Managing Biodiversity and Ecosystem Services for Sustainable Agricultural Production

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PADOVA-SYDNEY

Environment, Sustainable Agriculture and Forest Management

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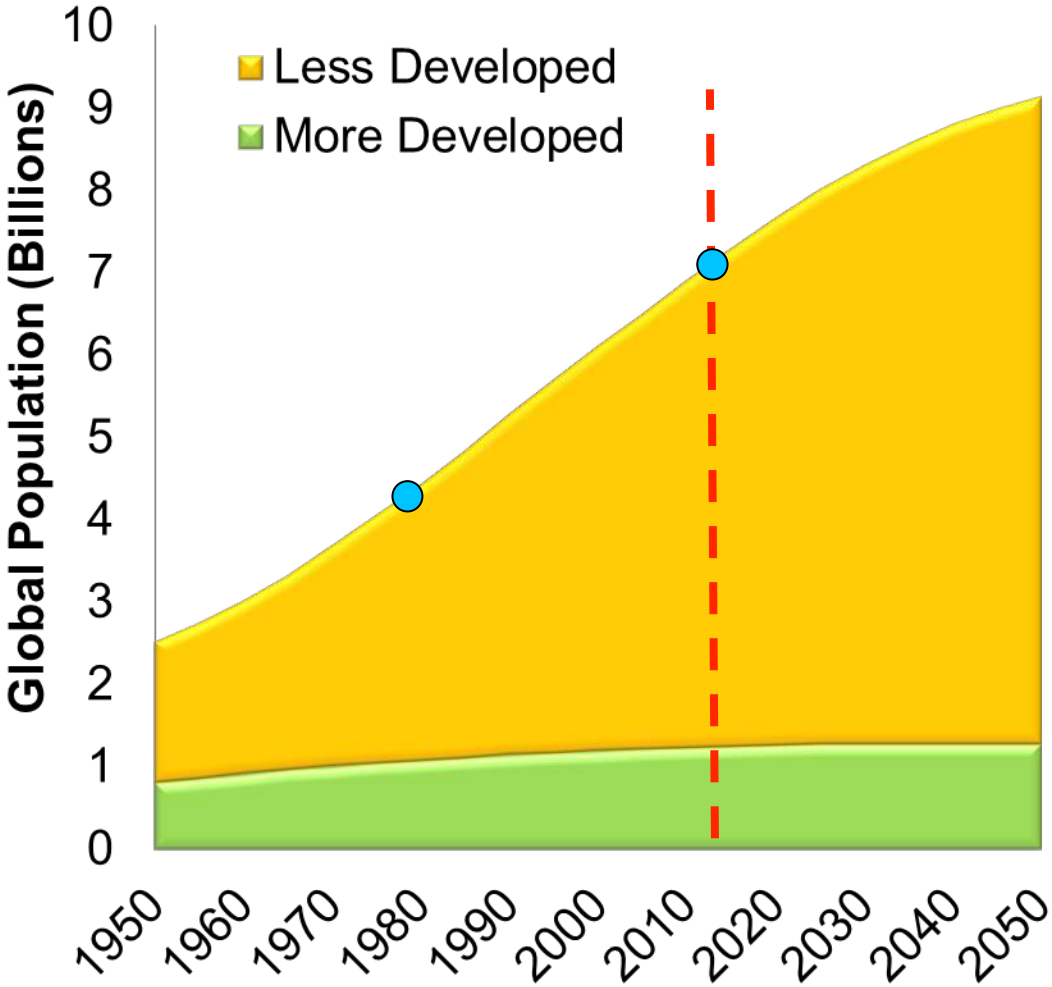
The LIBERATION project

LInking farmland Biodiversity to Ecosystem seRvices for effective ecological intensification (LIBERATION)

