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The role of agriculture in global efforts to reverse biodiversity decline

Lynn Dicks 2025

Outline

- Global biodiversity decline
- Why bother with biodiversity in farmland?
- **Theory**: how natural habitat fragments support production
- **Reality**: case studies in Indonesia, China and India

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Global biodiversity decline

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Saving biodiversity involves changing the food system

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Sustainably increased crop yields ("Closing Yield Gaps")

Increased trade

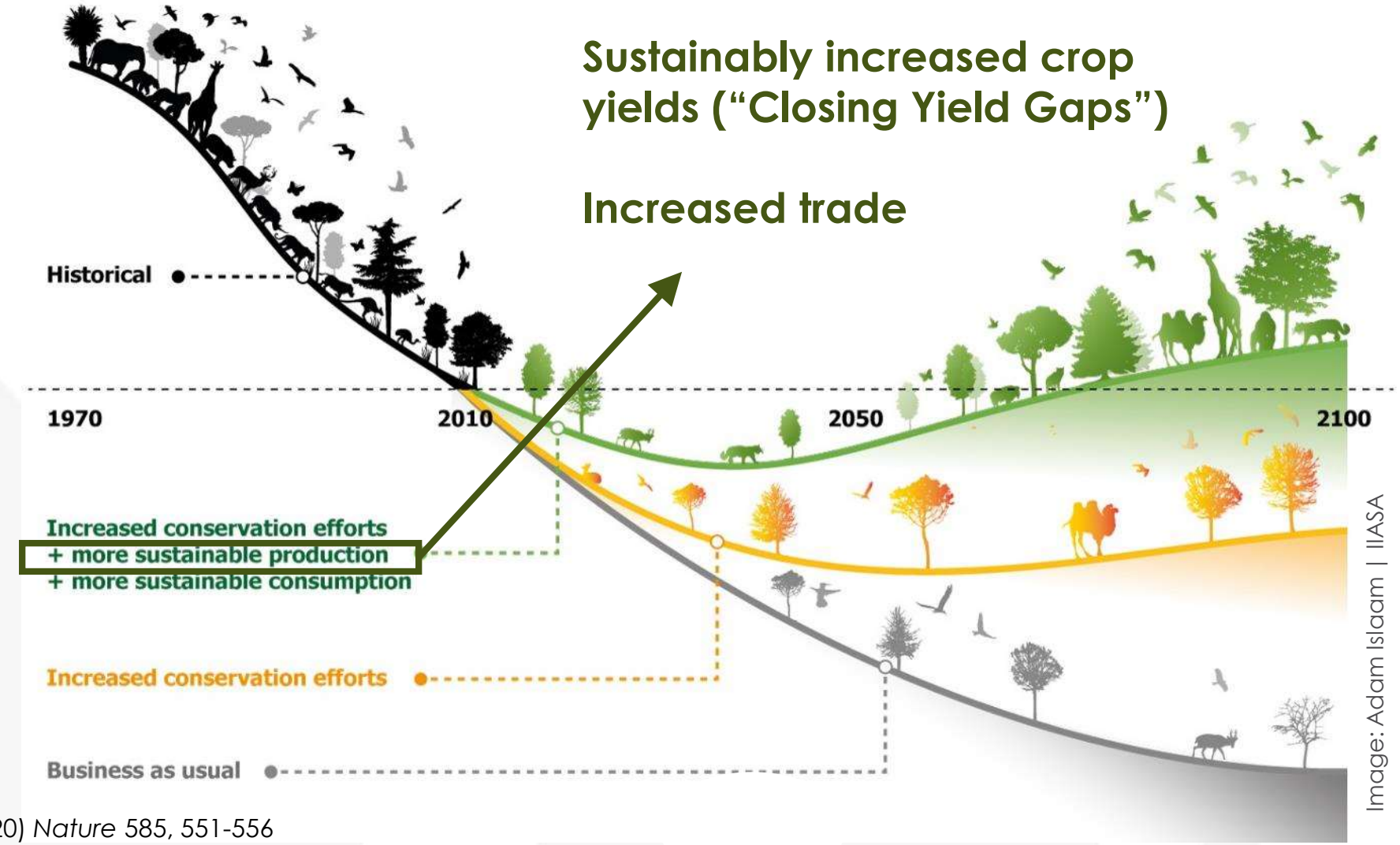

Image: Adam Islaam | IIASA

Leclère et al (2020) *Nature* 585, 551-556

Number of vertebrate species showing increased extinction risk

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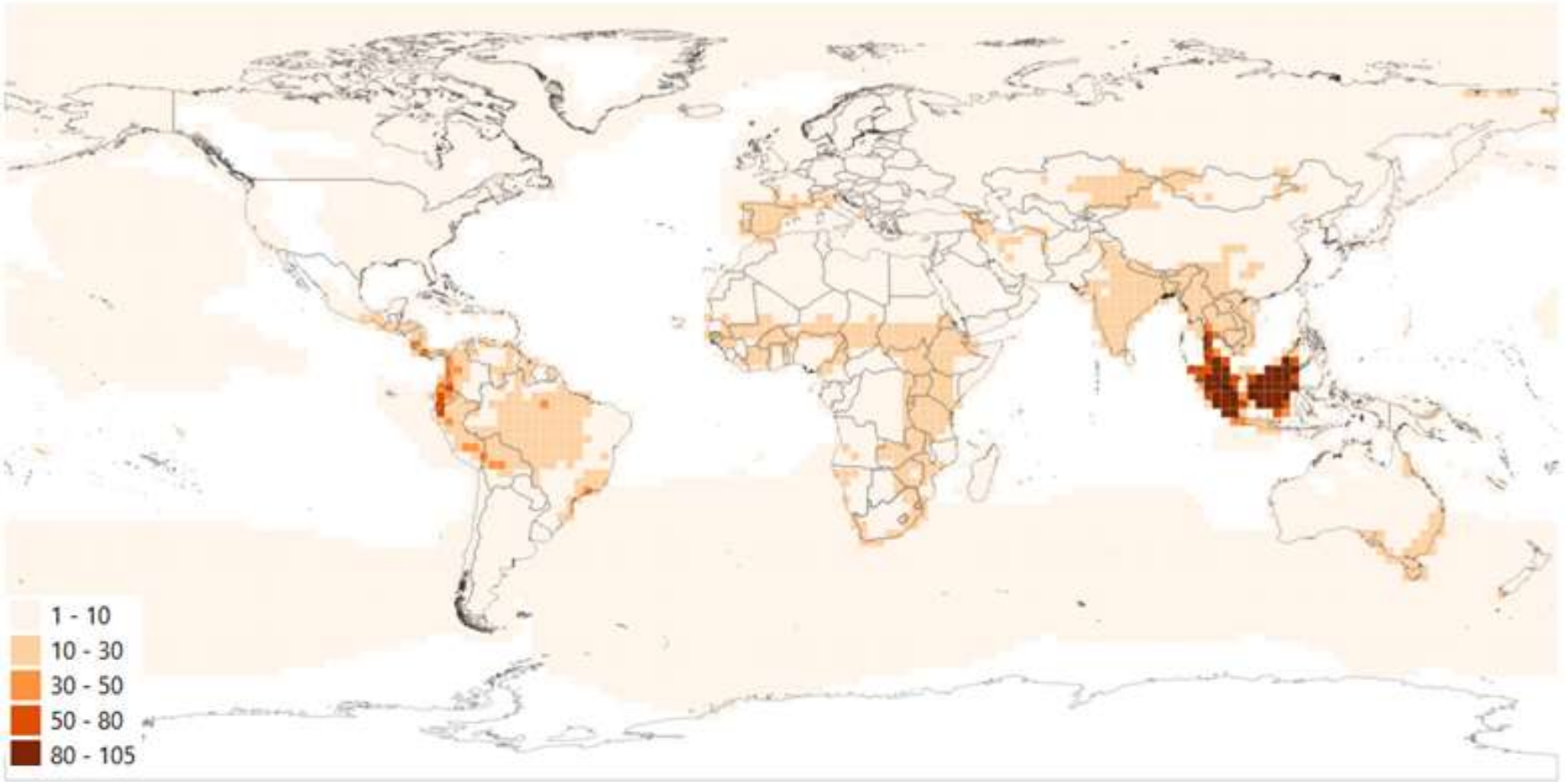

Simkins et al (2025) *PLoS Biology* 23(3): e3003051.

Kunming - Montreal

GLOBAL BIODIVERSITY FRAMEWORK

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Four long-term goals to 2050

23 targets to 2030

https://www.cbd.int/article/cop15-final-text-kunming-montreal-gbf-221222

Potentially incoherent targets

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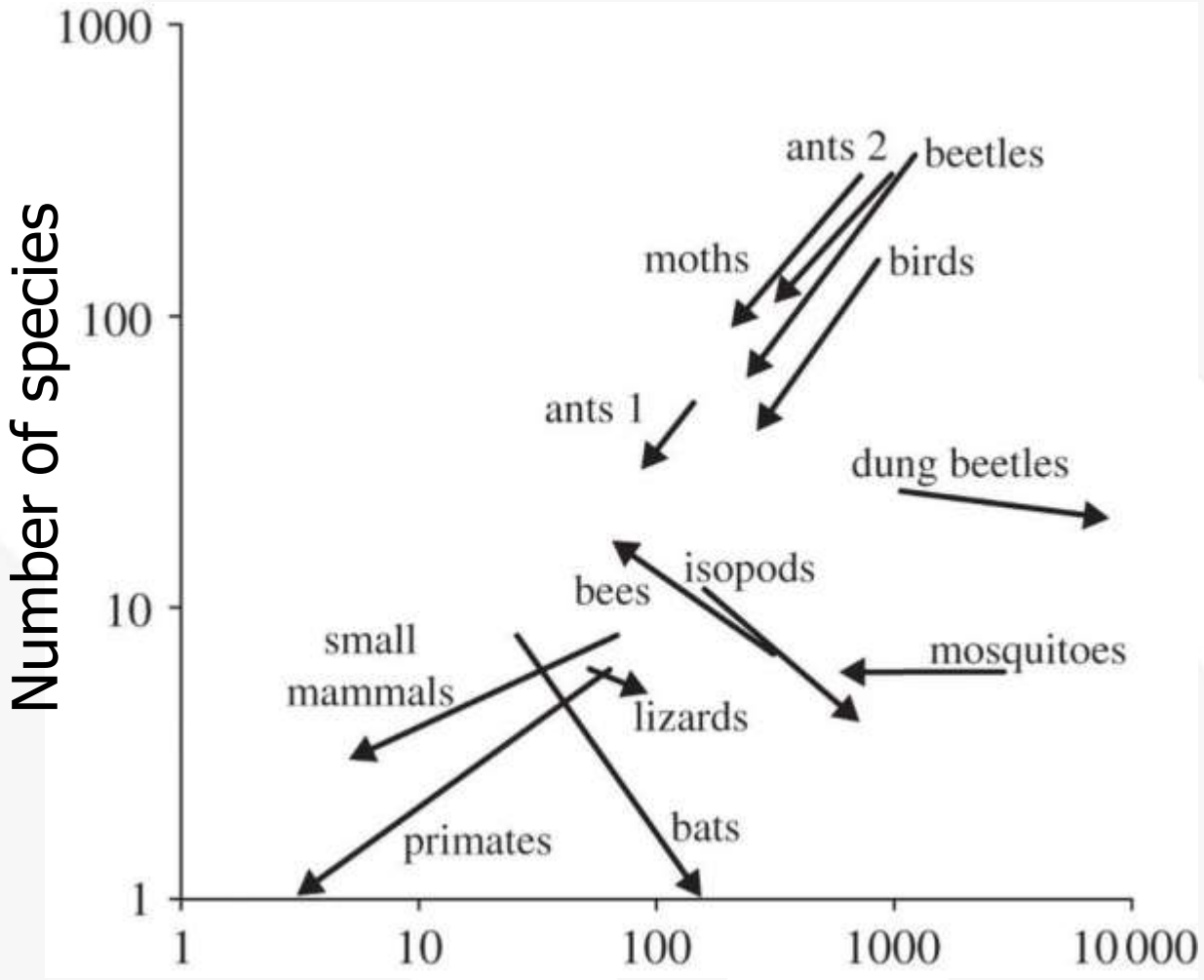
…***at least 30 per cent of terrestrial*** … *areas are effectively conserved and managed through ecologically representative…systems of* ***protected areas***

