

Agro-Ecology & Technology

Developments in agriculture of the 21st century



Wijnand Sukkel, 13-02-2020 Biofach

Changing context agriculture 21^e century

- Climate change (mitigation & adaption)
- Soil degradation,
- Growth world population
- Depletion of resources (phosphorus, fossil energy)
- Societal protest
- Decreasing biodiversity
- No space for & agriculture & landschape & recreation & biodiversity & energy production,, (NL)
- Very rapid technological developments

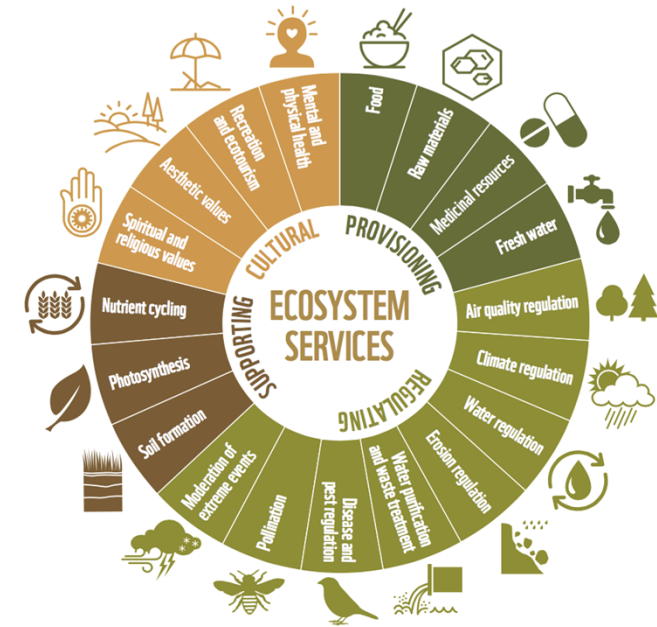
Chances for systemchanges!

Increasing Awareness of Multinationals in the Food Industry

<https://www.youtube.com/watch?v=HPIzGVAqEZ0>

What kind of agriculture is needed?

- Regenerative
- Productive
- Resilient



Regenerative – positive impact



'sustainable' currently – no impact



Conventional – negative impact



Agriculture 20th eeuw = monoculture

Advantage: efficiënt, low cost, mechanisation, simplicity, subsidies

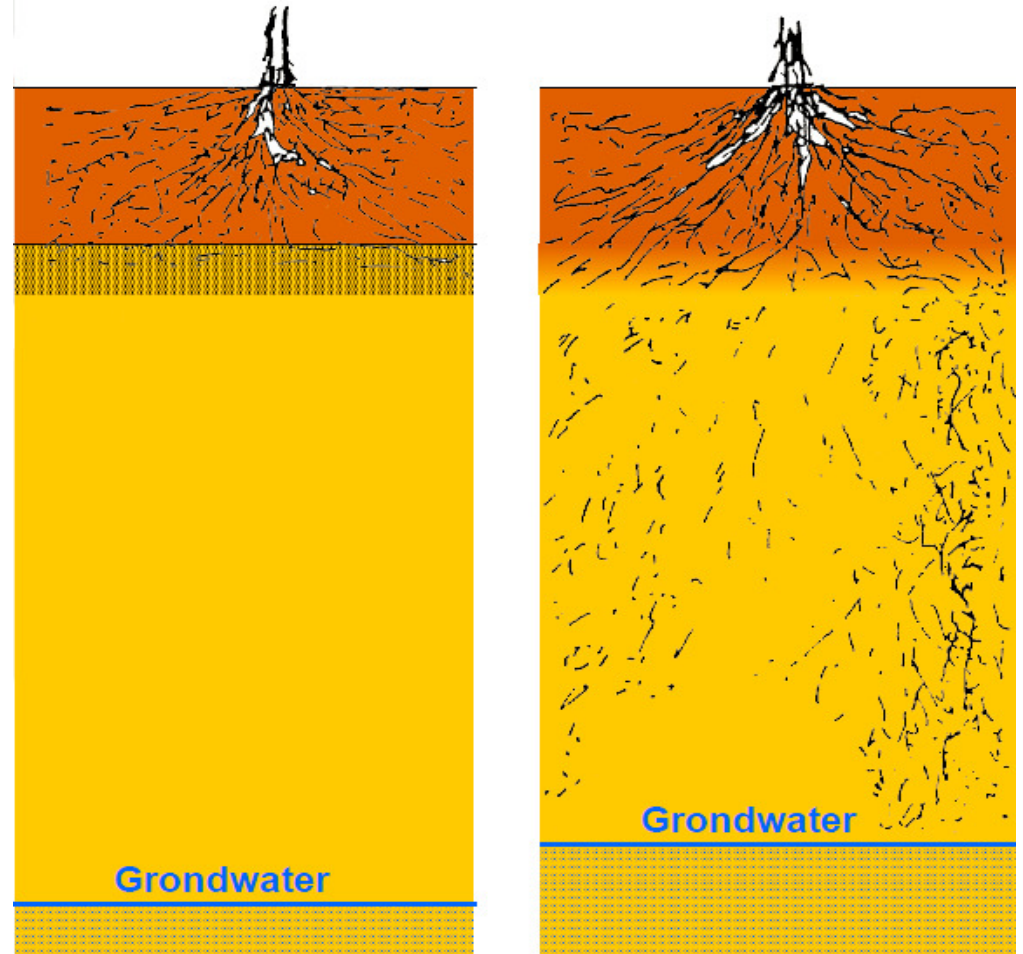
Downside:

- Sensitive for pests and diseases (host abundance)
- Sensitive for physical pressure: erosion, water, compaction
- Long term productionfunction < (soil)
- Very low biodiversity
- Seperated functions: agriculture ≠
 - Biodiversity
 - Landschape
 - Recreation



Sub soil compaction, an underestimated consequence of heavy machinery

- More runoff and erosion
- Less waterinfiltration
- Lower soilwater level
- Lower NUE
- Less soil cultivation
- Higher risks salination
- More slacking
- Higher irrigation demand
- Higher drought sensitivity



Centuries optimising monocultures

All practices are fine-tuned to monocultures

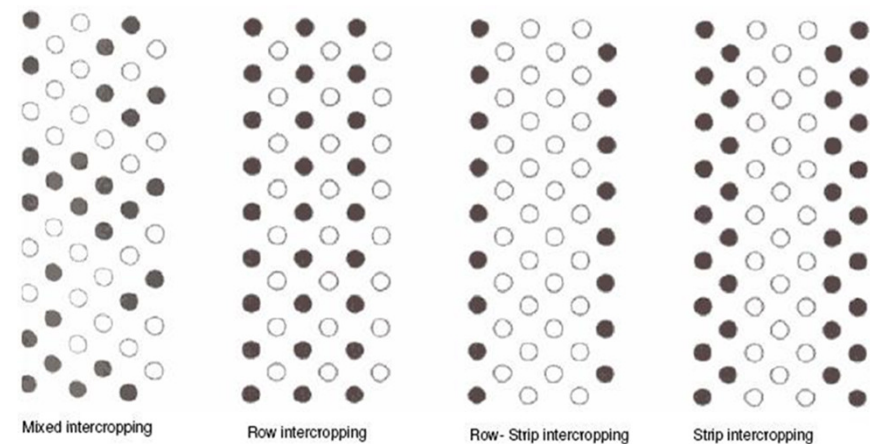
- Crop and soil management, Fertilisers, Pesticides
- Mechanisation
- Genotypes
- Data management
- Subsidies
- Legislation
- Knowledge
- Food chain



We are 'locked in' in several ways!

Diverse cr. systems ecological more efficient!