Project Coordinator: Wageningen University (NL), David Kleijn

Challenges for agriculture



~9 billion people to feed by 2050

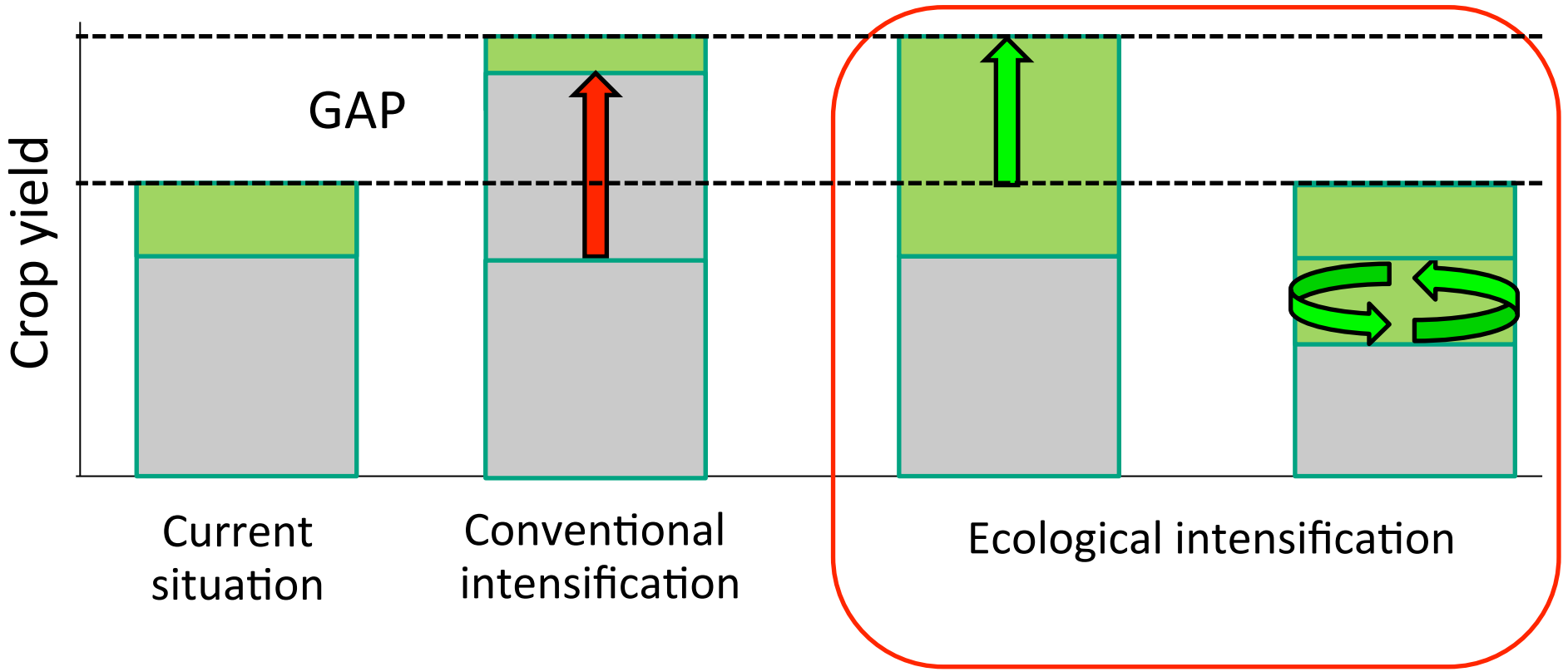
Increasing food demand

Innovative approaches to achieve sustainable crop production!

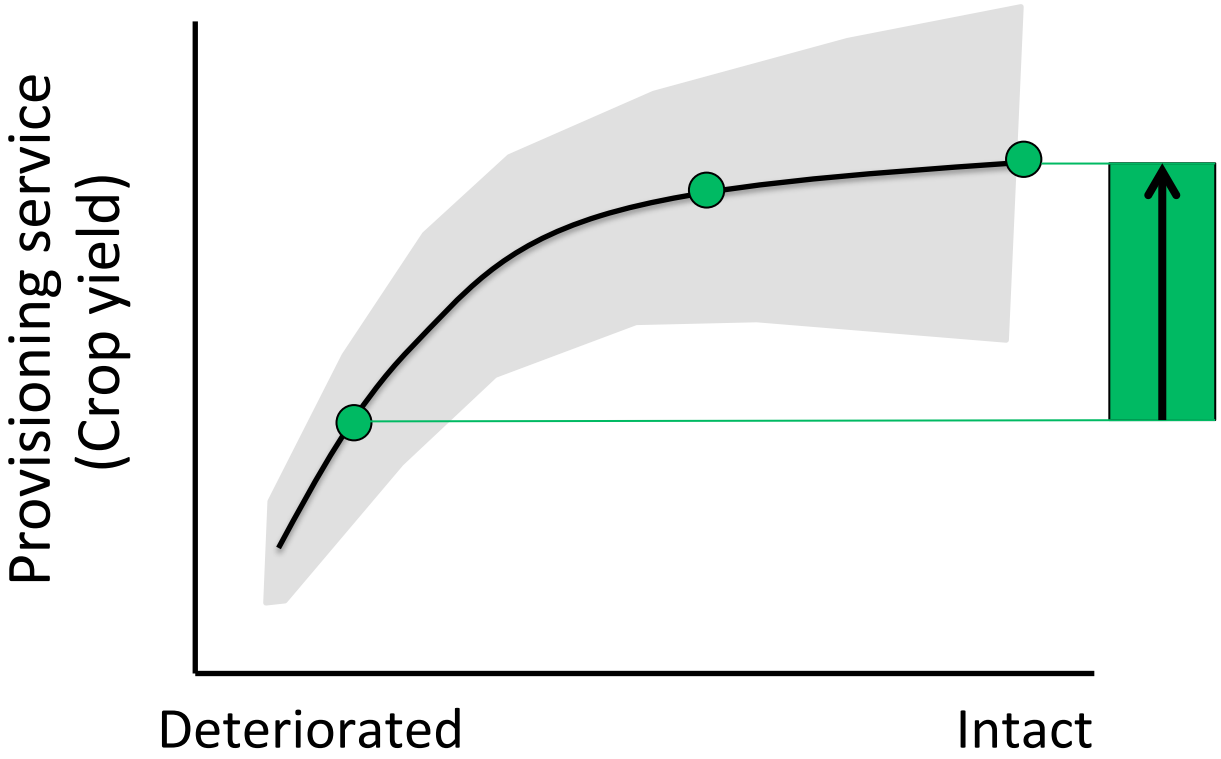
Ecological intensification

Ecosystem services (pollination, biological control, soil fertility...)

Traditional agronomic inputs (water, N, tillage...)



