

Within field functional biodiversity, concepts and practice

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Functional Agro Biodiversity

- Functional Agro Biodiversity had much focus on landscape and the non-productive agricultural field surface
 - Field margins, landscape elements, flower strips, ecological infrastructure
- With the current large surface of monocultures this FAB type has limited effects.
 - A lot of natural enemies and antagonists have a limited action range.
 - Many pathogens have a large action/dispersion range



What about 'in field' Functional Agro-biodiversity?

- Within Crops genetic variability
- Between Crops Mixed cropping, field dimensioning
- In the Soil
- On the Soil surface

Are these types of Biodiversity functional, are they possible to influence and is their use economically feasible?

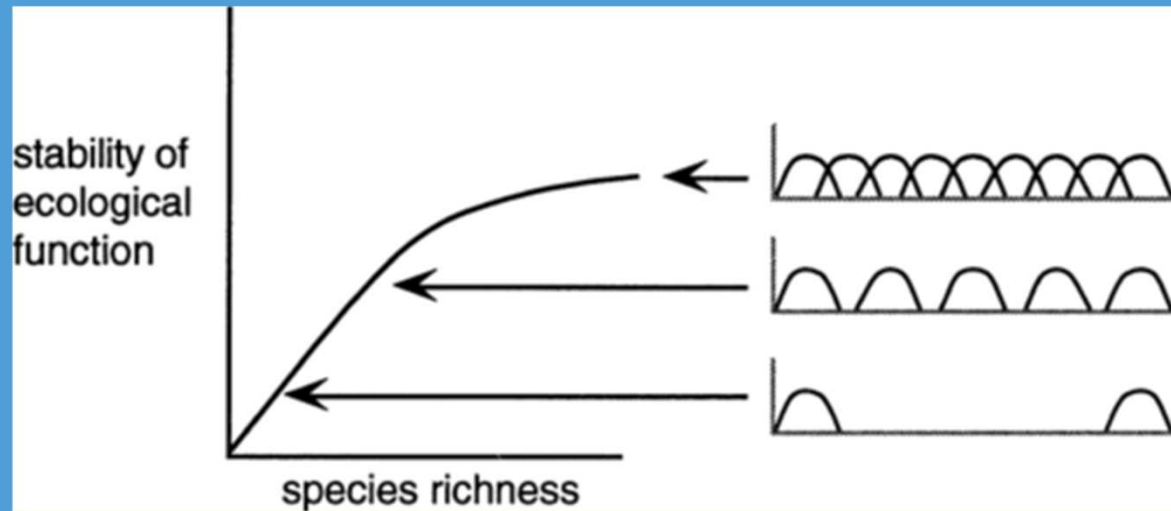


Functional? Biodiversity

- IPM (pests and diseases!)
- Pollination
- N- fixation, mineralization
- Organic matter decomposition
- Soil structure
- Soil erosion
- Water management
- De-composing toxins
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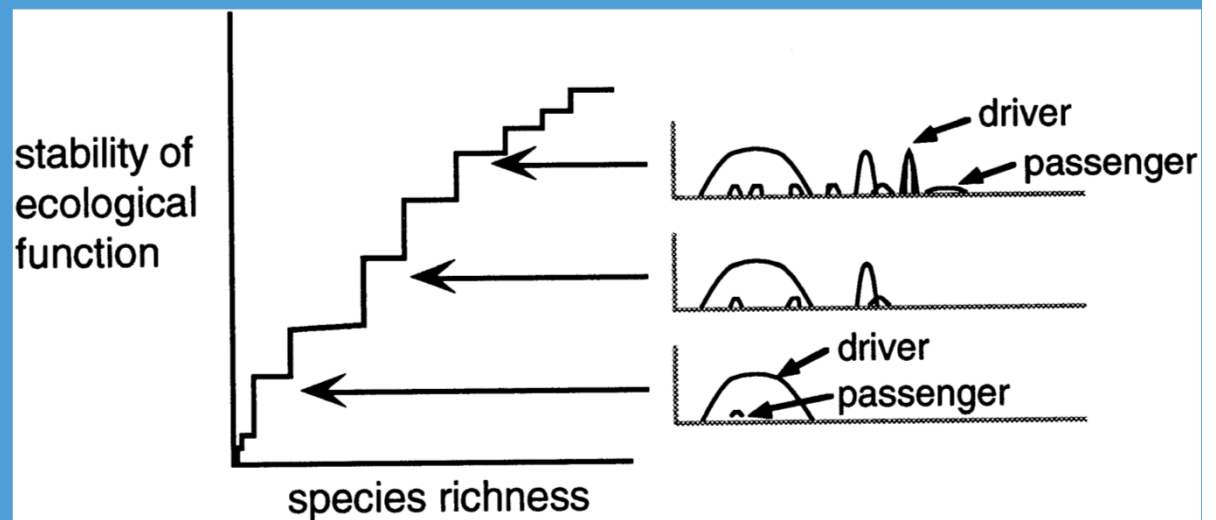