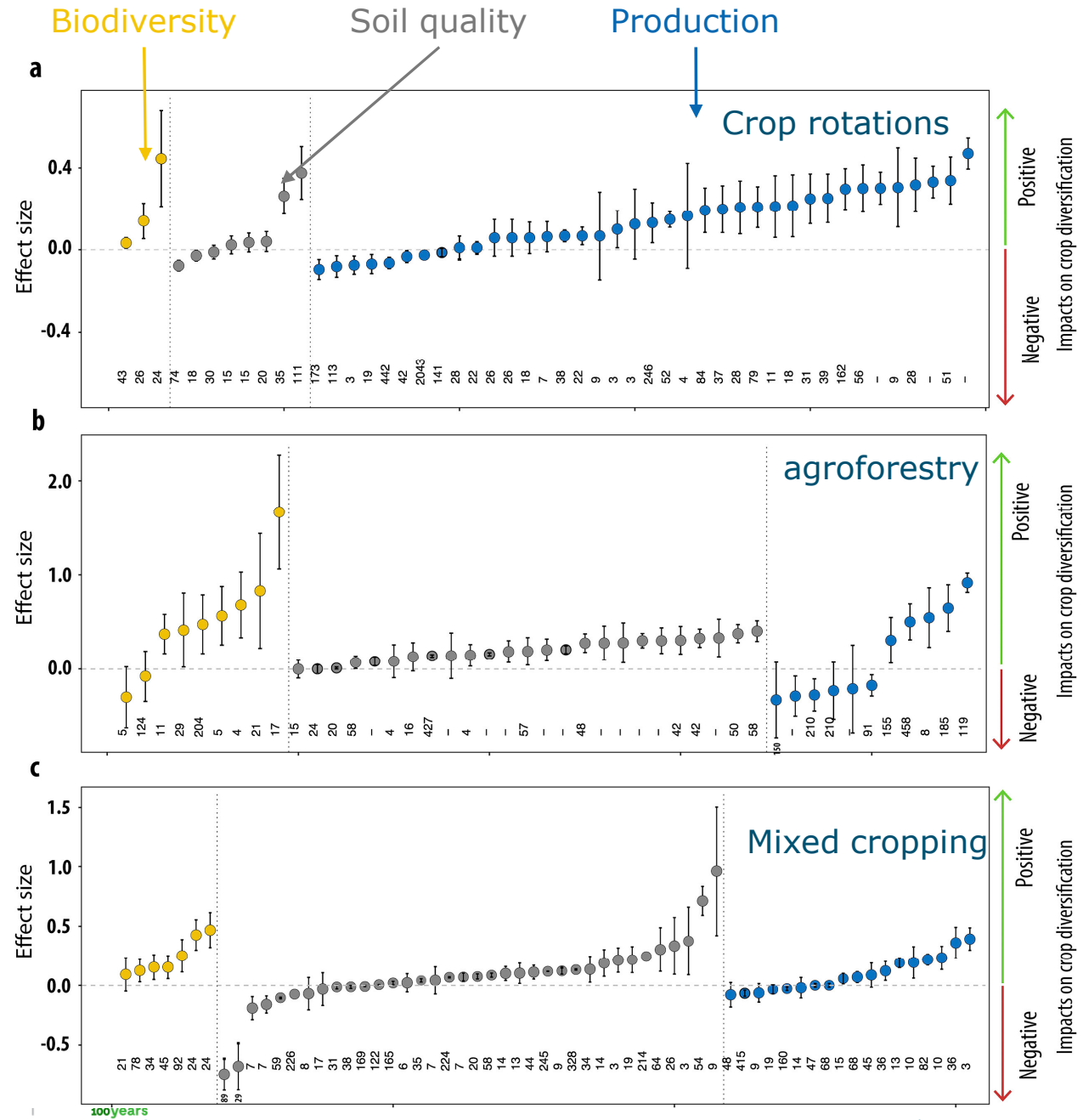
- Higher resource use efficiency
- Higher Land Equivalent Ratio
- Lower pest and disease pressure
- More biodiversity
- Higher C sequestration
- Better weed suppression
- Less erosion



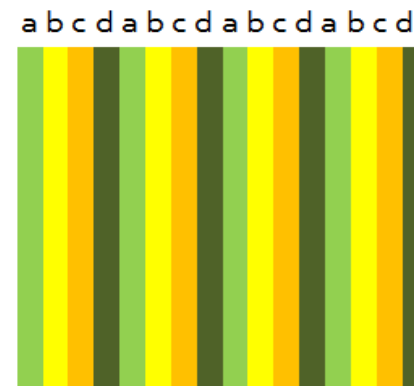
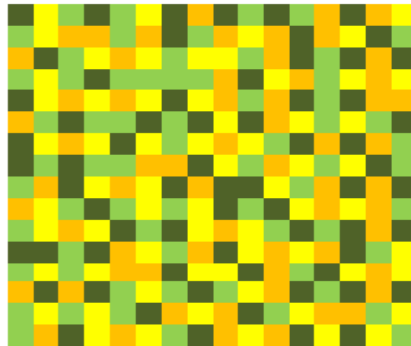
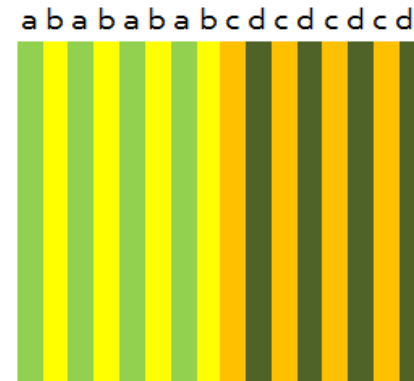
But with current applied technology economic less efficient (labour)

