

Redefining the field

“mobilizing 3D diversity and ecosystem services on the arable farm”

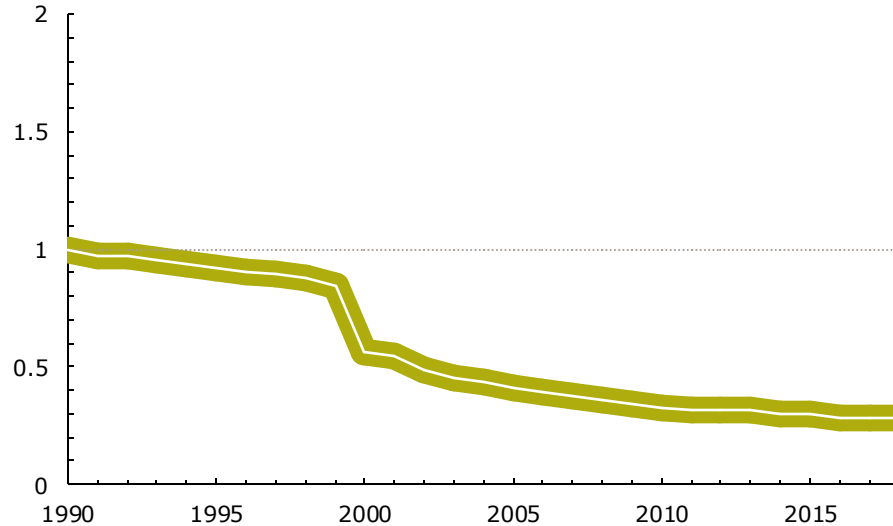
Dirk van Apeldoorn

Farming Systems Ecology Group en Praktijkonderzoek Openteelten



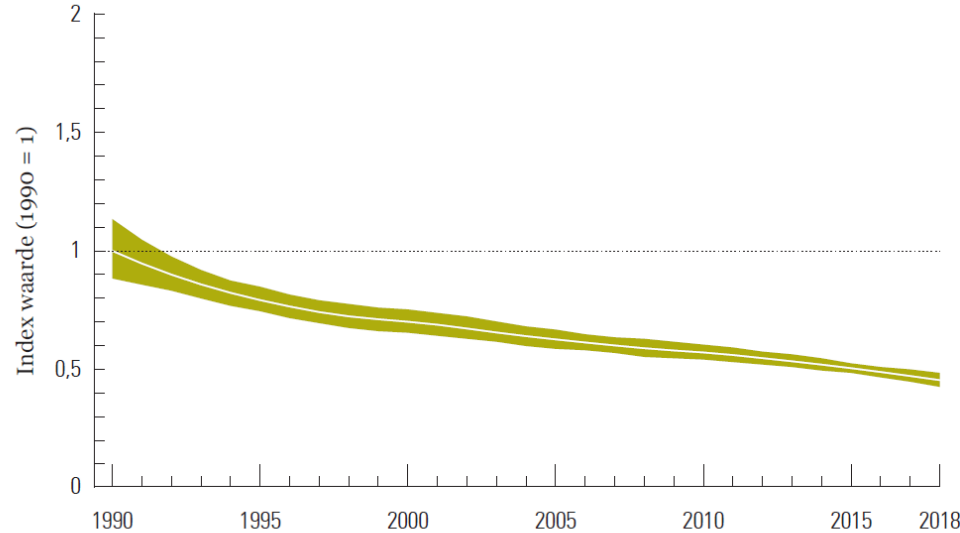
About me: Bending the curve

Farmers in the NL



CBS:[statline](#)

Biodiversity in rural areas in NL



WWF: [Living Planet Report Nederland](#)



Contents lists available at ScienceDirect

European Journal of Agronomy

journal homepage: www.elsevier.com/locate/eja



Redefining the field to mobilize three-dimensional diversity and ecosystem services on the arable farm

Lenora Ditzler^{a,*}, Dirk F.van Apeldoorn^{a,b}, Rogier P.O. Schulte^a, Pablo Tittonell^{c,d,e}, Walter A. H. Rossing^a

^a Farming Systems Ecology, Wageningen University & Research, P.O. Box 430, 6700 AK Wageningen, the Netherlands

^b Field Crops, Wageningen University & Research, Edelhertweg 10, 8200 AK Lelystad, the Netherlands

^c Agroecology, Environment and Systems Group, Instituto de Investigaciones Forestales y Agropecuarias de Bariloche (IFAB), INTA-CONICET, Modesta Victoria 4450 - CC 277 (8400), San Carlos de Bariloche, Río Negro, Argentina

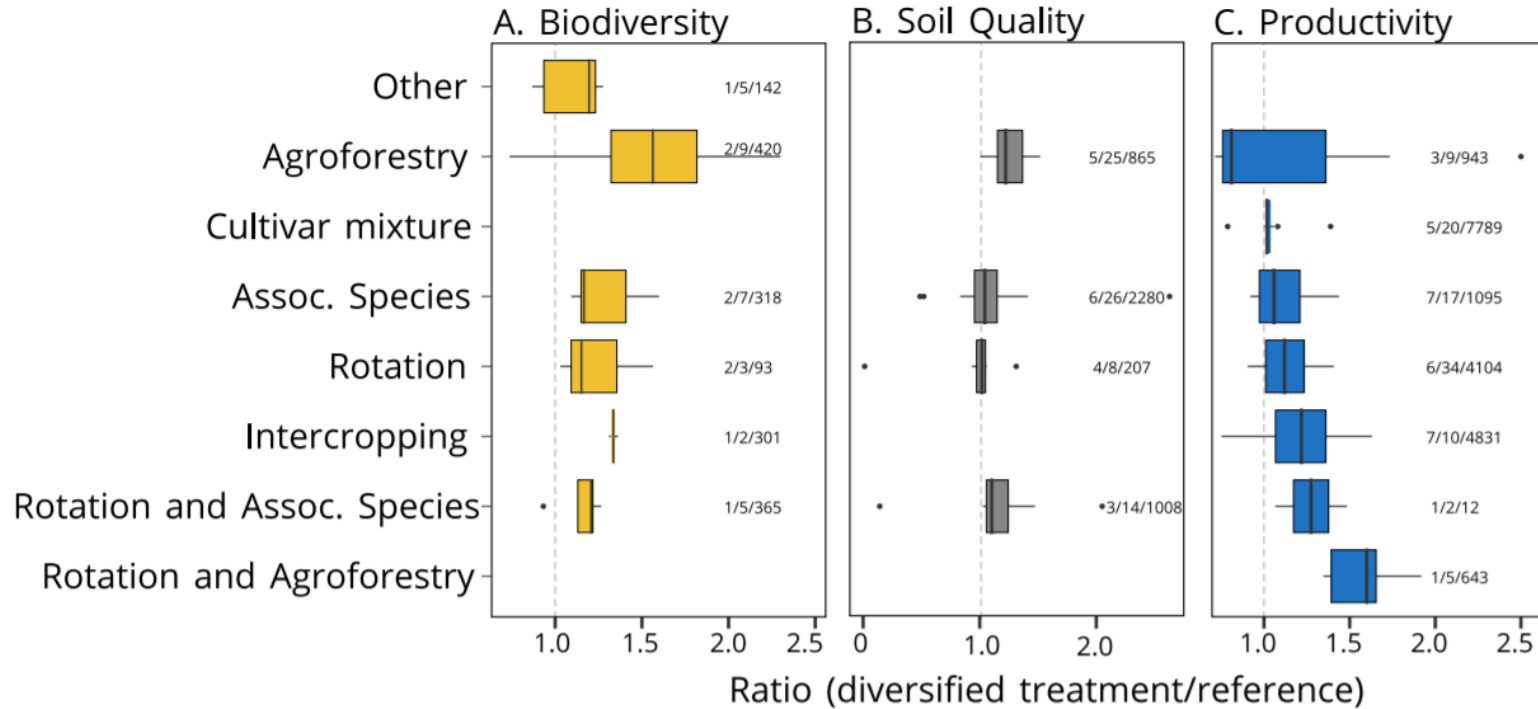
^d Agroécologie et Intensification Durable (AiDA), Centre de coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), Université de Montpellier, 34000 Montpellier, France

^e Groningen Institute of Evolutionary Life Sciences, Groningen University, PO Box 11103, 9700 CC Groningen, the Netherlands

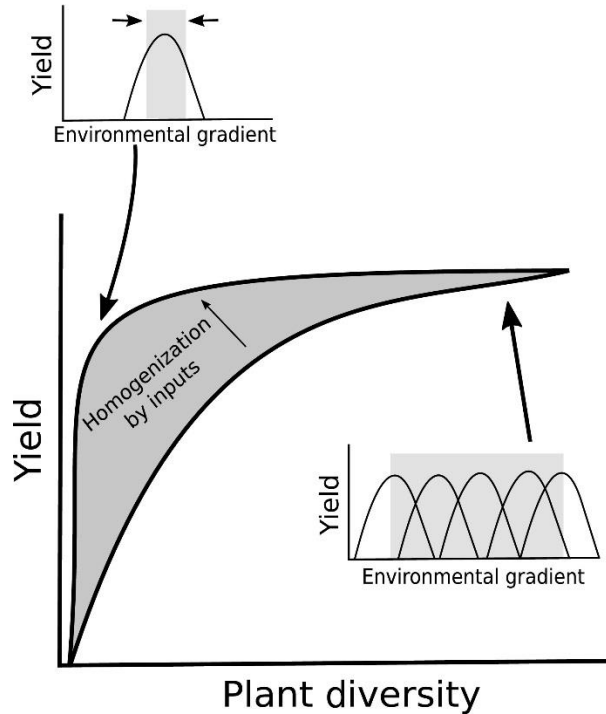
Beyond organic farming – harnessing biodiversity-friendly landscapes



Diversity works!

