



EXCELLENCE FOR SUSTAINABILITY

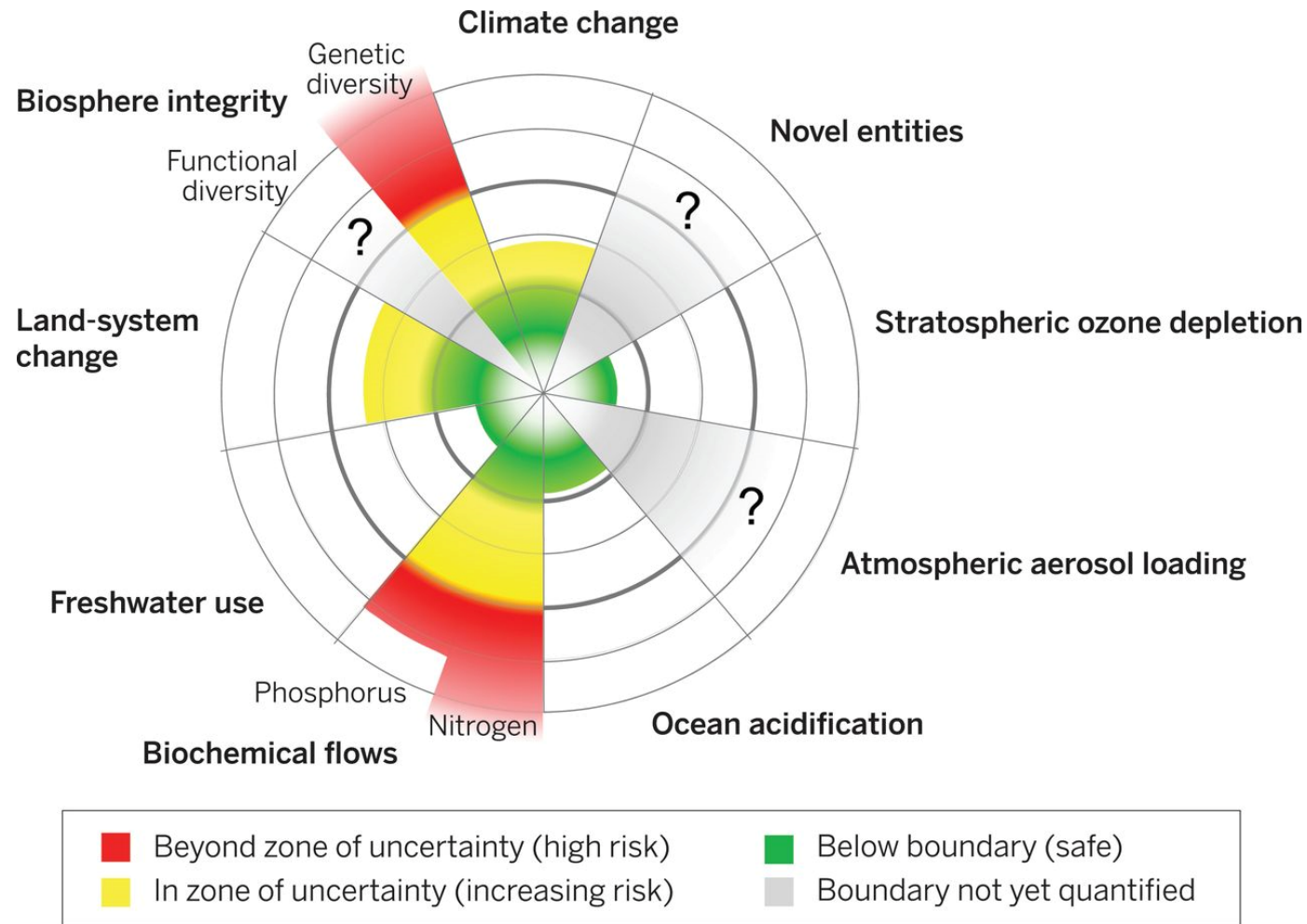
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# Nachhaltige Landwirtschaft und Biodiversität

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# Die Belastungsgrenzen des Planeten