Biodiversity and resilience



Ehrlich
and Ehrlich (1981)

- Walker (1992, 1995)



Management for (biological) resilience

Create continuity for functional biodiversity

- Food, shelter and habitat

Create discontinuity in hosts for pathogens (plant, crop, field, landscape)

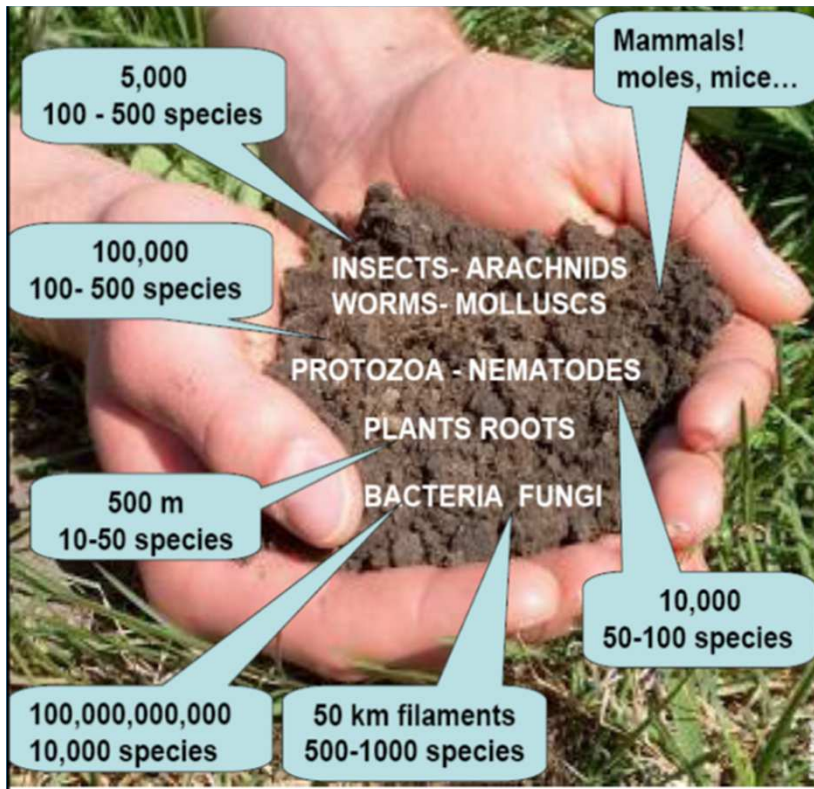
- Crop rotation, crop surface, genetic diversity, plant resistance

Spatial and temporal

"A central tenet of epidemiology is that both the number of diseases and the incidence of disease should increase proportionally to host abundance" (Tilman et al. 2002).

