Strategies for mitigating environmental risks from indirect effects of pesticides at field and landscape level

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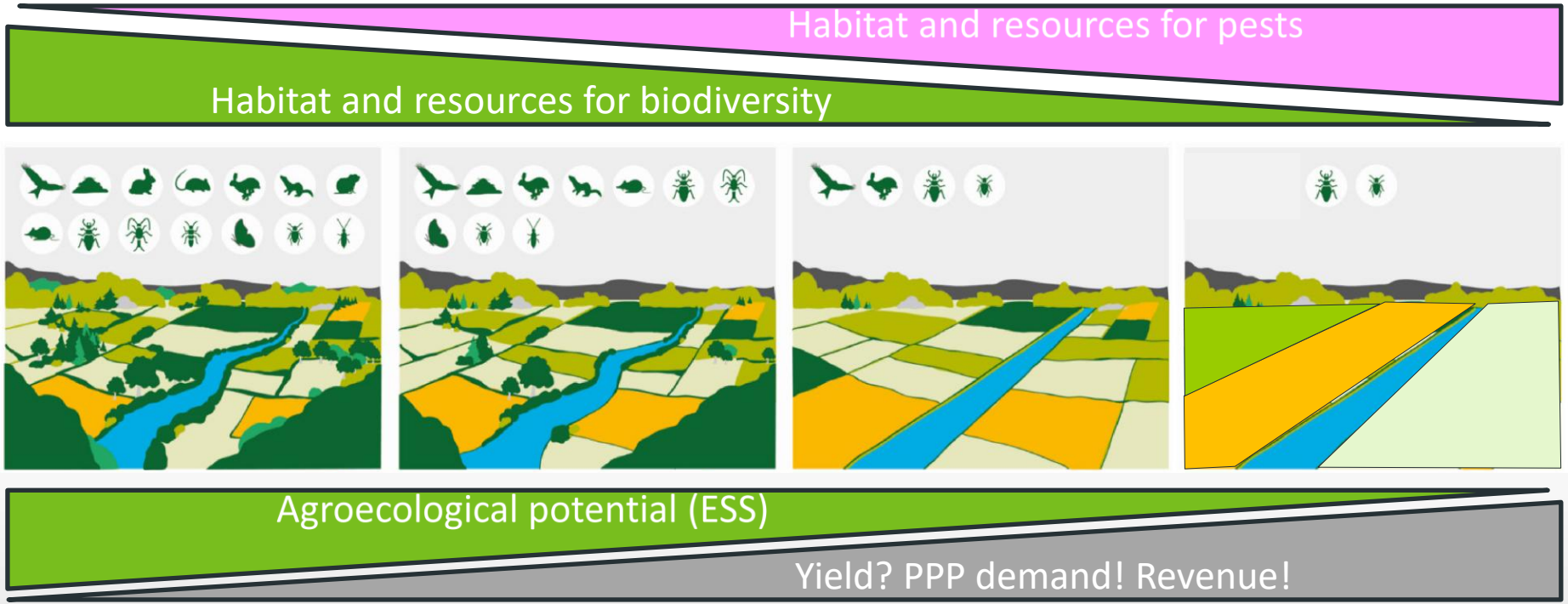
Land-use and landscape change – loss of biodiversity and loss of agroecological potential



Landscape pictures adapted from European Court of Auditors (2020) doi: 10.2865/336742

