Regenerative farming & food

Wageningen, Jan 2024

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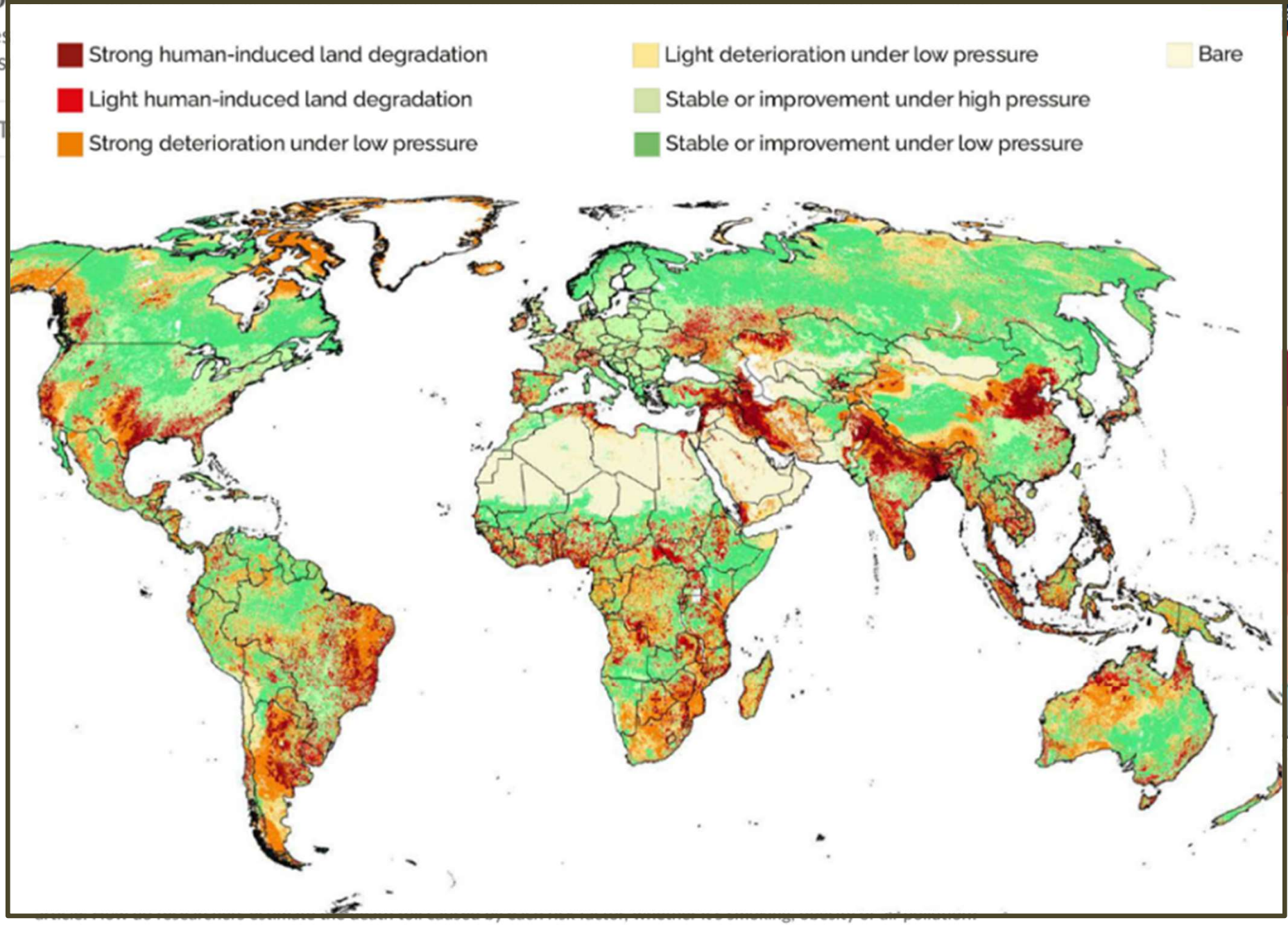
WWF Professor Resilient Landscapes for Nature and People
Groningen University, The Netherlands