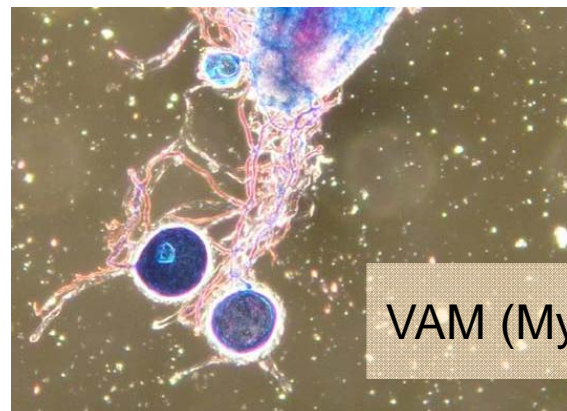
# Die biologische Vielfalt der Böden beruht auf Stoffkreisläufen



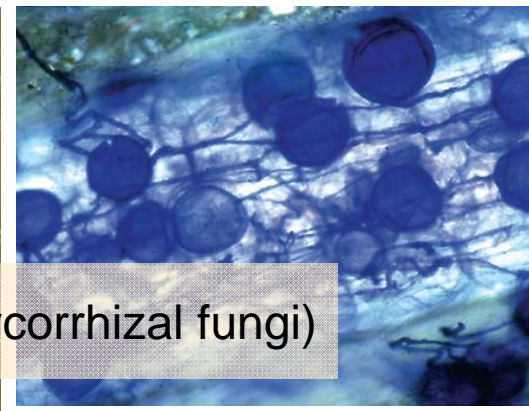
Ground beetles  
(Carabides)



PGPR (Plant growth-promoting rhizobacteria)



VAM (Mycorrhizal fungi)



Factors of influence (by farmers):

- soil tillage
- crop rotation, mixed farming
- (organic & green) manuring
- xenobiotics





Westlicher Maiswurzelbohrer (*Diabrotica virgifera virgifera*)

# Biocontrol with *Trichogramma* polyphagous wasps (endoparasitoids) against European corn borer (*Ostrinia nubilalis*)





# Innovative Applikationsmöglichkeiten von Biocontrol, Naturstoffen und physikalischen Methoden (Reduktion von Xenobiotika)

Example with *Trichogramma* polyphagous wasps (endo-parasitoids) against European corn borer (*Ostrinia nubilalis*), applied by drones (see right) instead of by hand (see below).



# Nutzung von Symbiosen



Höhere Vielfalt.  
Bessere Bodenbedeckung und  
–bewurzelung.  
Bessere Nährstofferschließung.  
Symbiotische N-Versorgung.  
Höhere Resilienz.  
Weniger PSM.





# Technological innovation



↑ The combination of contour and strip farming enabled by intelligent agricultural technology (-> precision agriculture).

→ The “stupid” use of agricultural technology for industrial monocrops.





