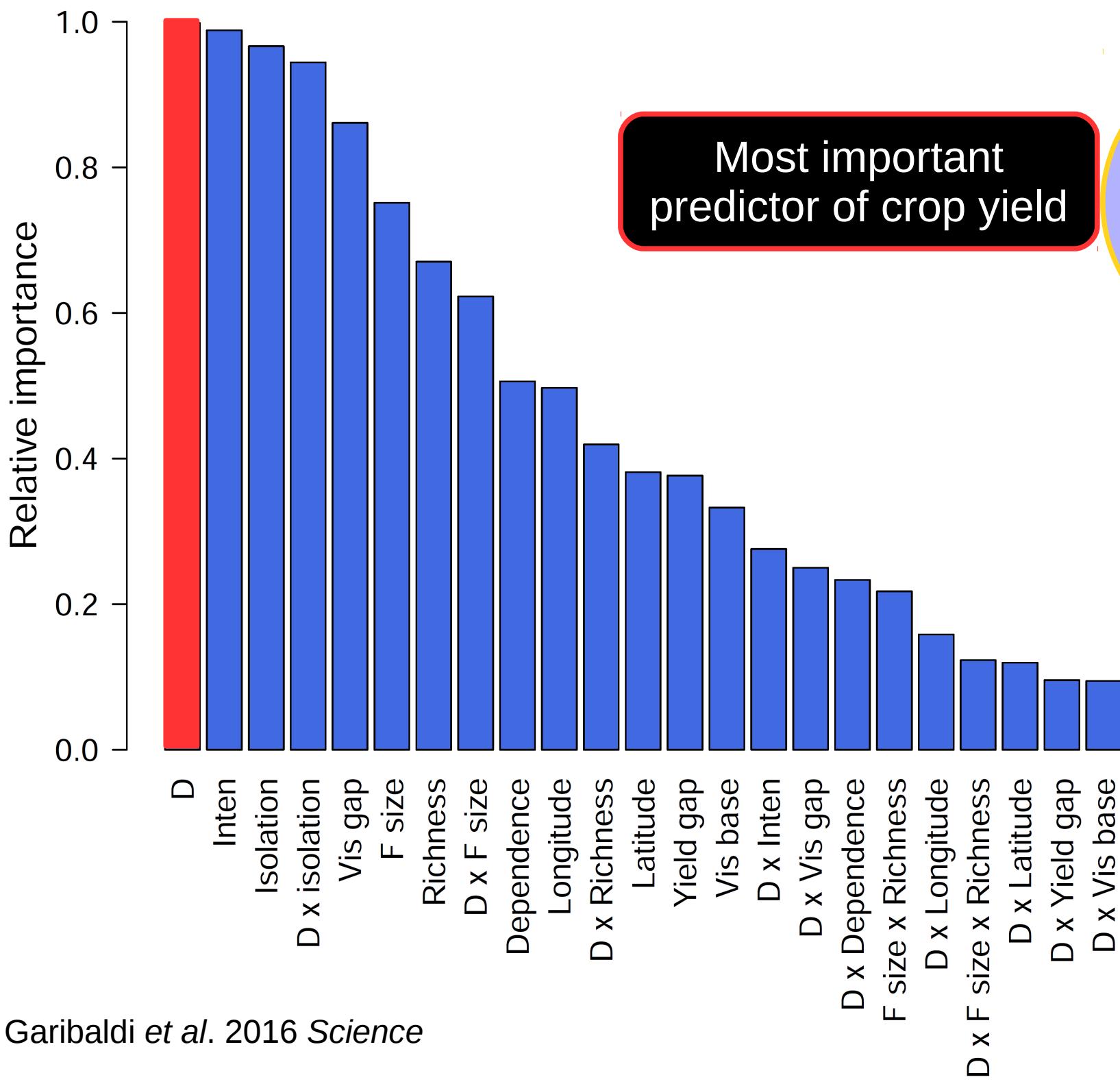