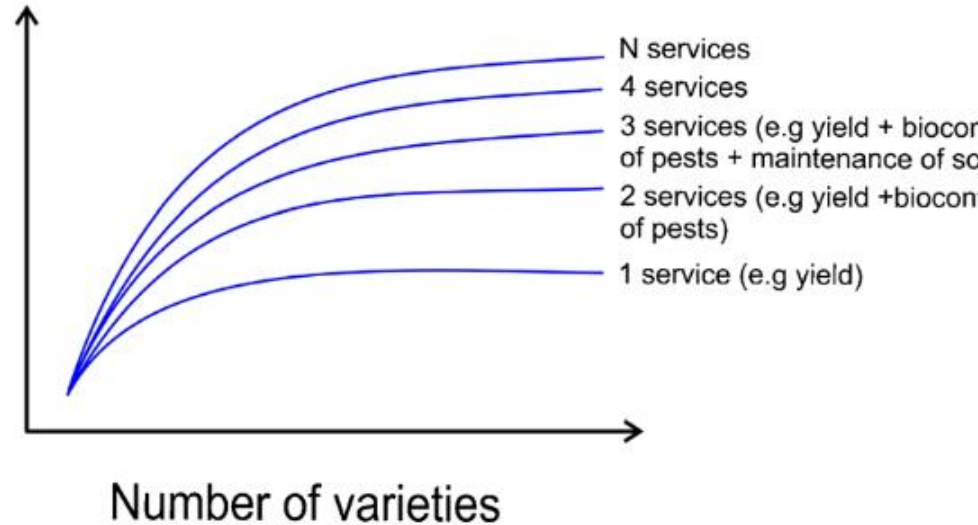


Ecological intensification: smart use of diversity



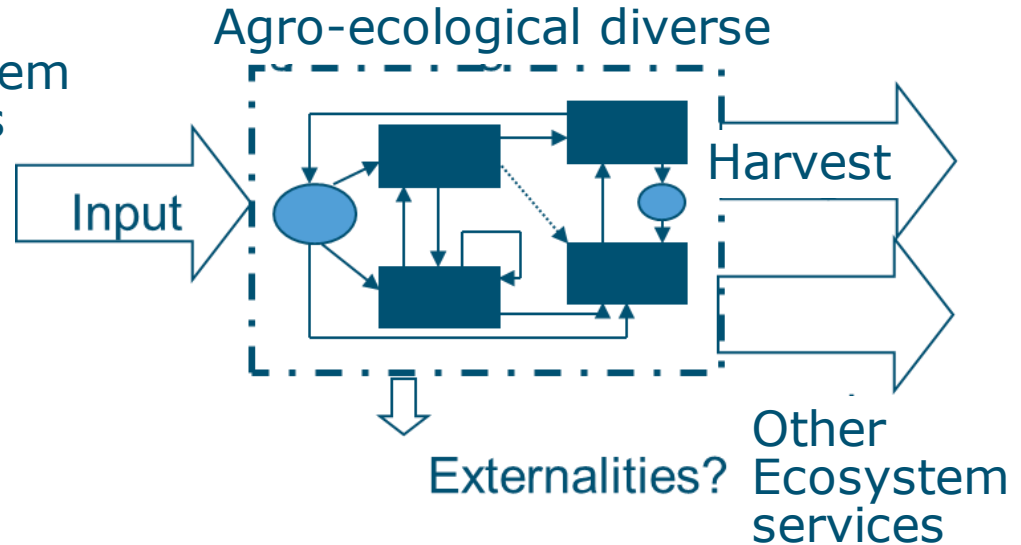
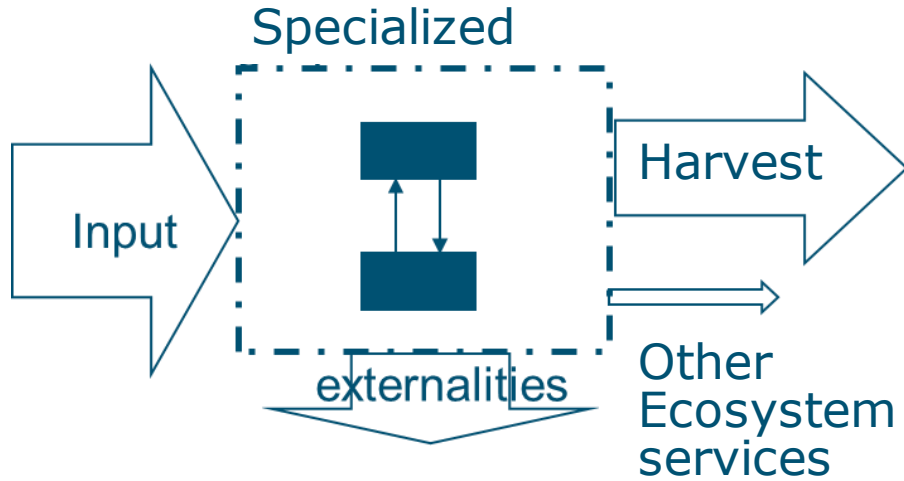
Forest et al (2017).
[doi:10.1111/1365-2745.12789](https://doi.org/10.1111/1365-2745.12789).

Sum of all services
provided by the mixture



Barot, et al. (2017).
doi.org/10.1007/s13593-017-0418-x

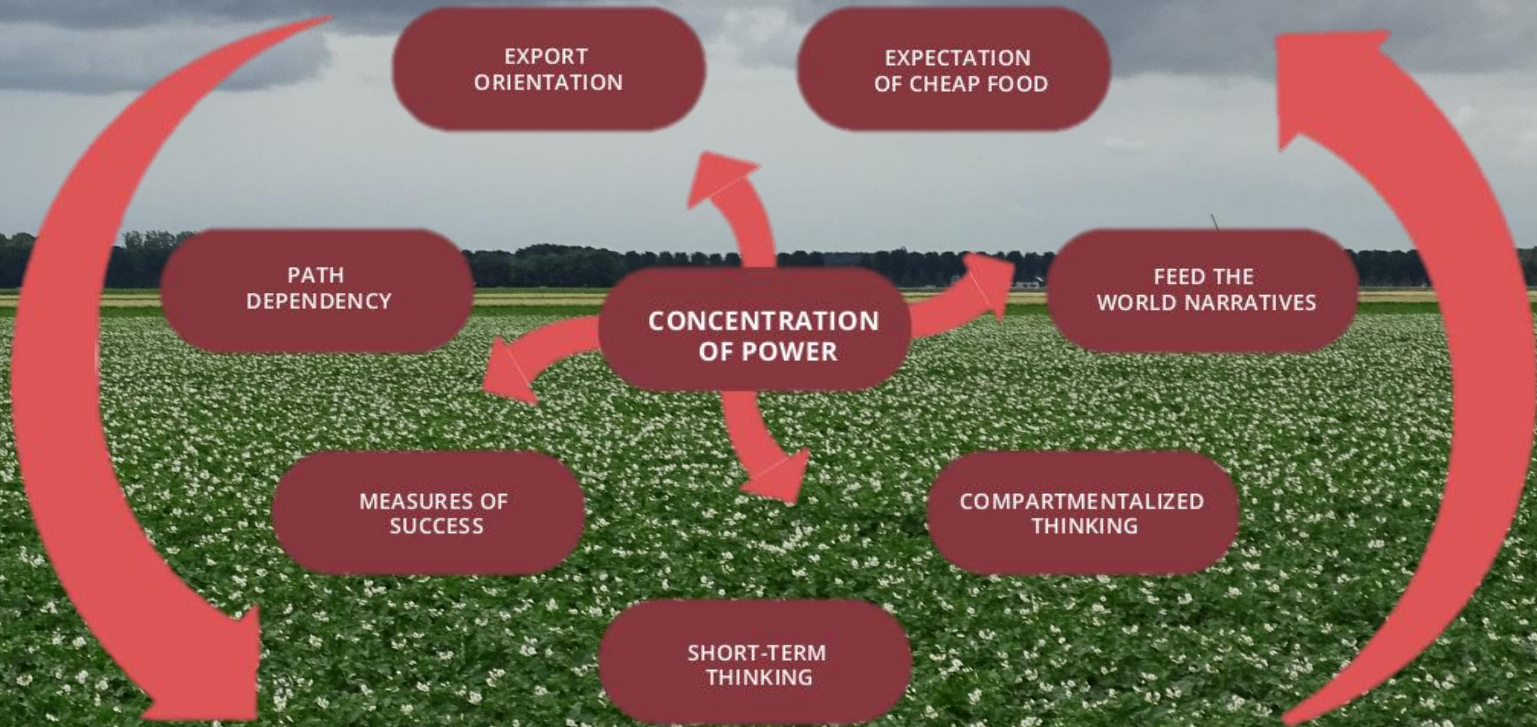
Diversified systems have multi-objectives