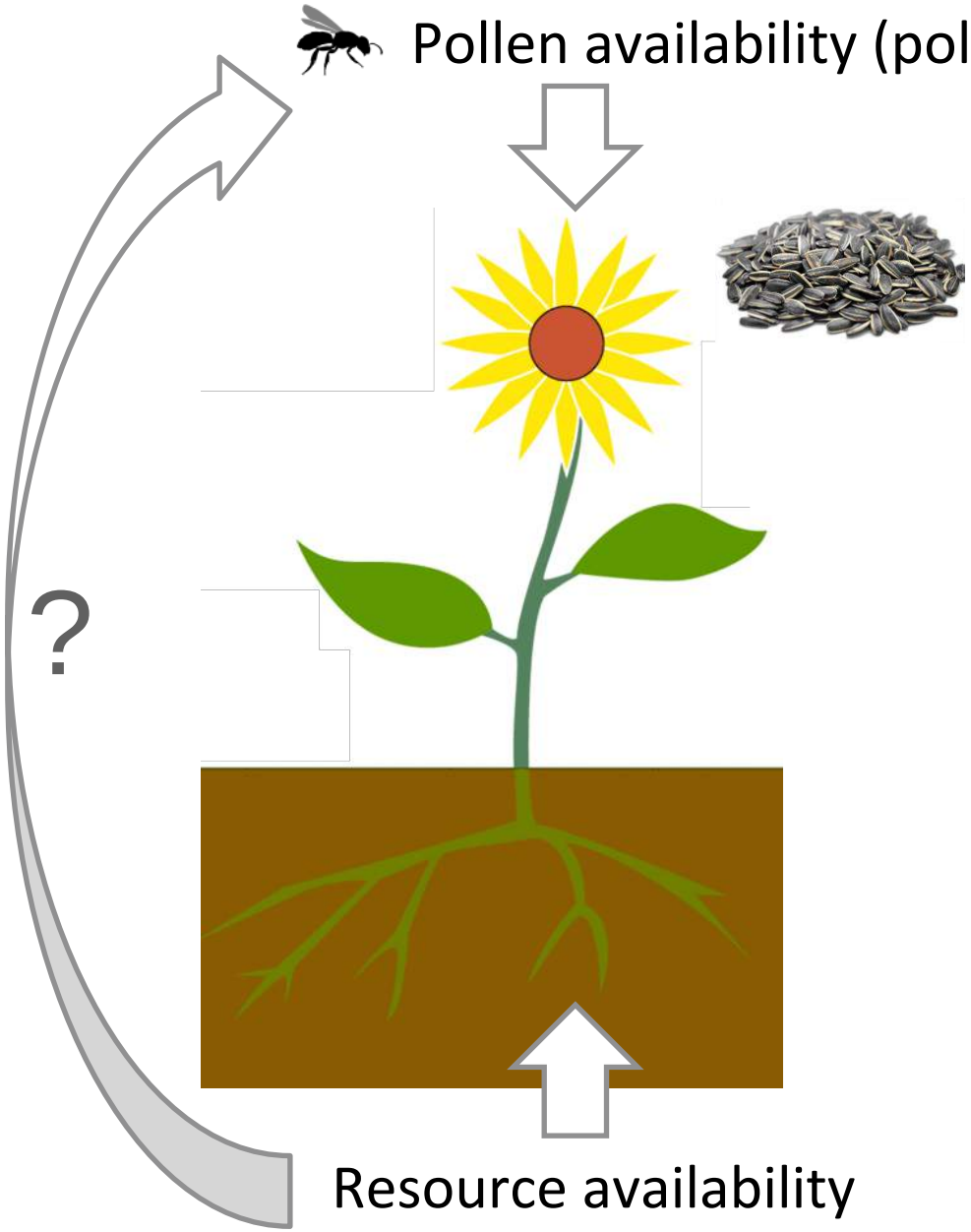
1. Testing for ecosystem service benefits to yield



