
# Agroecology for biodiversity conservation and agricultural production

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PLANT LINK

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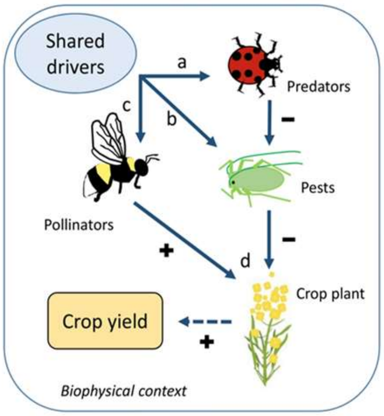
# Linking ecology and farming

"Human land use threatens global biodiversity and compromises multiple ecosystem functions critical to food production." (Dainese et al. 2019)




Dainese et al. (2019) A global synthesis reveals biodiversity-mediated benefits for crop production. Science Advances 5:eaax0121; Lundin, Rundlöf, Jonsson, Bommarco, Williams (2021) Integrated pest and pollinator management – expanding the concept. Frontiers Ecol Environ 19: 283-291.

# Few species deliver most crop pollination

2% of bee species deliver 80% of crop flower visits ≈ pollination (Kleijn et al. 2015)

Species of relevance in a Swedish context

| Rank | Species | Alfalfa | Almond | Apple | Carrot | Coffee | Cranberry | Field Bean | H. Blueberry | Leek | Musk melon | Oil Seed Rape | Onion | Passion fruit | Pear | Red Clover | Squash | Strawberry | Sunflower | Tomato | Watermelon | Total no. crops | Total no. studies |
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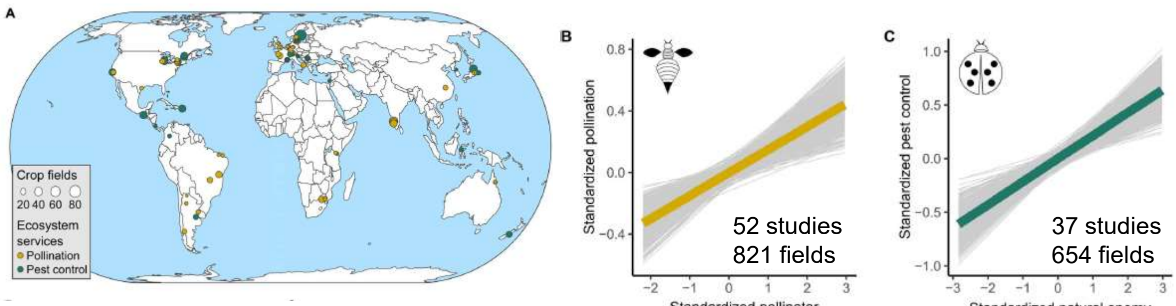
Kleijn et al. (2015) Delivery of crop pollination services is an insufficient argument for wild pollinator conservation. Nature Communications 6: 7414

# Linking ecology and farming

Can crop yield–related ecosystem services be maintained by a few dominant species?

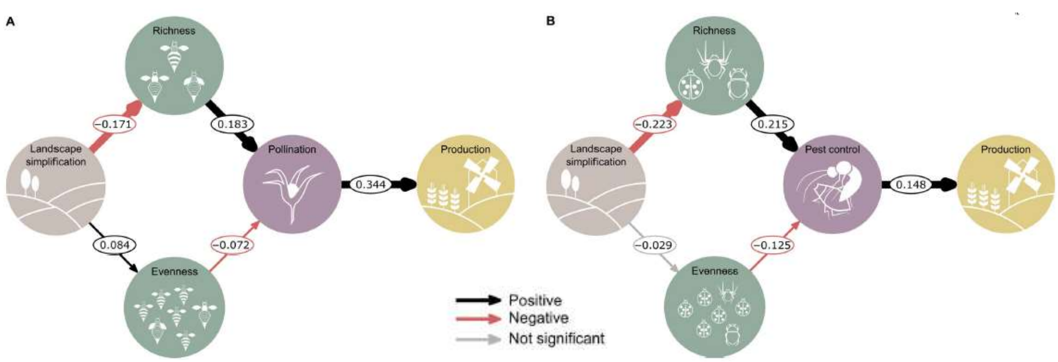



89 studies including 1475 crop fields

Dainese et al. (2019) A global synthesis reveals biodiversity-mediated benefits for crop production. Science Advances 5: eaax0121.