…urgent management actions to ***halt human induced extinction*** *[and]* ***significantly reduce extinction risk***

…a ***substantial increase*** *of the application of* ***biodiversity friendly practices****, such as …* ***agroecological*** *and other innovative approaches*

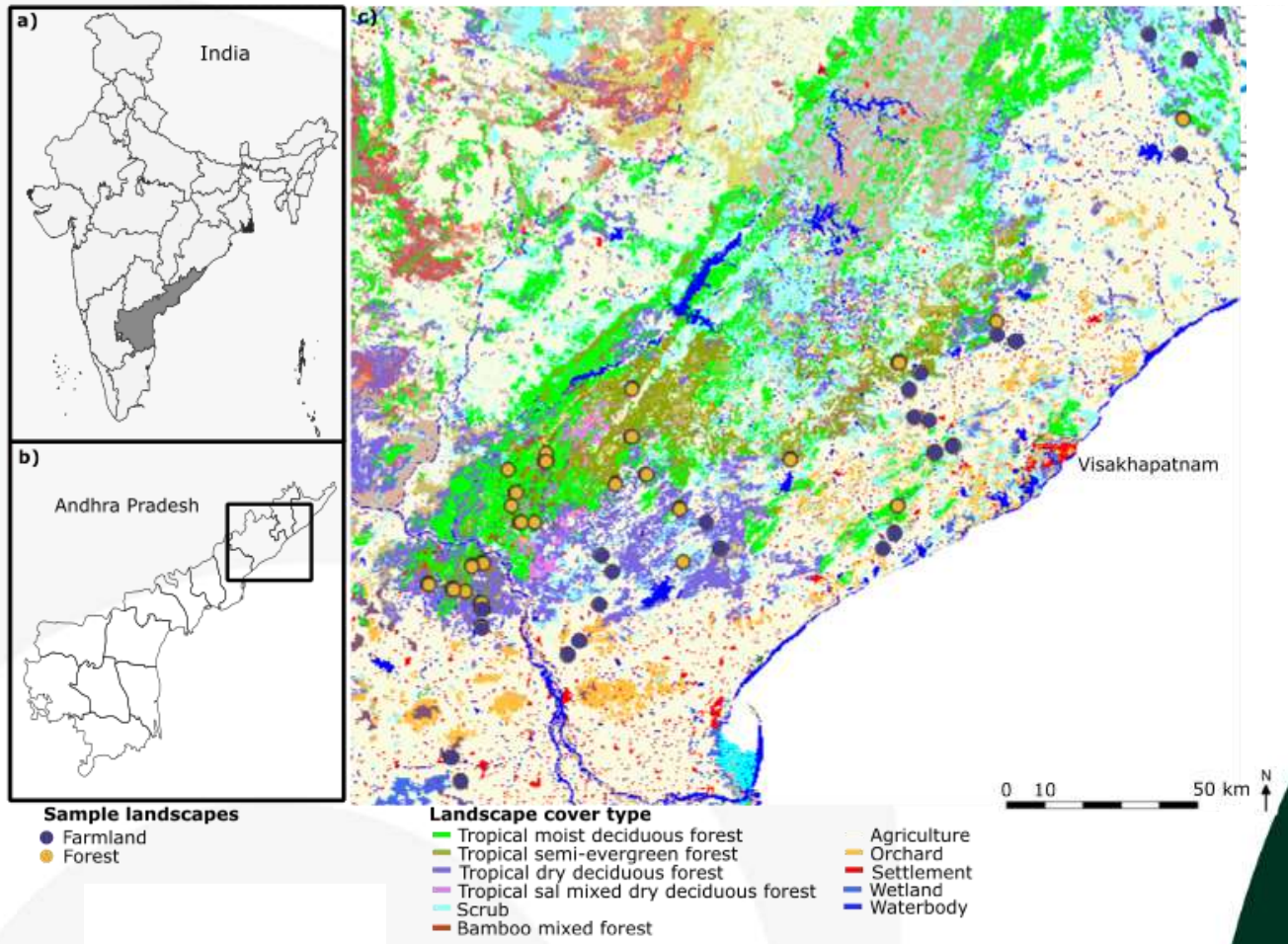
Natural habitat is *almost* always better for biodiversity



Foster et al (2011) *Philos. Trans. R. Soc.* B 366

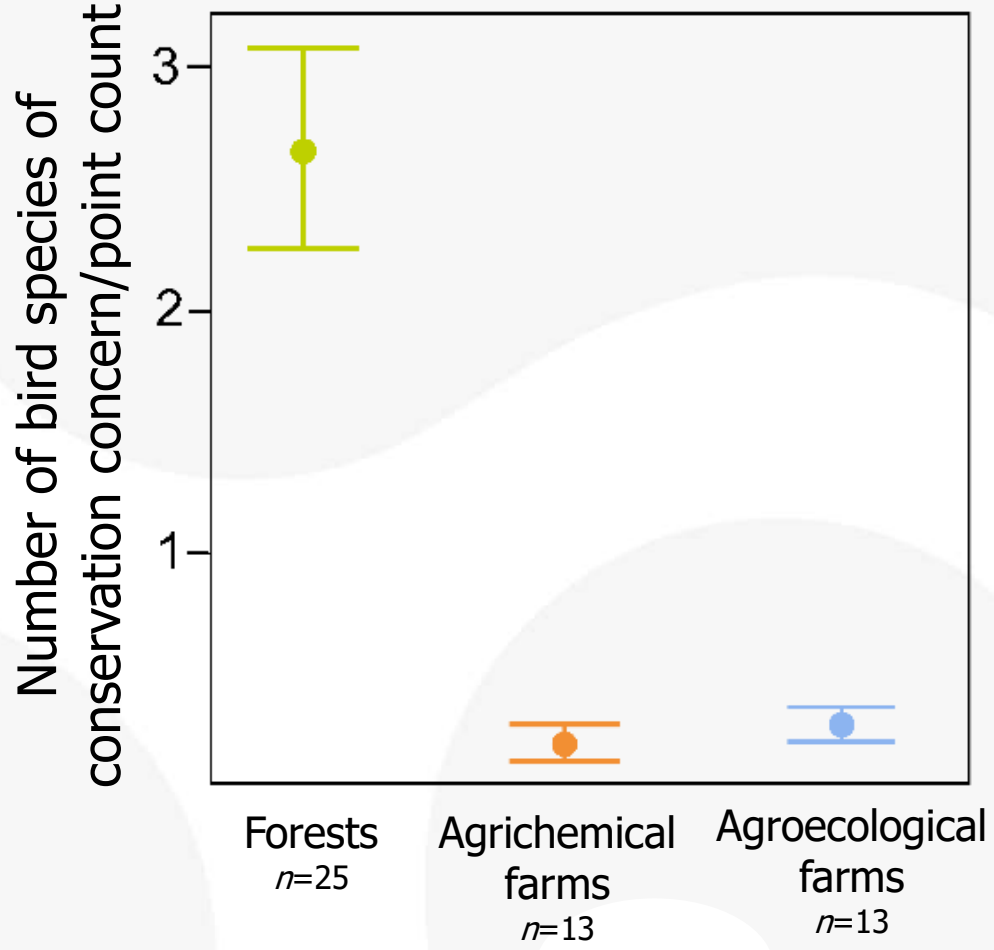
Forest

Oil Palm



- 26 farmed landscapes
- 25 forest landscapes

Natural habitat is *almost* always better for biodiversity



Berger , Kamble….Dicks (2025) *Nature Ecology & Evolution*

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Why bother with biodiversity in farmland?