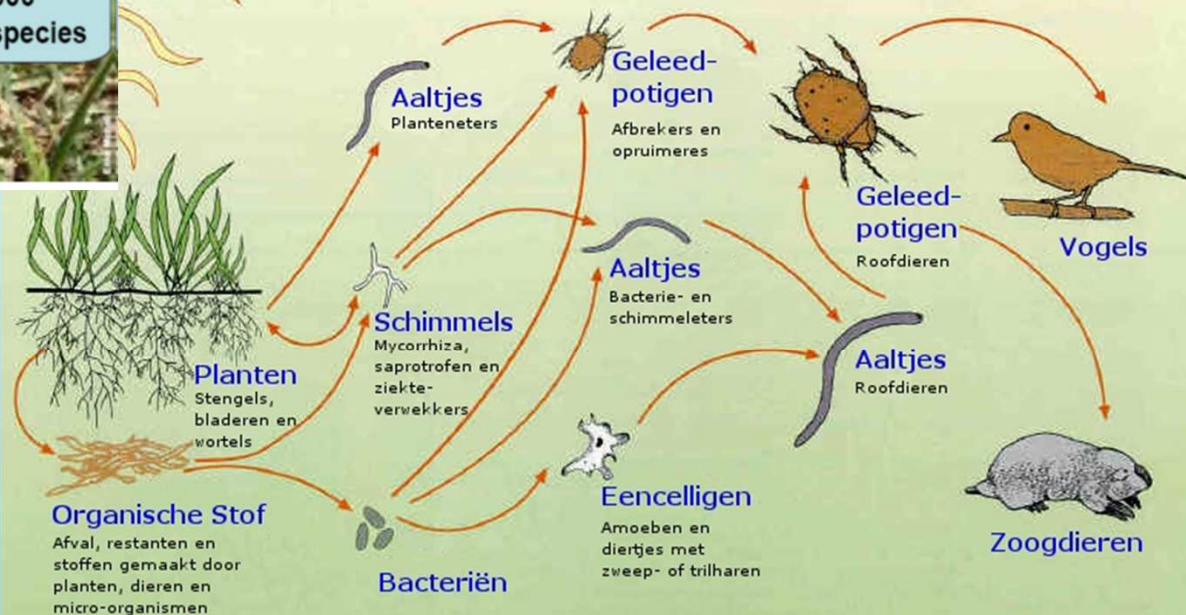


Soil is the Basis



Organic matter
plays a central
role

Het Bodem-voedselweb



1e voedings-niveau
Organismen met fotosynthese

2e voedings-niveau
Afbrekers en organismen die met planten samenleven of hen parasiteren