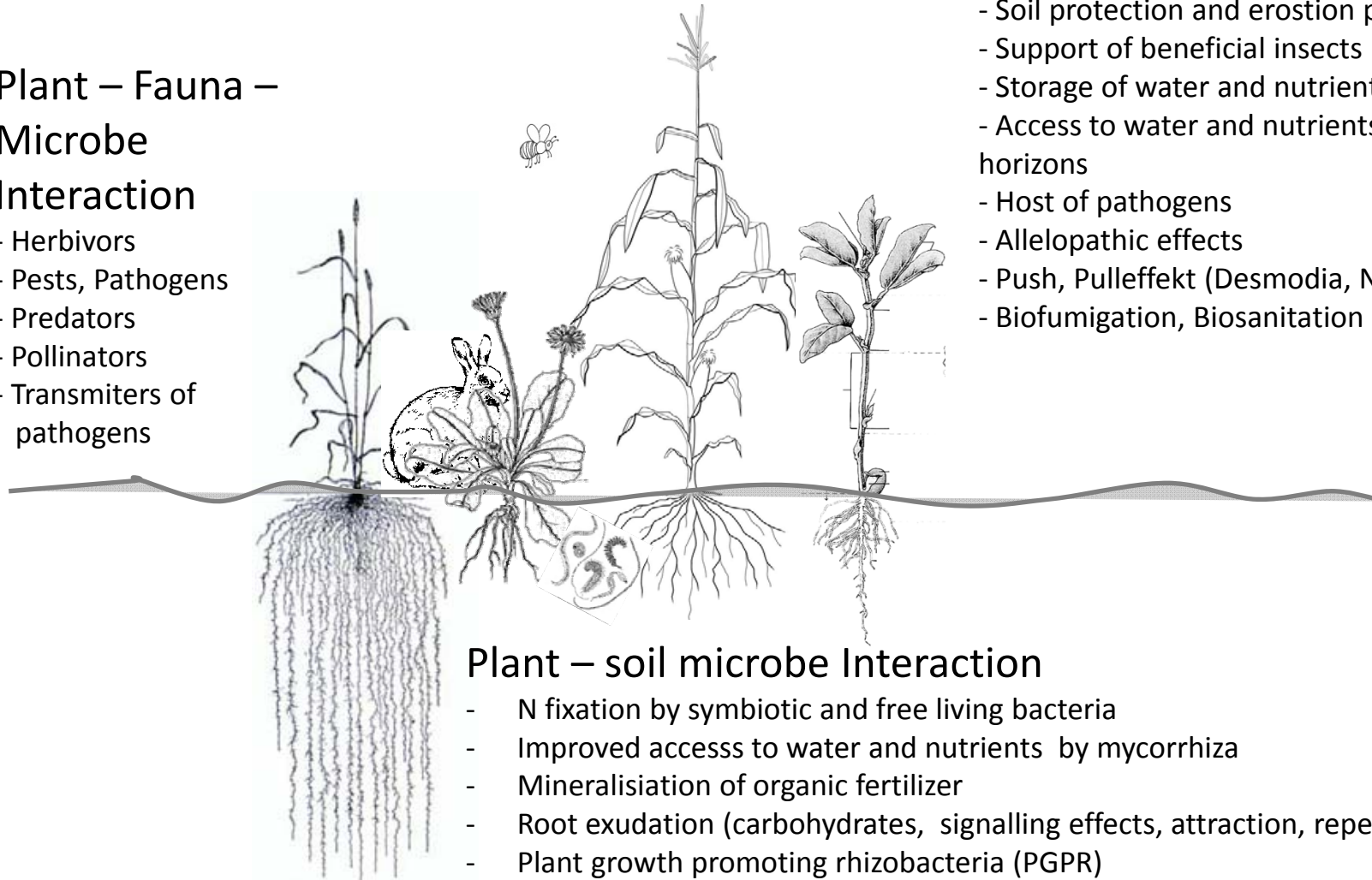
# Ziel ökologischer Züchtung: Interaktionen am Zielstandort

## Plant – Plant Interaction

### Plant – Fauna – Microbe Interaction

- Herbivores
- Pests, Pathogens
- Predators
- Pollinators
- Transmitters of pathogens

- Competition for light, water, nutrients
- Protection for light, wind, transpiration
- Soil protection and erosion prevention
- Support of beneficial insects
- Storage of water and nutrients
- Access to water and nutrients in deeper horizons
- Host of pathogens
- Allelopathic effects
- Push, Pulleffekt (Desmodia, Napiergras)
- Biofumigation, Biosanitation



## Plant – soil microbe Interaction

- N fixation by symbiotic and free living bacteria
- Improved access to water and nutrients by mycorrhiza
- Mineralisation of organic fertilizer
- Root exudation (carbohydrates, signalling effects, attraction, repellents)
- Plant growth promoting rhizobacteria (PGPR)
- Pathogenes & counterparts

# Potentially interesting applications of CRISPR/Cas9 for sustainable farming systems

- Increase of the mutation rate for specific traits (*site directed mutagenesis, single point mutagenesis*).
- Targeted gene knockout, altering or insertion of genes (cisgenetic/re-wilding).





# Habitat management <sup>against?</sup> and? genome editing?



# Zusammenfassung

- Ohne „Vielfalt“ gibt es keinen Ausweg aus den ökologischen Problemen der Landwirtschaft (und somit keine Nachhaltigkeit).
- Der Ansatz Züchtung ist nur ein partieller Lösungsansatz.
- Nachhaltige Landwirtschaft: Habitat „editing“ plus genome editing?