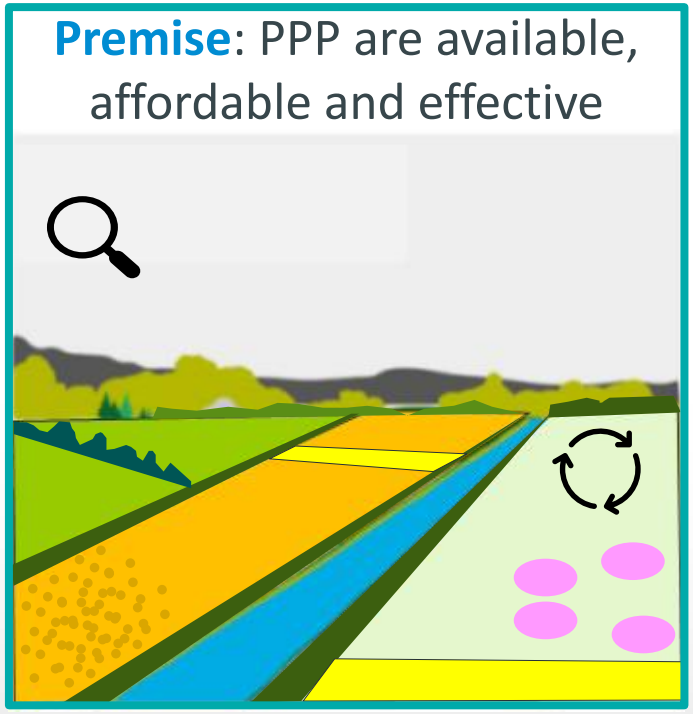
Incremental strategies of pesticide mitigation at field and landscape scale

IPM: Pest monitoring, economic thresholds

Limit PPP dispersion e.g. wind breaks

Cultivar selection; genetic diversification

Premise: PPP are available, affordable and effective



Buffer zones

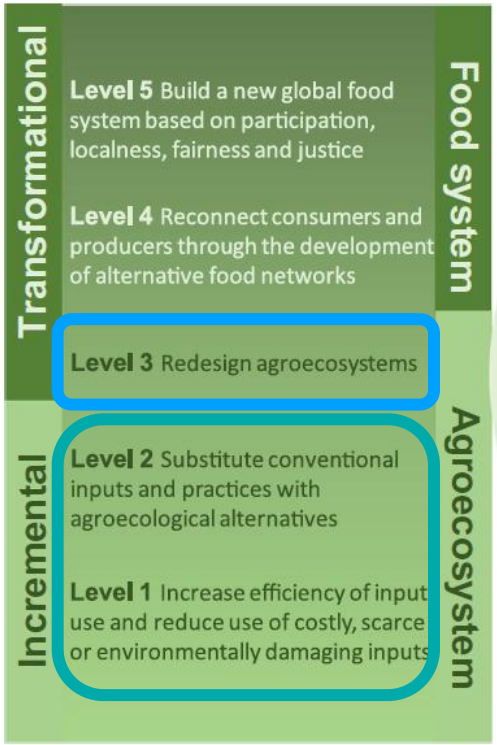
Refuge areas

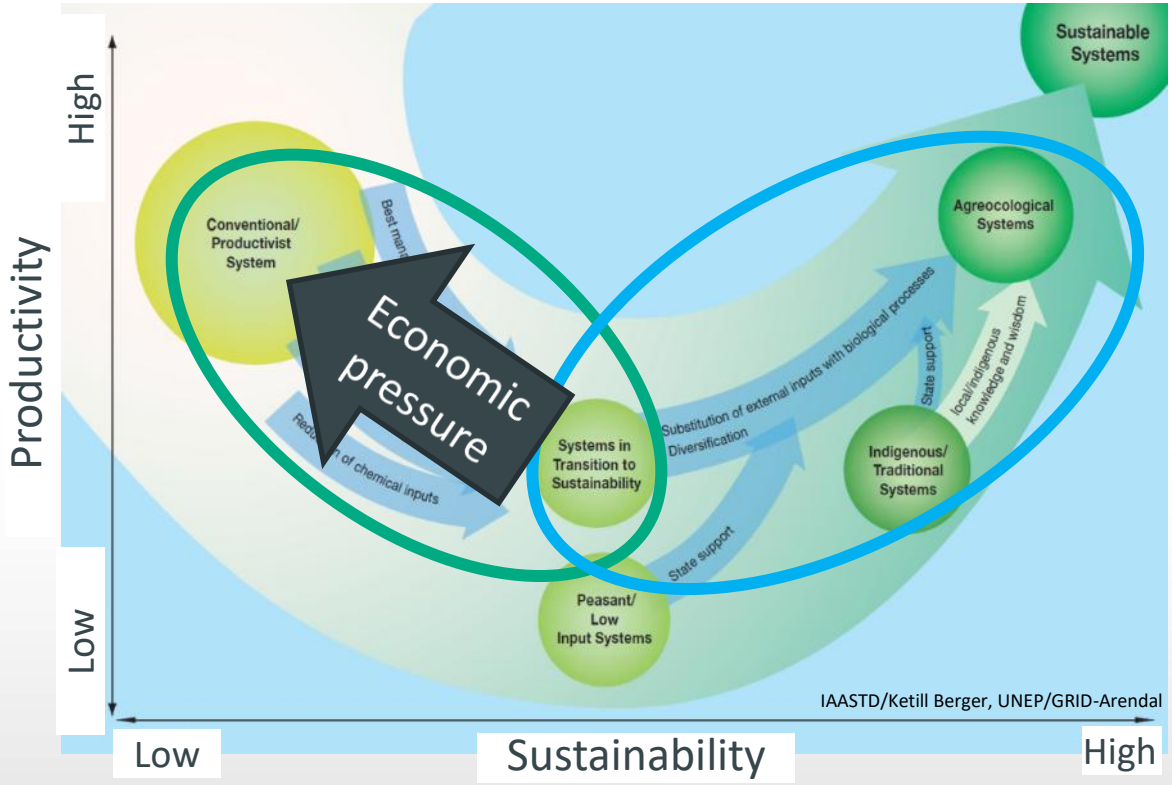
The most significant action to mitigate environmental contamination by PPPs is to reduce the amount of PPPs being used!