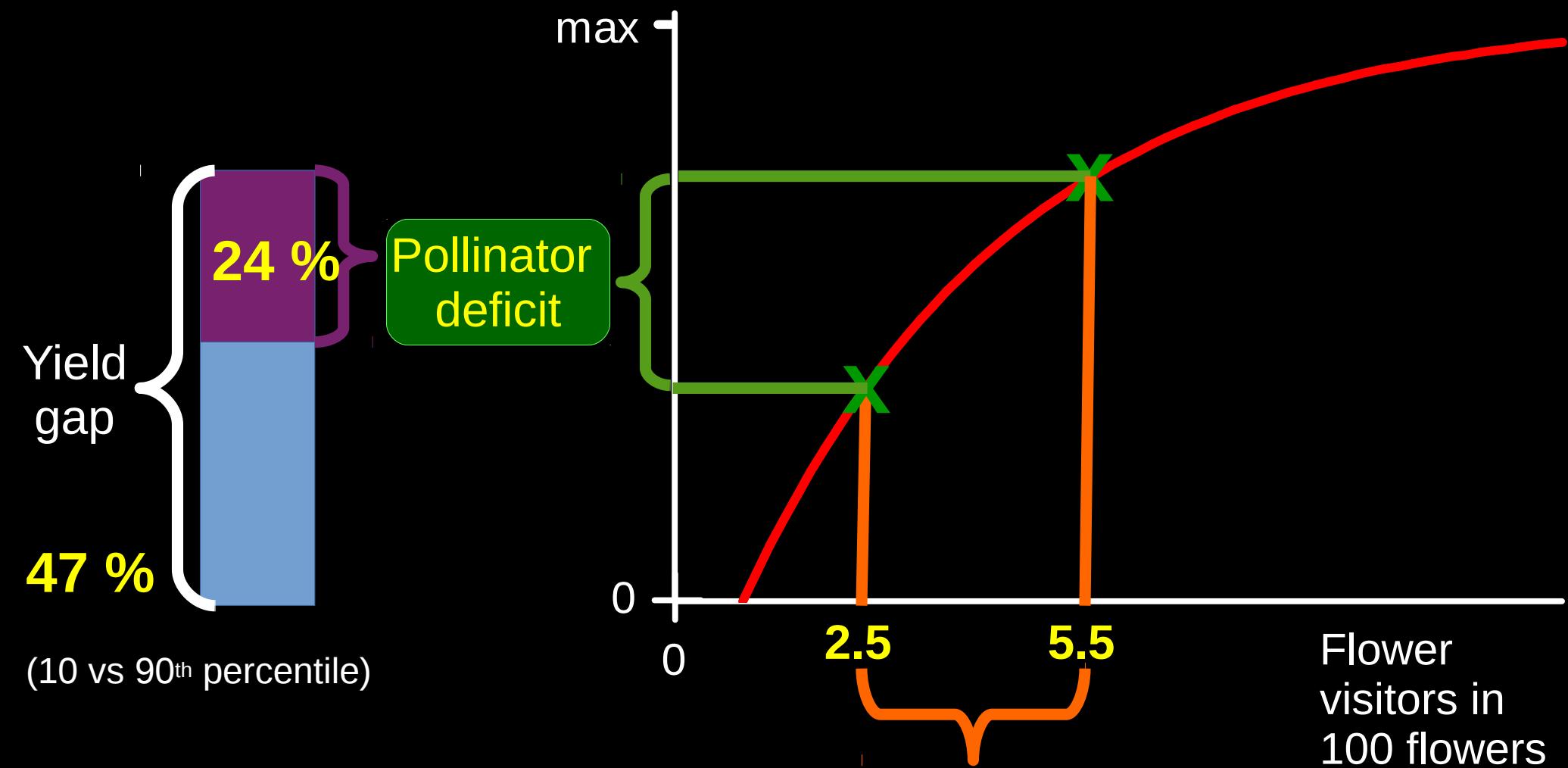