# Linking ecology and farming

Pollinator and pest natural enemy richness supported ecosystem services alongside and independently of abundance and dominance – with up to 50% of negative links between landscape simplification and ecosystem service delivery due to richness loss

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# Linking ecology and farming

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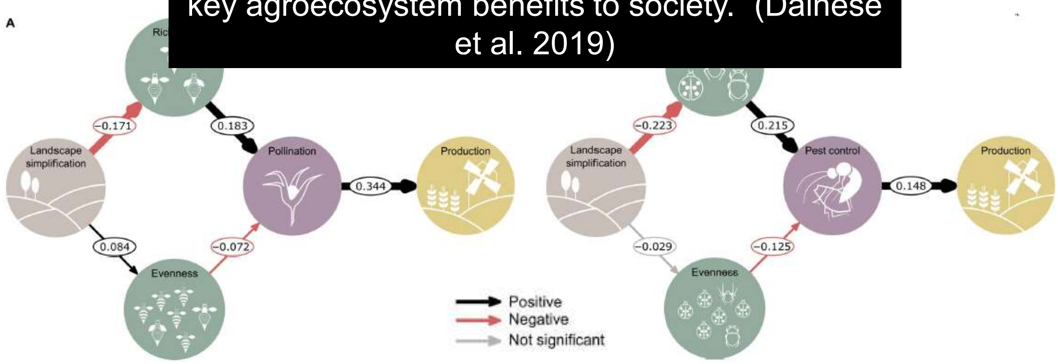
"Maintaining the biodiversity of ecosystem service providers is therefore vital to sustain the flow of key agroecosystem benefits to society." (Dainese et al. 2019)

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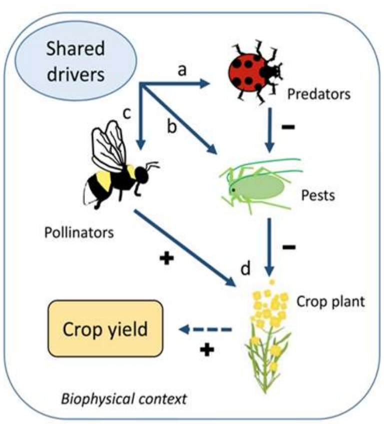
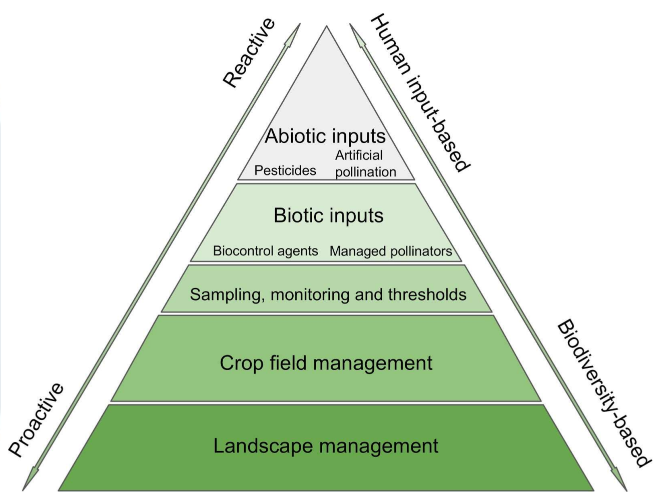
# Integrated Pest and Pollinator Management - IPPM