3e voedings-niveau
Afbrekers, roofdieren, bacterie- en schimmeleters

4e voedings-niveau
Roofdieren

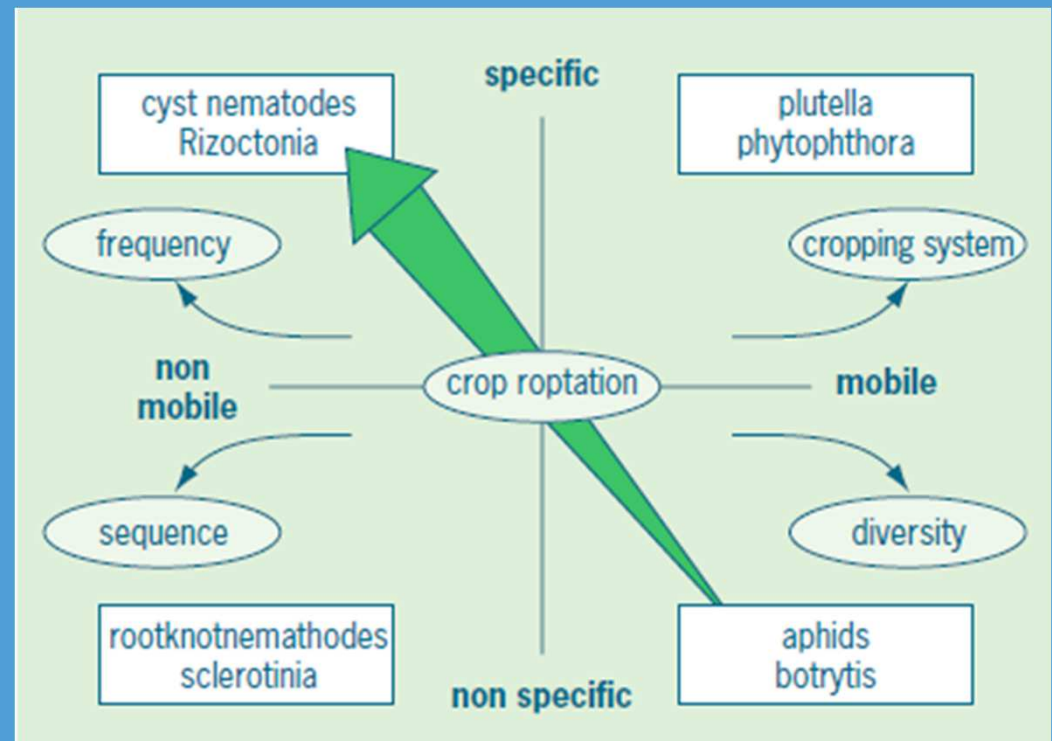
5e voedings-niveau
Roofdieren



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Management options soil

- Organic matter, pH, compaction, soil biodiversity, soil health, ..
- Reduced tillage
- Soil cover (cover crops, mulches)
- Crop rotation
- Nutrient management
- Minimum use of pesticides
- Organic matter management