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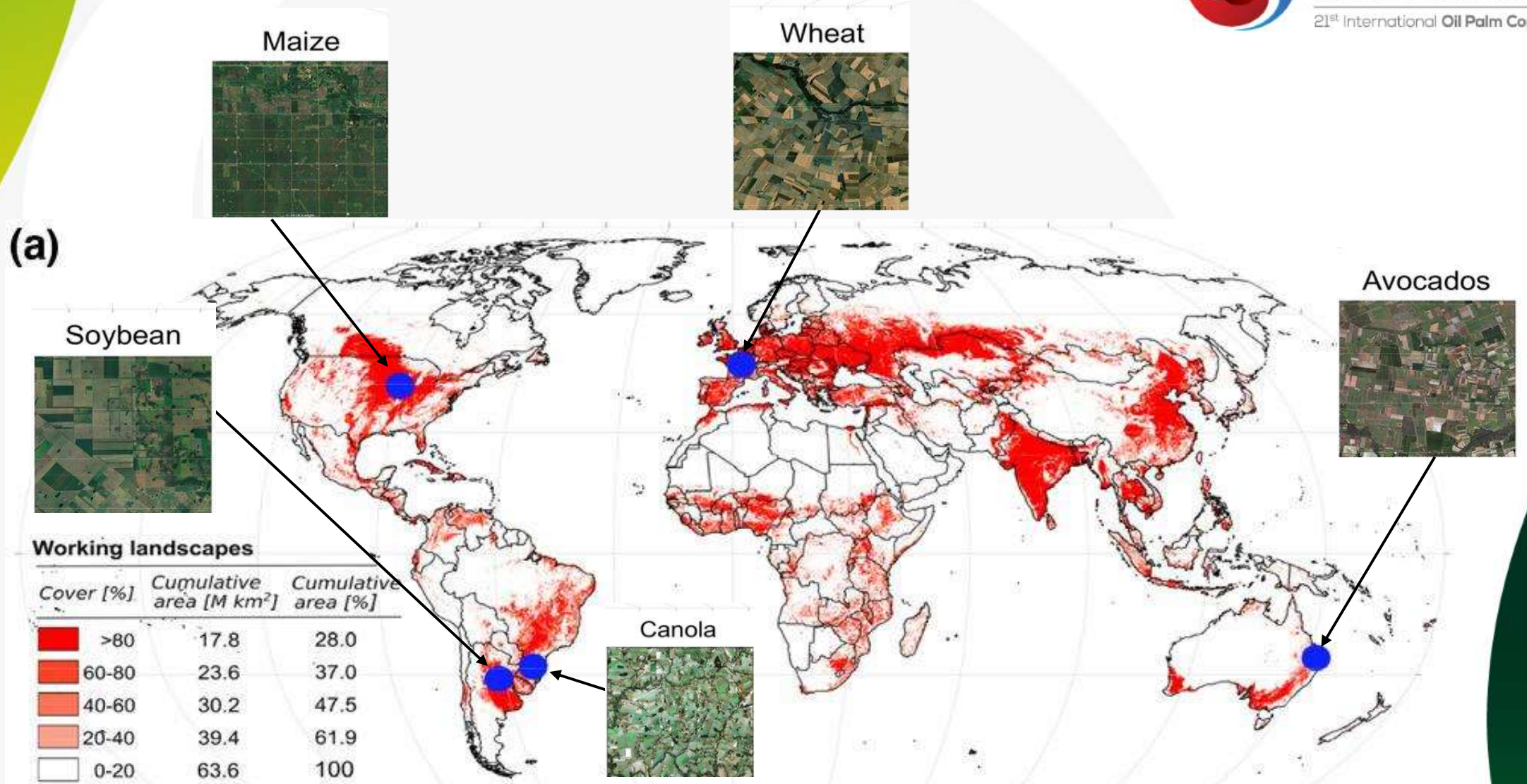
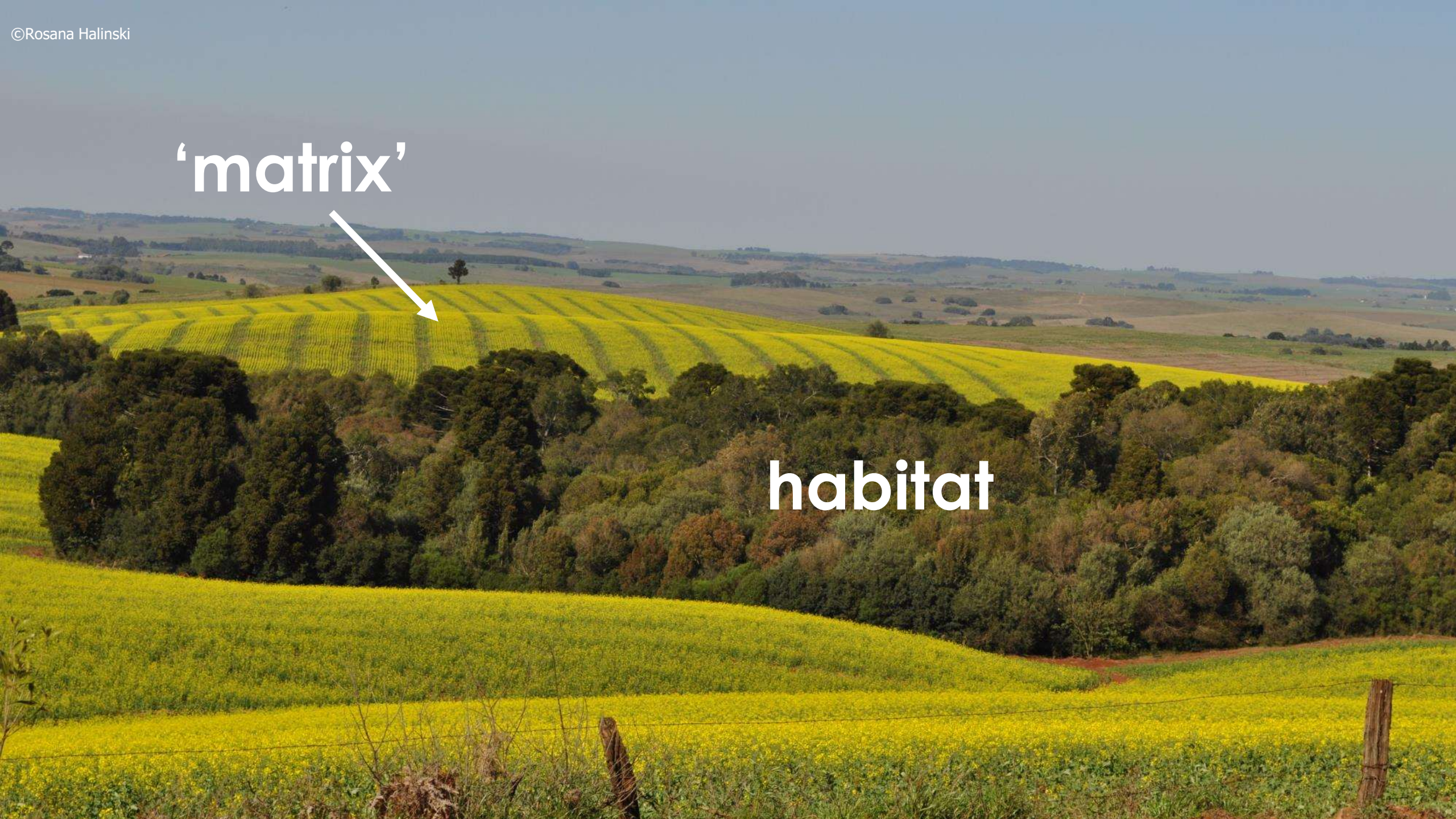
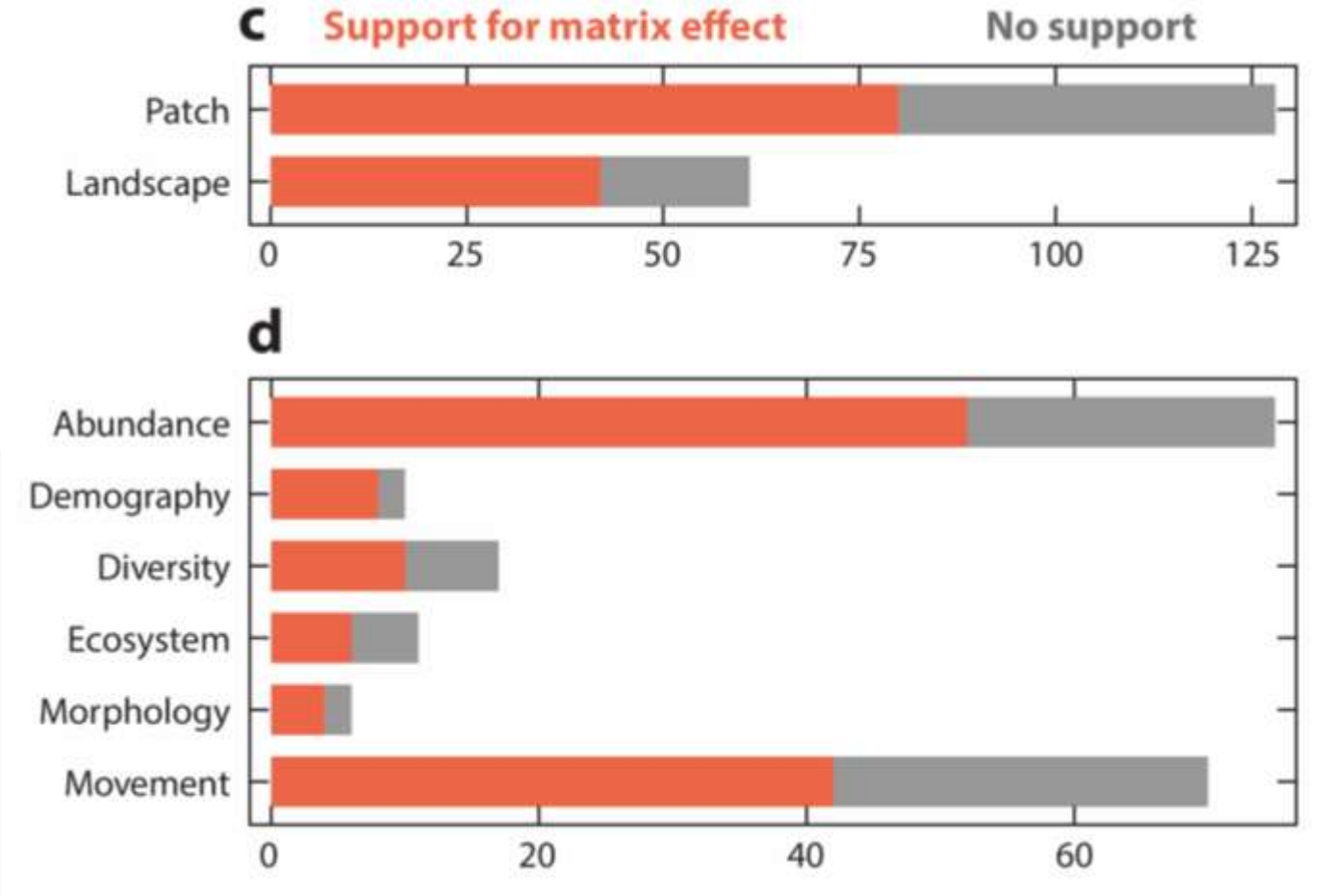
Half the worlds's land



Garibaldi *et al*. (2020) Working landscapes need at least 20% native habitat. *Conservation Letters* e12273


©Rosana Halinski
‘matrix’
habitat

Space between habitats matters



A 'matrix effect' is when the quality or structure of the matrix affects core ecological processes, or species living in habitat fragments

Fletcher *et al*. 2024 *Annual Review of Ecology, Evolution, and Systematics*, 55, 423-447.