Crop rotation

Precision farming e.g. spot spraying; mechanical weeding

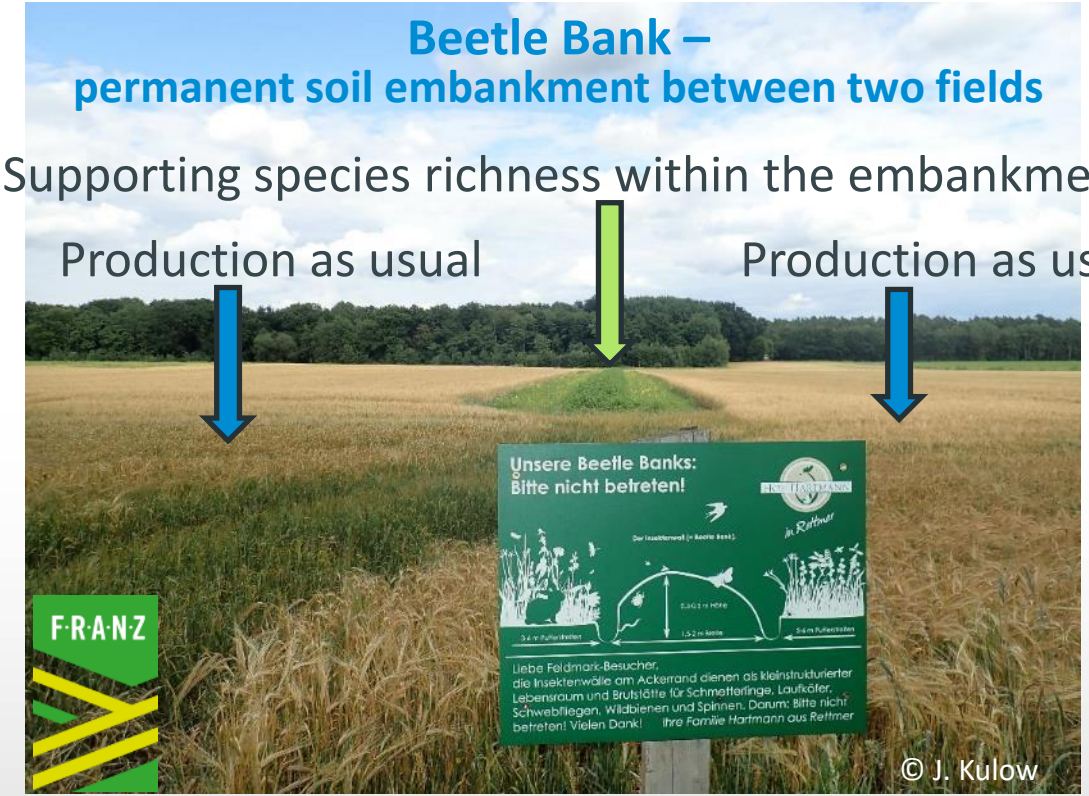
System redesign and agroecological transformation