Global soil degradation



Regenerative practices

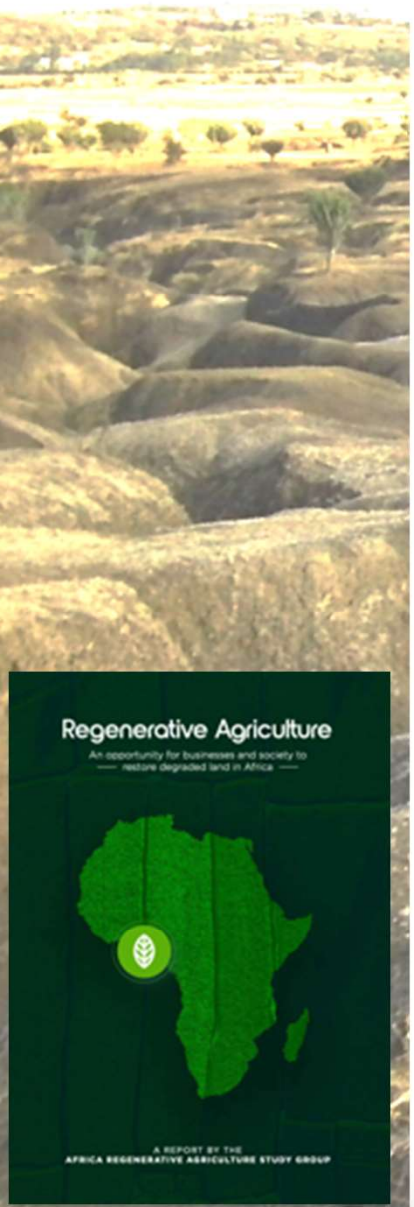
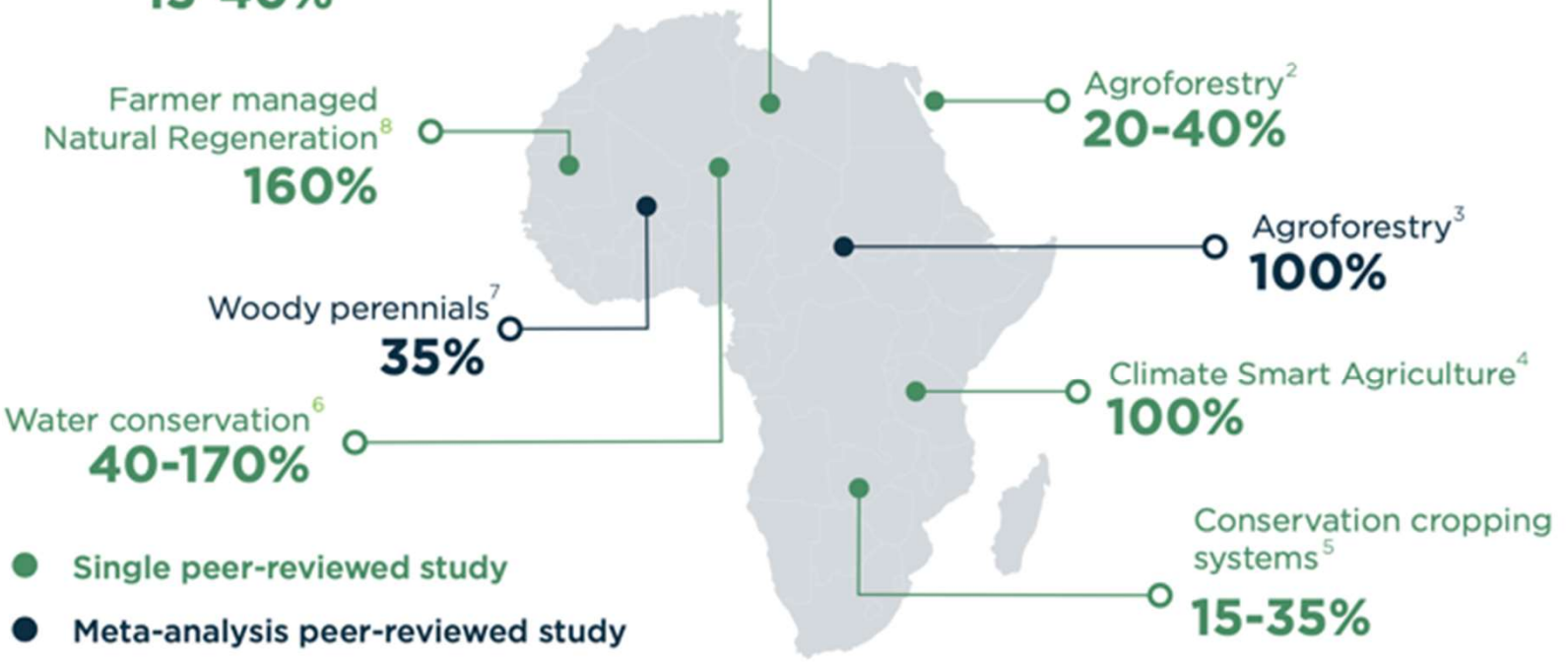