Walter Rossing
UNIVERSITY & RESEARCH

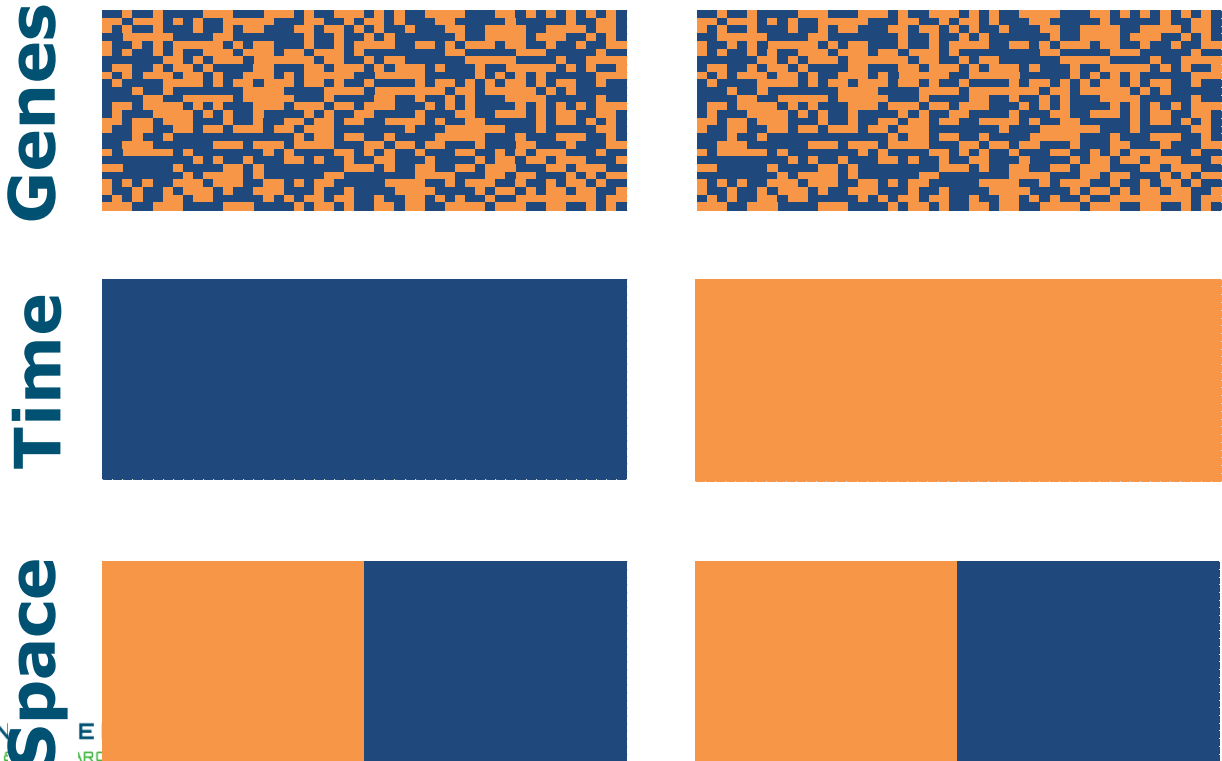


Industrial agriculture is locked-in



Mobilizing diversity

Step->



Genes: (bio)diversity



OPV emergence 9:10

Imposa (variety) 1:10

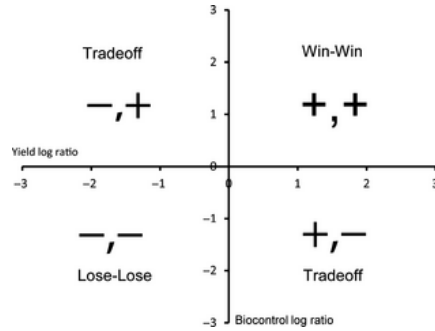
Components
Crops
Cultivars

Mixed farming

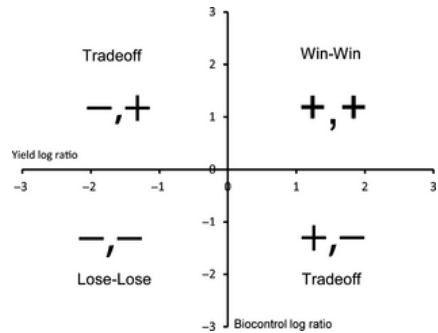
Crop mixtures

Cultivar mixtures

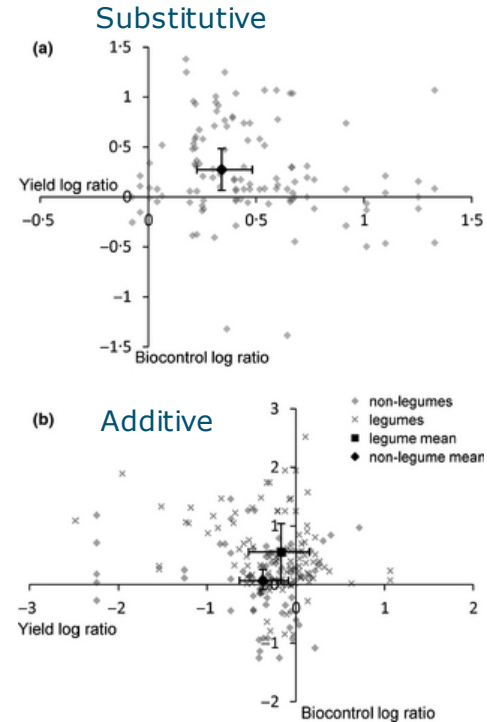
genes: mixed cropping of cereals and legumes