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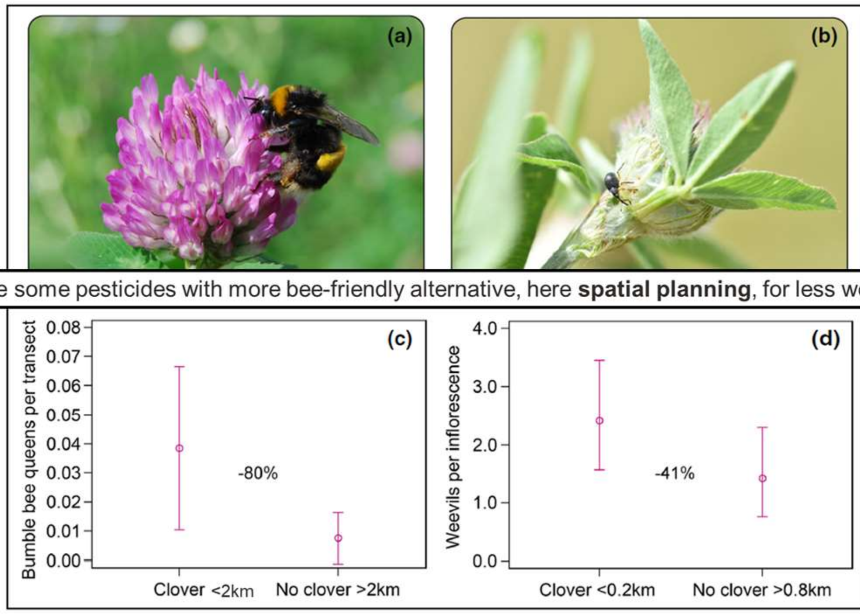
Biddinger & Rajotte (2015) Integrated pest and pollinator management — adding a new dimension to an accepted paradigm. Current Opinion in Insect Science 10: 204-209; Egan et al. (2021) Delivering integrated pest and pollinator management (IPPM). Trends Plant Sci 25: 577-589; Lundin, Rundlöf, Jonsson, Bommarco, Williams (2021) Integrated pest and pollinator management – expanding the concept. Frontiers Ecol Environ 19: 283-291.




Replace some pesticides with more bee-friendly alternative, here **spatial planning**, for less weevils in clover seed

Rundlöf et al. (2014) Late-season mass-flowering red clover increases bumble bee queen and male densities. Biol Conserv 172: 138–45; Lundin O, Rundlöf M, Smith HG, and Bommarco R. 2016. Historical change and drivers of insect pest abundances in red clover seed production. Agr Ecosyst Environ 233: 318–24; Lundin, Rundlöf, Jonsson, Bommarco, Williams (2021) Integrated pest and pollinator management – expanding the concept. Frontiers Ecol Environ 19: 283-291.

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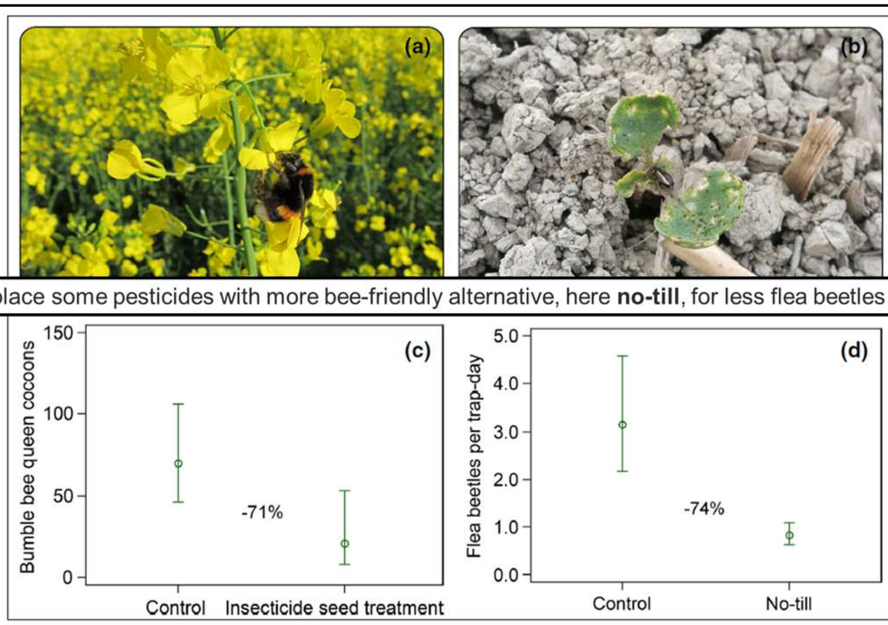


Replace some pesticides with more bee-friendly alternative, here **no-till**, for less flea beetles in oilseed rape

Rundlöf et al. (2015) Seed coating with a neonicotinoid insecticide negatively affects wild bees. Nature 521: 77-80; Lundin O. 2019. No-till protects spring oilseed rape (*Brassica napus* L) against crop damage by flea beetles (*Phyllotreta* spp). Agr Ecosyst Environ 278: 1–5; Lundin, Rundlöf, Jonsson, Bommarco, Williams (2021) Integrated pest and pollinator management – expanding the concept. Frontiers Ecol Environ 19: 283-291.