Figure 1: Crop yield increase observed in several regenerative agriculture initiatives across sub-Saharan Africa



Note: Values in the figure are rounded values. 1. Ibrahim et al. (2015), 2. Fahmi et al. (2018), 3. Shem Kuyah et al. (2019), 4. Amadu et al. (2020), 3. Shem Kuyah et al. (2019)5. Thierfelder et al. (2015)., 6. Reij et al. (2010), 7. Félix et al. (2018), 8. Birch et al. (2016) Reij et al. (2010). Thierfelder et al. (2015).

...ded soils

Contents lists available at SciVerse ScienceDirect

Field Crops Research

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

Agroecology-based aggradation-conservation agriculture (ABACO): Targeting innovations to combat soil degradation and food insecurity in semi-arid Africa

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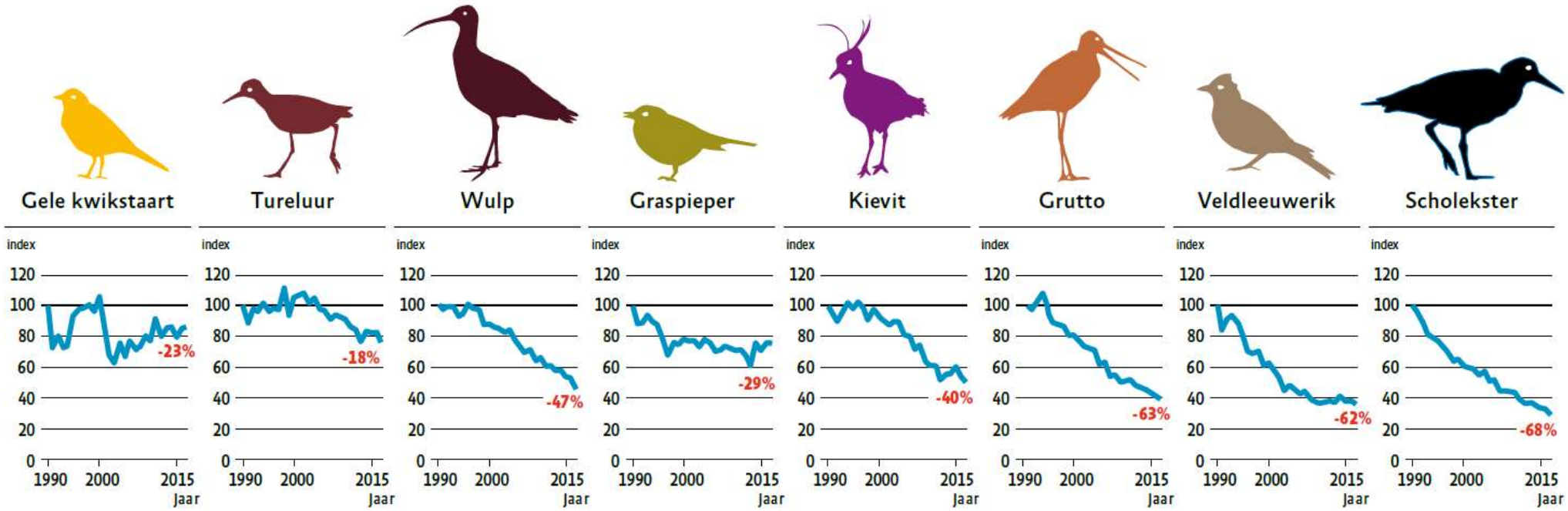
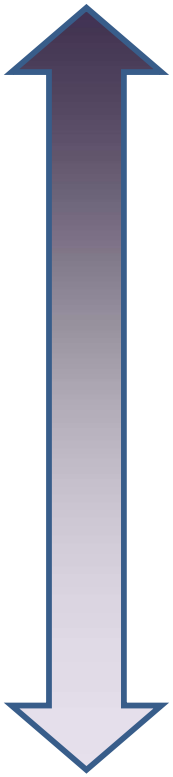
The farming sector in The Netherlands