genes: mixed cropping of cereals and legumes

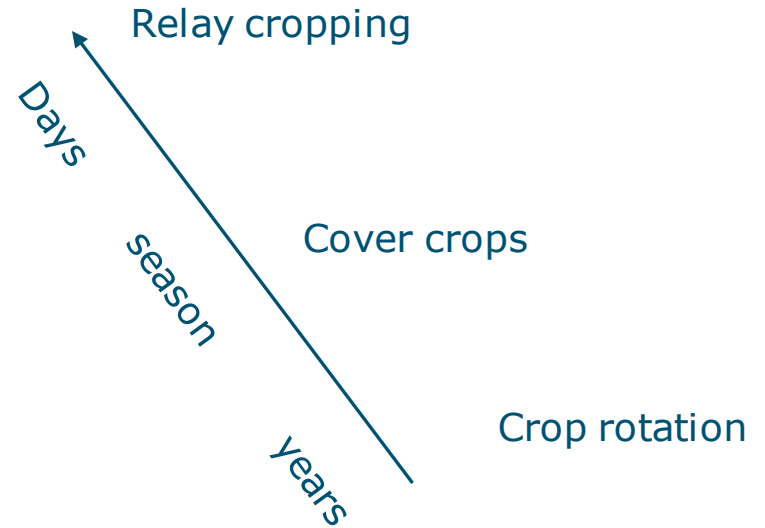


	Yield	biocontrol
Legumes additive	0.85	1.74
Legumes substitutive	1.51	1.36

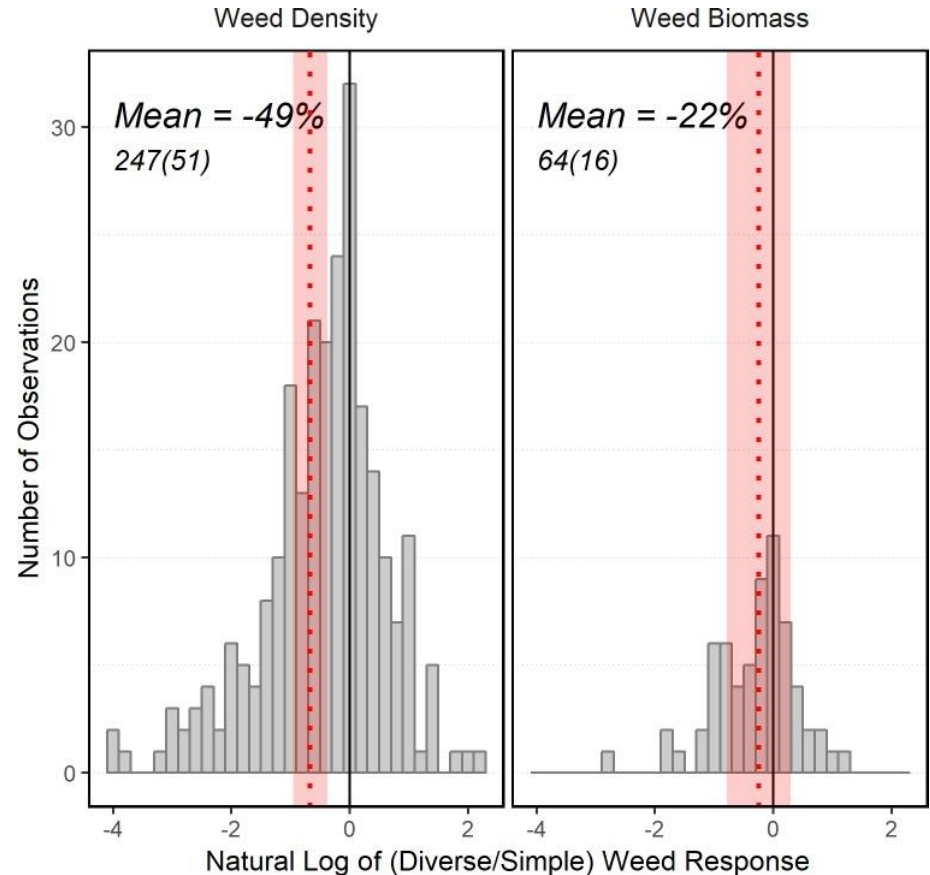


Iverson et al., (2014) DOI: 10.1111/1365-2664.12334

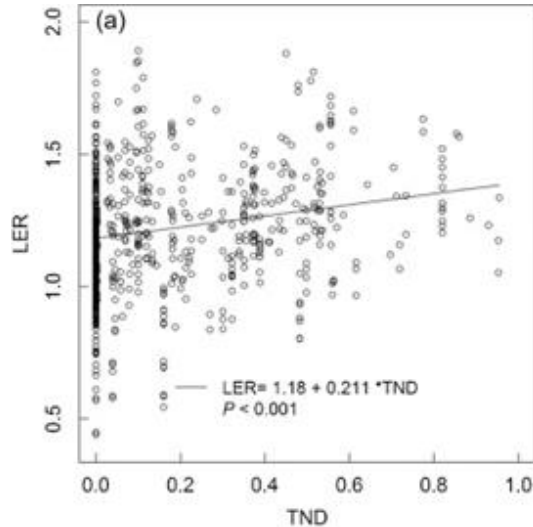
Time: asynchrony



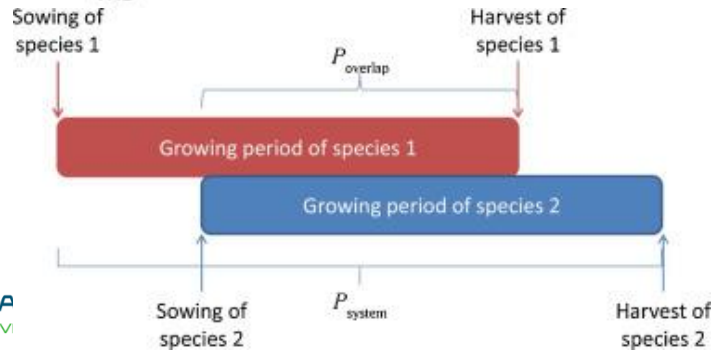
Time: diverse rotations reduce weeds



Time: more different is higher yield



<http://dx.doi.org/10.1016/j.fcr.2015.09.010>