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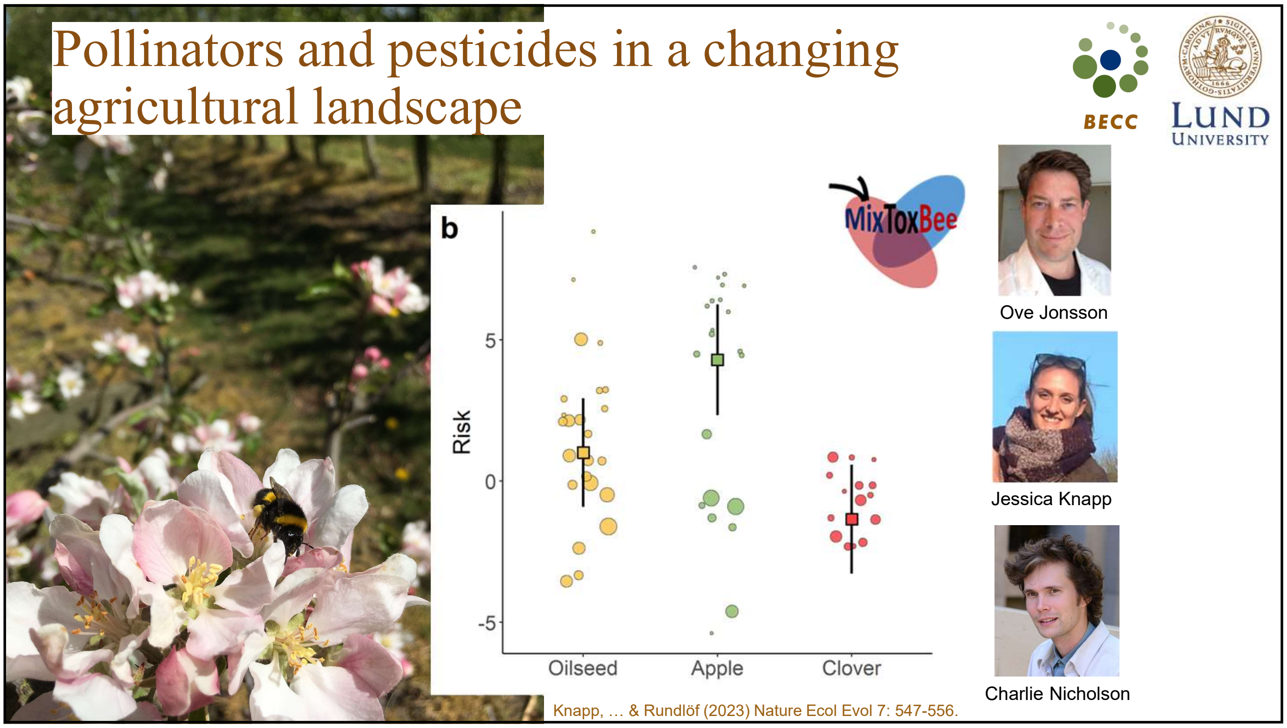
Pollinators and pesticides in a changing agricultural landscape
BECC
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MixToxBee
b
Risk
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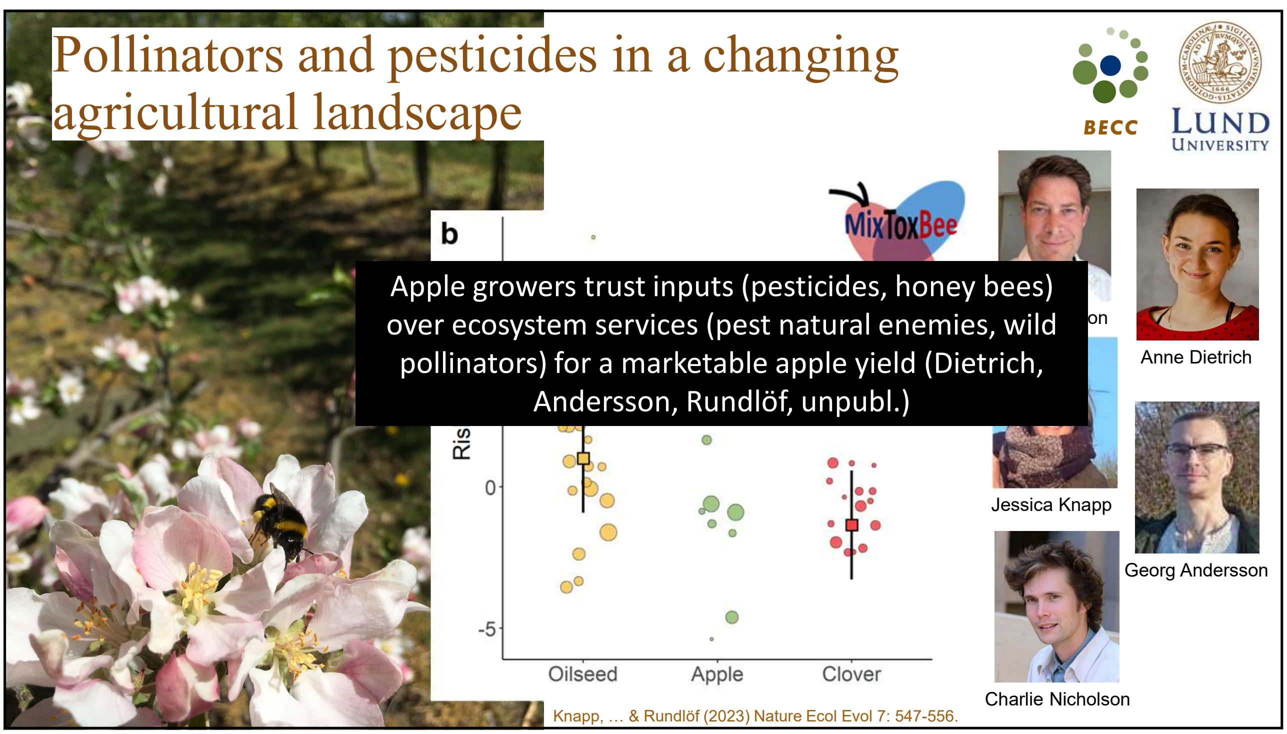
Oilseed
Apple
Clover
Ove Jonsson
Jessica Knapp
Charlie Nicholson
Knapp, … & Rundlöf (2023) Nature Ecol Evol 7: 547-556.