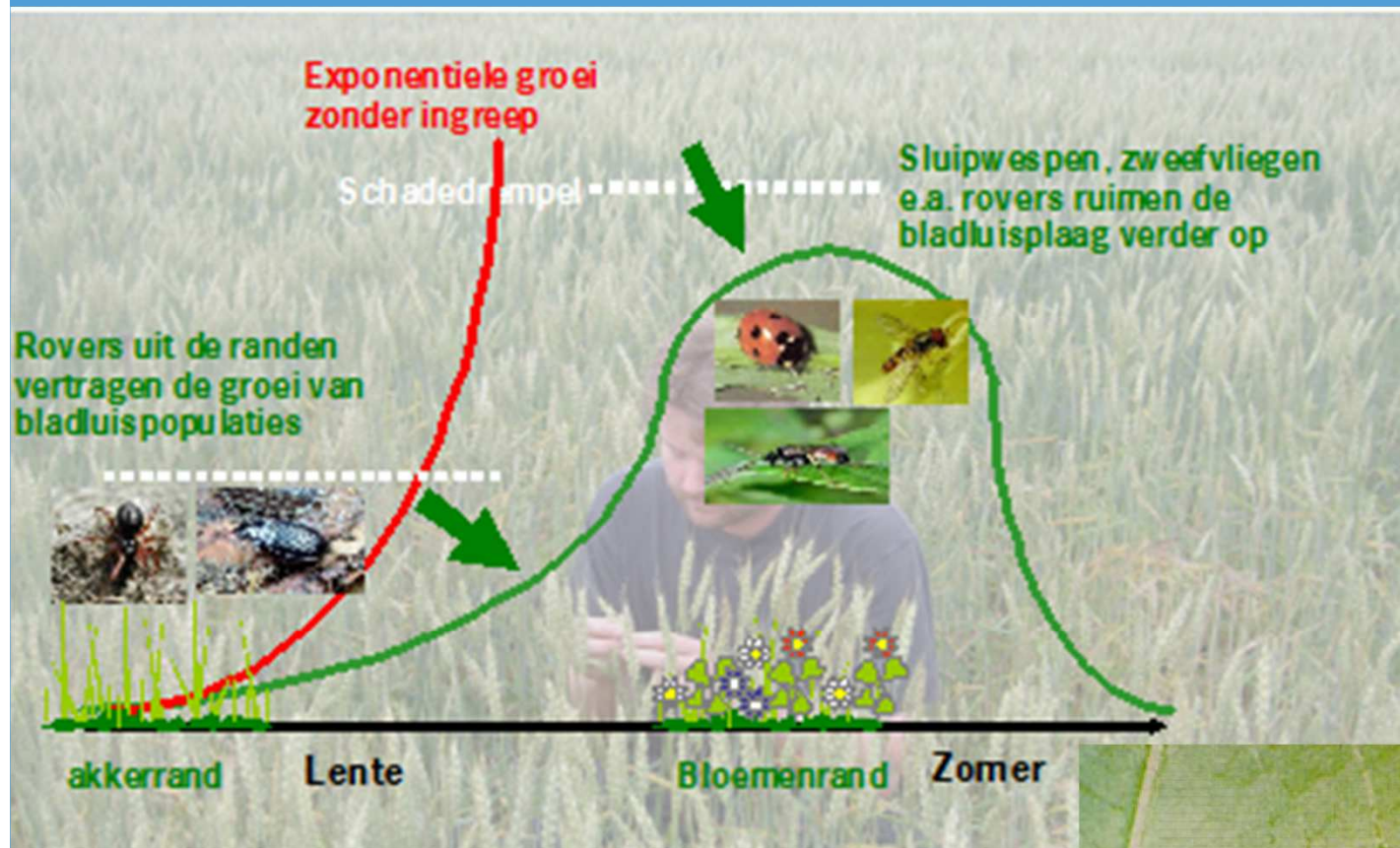
Continuity for beneficials

Food, Shelter, Habitat

- Landscape: Ecological infrastructure. Natural elements
- Field margins (presence and management)
- Soil management (reduced tillage, organic matter, mulch)
- Field size and dimensions
- Alternative food sources
- Flower strips
- Crop management



Effects spiders and beetles



Discontinuity for pathogens

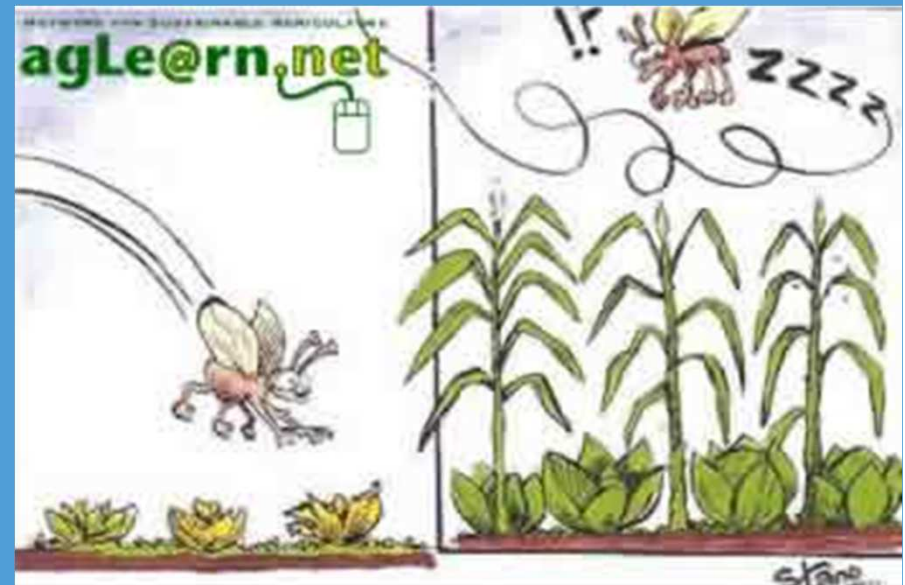
Host scarcity, repellent, confusion, unfavourable habitat