Space: heterogeneity



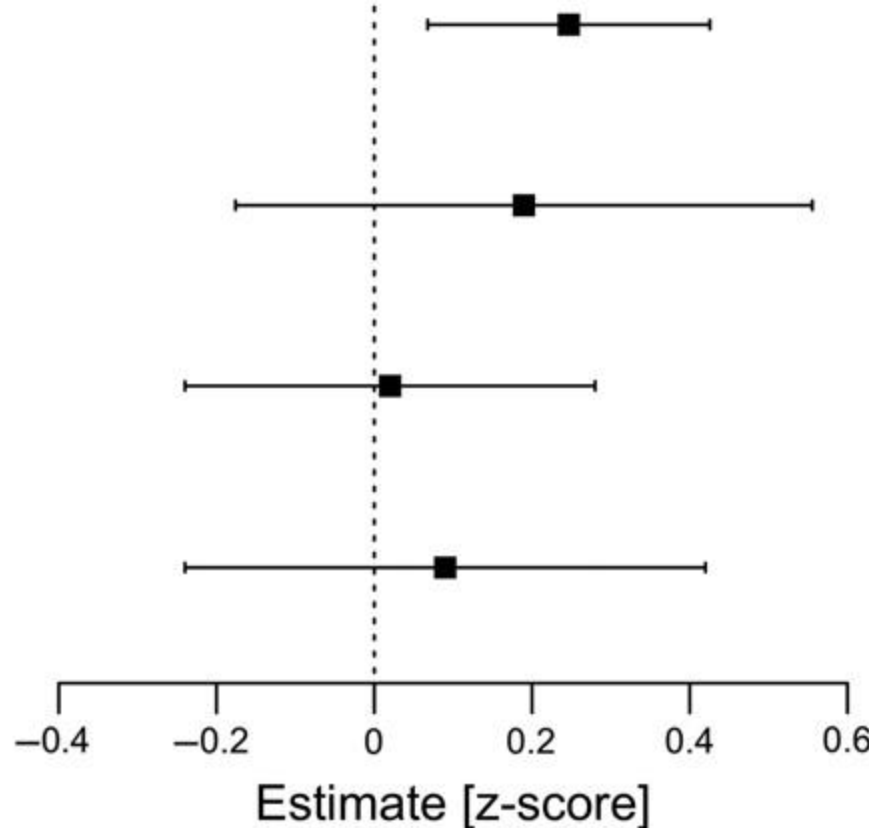
Pest control flower strip

Pest control hedgerow

Pollination flower strip

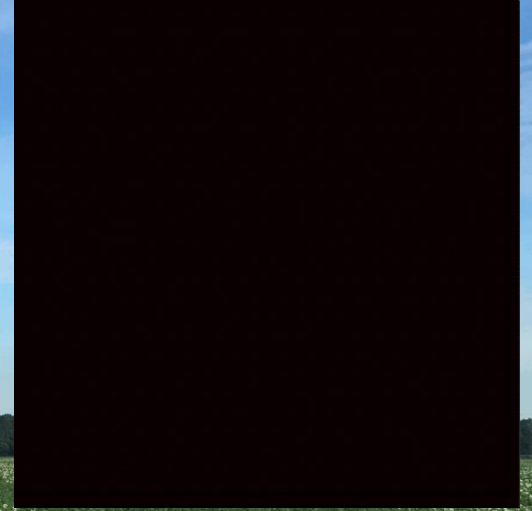
Pollination hedgerow

distance

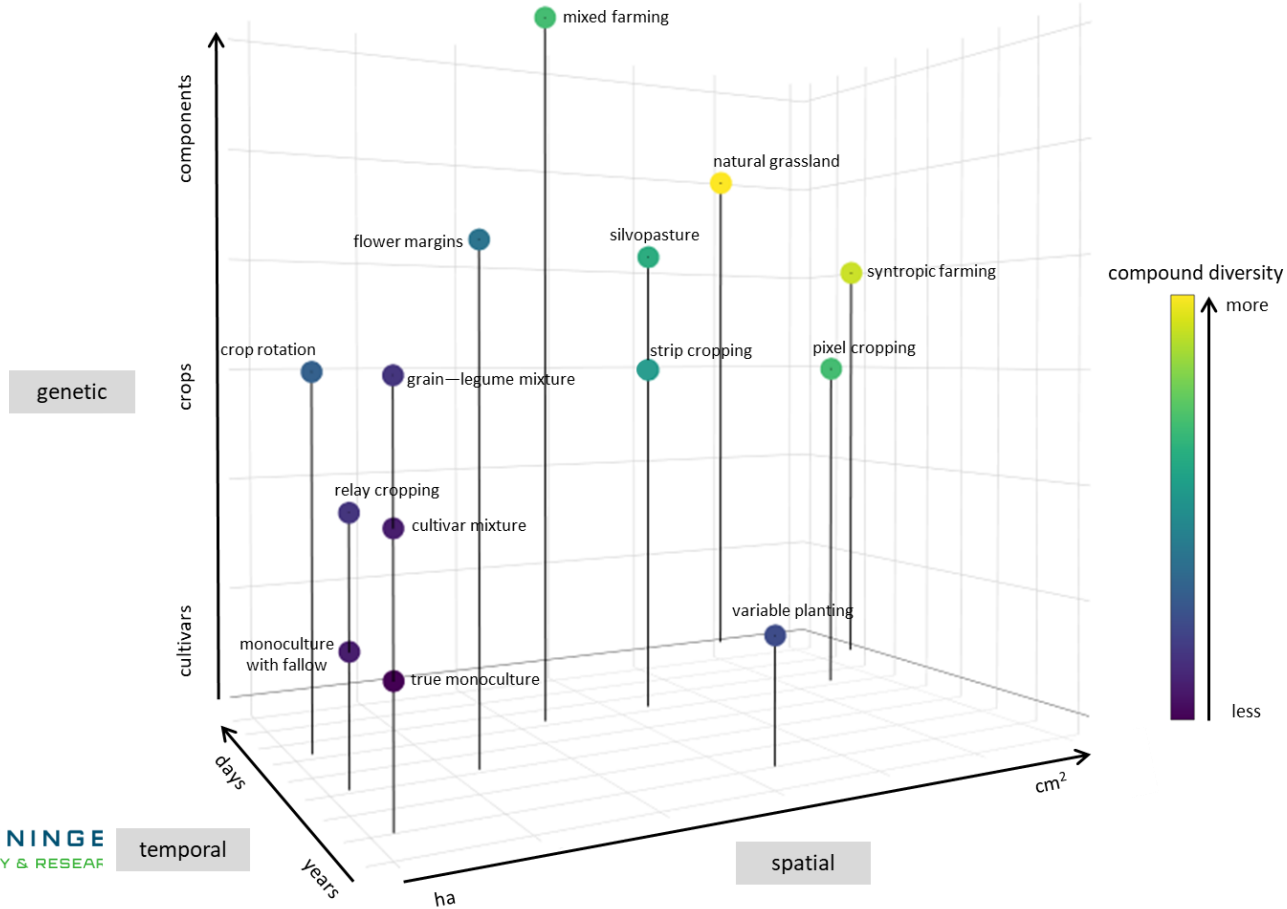


doi: 10.1111/ele.13576

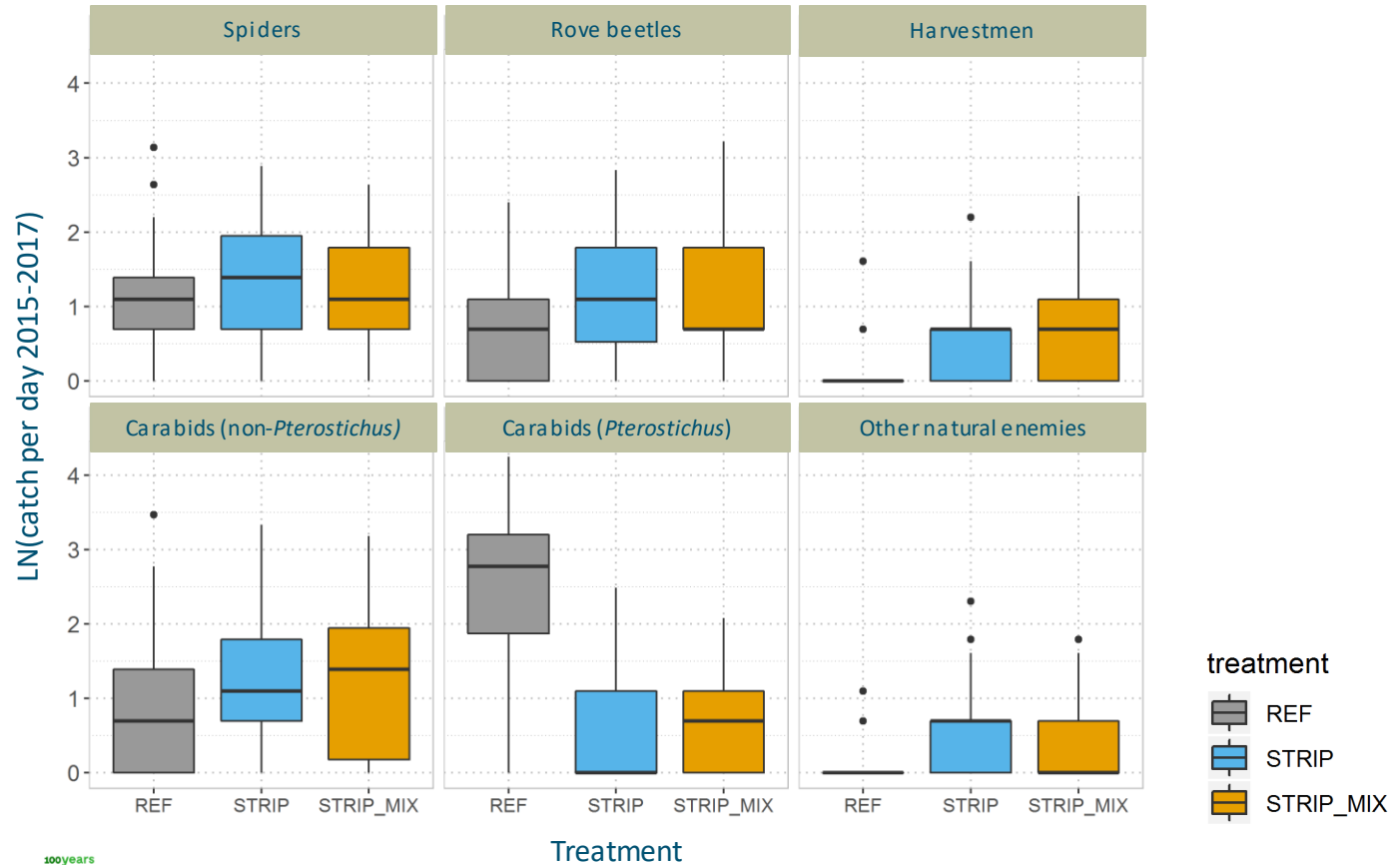
Space: social distancing for crops



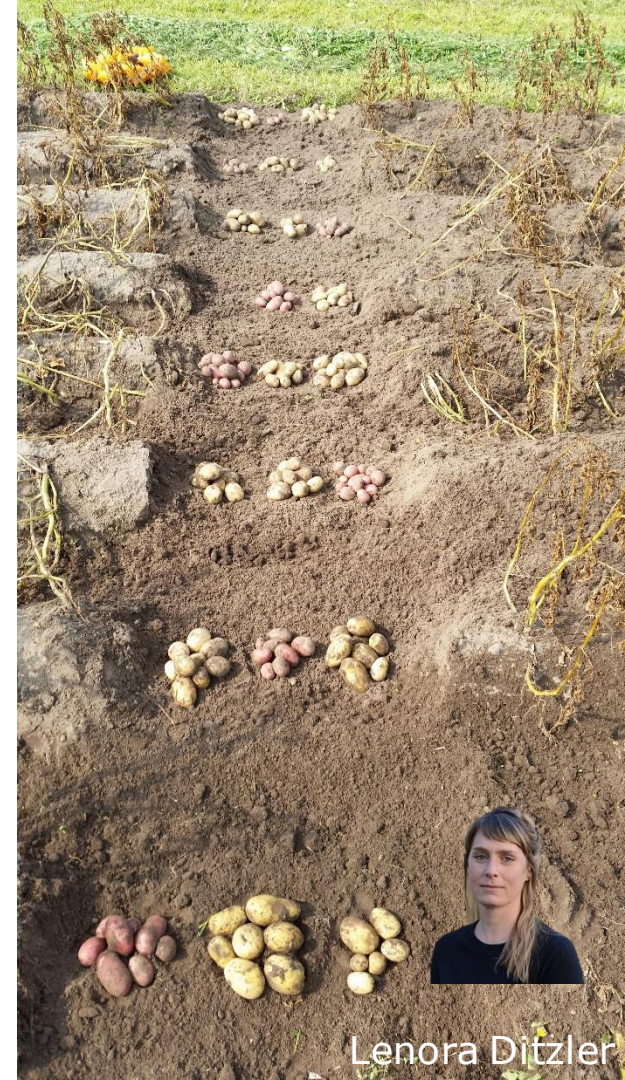
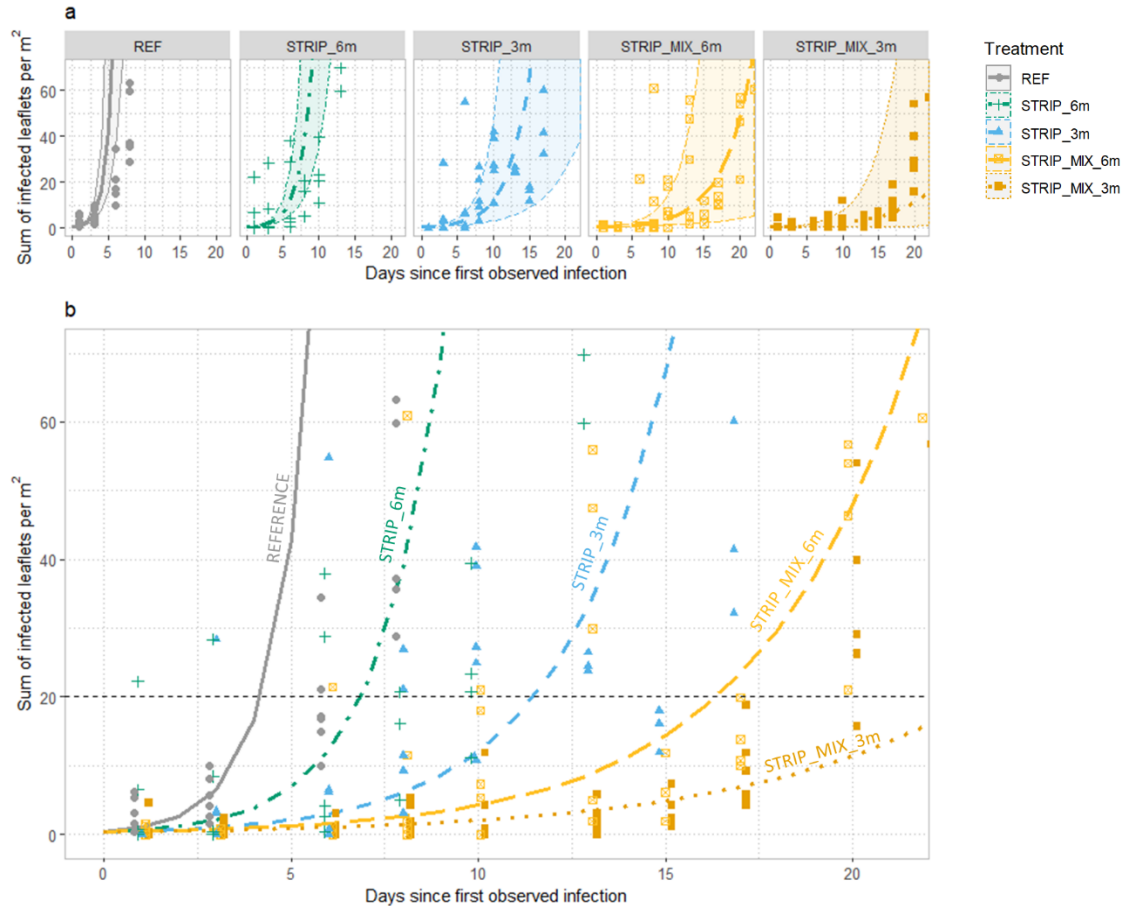
Stacking it