‘Functional’ biodiversity supports food production

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Pollinators
(fruit/seed set)

Predators
(pest control)

Decomposers
(recycling)

75% of major food crops depend on pollinators
5-8% of human food (by volume) depends directly

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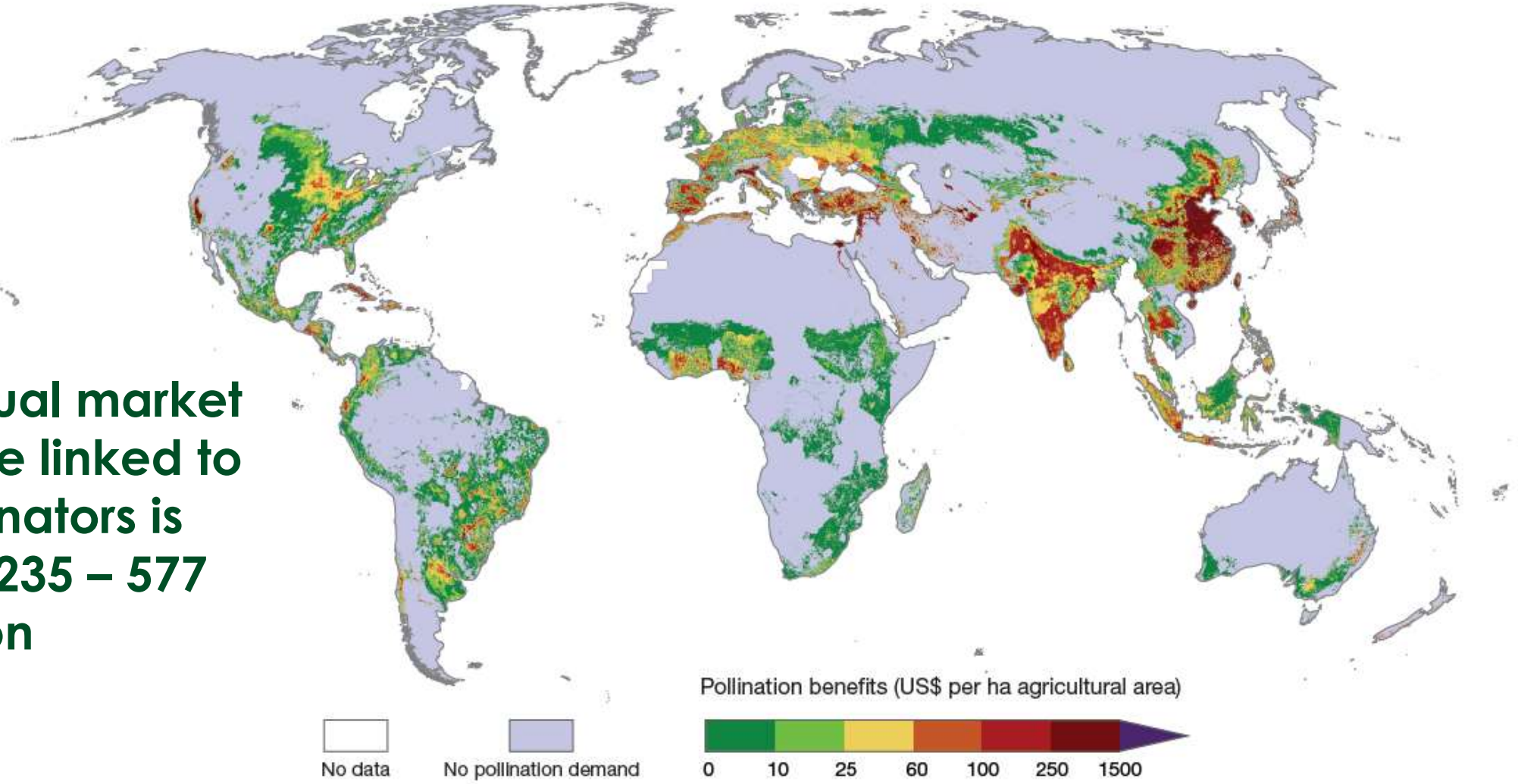

Annual market value linked to pollinators is US$ 235 – 577 billion

Source: Potts *et al* (2016). *Nature* 540, 220-229

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Target 10 addresses these issues

- Proportion of semi-natural or natural habitat in intensive agricultural landscapes is emerging as a key indicator
- **10% of area** often suggested as a threshold
- Can this be reconciled with the need to sustainably **increase** crop yields ('close yield gaps')?

NATURE POSITIVE INITIATIVE

TNFD

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Theory: how natural habitat fragments support production

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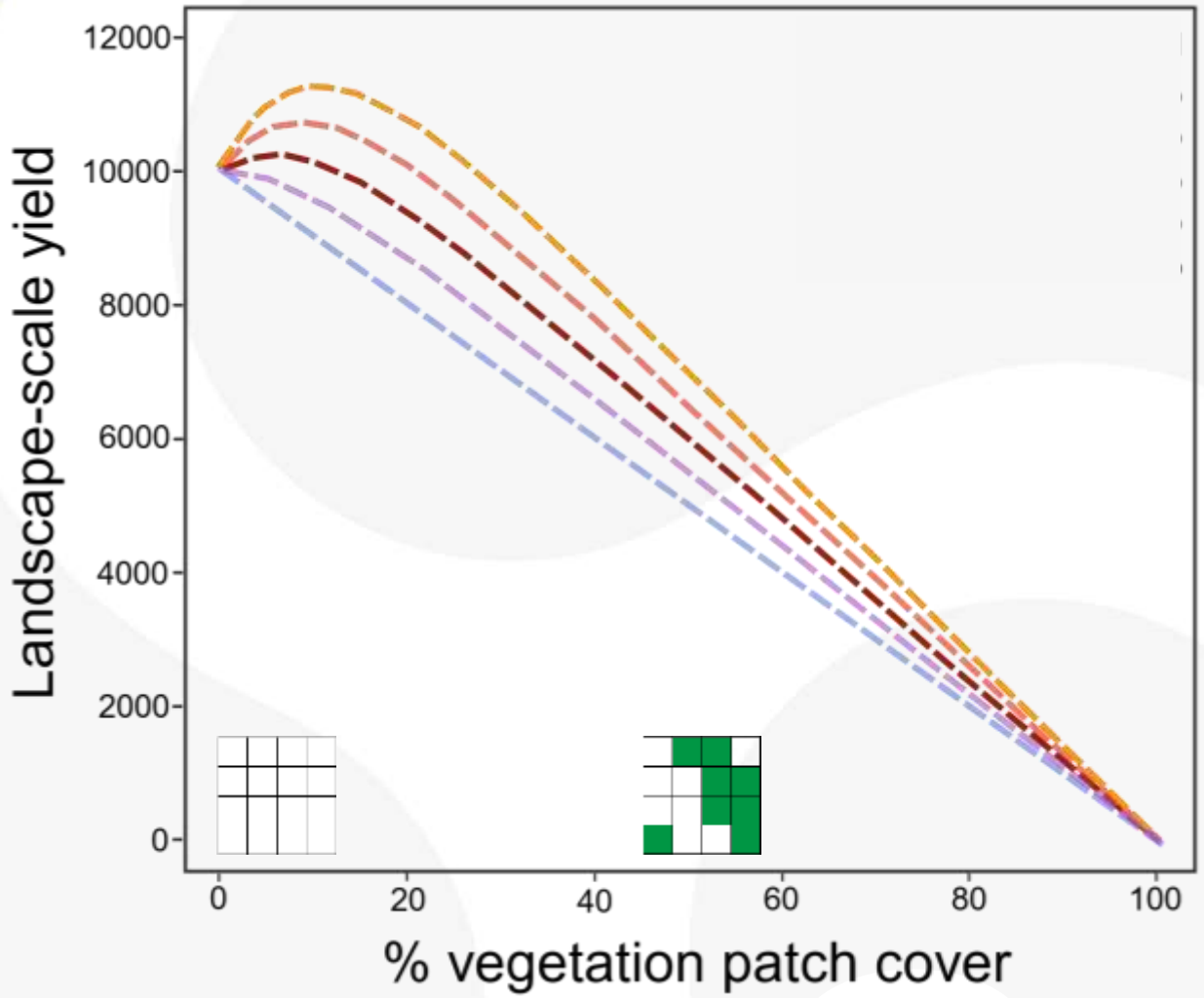
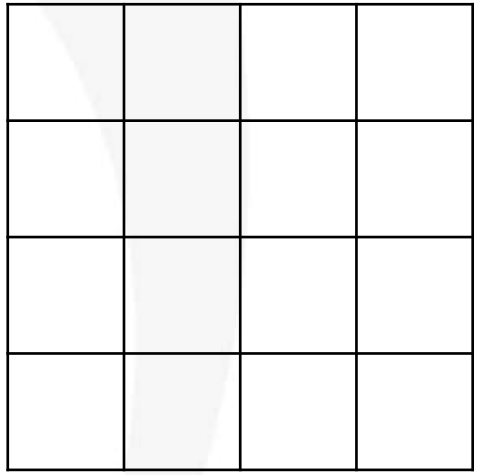
Fragments, or patches of native vegetation

In theory, native vegetation patches benefit production



Benefit to field-level yield in adjacent areas

- 0%
- 10%
- 20%
- 30%
- 40%



Adapted from Garibaldi et al (2020) *Conservation Letters,* 14, e12773

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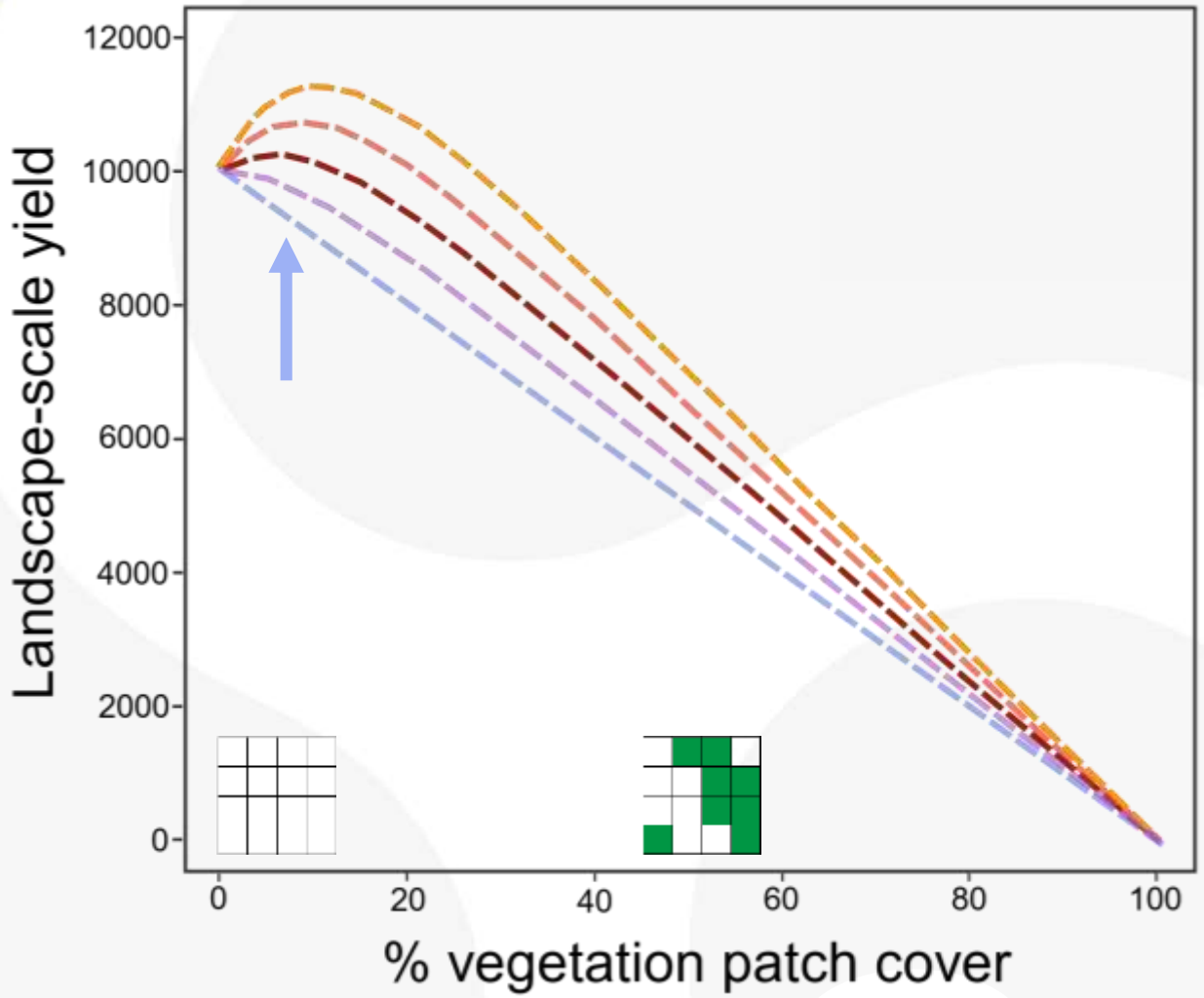