Pollinators and pesticides in a changing agricultural landscape
BECC
LUND UNIVERSITY
MixToxBee
b
Apple growers trust inputs (pesticides, honey bees) over ecosystem services (pest natural enemies, wild pollinators) for a marketable apple yield (Dietrich, Andersson, Rundlöf, unpubl.)
Anne Dietrich
Georg Andersson
Jessica Knapp
Charlie Nicholson
0
-5
Oilseed
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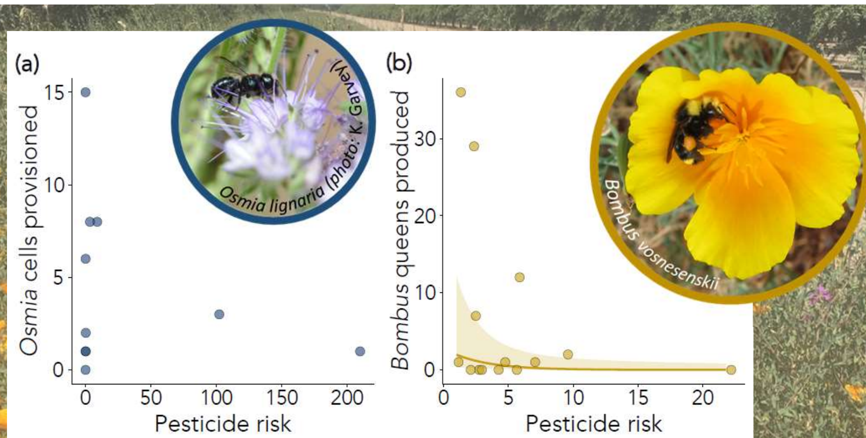
# Pesticide effects on bees