Natural enemies in strips

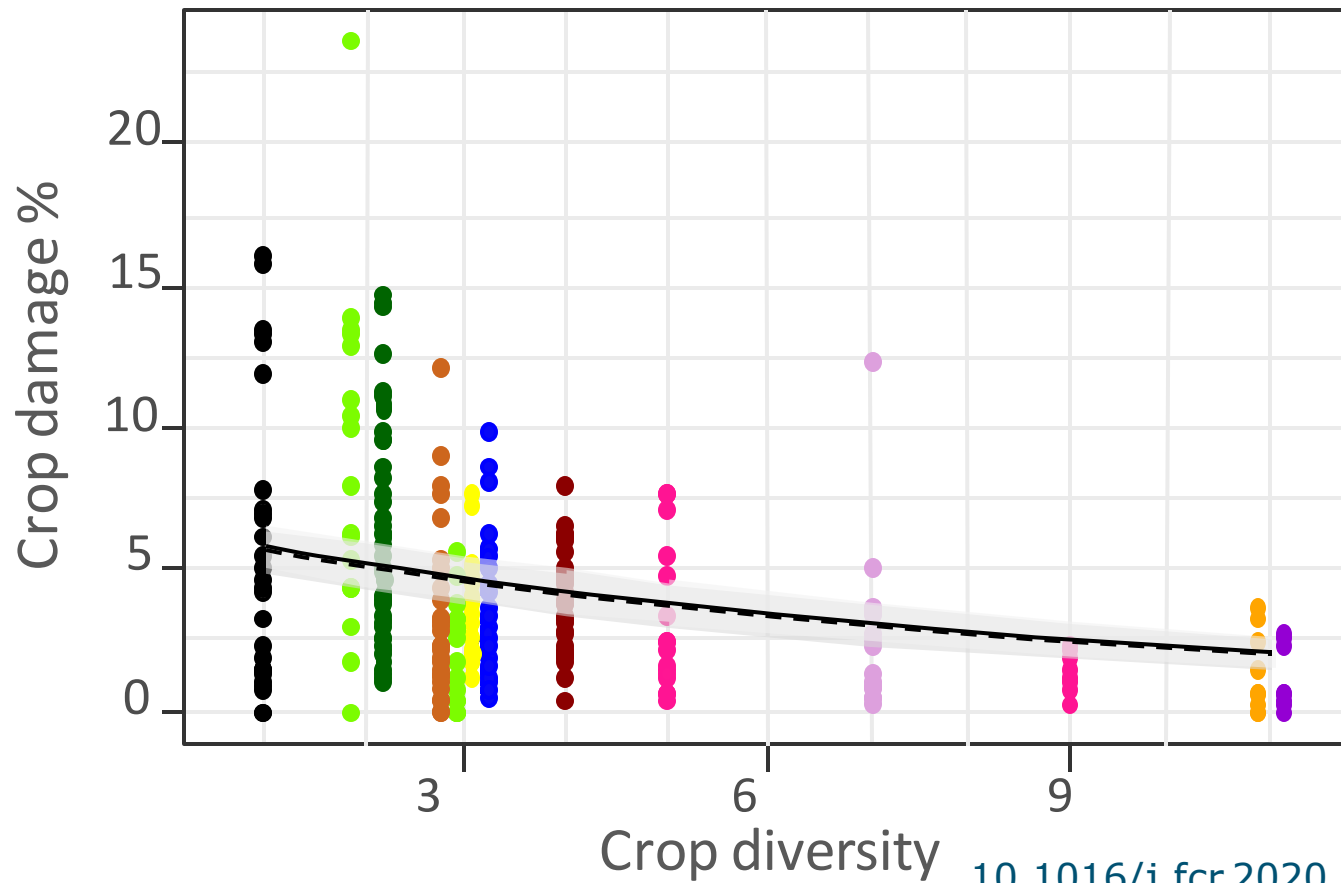


Mixed strip-intercropping



Lenora Ditzler

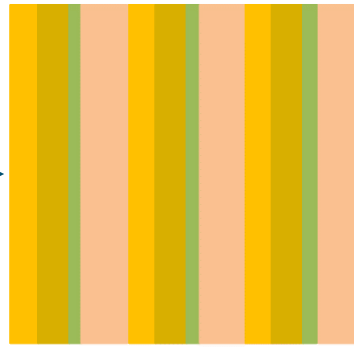
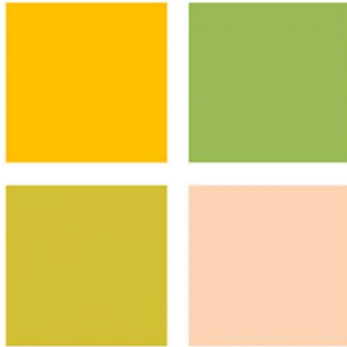
Pixel cropping