And Much more complex to manage

Crop Diversity works!



Spatial Crop Diversity



Strip cropping: Different crops in strips with own management



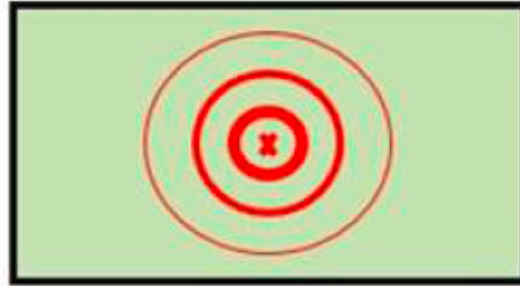
Strip cropping, ERF bv Almere (since 2017)



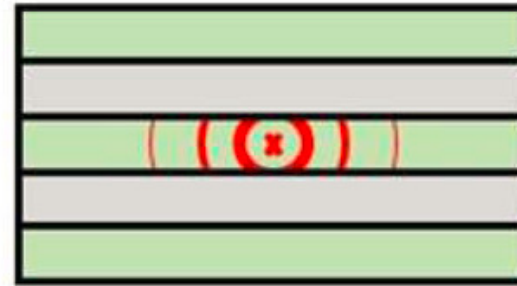
WAGENINGEN
UNIVERSITY & RESEARCH



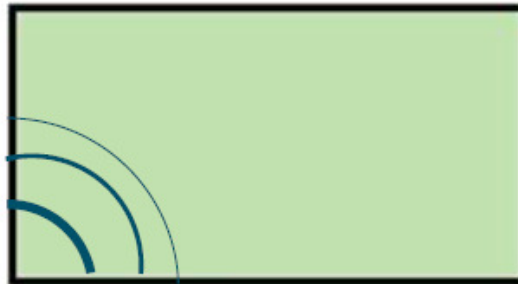
Strip effects



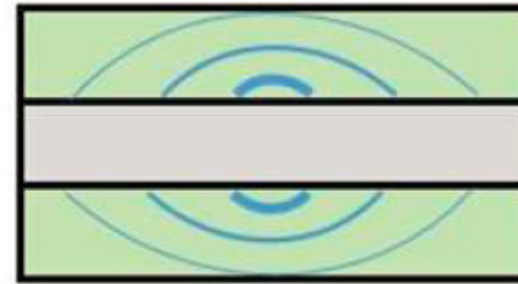
No control of disease propagation in sole crop