Foto por A Klein

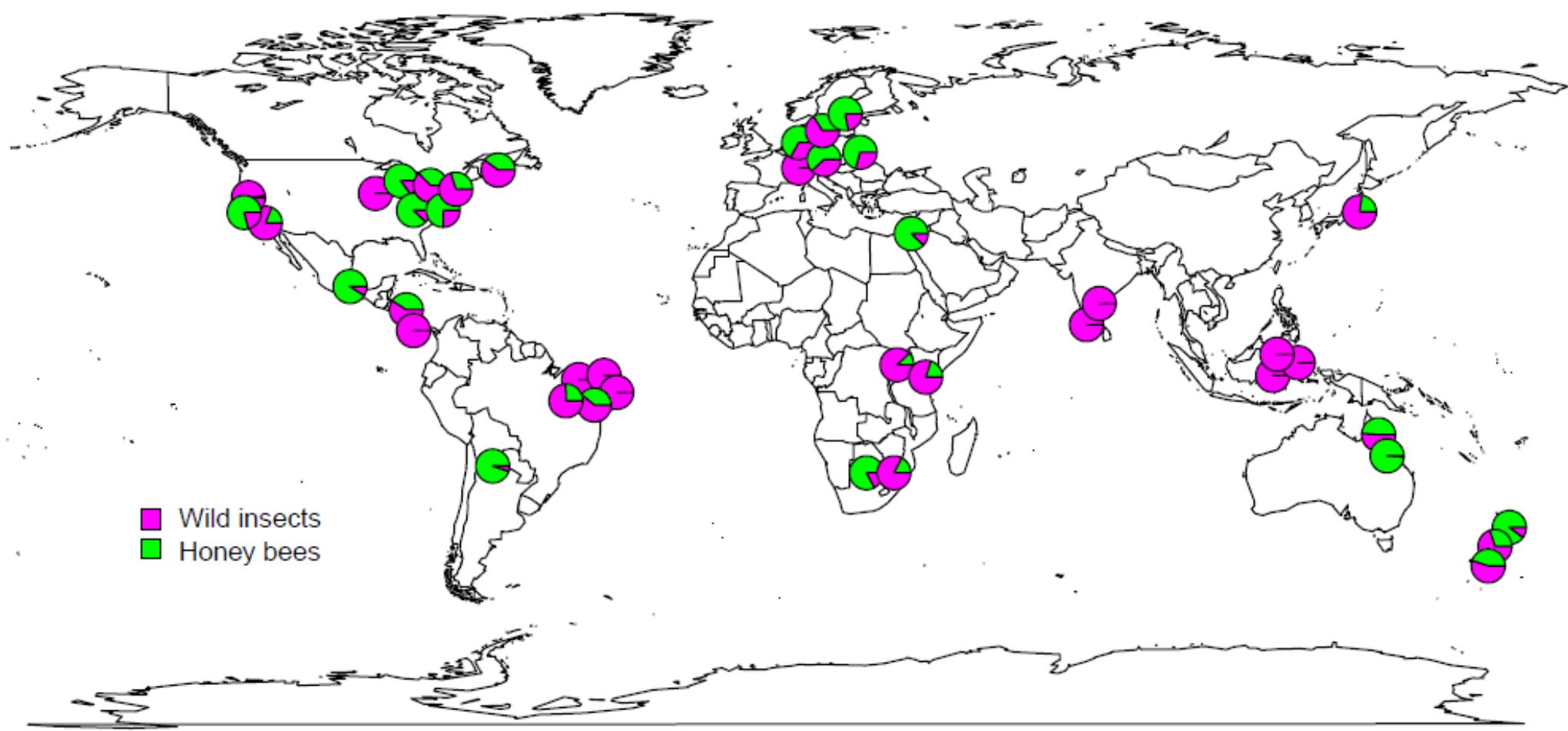






For **larger holdings**, such level of yield benefits only occurred if they sustained high flower-visitor **richness**