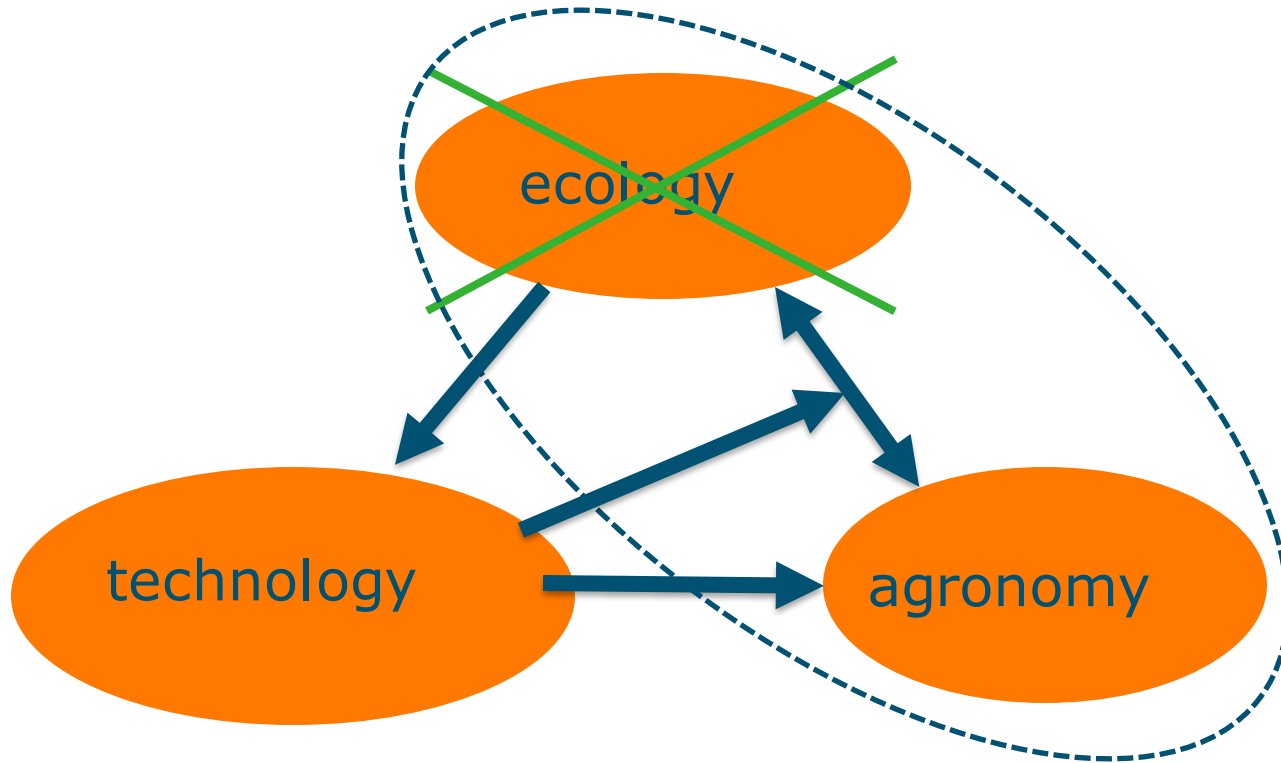
Breaking out



A new role for technology



Vision: technology facilitating ecology

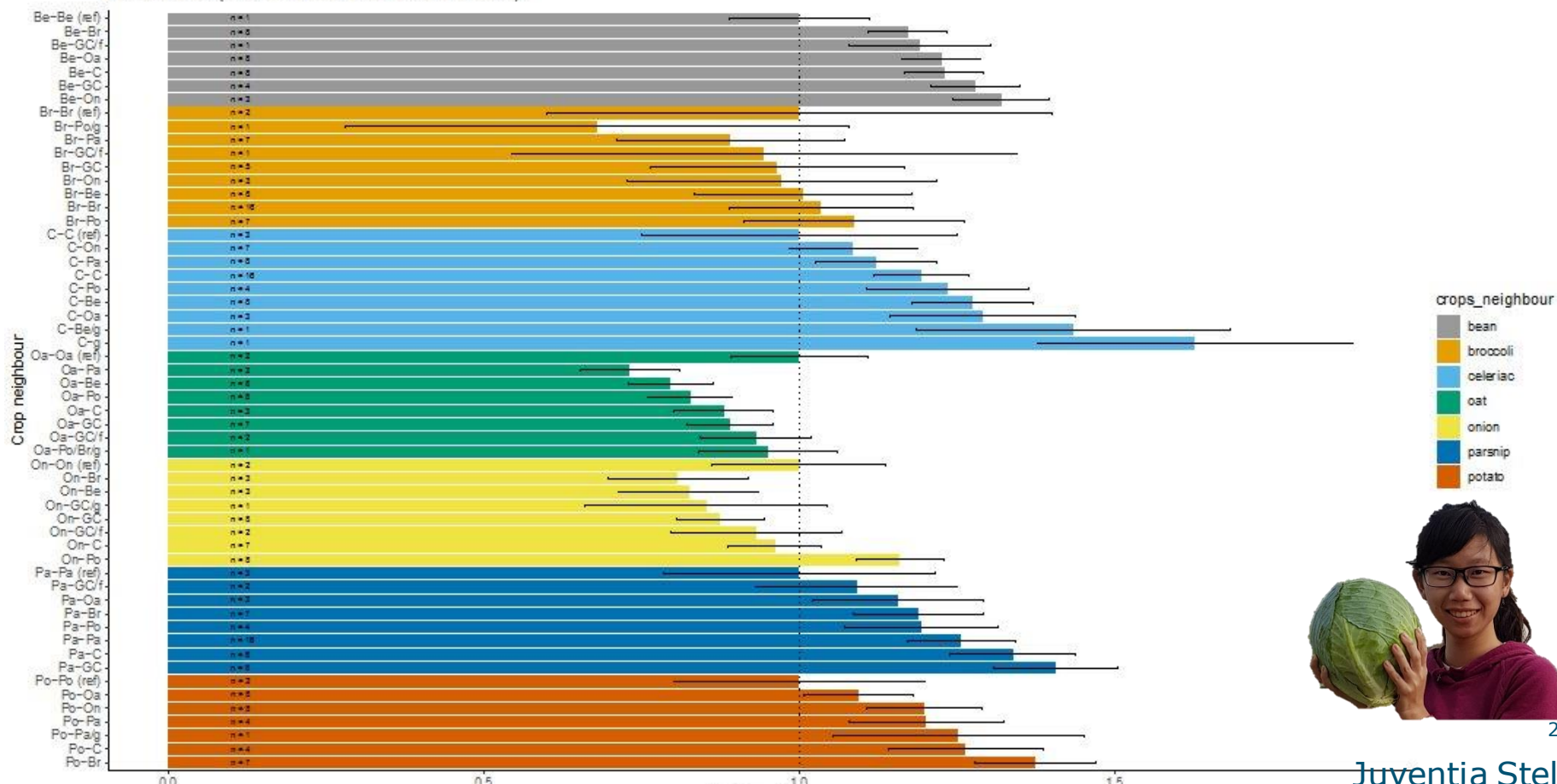


Wijnand Sukkel

What makes good combinations

All crops (pairs)

ERF Gz5 2020 (model results with block as random effect)



What makes good combinations

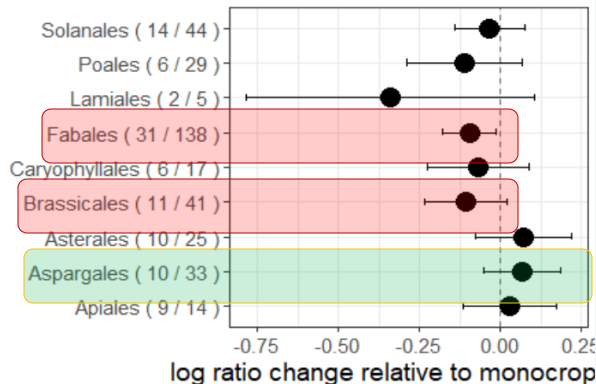


Objective determines good combinations

Taxonomic (plant order)

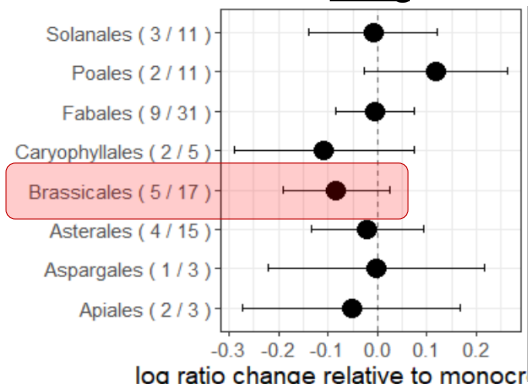
Agronomic classification

Productivity

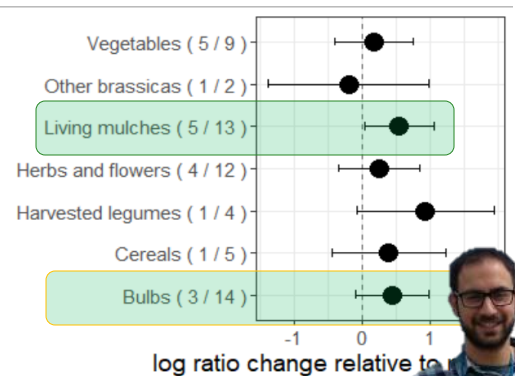
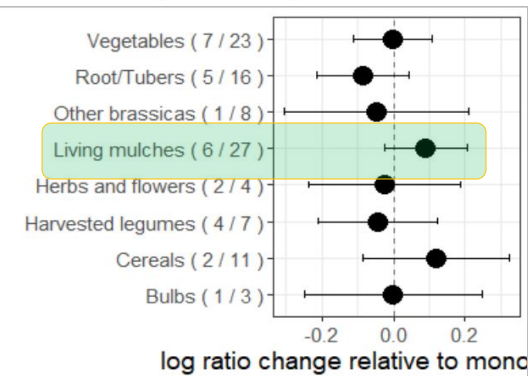
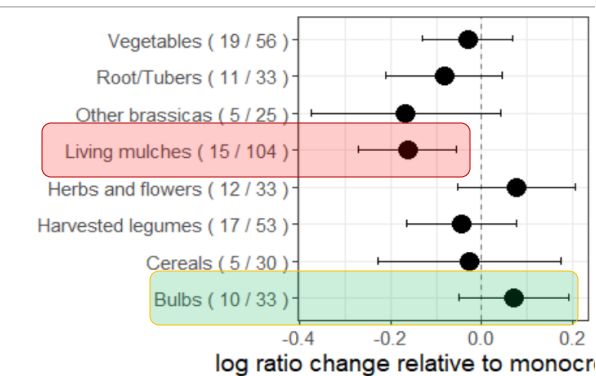
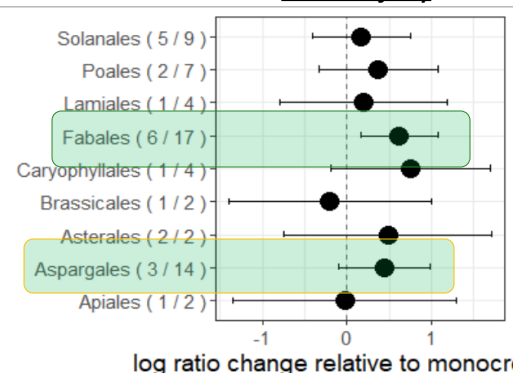