Wezel et al. (2020) Agronomy for Sustainable Development 40:40, https://doi.org/10.1007/s13593-020-00646-z

Beetle banks – an example for the difference between incremental change and system redesign



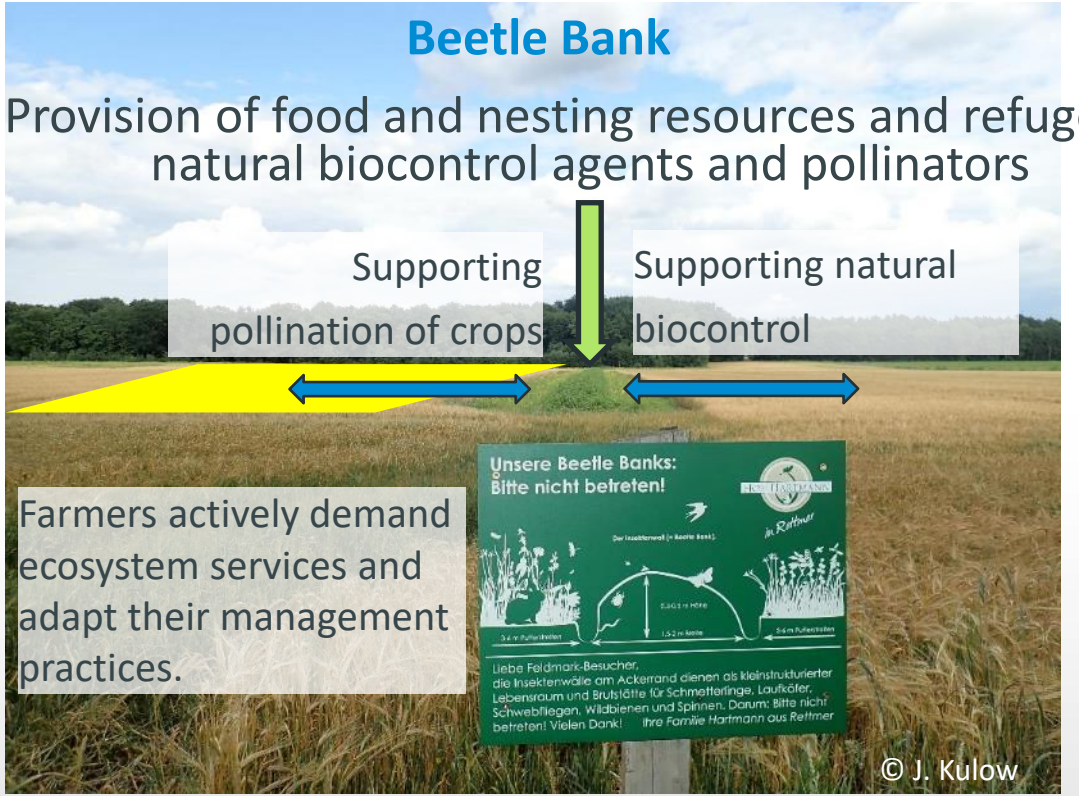
Incremental change

No or little harnessing of ecosystem services

Land sparing

Species conservation and agricultural production are spatially seperate

Beetle banks – an example for the difference between incremental change and system redesign