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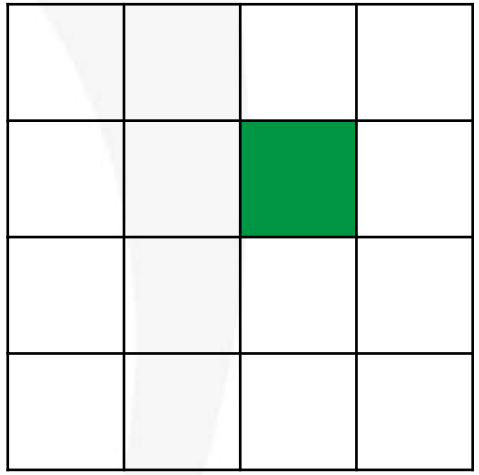

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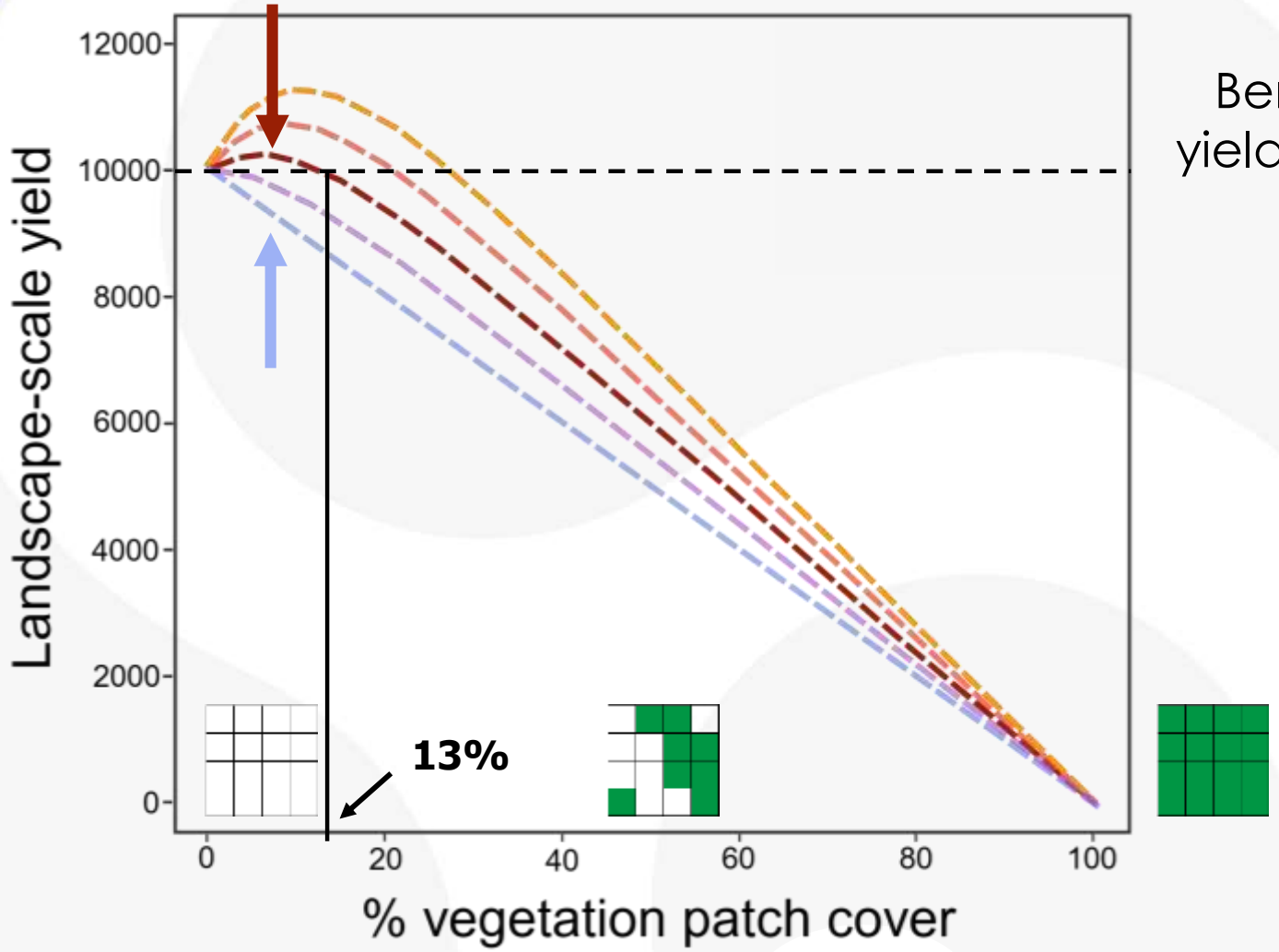

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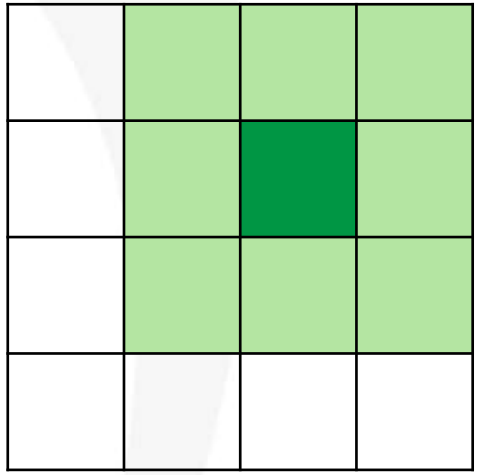

Adapted from Garibaldi et al (2020) *Conservation Letters,* 14, e12773

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Reality: case studies in Indonesia, China and India

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Native tree species in ‘tree islands’, <5% of oil palm plantation