Product Quality

Sizing



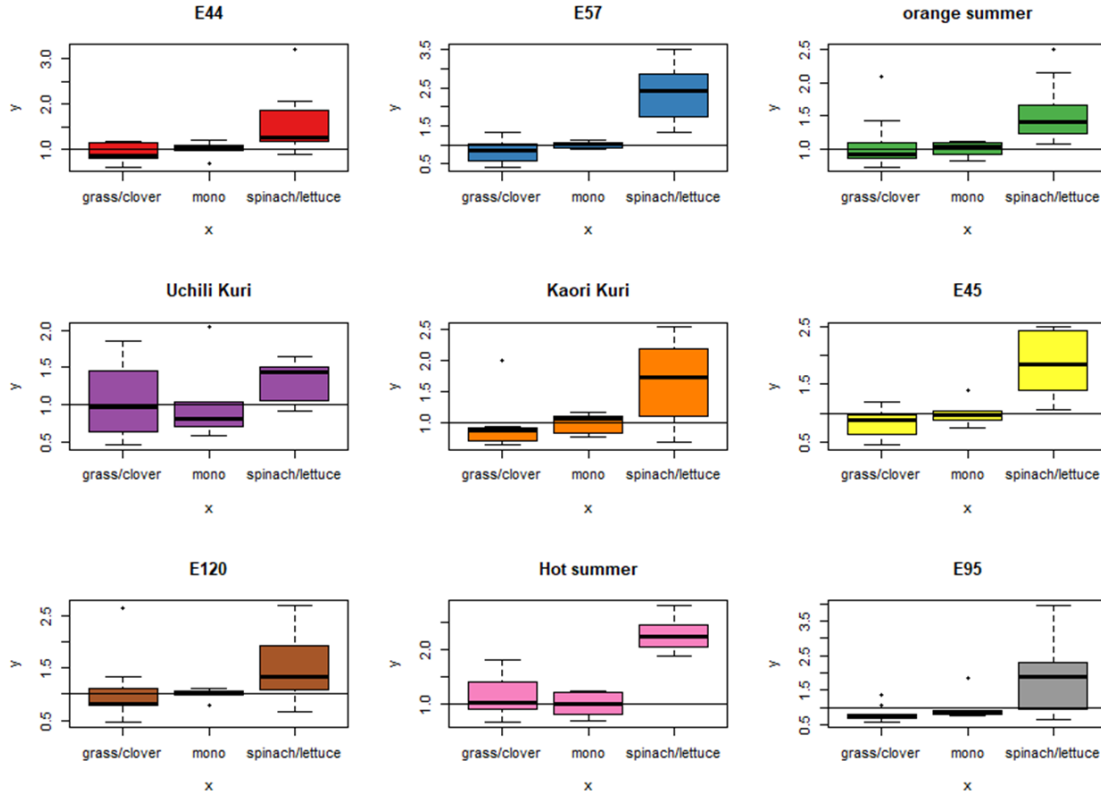
Pest injury



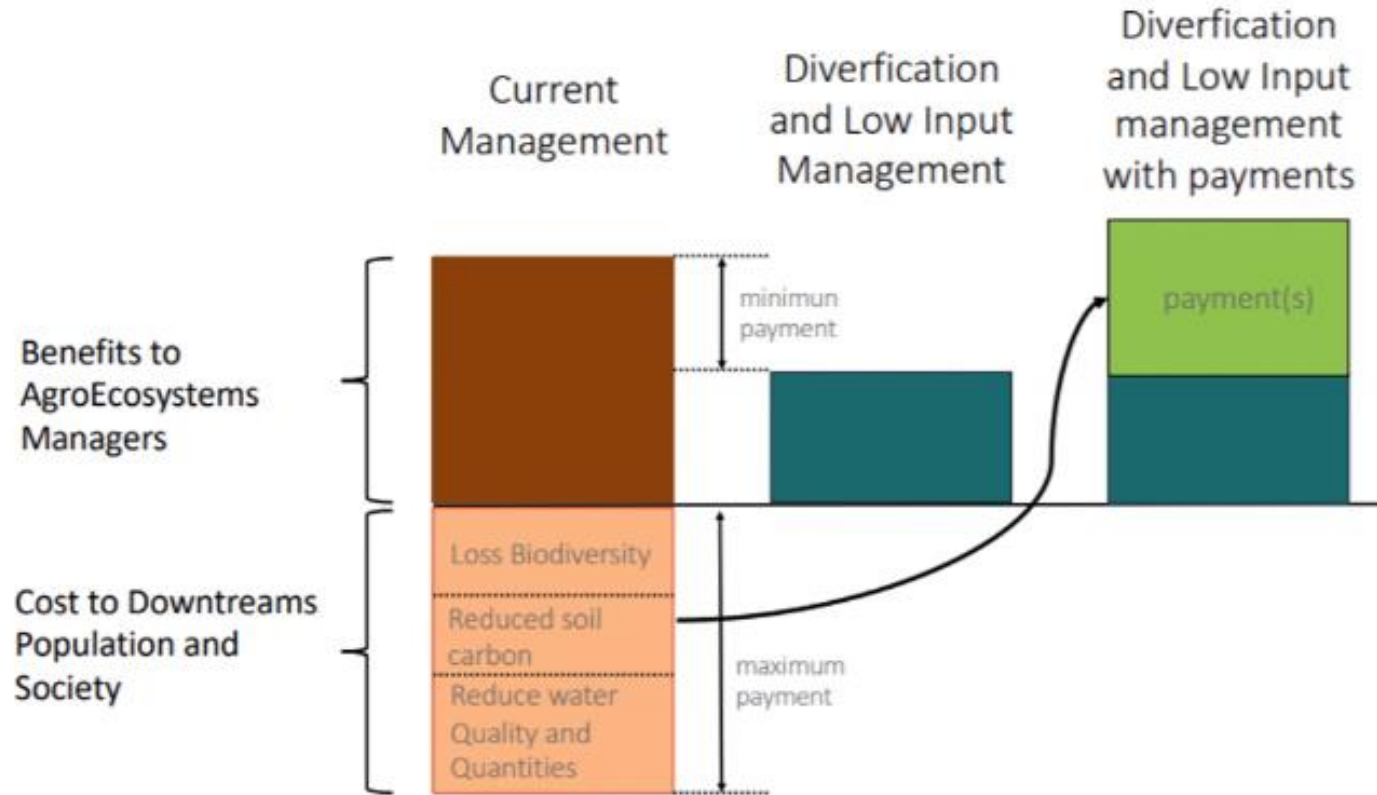
Javier Carrillo & Titouan Le No

what traits are needed?

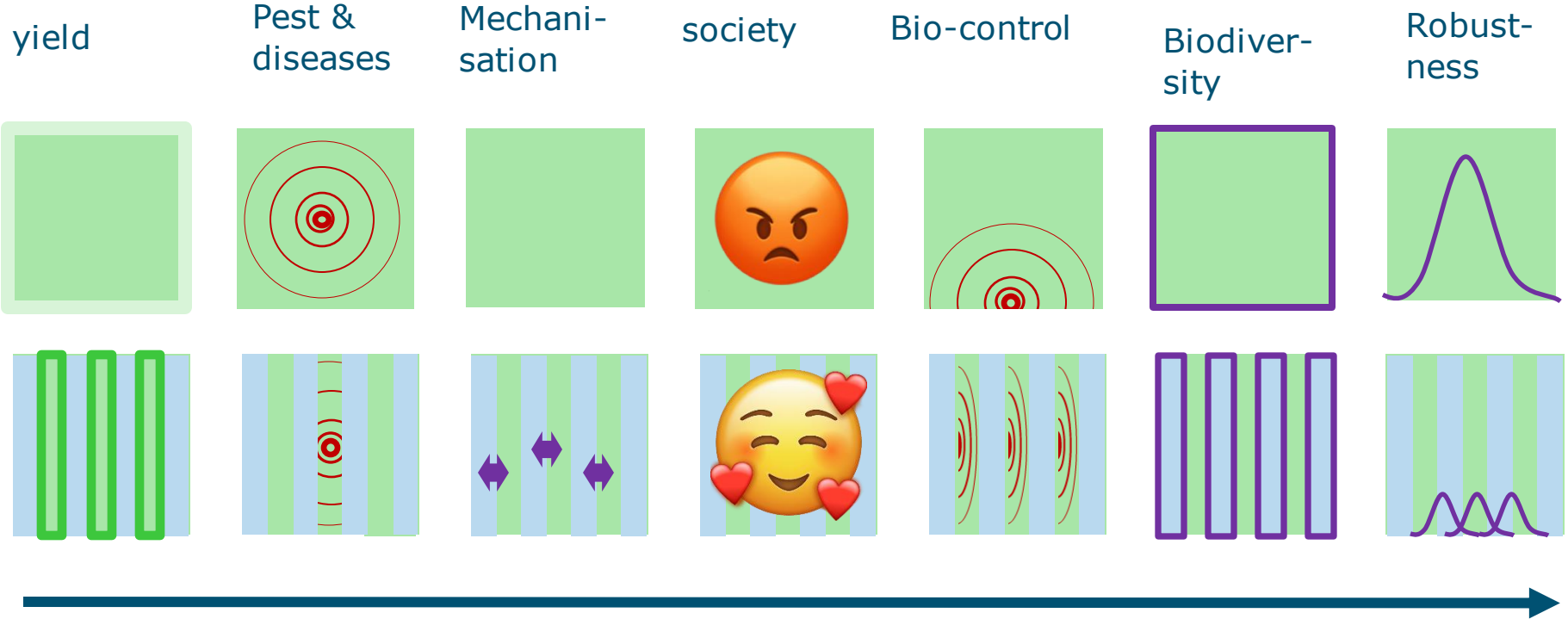
Pumpkin (intercropping index)



How to make a living?



Optimal strip width for ES



Bending the curve

- All farmers report more joy
- Diversity begets diversity
- We can start now

Thanks to:

Walter Rossing, Wijnand Sukkel,
Lenora Ditzler, Luuk Croijmans
Fogelina Cuperus, Stella Juventia
and many many students



Dirk.vanapeldoorn@wur.nl
www.wur.nl/strokonteelt
#strokonteelt