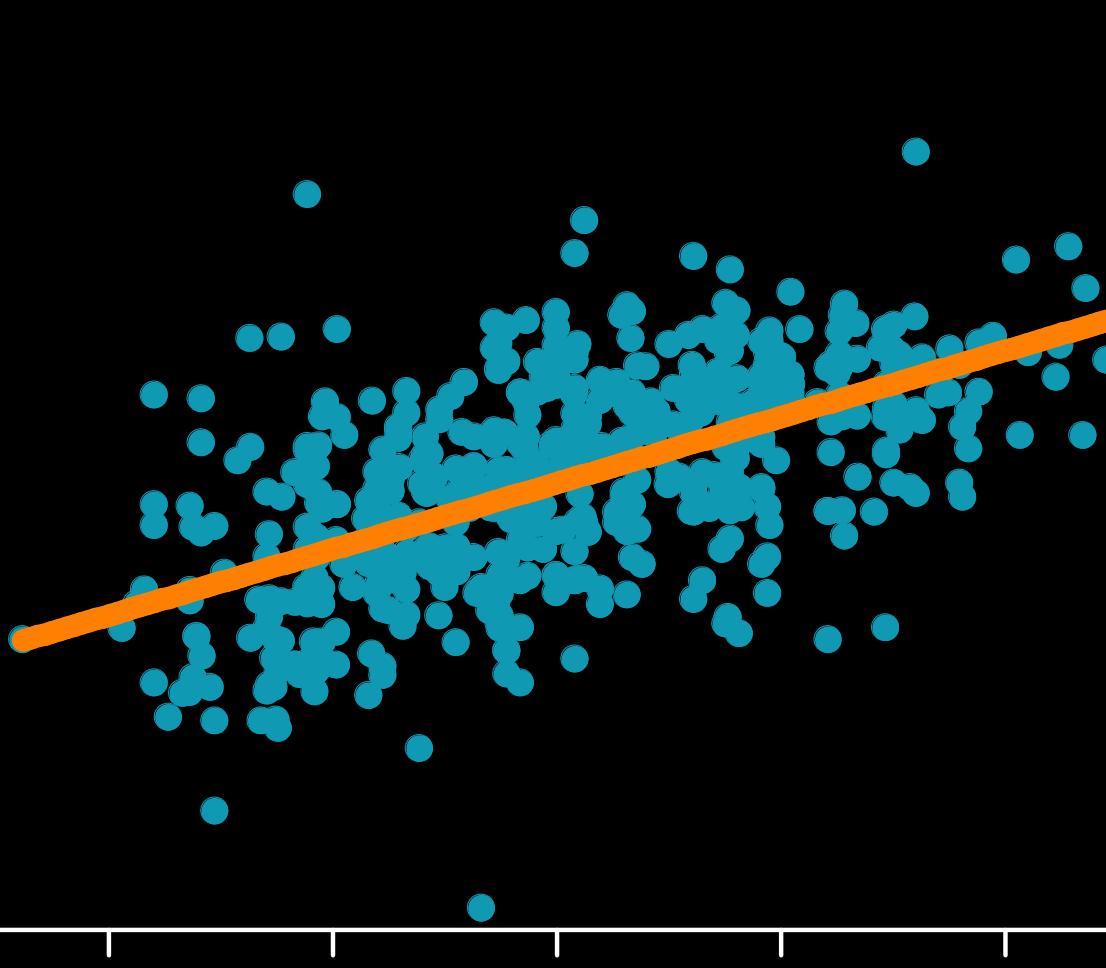
Greenleaf 2003



Wild-insect visitation
(z scores)

4
2
0
-2
-4

Flower-visitor richness (z scores)