Figuur 1: Populatieontwikkeling weidevogelsoorten in Nederland 1990-2015. Bron: NEM (SOVON, CBS, Provincies, Vogelbescherming

The farming sector in The Netherlands

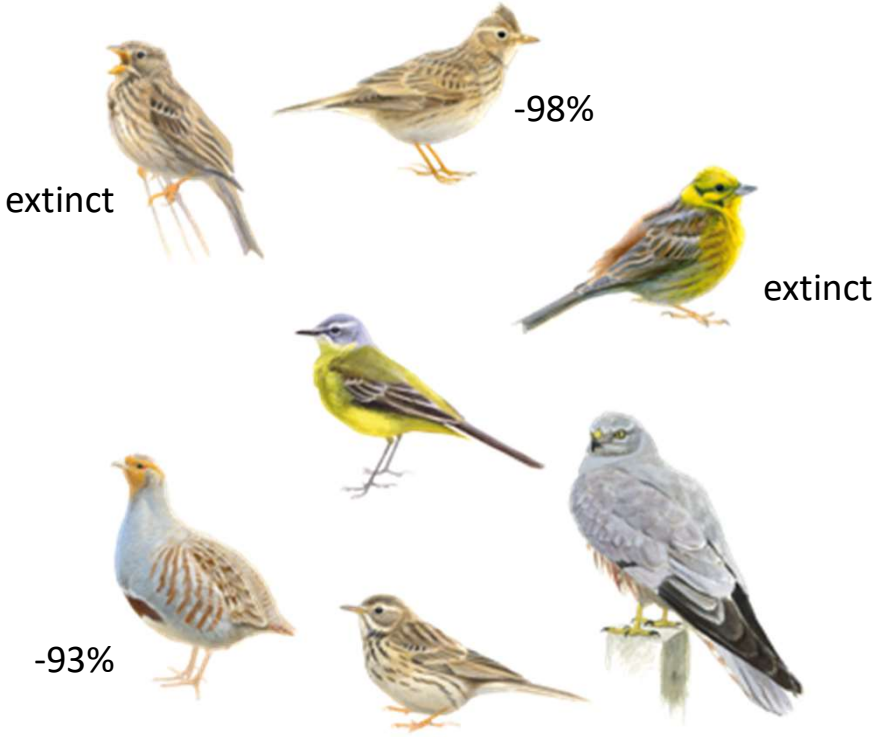
clay



sand

traditionally (1900-1950)

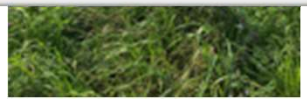
- winter wheat
- ~~alfalfa~~
- ~~peas~~
- ~~turnip~~
- ~~fodder/sugar beets~~
- potatoes
- barley
- ~~rye~~ & ~~oat~~
- ~~buckwheat~~



Nature-driven & profitable!

Compost-turner vormt hart van melkveebedrijf Wytse Bouma

Biologisch bedrijf met 12.300 kilo melk per koe



Innovation Platform on **A**groecology,
Regenerative and **N**ature-driven **A**griculture
in the North of The Netherlands

ARENA
innovation platform agroecology

What is regenerative agriculture?

Regenerative organic agriculture

syngenta

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Terramera unveils bold plan for Global Centre for Regenerative Agriculture, powered by Microsoft Azure