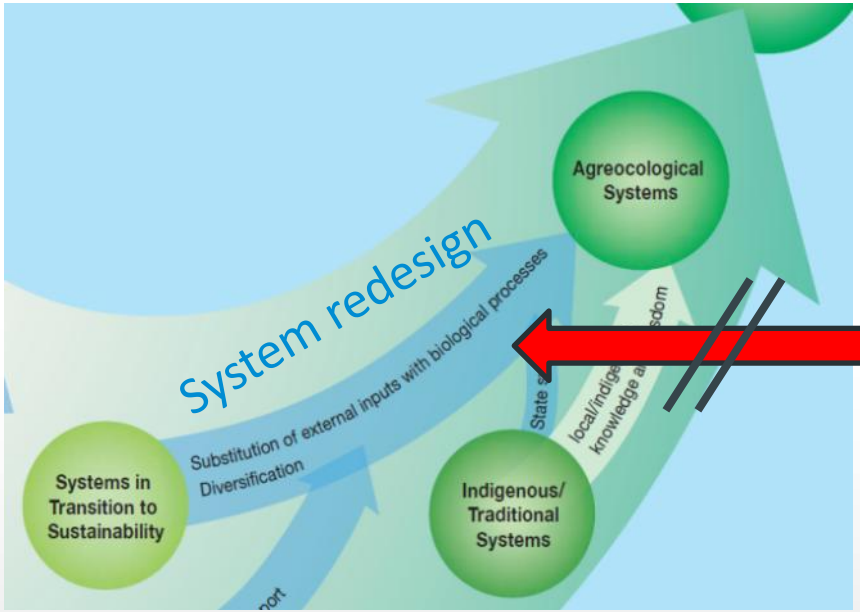
System redesign

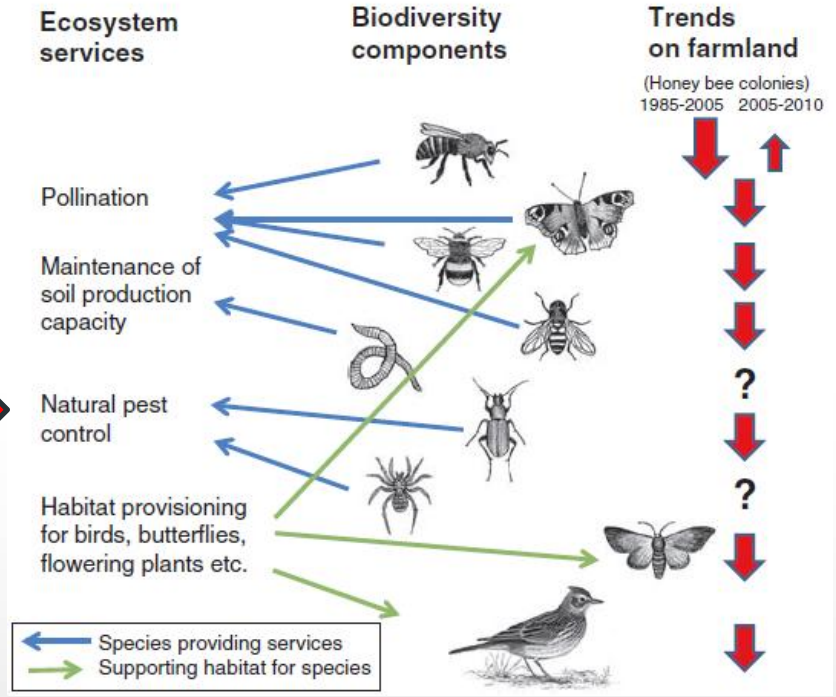
Transition to agroecological practices

Land sharing

Conservation and use of biodiversity spatially connected.

Substitution of PPP inputs with biological processes (ESS)





EASAC policy report 26, 2015:
https://easac.eu/fileadmin/PDF_s/reports_statements/Easac_15_ES_web_complete.pdf

Transformational strategies of pesticide mitigation at field and landscape scale

Premise: limited availability of PPP

IPM: Pest monitoring, economic thresholds

Crop diversification
Agroforestry systems

Cultivar selection; genetic diversification

Intercropping, strip cropping, mixed cropping

Trap crops, push-pull-systems

Wide crop rotation including perennial cultures, break and catch crops

Precision farming e.g. spot spraying, mechanical weeding

Landscape refurbishing: smaller fields, high amount of semi-natural habitats, connectivity