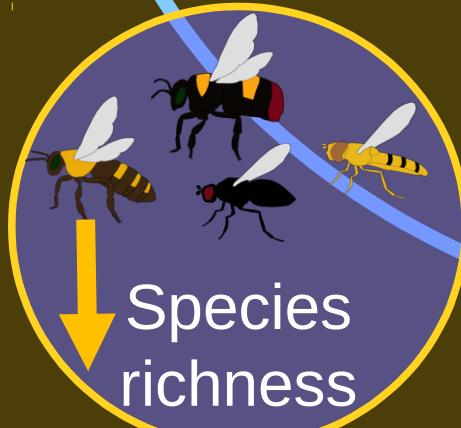


Garibaldi *et al.* 2013 *Science*

Garibaldi et al. 2011 PNAS

↓
**Pollination
(mean & stability)**

Garibaldi et al. 2011
Ecology letters



↓
**Species
richness**

Garibaldi et al. 2011
Ecology letters

↓
**Crop yield
(mean & stability)**

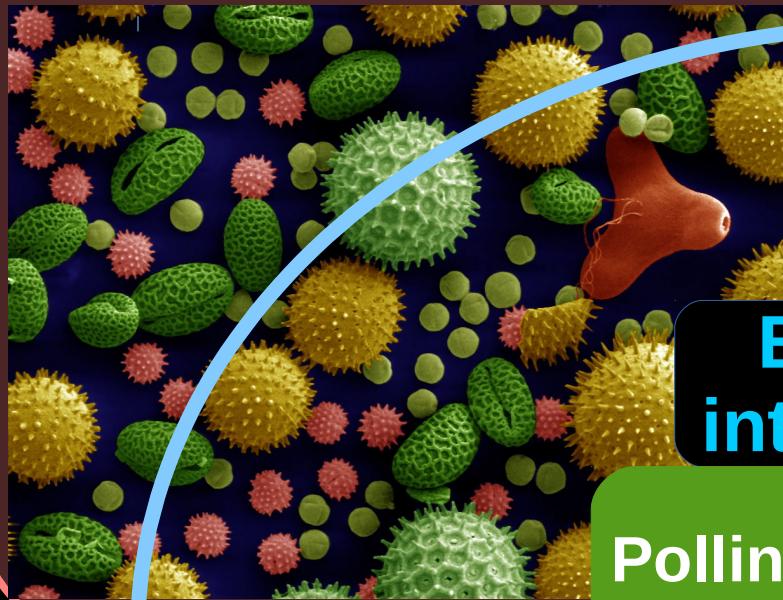
Garibaldi et al. 2011 PNAS

↑
**Agricultural
area**

Foley et al. 2011
Nature

↓
**Natural
habitat**

Pollen



Crop production



**Ecological
intensification**

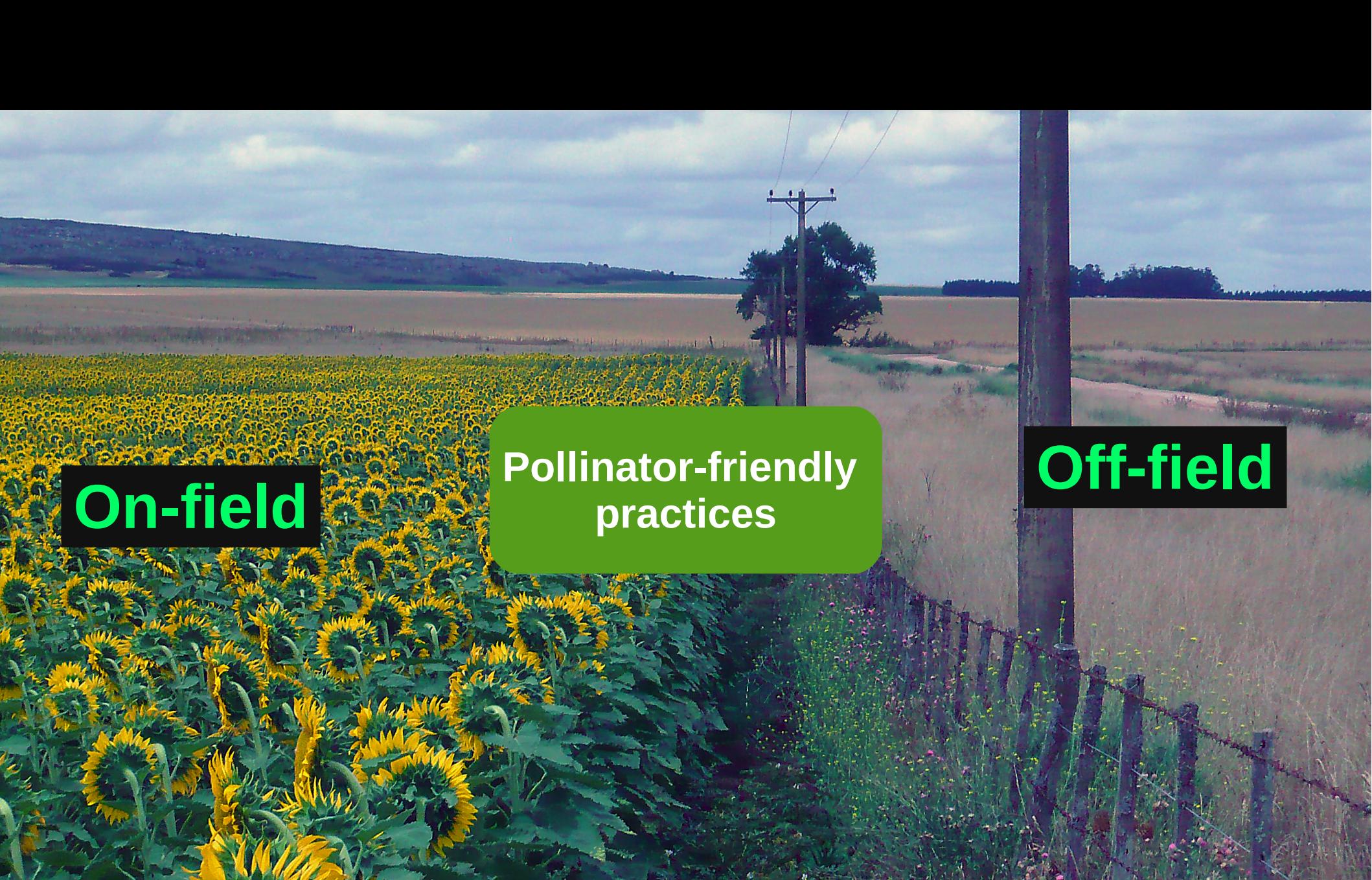
Pollinator-friendly
practices

Flower visitors



Environment







Garibaldi et al. 2014 *Frontiers Ecol & Environ*



Garibaldi et al. 2014 *Frontiers Ecol & Environ*



Garibaldi et al. 2014 *Frontiers Ecol & Environ*







Garibaldi et al. 2014 *Frontiers Ecol & Environ*



Garibaldi et al. 2014 *Frontiers Ecol & Environ*

wild pollinators honey-bee health

Synergies

Pollinator-friendly