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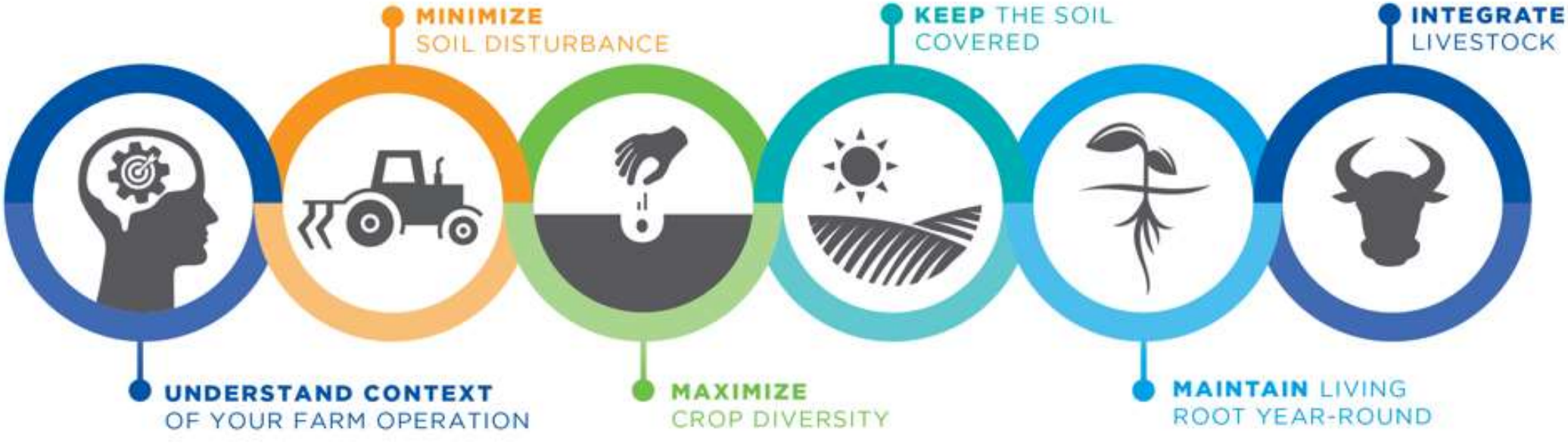
Vancouver, BC, Canada
November 2, 2020