Disease propagation limited to the strip initially contaminated

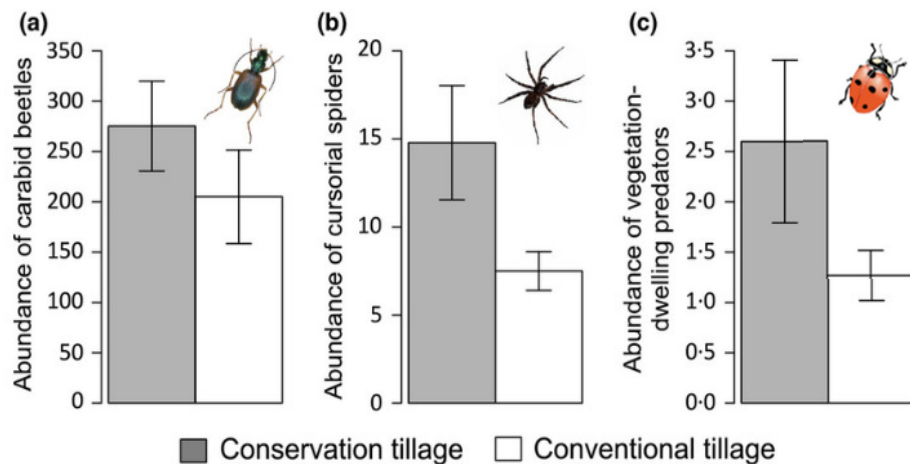
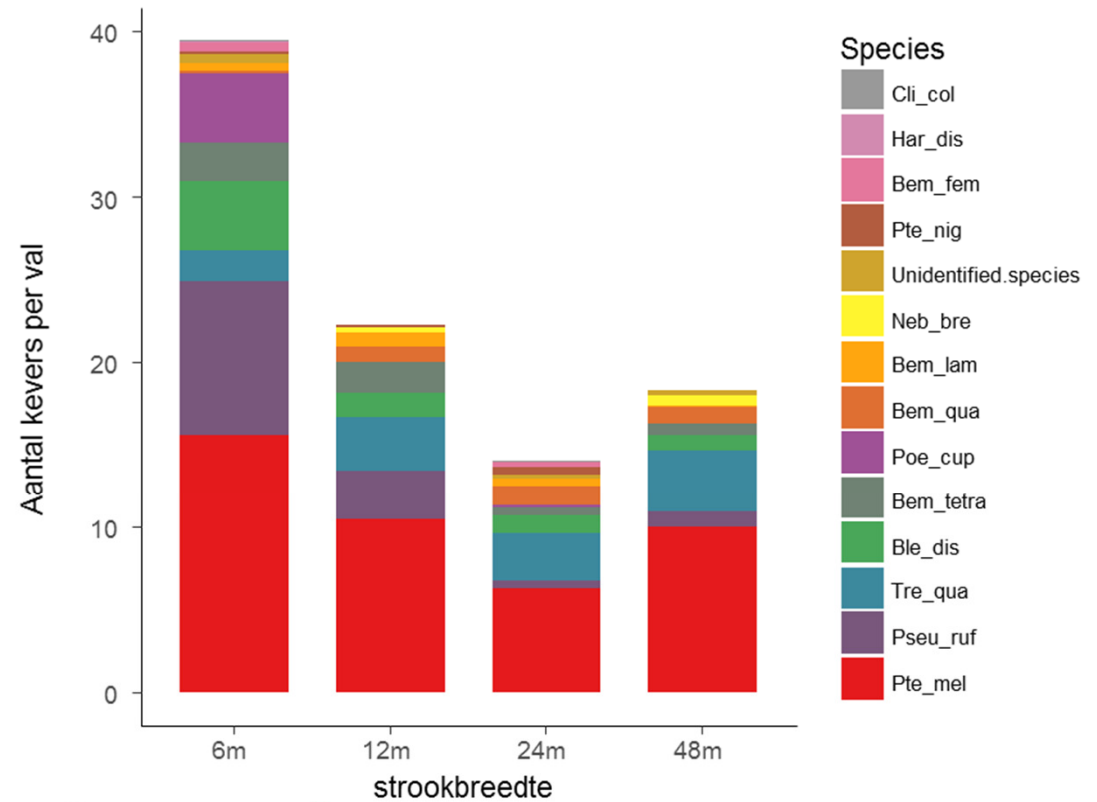