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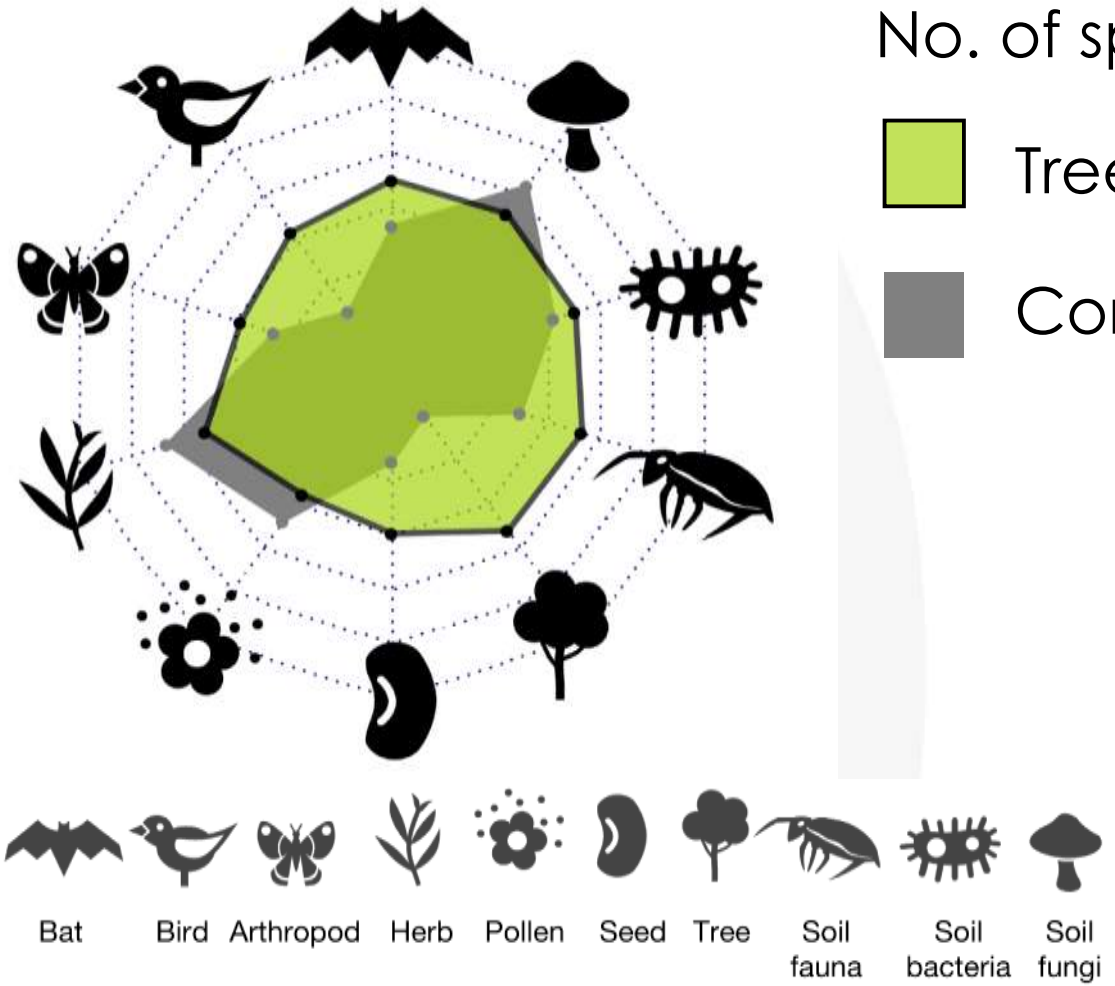
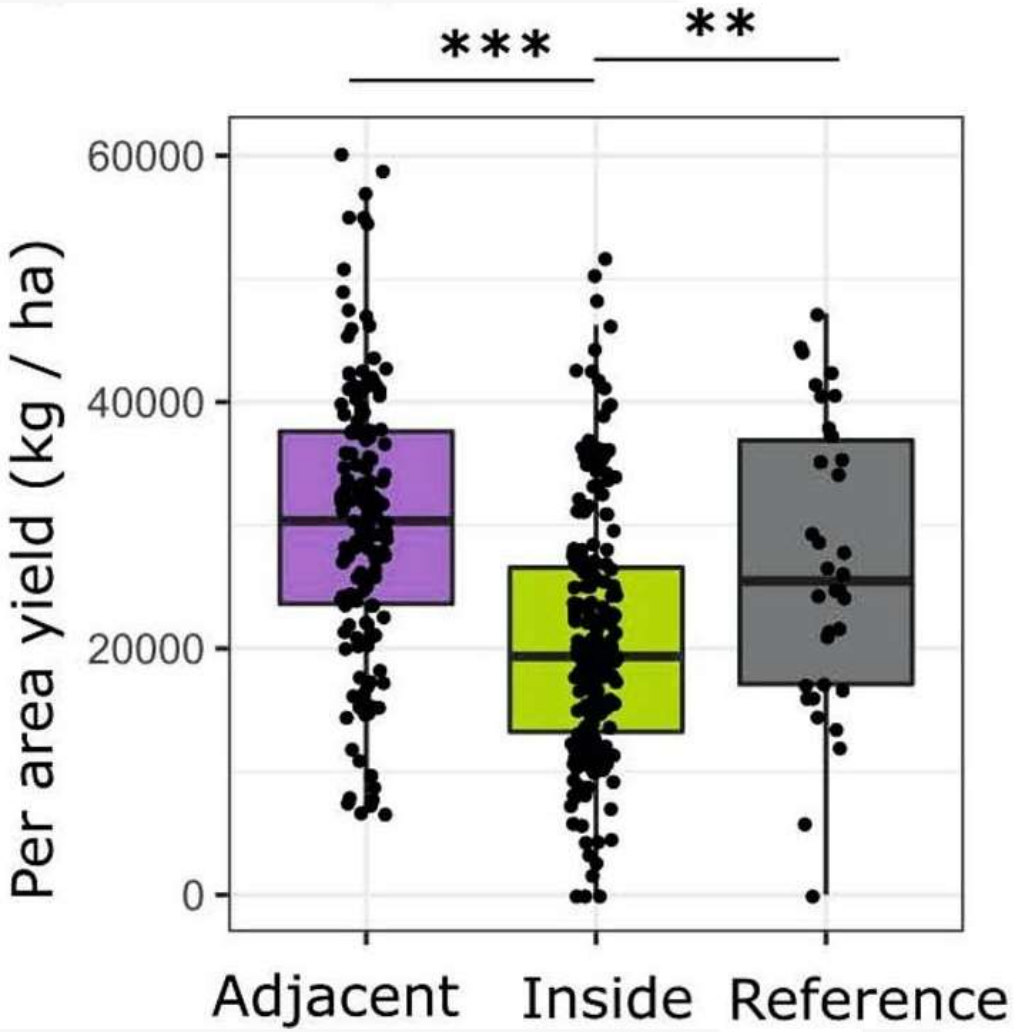


No. of species in:

- Tree islands
- Controls

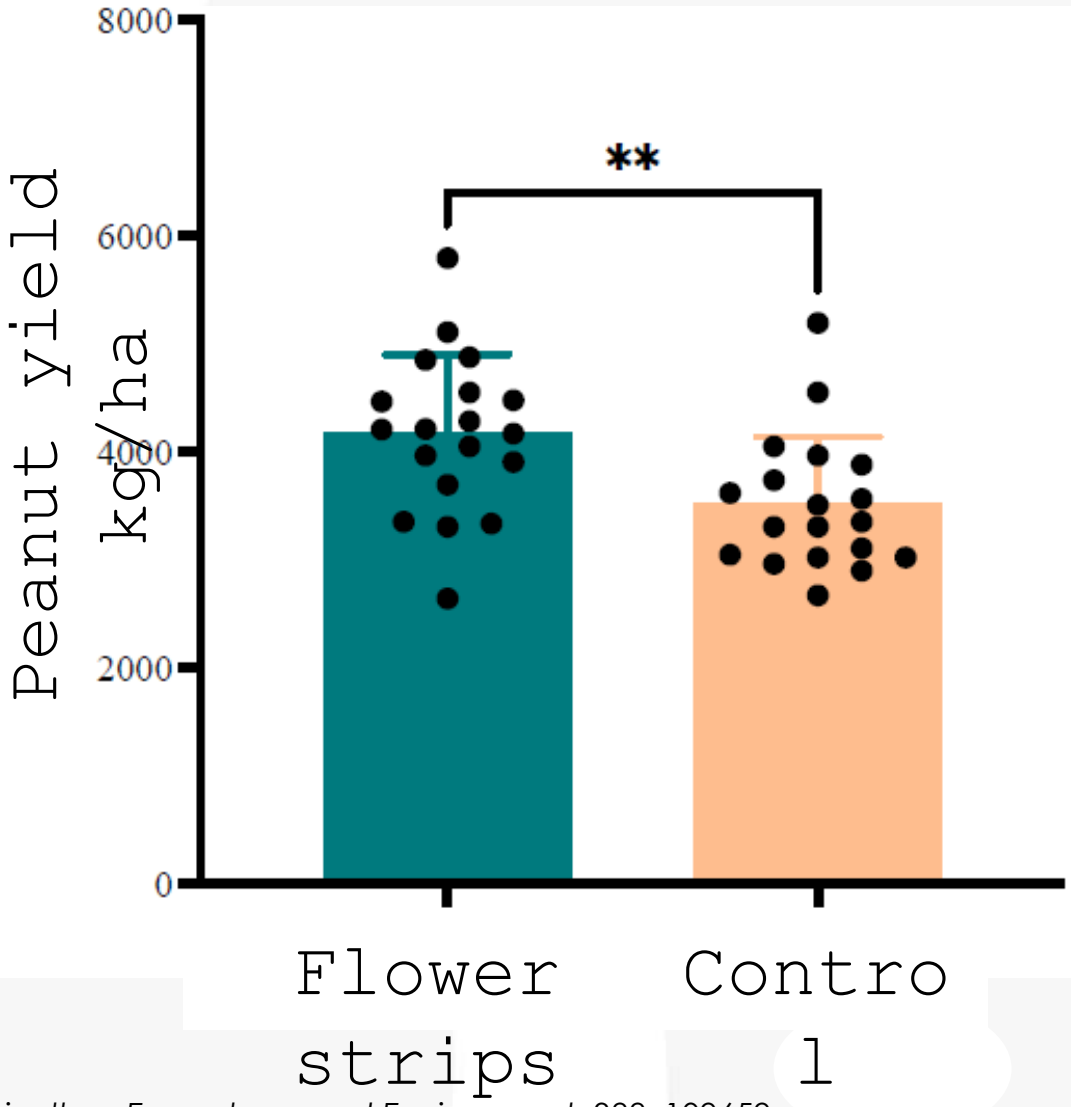
Zemp et al. (2023) *Nature,* 618, 316-321

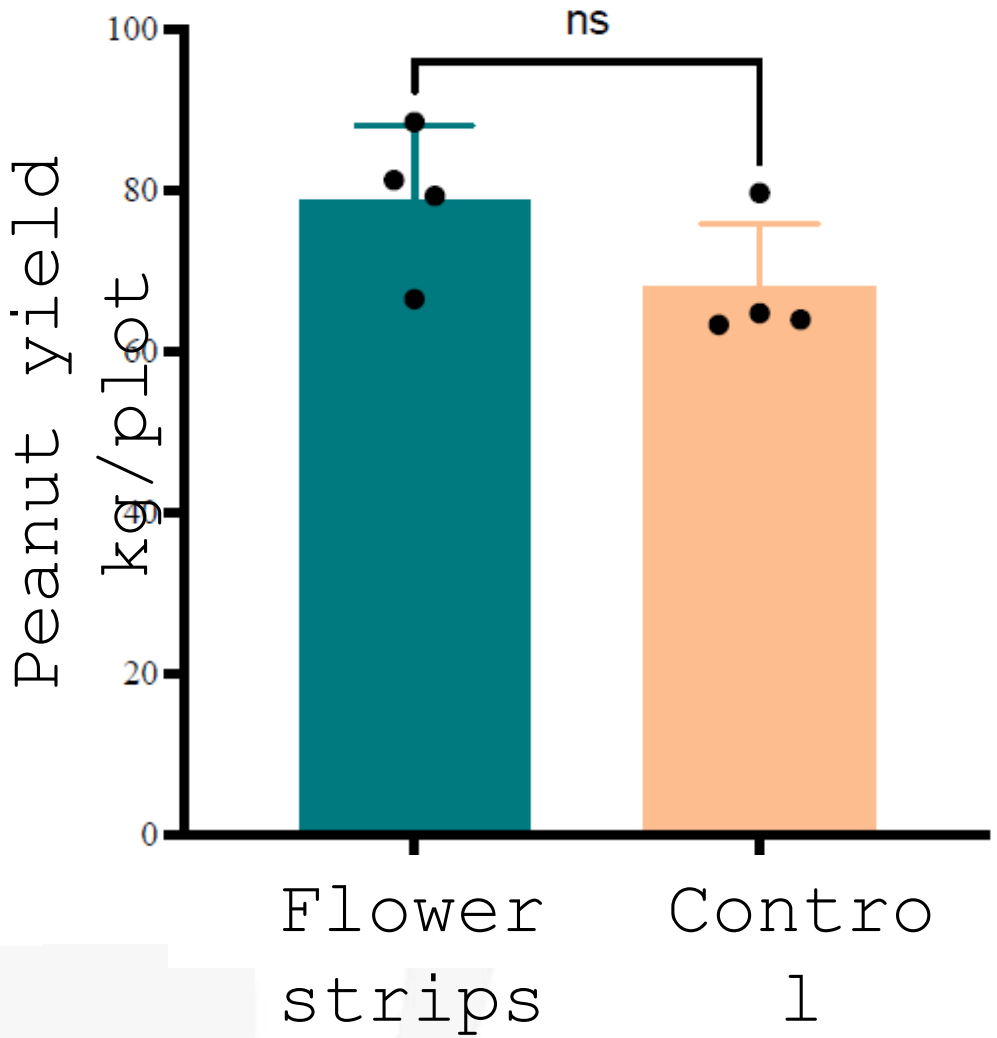
Native tree species in ‘tree islands’, <5% of oil palm plantation