- $830M plan to turn Canada's economic and climate crises into an opportunity

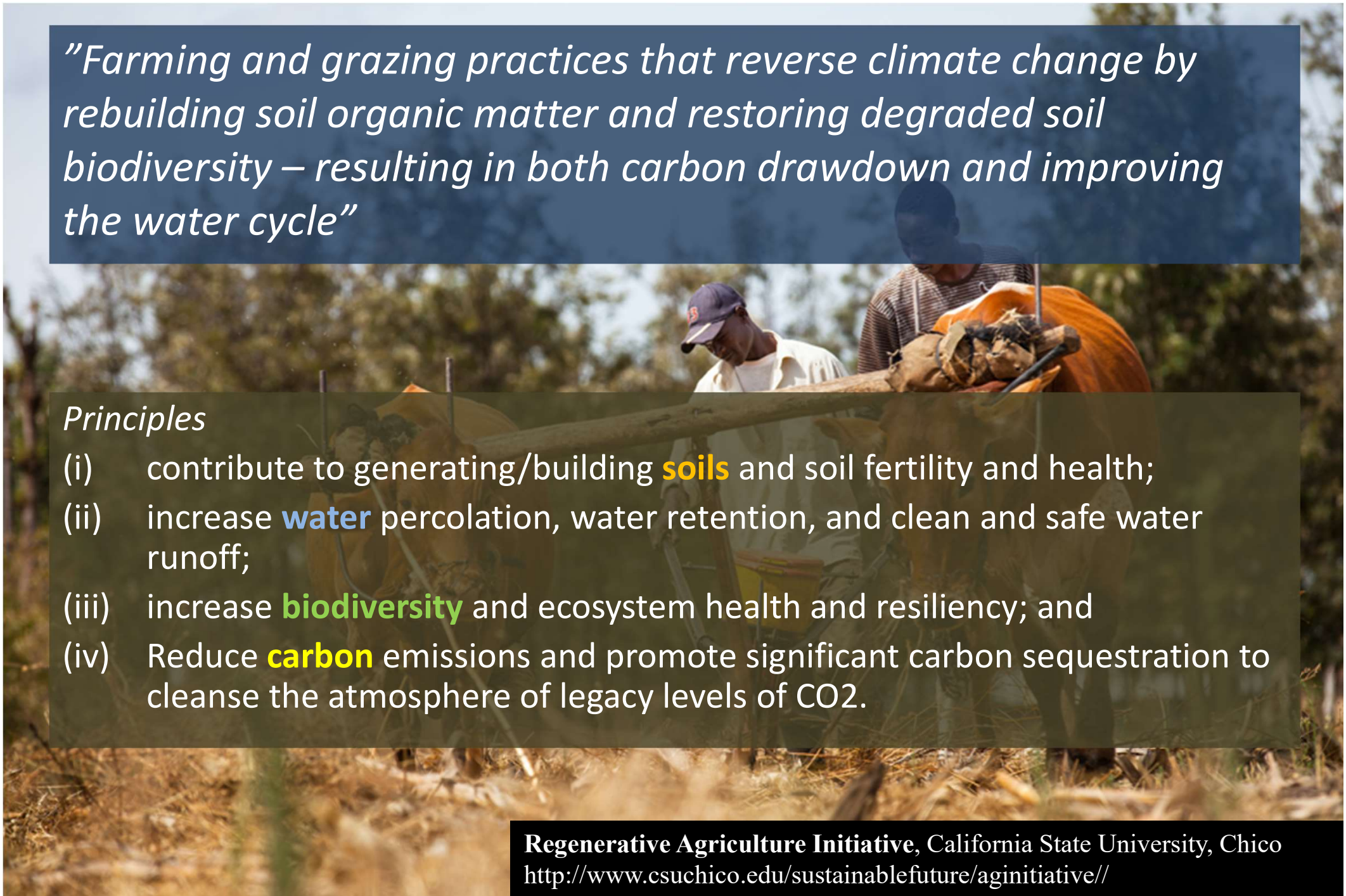
Terra Genesis
International

6 Core Principles of
REGENERATIVE AGRICULTURE

General Mills



What is regenerative agriculture?



"Farming and grazing practices that reverse climate change by rebuilding soil organic matter and restoring degraded soil biodiversity – resulting in both carbon drawdown and improving the water cycle"

Principles

(i) contribute to generating/building **soils** and soil fertility and health;

(ii) increase **water** percolation, water retention, and clean and safe water runoff;

(iii) increase **biodiversity** and ecosystem health and resiliency; and

(iv) Reduce **carbon** emissions and promote significant carbon sequestration to cleanse the atmosphere of legacy levels of CO2.

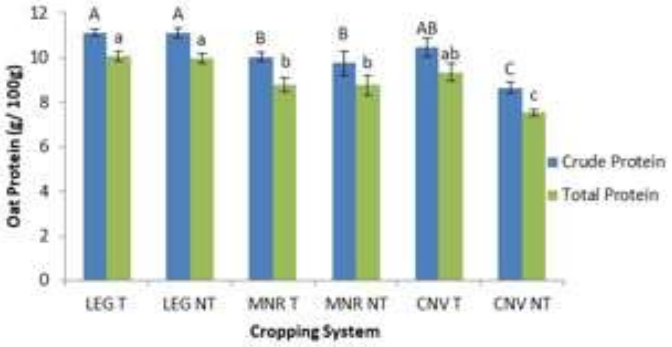
Regenerative Agriculture Initiative, California State University, Chico
http://www.csuchico.edu/sustainablefuture/aginitiative//

Evidence supporting regenerative agriculture?

Experimental data

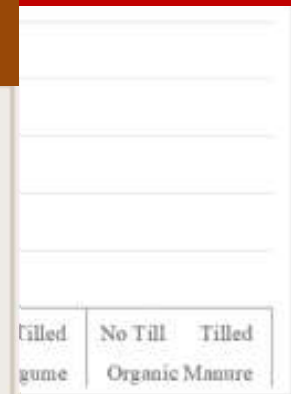
Crop yields and gross margins (us$)

Crop nutritional density (g/100 g)



Soil organic matter (%)

Pesticide leaching (ppb)



After 40 years comparisons, regenerative organic systems:

ARE COMPETITIVE WITH CONVENTIONAL YIELDS
AFTER A 5-YEAR TRANSITION PERIOD

PRODUCE YIELDS UP TO 40% HIGHER IN TIMES OF DROUGHT

EARN 3-6X GREATER PROFITS FOR FARMERS

LEACH NO TOXIC CHEMICALS INTO WATERWAYS

USE 45% LESS ENERGY

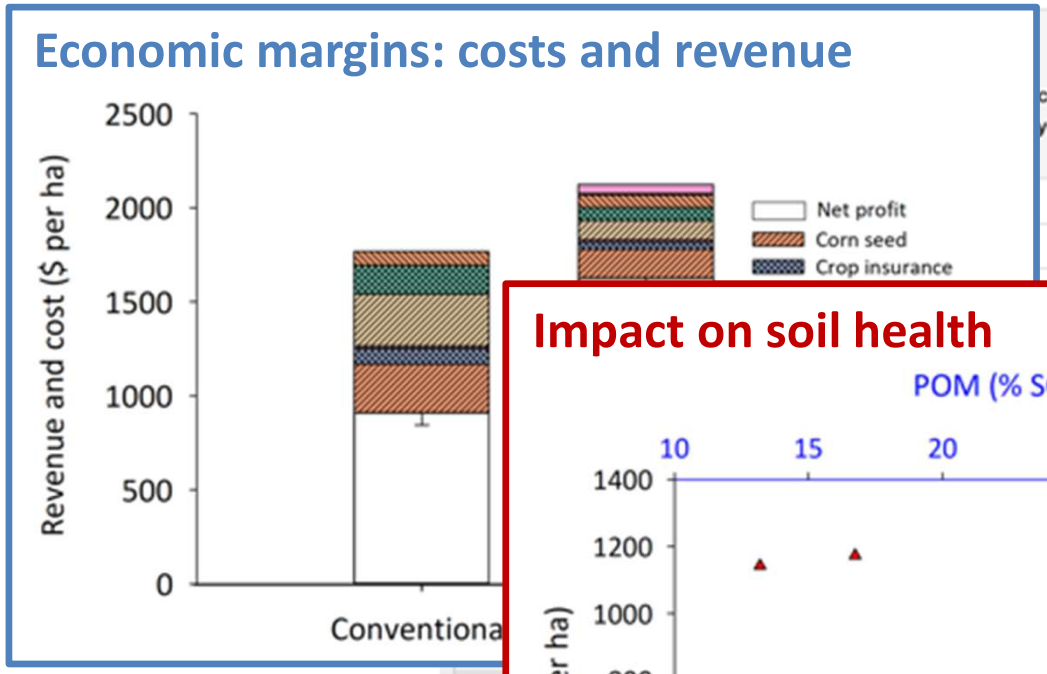
RELEASE 40% FEWER CARBON EMISSIONS

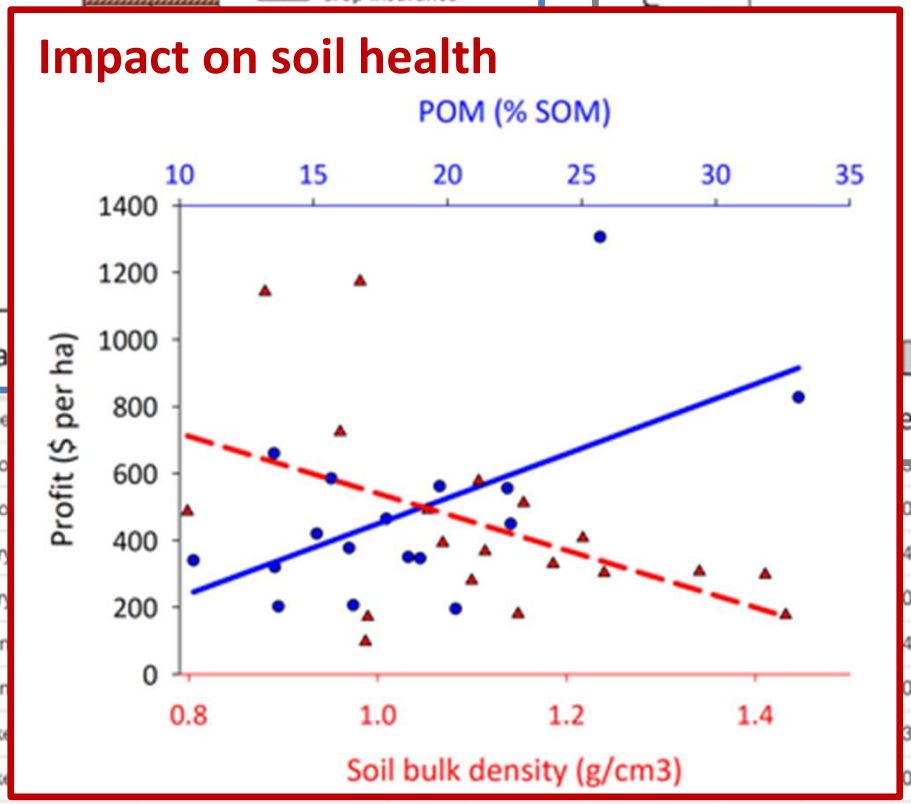
Regenerative organic with
Regenerative organic with
Conventional agriculture