Absence of beneficial natural enemies in sole crop

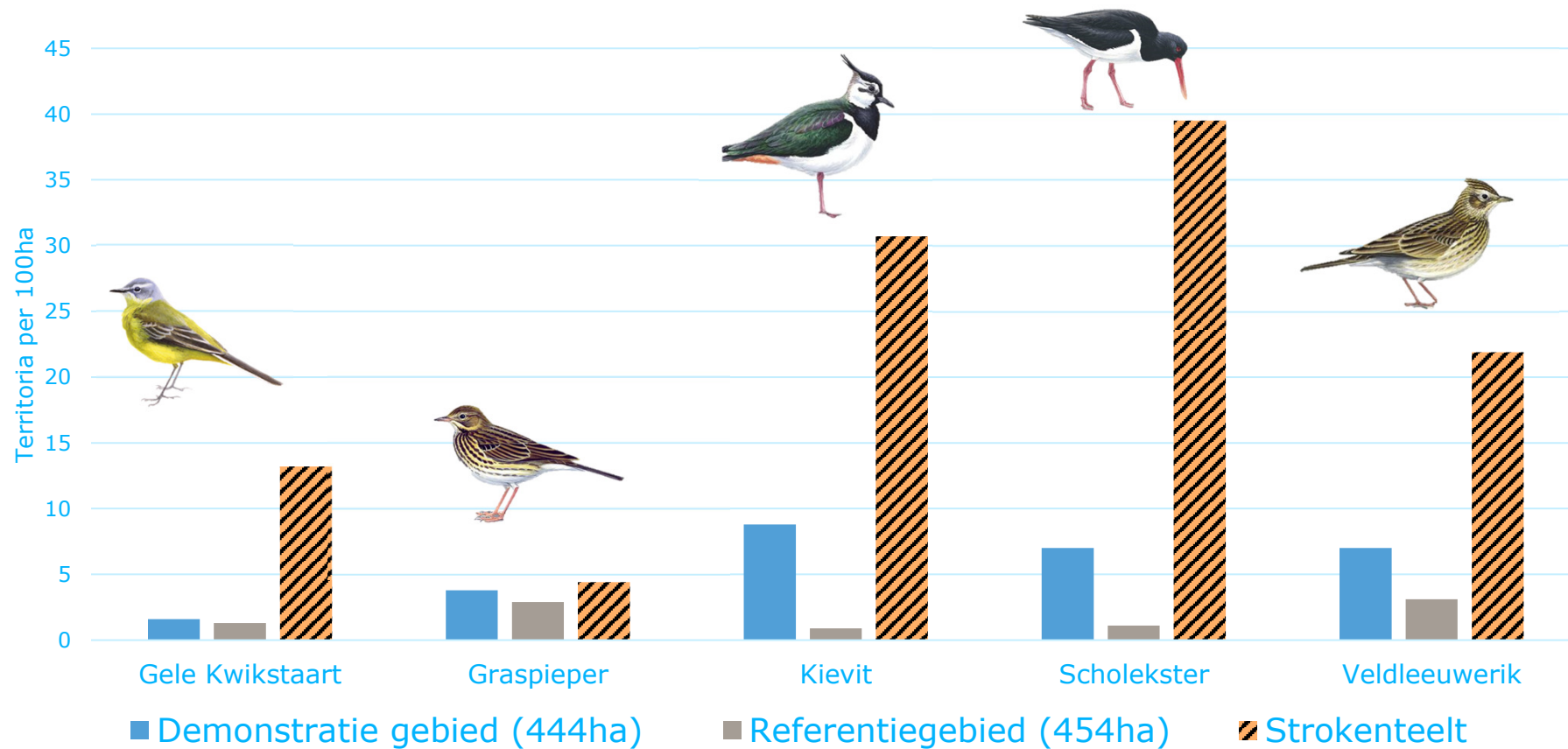


Spread of beneficial natural enemies hosted in one of the component crop

Crop diversity and CA increase population of soil dwellers



Tamburini et al 2015. , Journal of Applied Ecology 53(1):n/a-n/a .



	Demonstratie gebied (444ha)		Referentiegebied (454ha)		Strokenteelt (22,8ha)	
	terr.	terr./100ha	terr.	terr./100ha	terr.	terr./100ha
Gele Kwikstaart	7	1,6	6	1,3	2	13,2
Graspieper	17	3,8	13	2,9	1	4,4
Kievit	39	8,8	4	0,9	7	30,7
Scholekster	31	7,0	5	1,1	9	39,5
Veldleeuwerik	31	7,0	14	3,1	5	21,9

Tabel 1: Broedvogelterritoria 2018 voor het PARTRIDGE demonstratiegebied, PARTRIDGE referentiegebied (zonder maatregelen) en de strokenteelt gelegen in het demonstratiegebied.

How could this look like?

Proeftuin Agroecologie & Technologie

Agroecologische bouwstenen, ondersteund door technologie
Voor een toekomstbestendig, regeneratief landbouwsysteem.