2. Can we incorporate ES management in cropping systems?

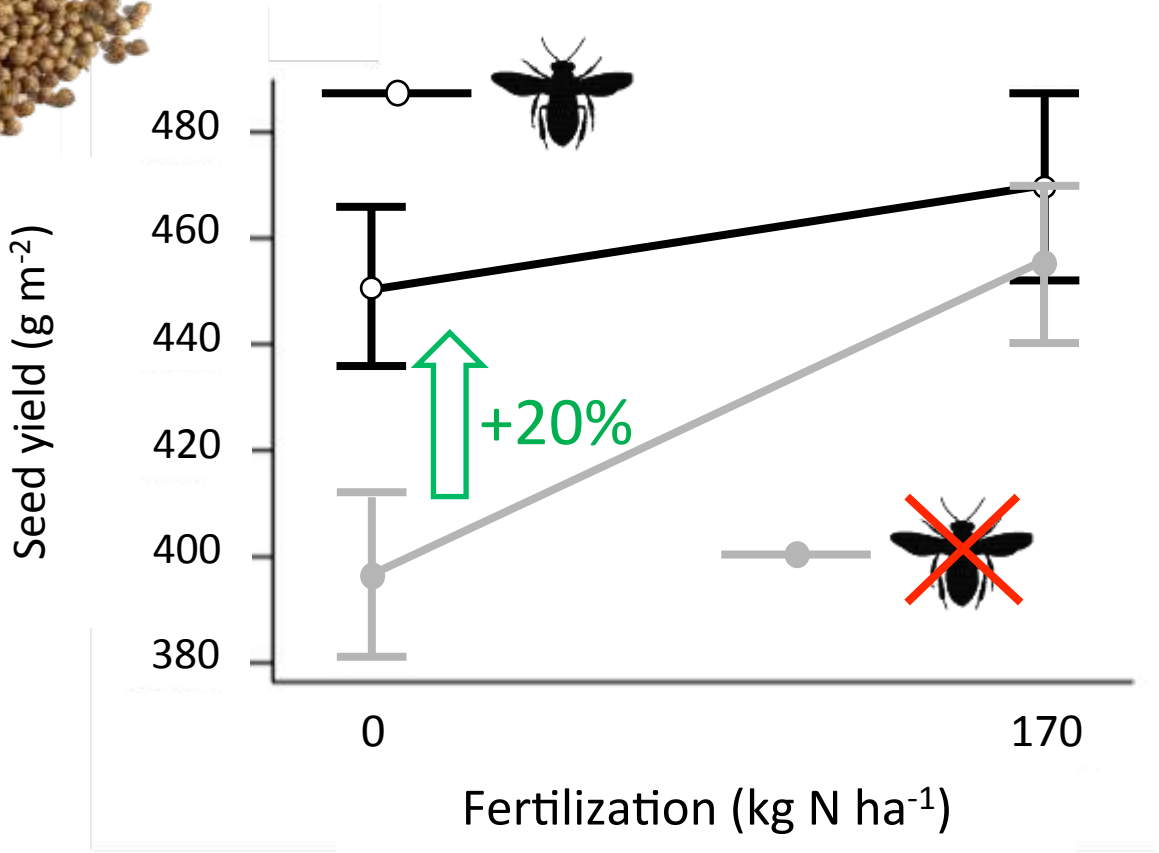
Crop pollination

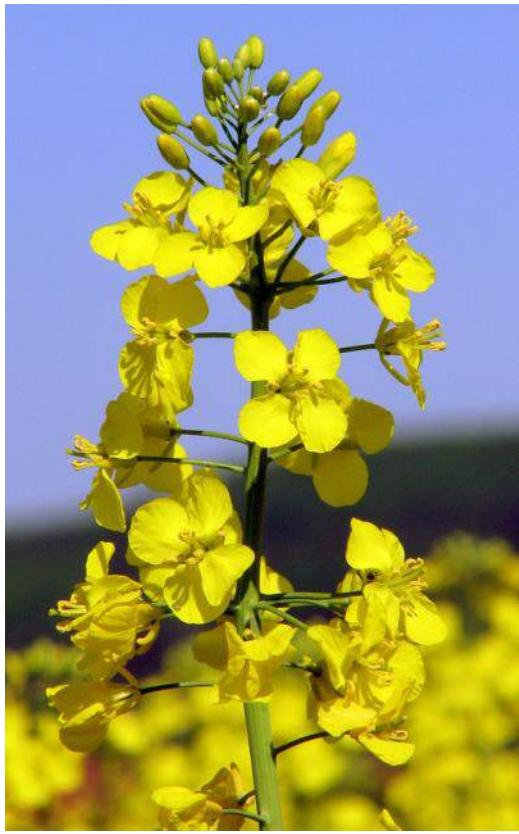
Pollination contribution to yield



Insect pollination benefits are assumed to be constant:
-Oil seed rape 20%
-Sunflower 10%
-Strawberry 40% etc.

Interaction between pollination and N in oilseed rape





What about true soil services?
Other crops?

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Contents lists available at ScienceDirect

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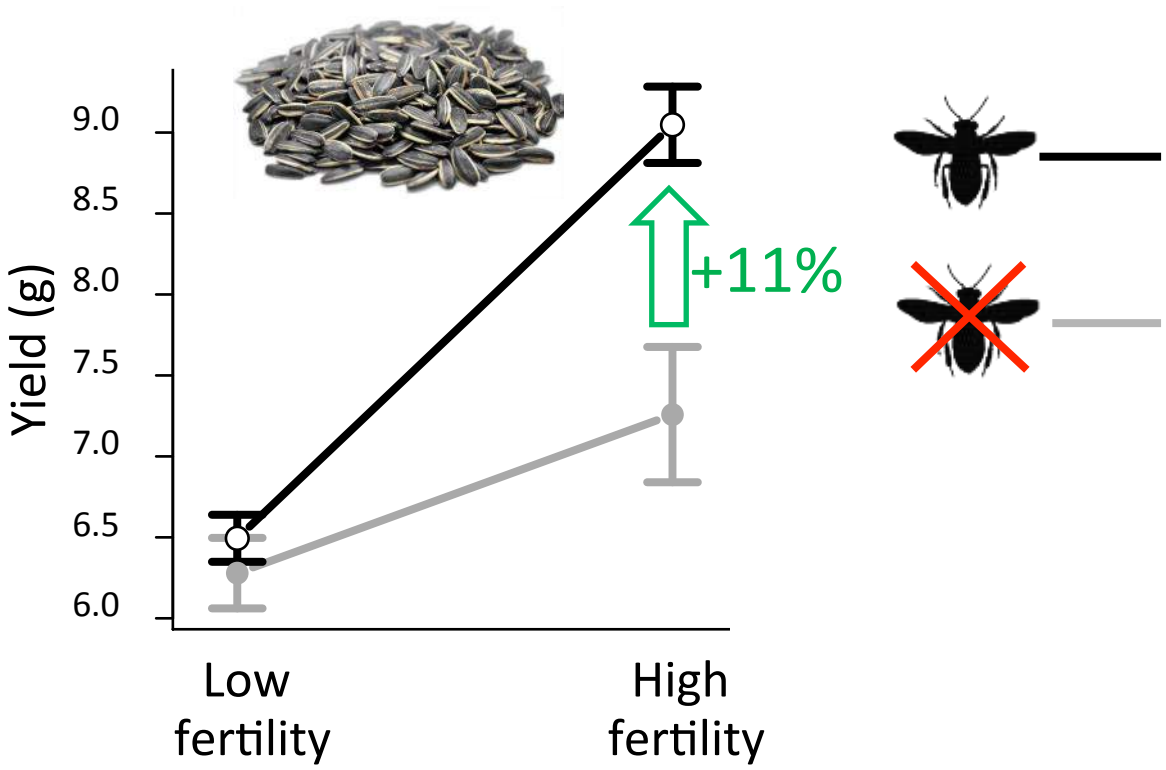
journal homepage: www.elsevier.com/locate/agee

Crop management modifies the benefits of insect pollination in oilseed rape

Lorenzo Marini [a,*], Giovanni Tamburini [a], Edoardo Petrucco-Toffolo [a], Sandra A.M. Lindström [b,c], Federica Zanetti [d], Giuliano Mosca [a], Riccardo Bommarco [b]

Poor soil fertility can cancel pollination benefits



Oecologia (2016) 180:581–587
DOI 10.1007/s00442-015-3493-1

ECOSYSTEM ECOLOGY - ORIGINAL RESEARCH

Degradation of soil fertility can cancel pollination benefits in sunflower

Giovanni Tamburini[1] · Antonio Berti[1] · Francesco Morari[1] · Lorenzo Marini[1]

From the experiments to the real landscapes!