- Our North American field study including two species of bees suggests that the pesticide mixture risk limits nesting and reproduction given flower resources





Rundlöf, Stuligross, Lindh, Malfi, Burns, Mola, Cibotti, Williams (2022) J Appl Ecol. 59:2117–2127.

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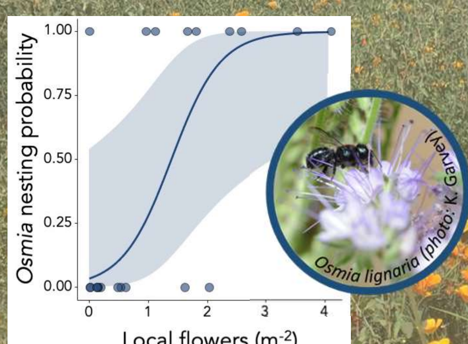
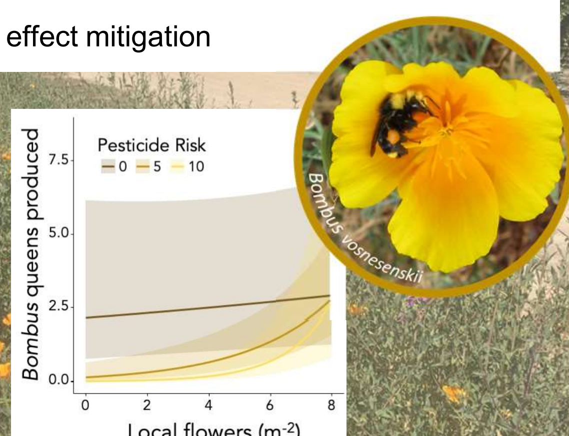
# Flowers for pesticide mitigation

- That same field study also suggests that flower plantings can be a source of pesticide exposure, BUT **provide a net reproductive benefit**
- For the bumble bee also pesticide effect mitigation





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→ wild pollinator conservation can't be argued through crop pollination services

Species of relevance in a Swedish context

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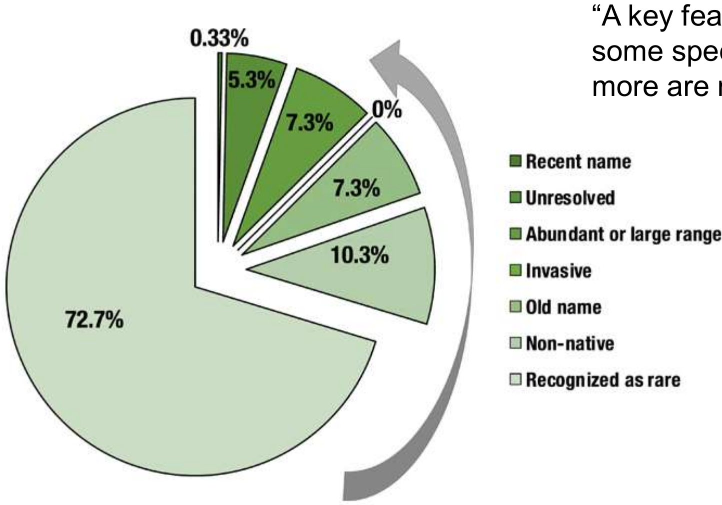
# Most species are rare




"A key feature of life's diversity is that some species are common but many more are rare." (Enquist et al. 2019)

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Enquist et al. (2019) The commonness of rarity: Global and future distribution of rarity across land plants. Science Advances 5: aaz0414.


Conserving and restoring habitat for the rare
Funded by the European Union
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Conserving and restoring habitat for the rare
Need for both land sparing and sharing for achieving both biodiversity conservation and agricultural production
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