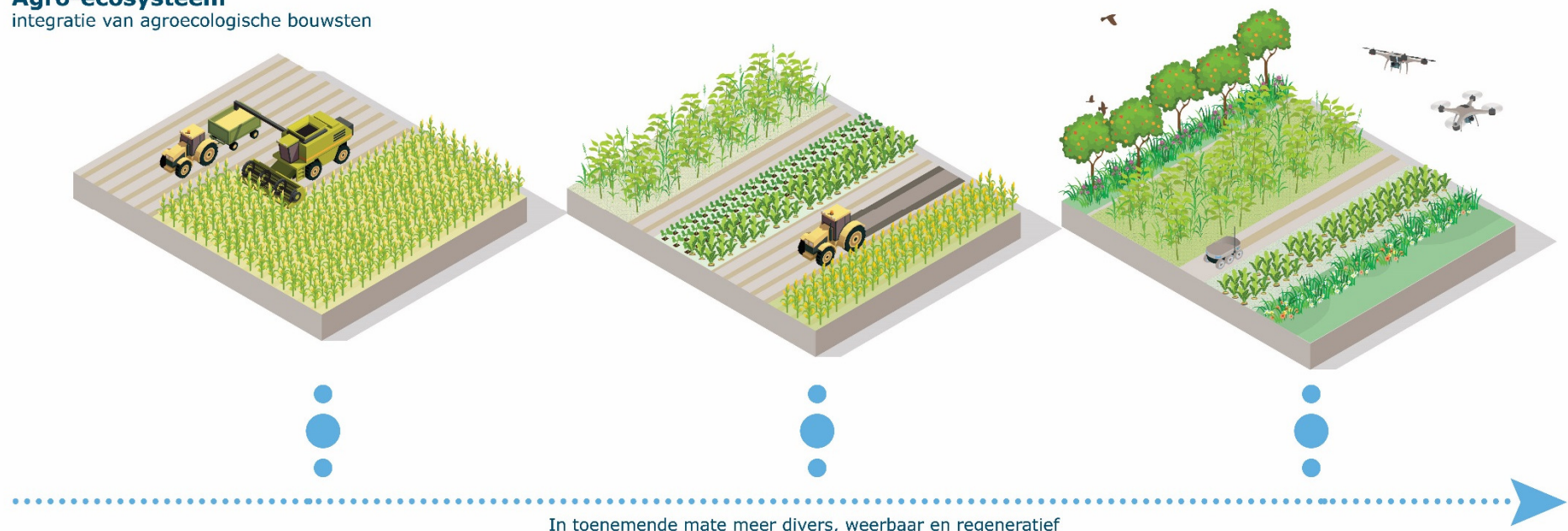


Bouwstenen



Agro-ecosysteem

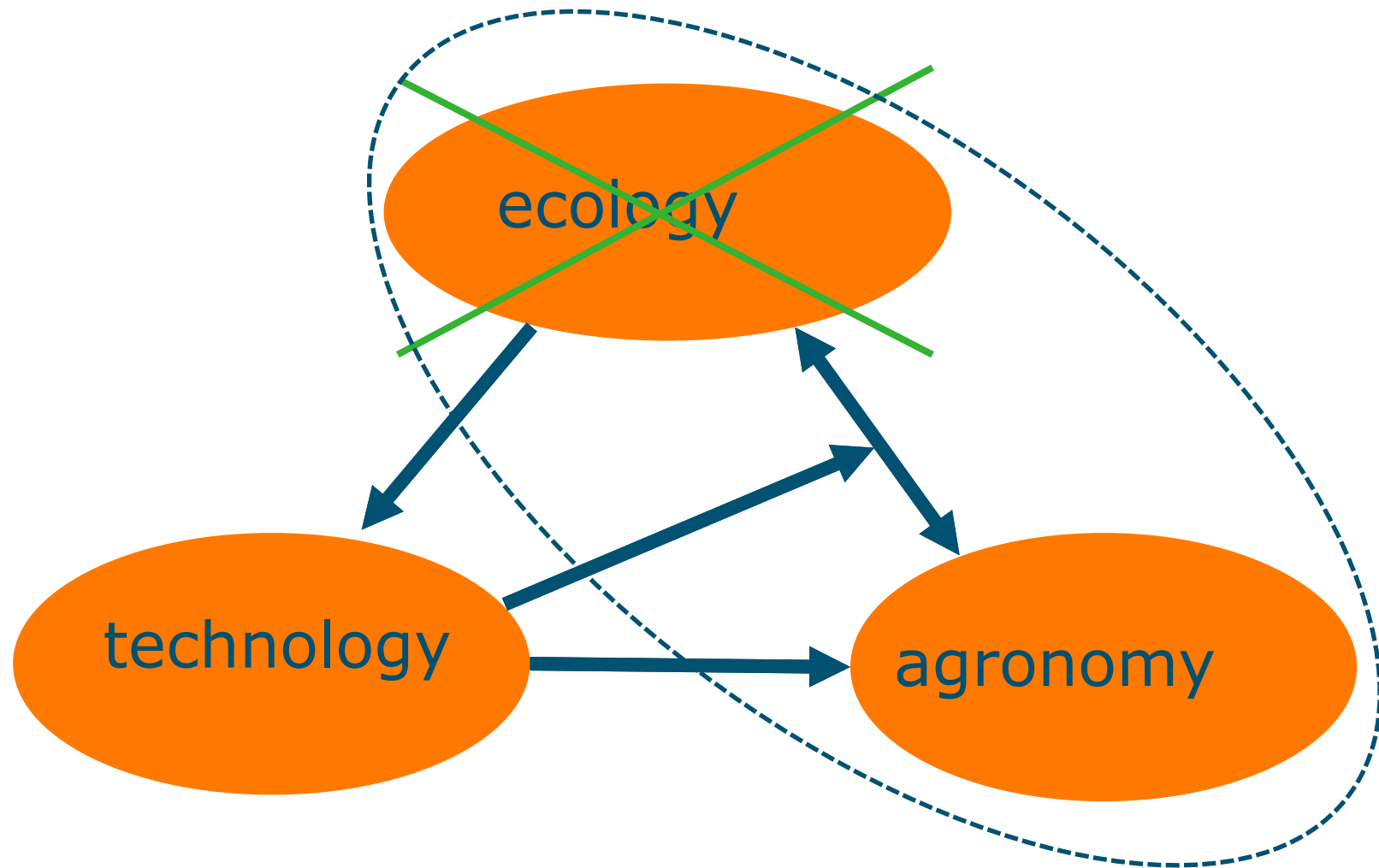
integratie van agroecologische bouwstenen



How can technology help?

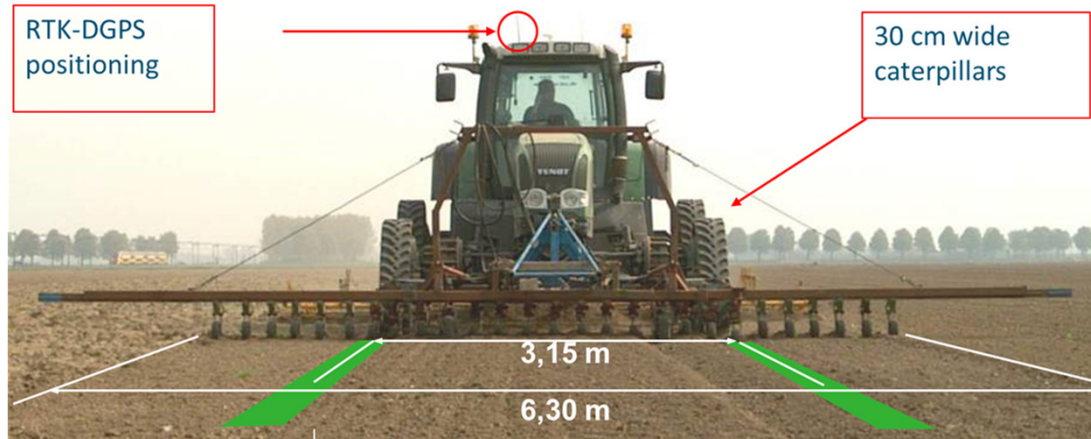
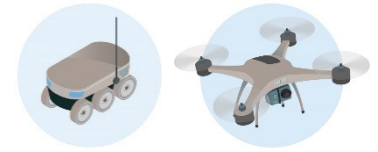


Connect agronomy, ecology and technology





Developments in Technology



Summary

- Context for food production strongly changing
- Current way of food production is a dead end!
- Drastic system changes needed
- Technology very rapidly developing
- Crop diversity works
- Ecology based mechanisation
- From heavy with driver to light and autonomous

Thank you for your attention!