How to implement interventions to maximize biodiversity-based ecosystem services in real landscapes?

On-field and off-field interventions

Biological control of pests

Biocontrol of aphids in winter wheat

On-field: Till vs. no-till

Aphid control

Off-field: Gradient in semi-natural habitats (0-20%)

Journal of Applied Ecology

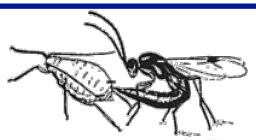
British Ecological Society

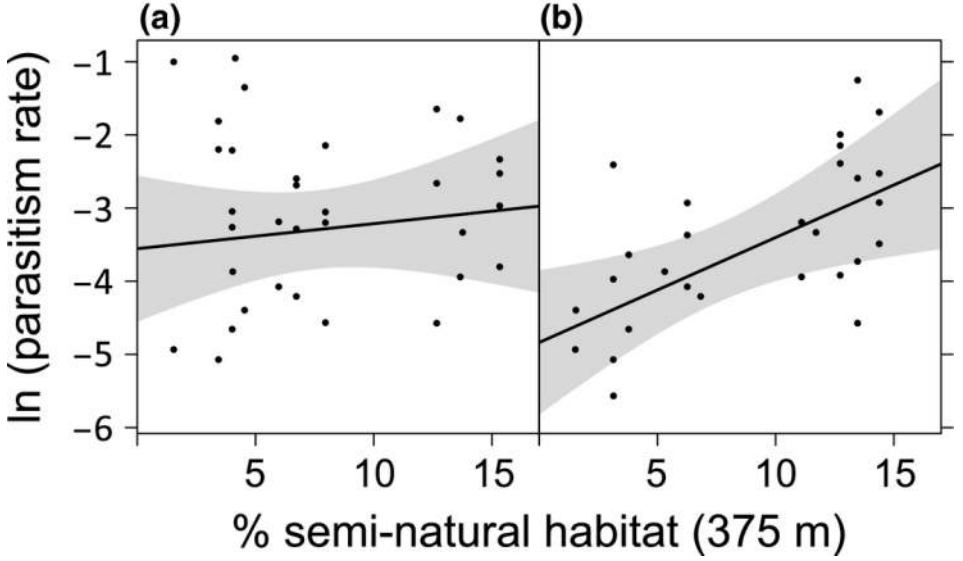
Journal of Applied Ecology 2016, **53**, 233–241 doi: 10.1111/1365-2664.12544

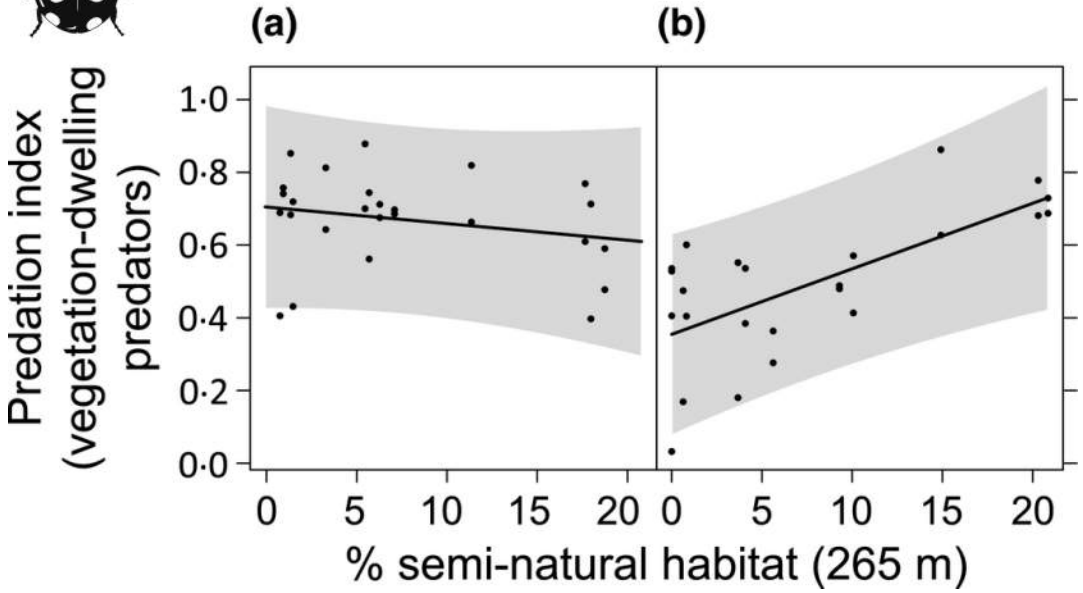
Conservation tillage mitigates the negative effect of landscape simplification on biological control

Giovanni Tamburini[1]*, Serena De Simone[2], Maurizia Sigura[2], Francesco Boscutti[2] and Lorenzo Marini[1]