Targeted flower strips, beetle banks with companion plants

Research exists but lack of integration into practice

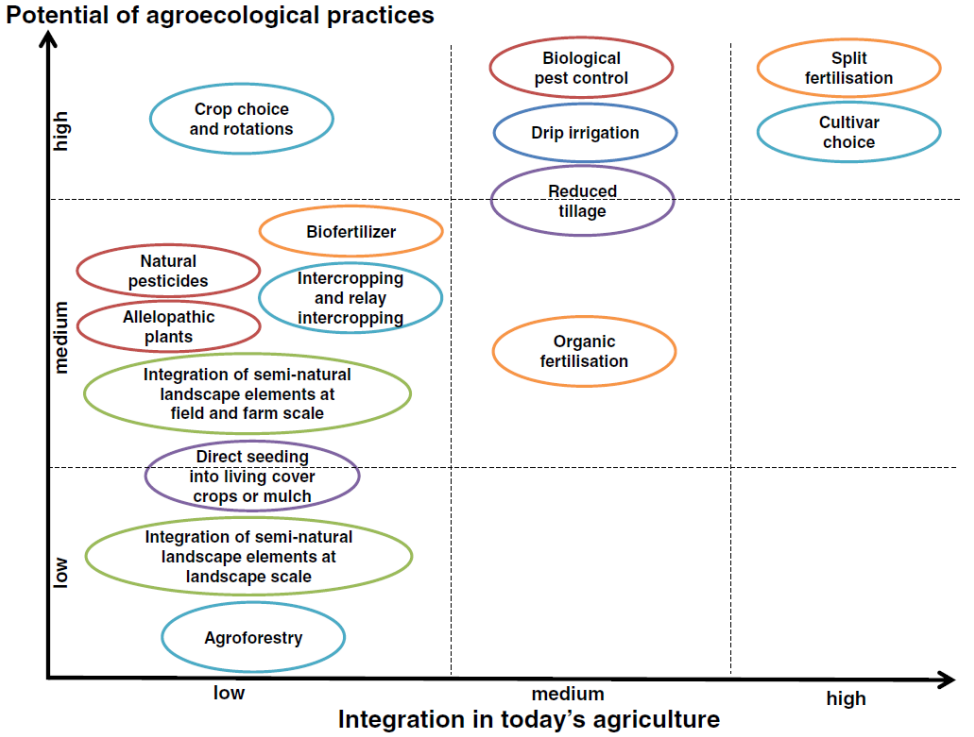
Many open questions for redesign:

How much semi-natural habitat is required?

How many targeted fower strips are necessary in which spatial distance to effectively support biocontrol?

Which species can be used as companion plants?

How should a push-pull system be designed for oilseed rape cultivation?