- Crop Rotation

- Frequency, sequence, field adjacency

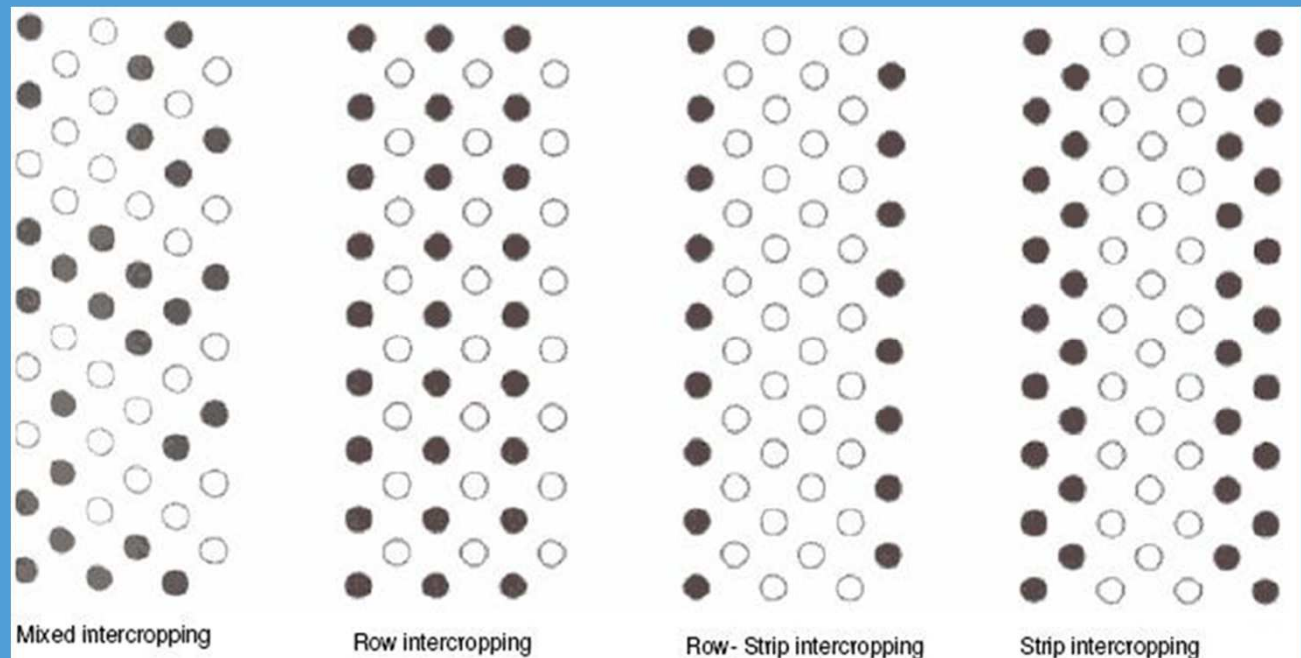
- Intercropping

- Strips, Rows,
 - Crop mixtures
 - Undersowing
 - Agroforestry



Intercropping/mixed cropping

- Making more efficient use of resources (light, water, nutrients)
- In general higher production
- Positive/negative crop interactions
- Reducing host abundance





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Undersowing clover





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Conflicting objectives and thresholds?

- Market demands uniformity
- Mechanisation and field operations demand uniformity
- Economy and policy (subsidies) promote uniformity
- Research focus on G-M-E solutions

Already economically viable

- Field margins; Flower strips; Reduced tillage; Cover crops; equal or positive organic matter balance; mixed cropping for fodder crops; undersowing; multifunctional crop rotation; variety mixes

Needs further Paradigm shift; research; technology; ..

- Strip cropping; agroforestry, intensive crop mixes; genitically heterogeneous varieties;



Knowledge, research and adoption

- Interdisciplinary approaches
- Development techniques (sensors, ICT, GPS, robots, ...) to solve the conflicting objectives
- Combine with on farm research, farmerfield schools, stakeholder involvement, ...

Some references and contacts

- Tillage and crop diversity effects on overwintering of natural enemies – willemien.geertsema@wur.nl
- Earthworm diversity and soil functions in reduced tillage systems and field margin strips – mirjam.pulleman@wur.nl
- Disease suppressiveness of soil amendments - joeke.postma@wur.nl
- Soil health and soil management - gerard.korthals@wur.nl
- Reduced Tillage and soil Biodiversity derk.vanbalen@wur.nl
- Resilience through Diversity - wijnand.sukkel@wur.nl
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Thank you very much
for your attention!



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