Conservation tillage





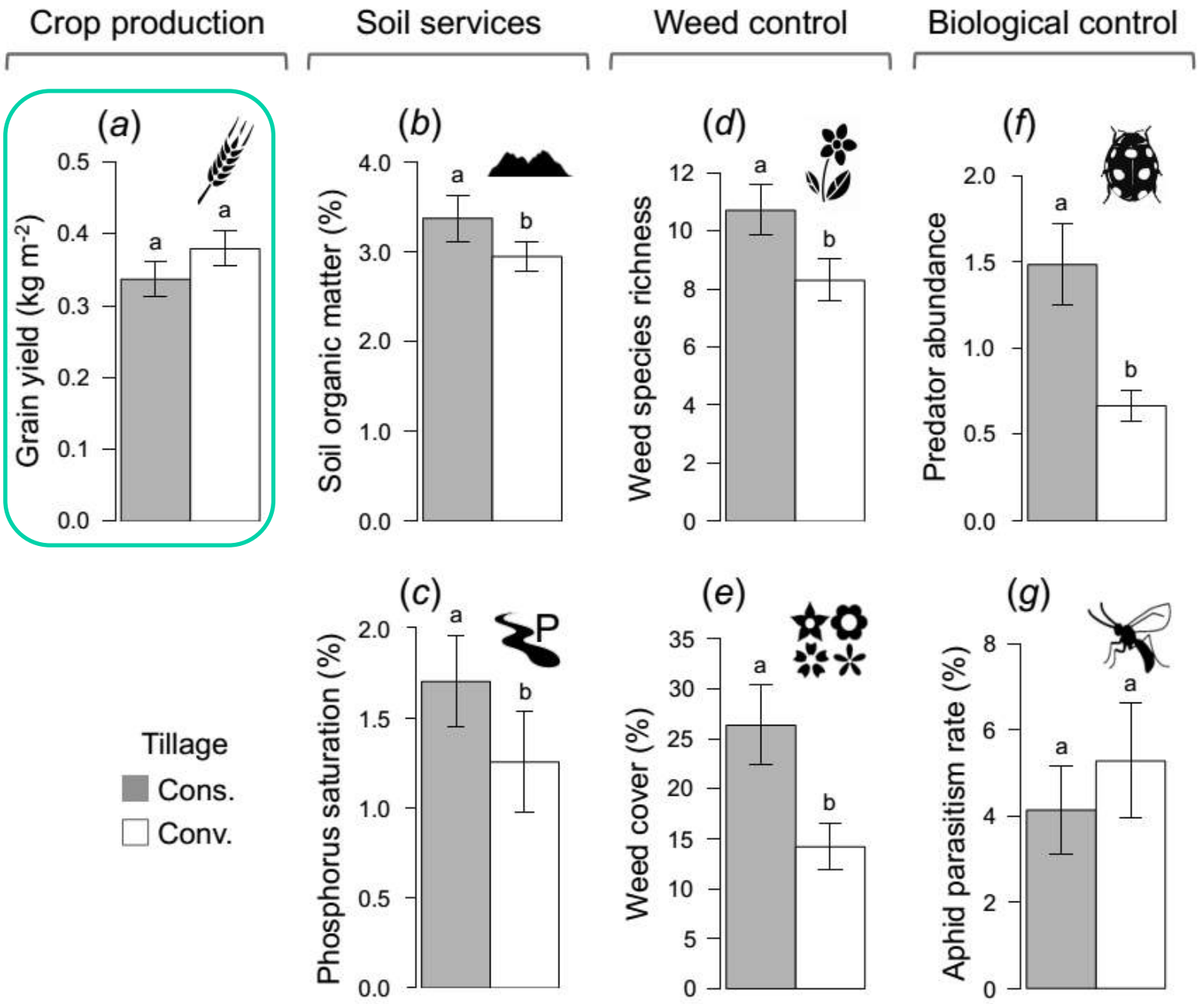


No-till Till

No-till Till

What happens to crop yield and other ES?