Wezel et al. (2014) Agron. Sustain. Dev. 34:1–20

Complementary research and infrastructures required

Field experiments

Processes, functions and interactions

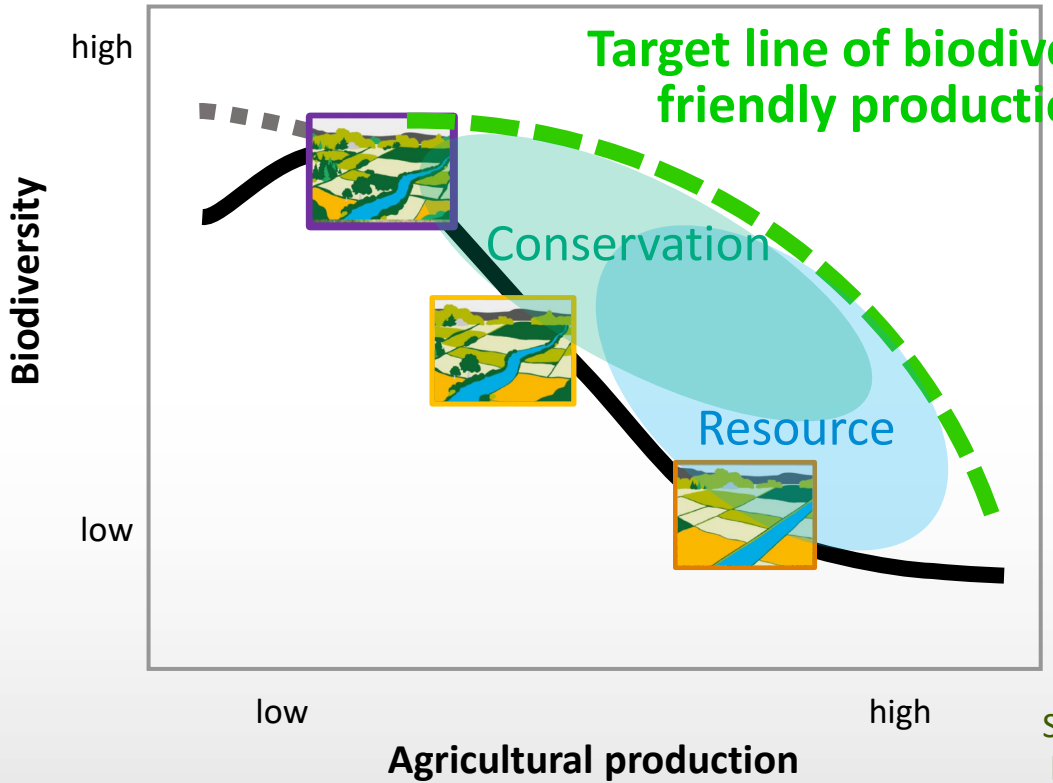
Demonstration farm networks

Application of innovations at farm level

Agroecology Living Labs

Functioning and acceptance of the innovation at systems level (regional scale), co-design: catalysis of transformation

Option space for optimising agricultural production and biodiversity

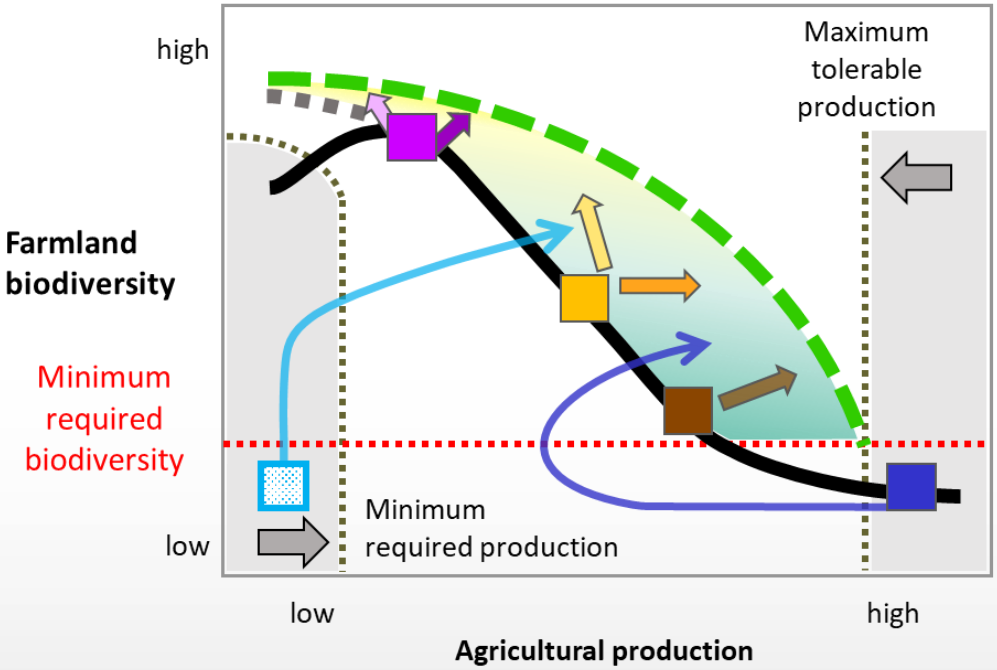


➡ Conservation of biodiversity

➡ Biodiversity as resource of agricultural production

Sietz et al. (2022) Comm Earth Environment
https://doi.org/10.1038/s43247-022-00527-1

Conceptual model for transformation pathways



Farmland biodiversity

- Current state in agricultural landscapes
- Link to natural systems
- Transformative vision