Zemp et al. (2023) *Nature,* 618, 316-321

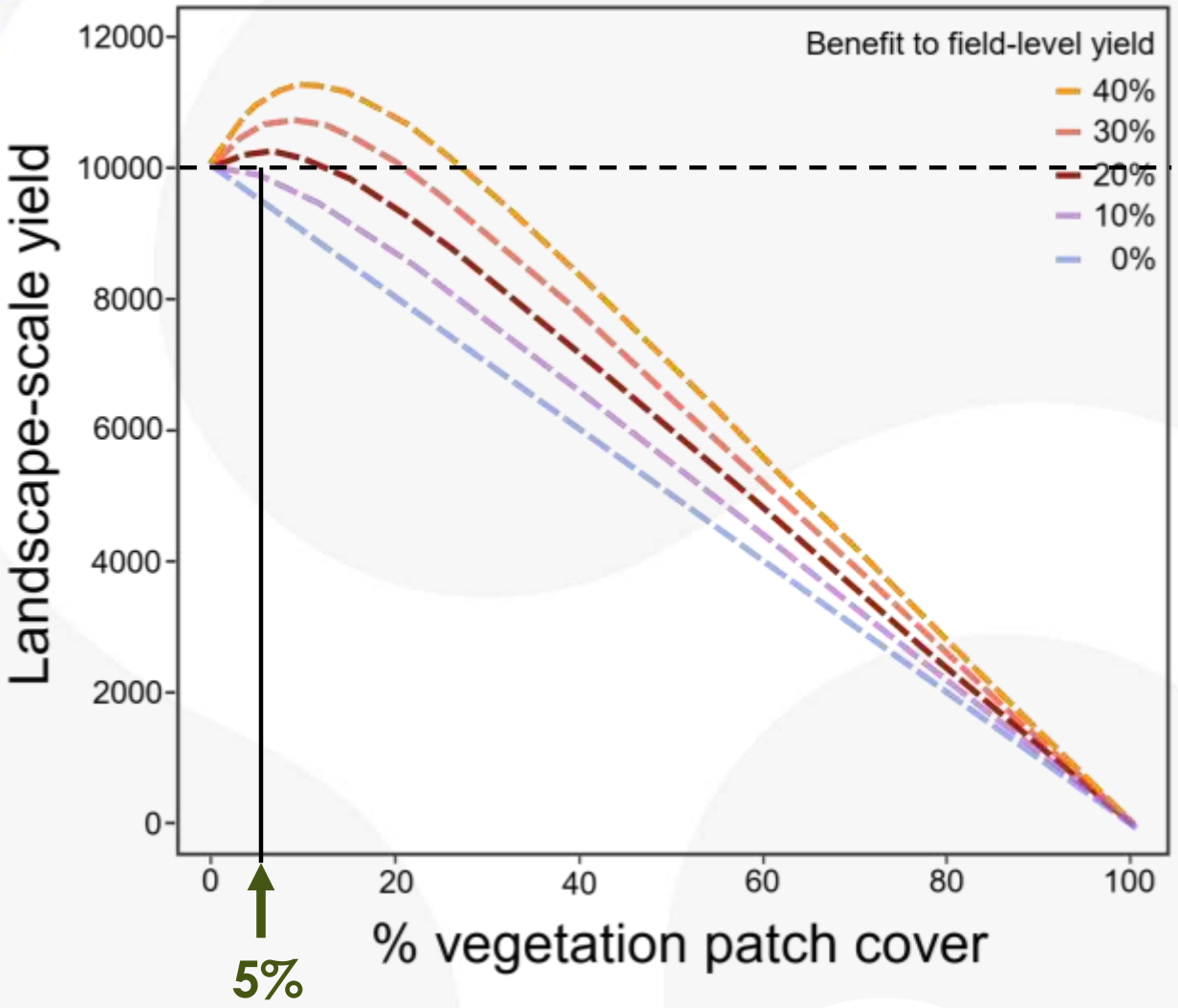
Native flower strips in 4% of peanut-growing area





Ju et al (2025) *Agriculture Ecosystems and Environment*, 388, 109659

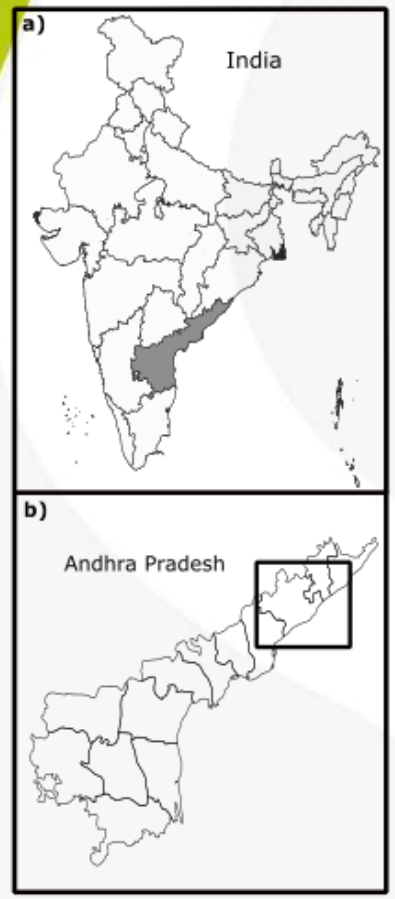
How do these examples fit the theory?

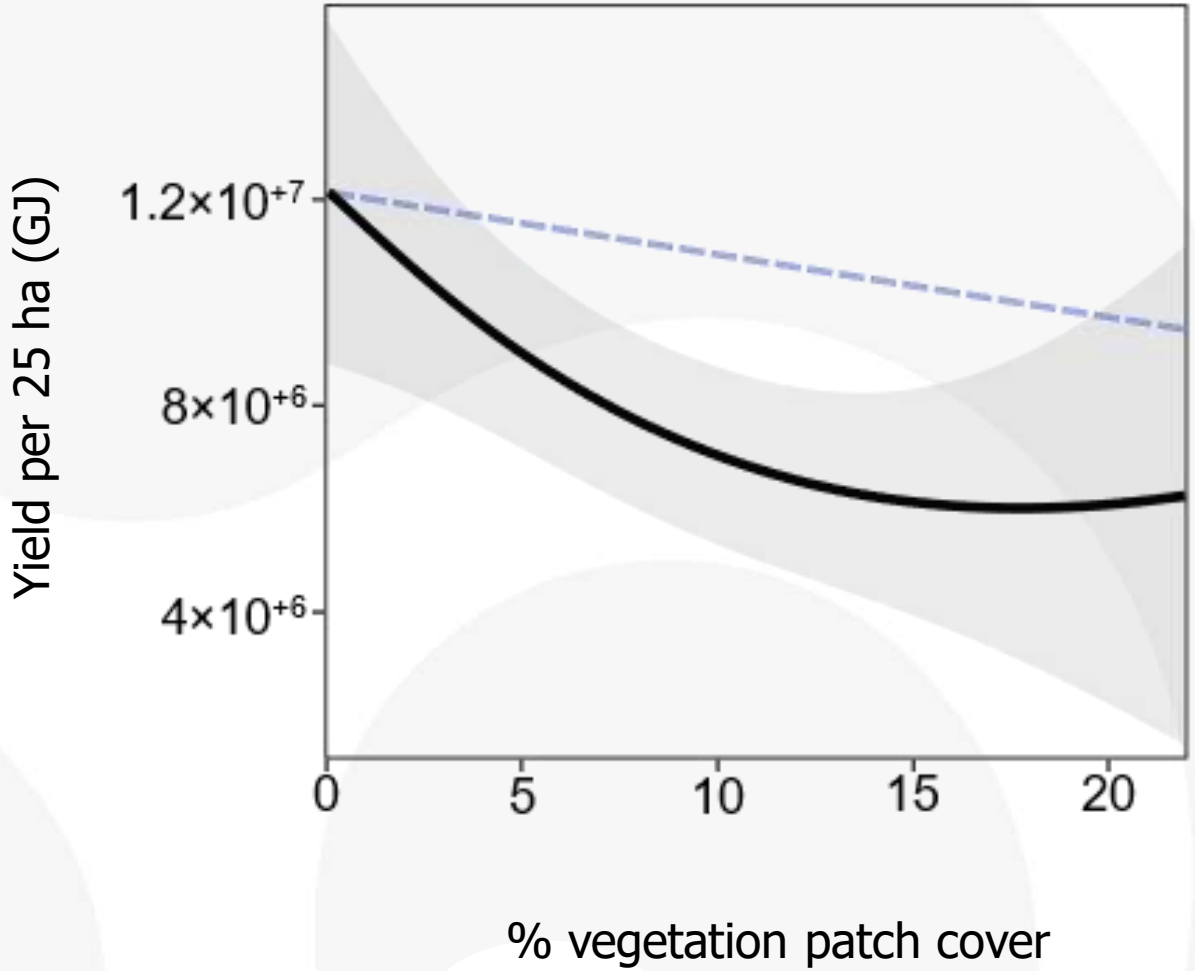


Native trees among oil palm or flowers strips alongside peanuts:

4-5% of land out of production, no overall loss of yield.

But NOT in rice-dominated landscapes in India





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- 40%

Berger, Kamble ….. Dicks (2025) *Landscape Ecology*, 40, 145


©Iris Berger

This agroecological system (ZBNF) is productive and more profitable….