Conservation tillage on multiple ES



PROCEEDINGS B

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Research

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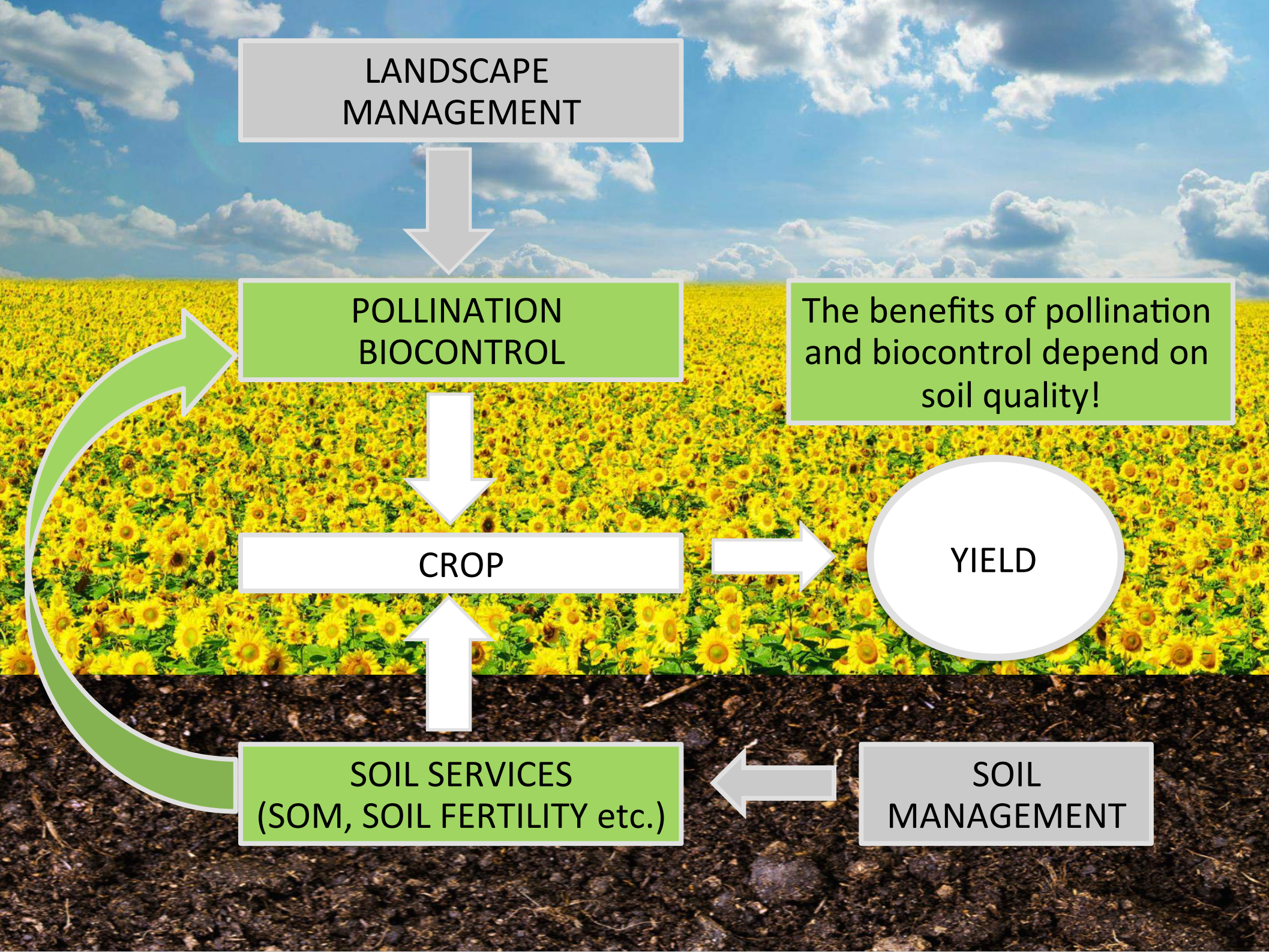
Cite this article: Tamburini G, De Simone S, Sigura M, Boscutti F, Marini L. 2016 Soil management shapes ecosystem service provision and trade-offs in agricultural landscapes. *Proc. R. Soc. B* **283**: 20161369. http://dx.doi.org/10.1098/rspb.2016.1369