Intrinsic biodiversity value

Focus on ecosystem services

Production-systems

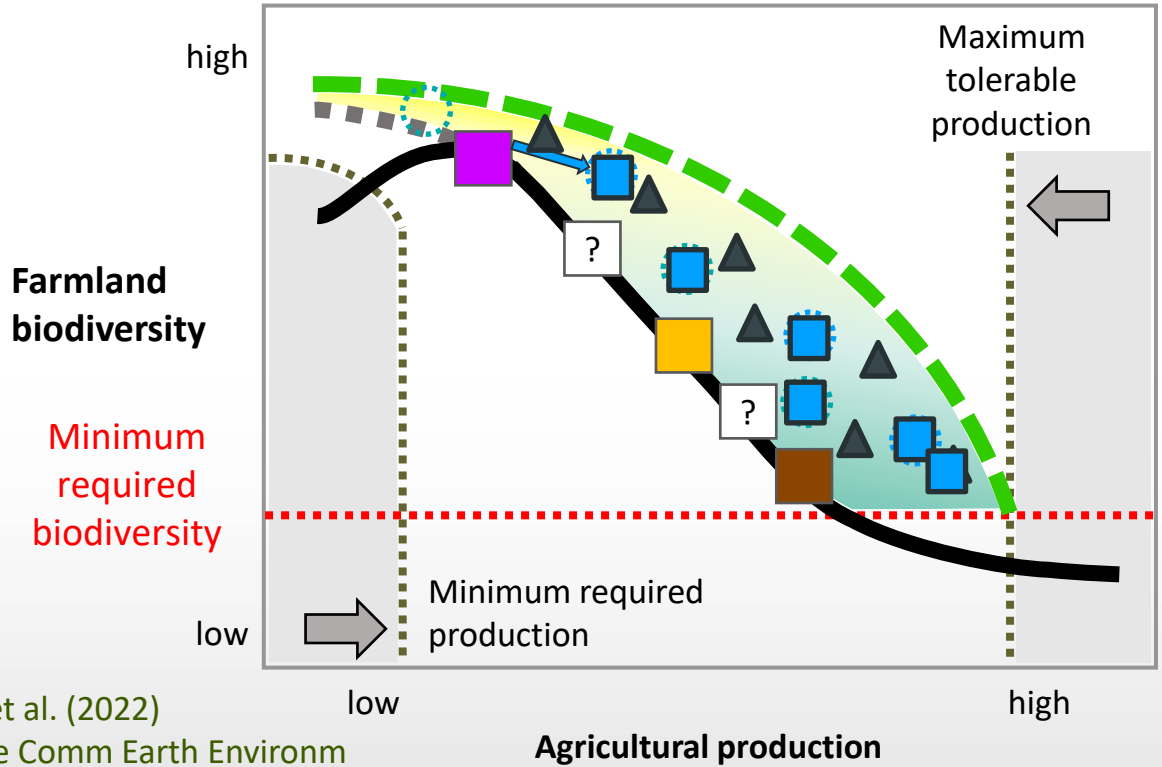
- Typ A
- Typ B
- Typ C
- Typ D
- Typ E

Transformation pathways

- I
- I_2
- II_1
- II_2
- III
- IV
- V

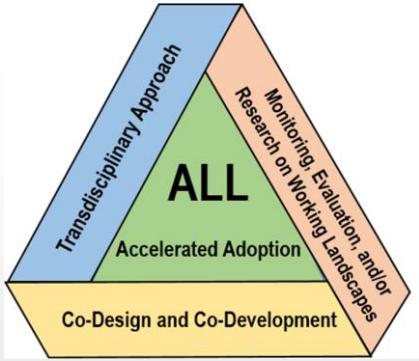
Sietz et al. (2022) Comm Earth Environment
https://doi.org/10.1038/s43247-022-00527-1

Strategic spatial allocation of research infrastructures and living labs



Sietz et al. (2022)
Nature Comm Earth Environm

- Farm demonstration networks
- Agroecology Living Labs (ALL)



Conclusions

Incremental measures at field and landscape level…

…can help limiting PPP dispersion and reducing post-application transfers

…can reduce organism vulnerability and increase capacity of ecosystem recovery

…can preserve food resources, ecological connectivity, and habitat space

But: …have to be economically sustainable

Agroecological transition of farming systems and landscapes…

…would significantly reduce environmental contamination by PPPs and the resulting ecotoxicological effects by reducing the amount of PPP used

…perhaps most efficient and sustainable

But: …applied research and transfer of innovations to farming practice required

Thank you!

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