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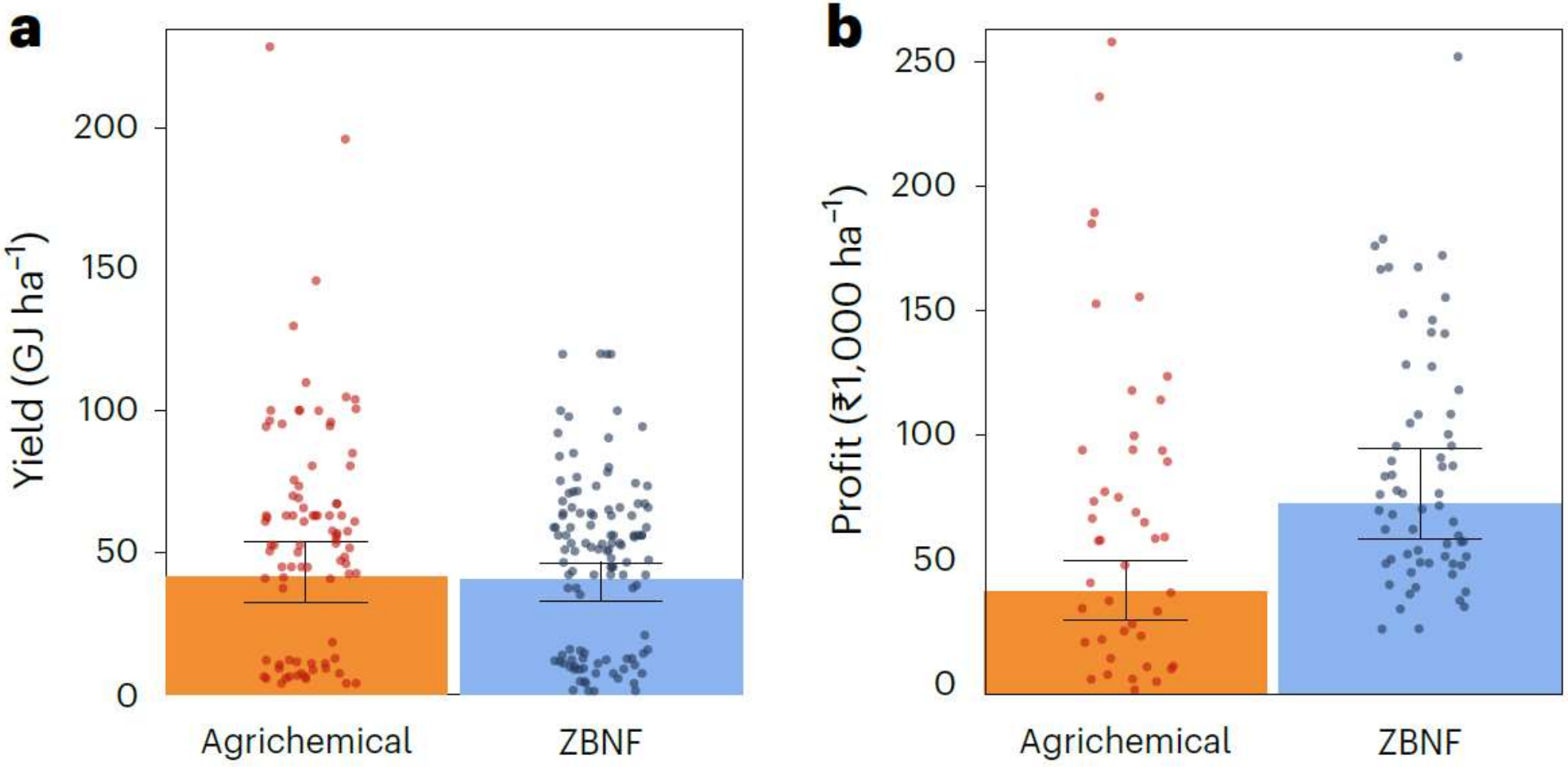
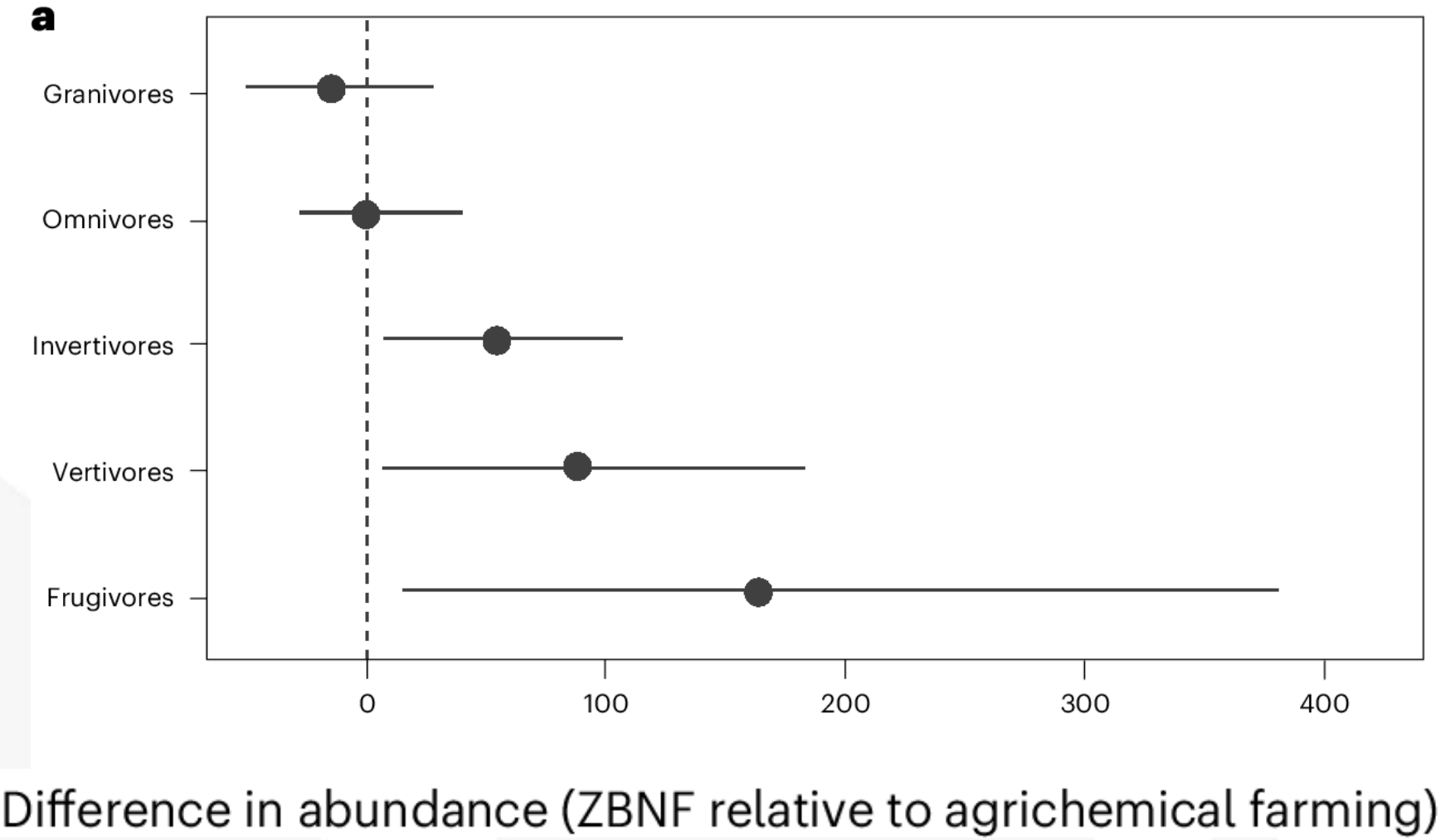


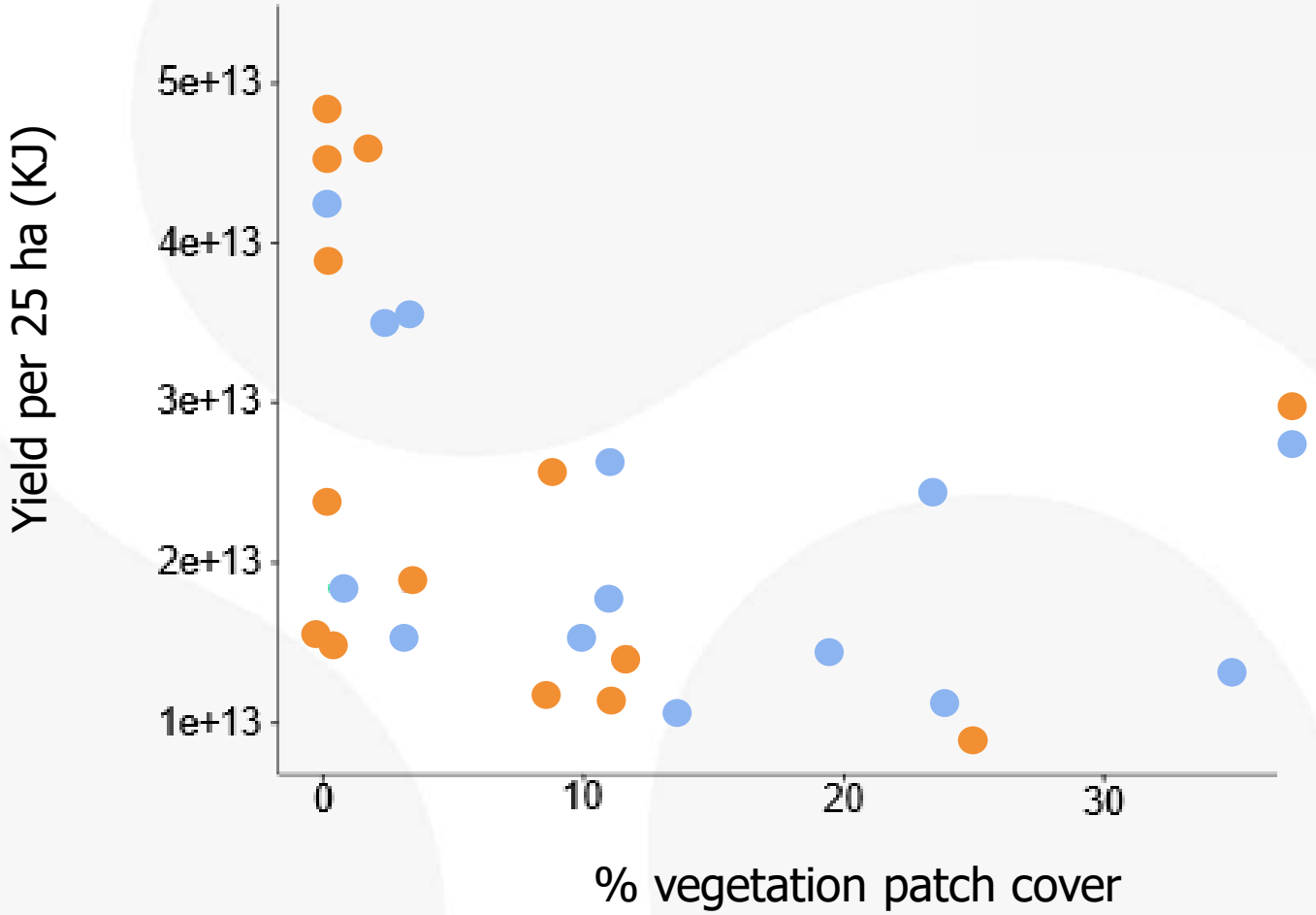
Berger , Kamble….Dicks (2025) *Nature Ecology & Evolution*

…supports functionally beneficial birds, like insectivores…



Berger , Kamble….Dicks (2025) *Nature Ecology & Evolution*

…these effects are not due to habitat patches



- Agrichemical
- Agroecological

Berger , Kamble….Dicks (2025) *Nature Ecology & Evolution*

What is the role of agriculture in protecting biodiversity?

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- Large areas of **natural habitat** must not be compromised for 'more sustainable' farming

- Agricultural landscapes support **'functional' biodiversity** and allow other species to move through them

- **Agroecological approaches** are part of the solution when they are highly productive and carefully designed

MUCHAS GRACIAS

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