IMPLICATIONS FOR POLICY AND MANAGEMENT

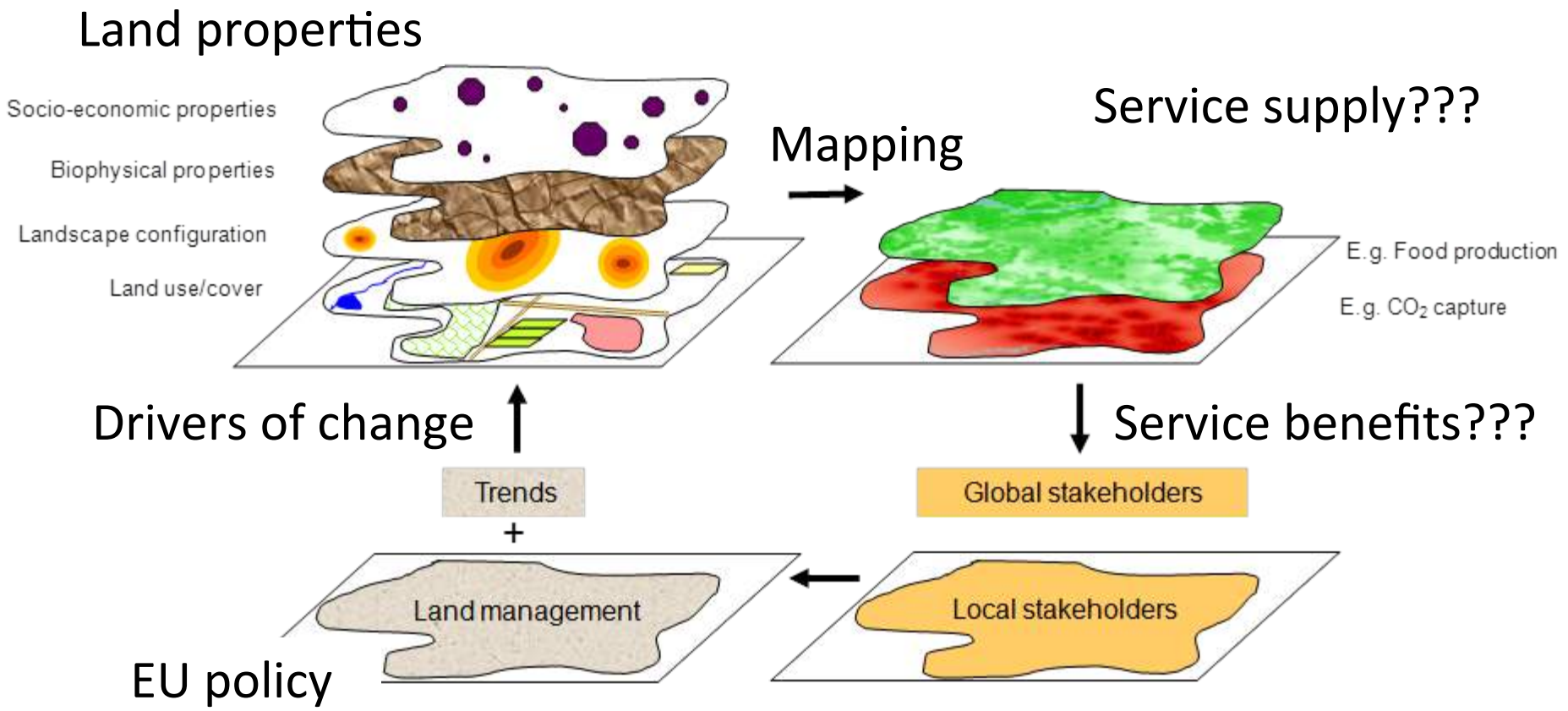
European Commission

Agricultural Policy Perspectives Brief *N°5* / December 2013*

Overview of CAP Reform 2014-2020


LANDSCAPE MANAGEMENT
POLLINATION BIOCONTROL
The benefits of pollination and biocontrol depend on soil quality!
CROP
YIELD
SOIL SERVICES (SOM, SOIL FERTILITY etc.)
SOIL MANAGEMENT

I – Mapping of ecosystem services can be tricky



Current policy on ES is not evidence-based!

II - Innovative combinations of interventions

Local

Fertilization

Tillage

Organic farming

Pest management

...

Landscape

Hedgerows

Flower strips

Set-aside

Landscape

...

We need long-term data from complete crop rotations

Thanks for your attention!

Lorenzo Marini
DAFNAE-University of Padova

Giovanni Tamburini

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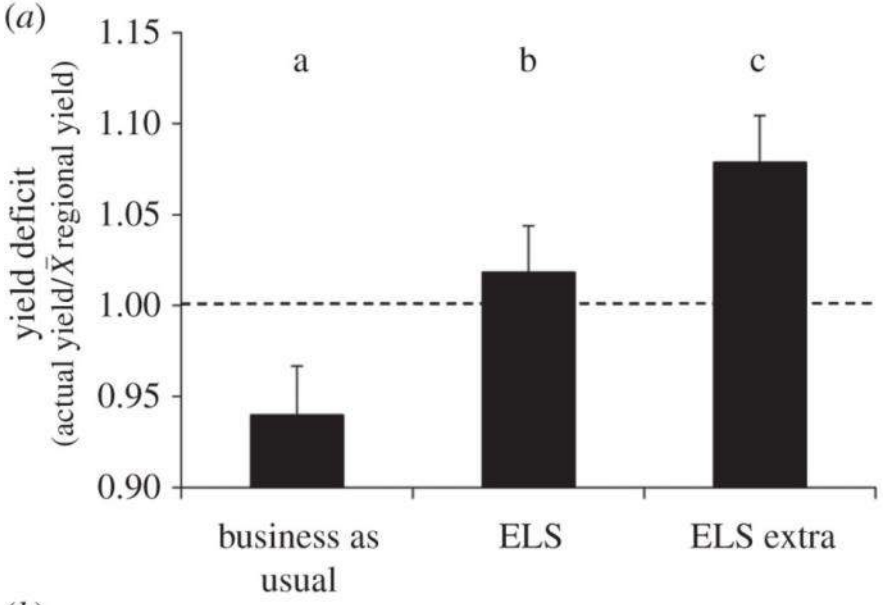
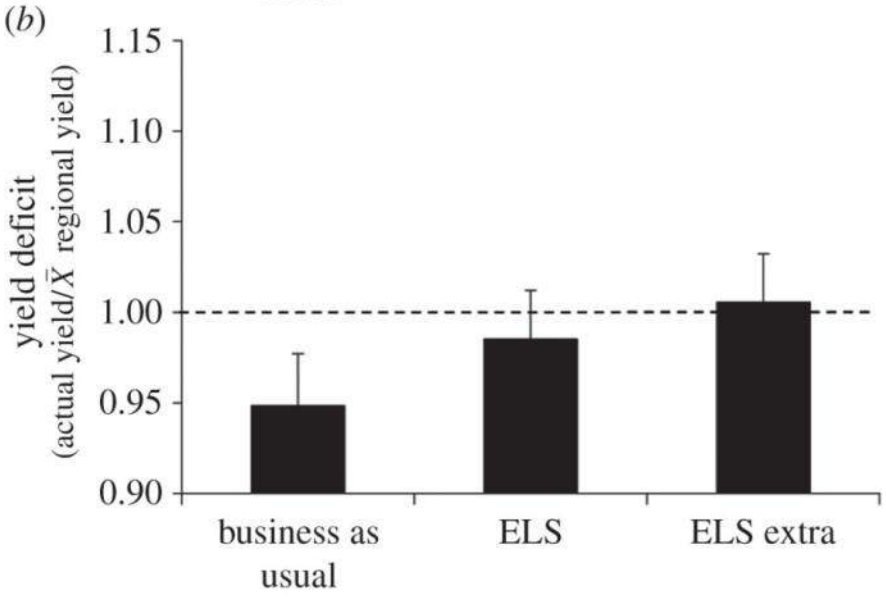
Project Coordinator: Wageningen University (NL), David Kleijn

Way forward: New evidence for ecological intensification!





ELS extra (-8%)

ELS (-3%)

Business as usual

PROCEEDINGS B

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Research

Wildlife-friendly farming increases crop yield: evidence for ecological intensification

Richard F. Pywell[1], Matthew S. Heard[1], Ben A. Woodcock[1], Shelley Hinsley[1], Lucy Ridding[1], Marek Nowakowski[2] and James M. Bullock[1]