practices

Bees



Environment



Kremen & Miles 2012
Wratten et al. 2012
Shackelford et al. 2013

Synergies

Pollinator-friendly
practices

- Soil erosion
- Water contamination
- + Pest control
- + Biodiversity
- + Scenic value & Tourism

Environment



Short-term revenues



Pollinator-friendly
practices

Trade-offs

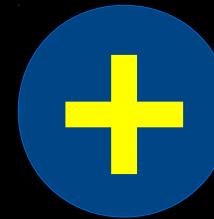
↑*Synergies*

Pollinator-friendly
practices

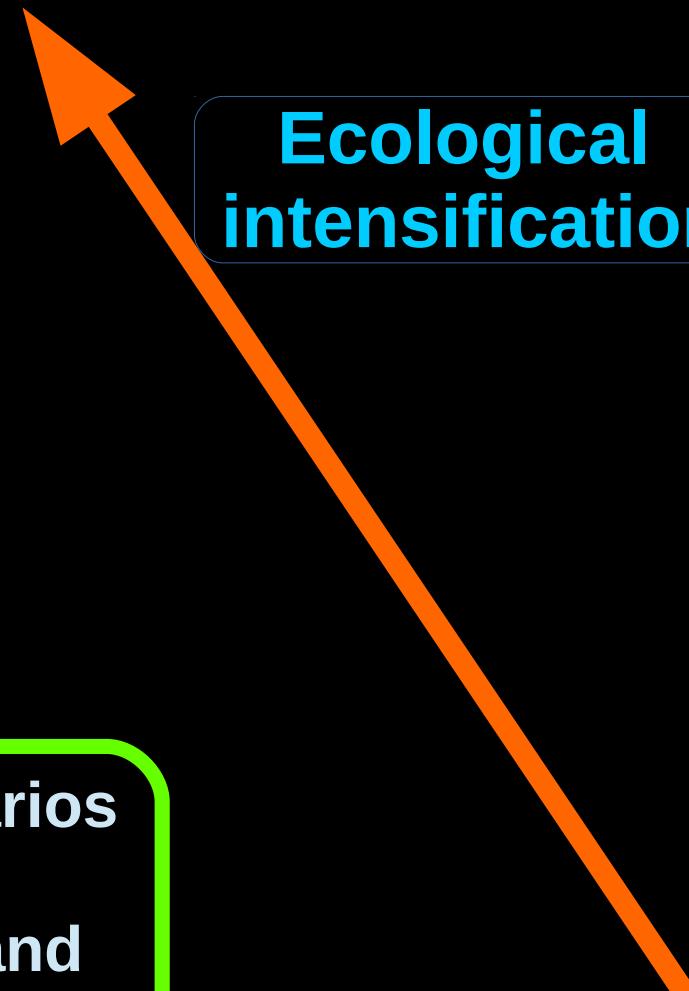
↓*Trade-offs*

Marginal lands

Water sources



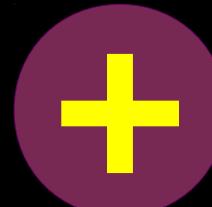
Crop yield



Smallholdings

Largeholdings

Win-win scenarios
between
biodiversity and
crop yield



Wild biota

Ecosystem services

nutrient cycling
pest control
wild pollination



Thanks!

Thanks!



Thanks!

POLLINATOR DIVERSITY

Mutually beneficial pollinator diversity and crop yield outcomes in small and large farms

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Thank you!