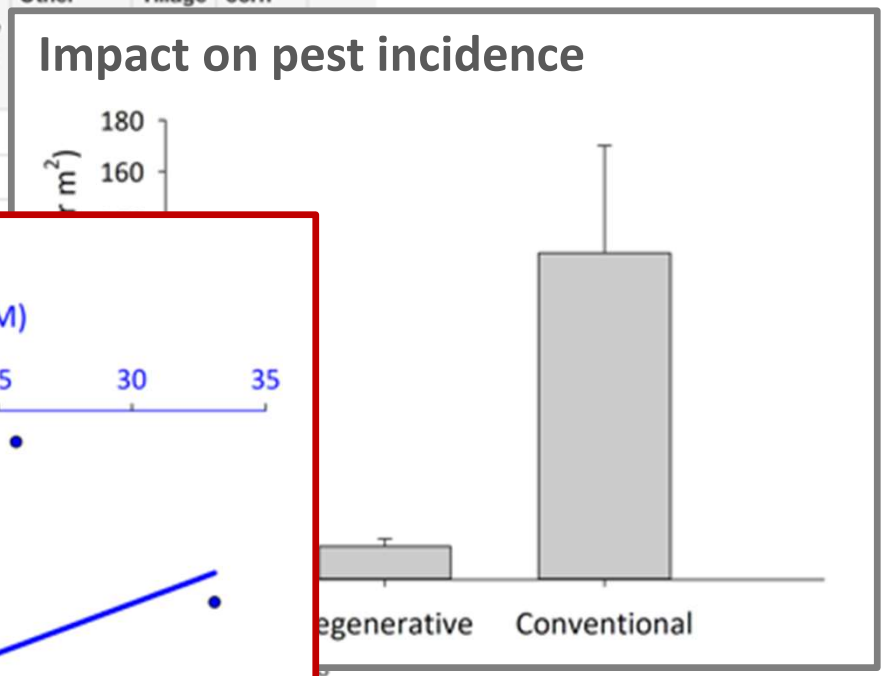
Rodale Institute - ania, 1981 - 2021

Evidence supporting regenerative agriculture?

On-farm data (Maize in USA)







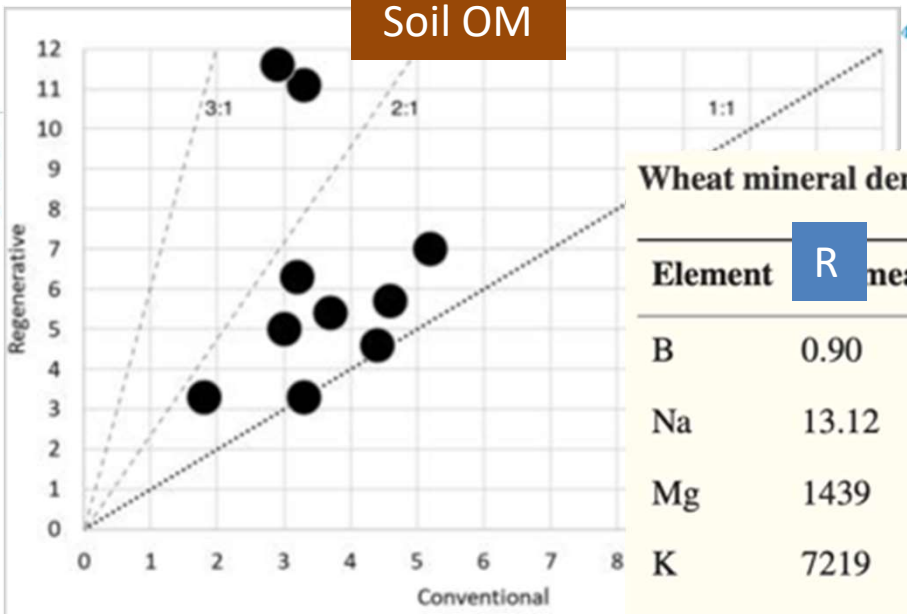
LaCanne and Lundgren (2018)

Table 1:
Trait matrix used to assign farms to regenerative or conventional corn production systems.
The composite rank scores are based on the number of regenerative practices used on a particular farm. Farms whose rank scores are in the top 50% of farms are considered regenerative (shaded rows); those with rank scores in the lower half are conventional (white rows). To aid interpretation, additional traits of each system could be included in enhanced trait matrices. Organic operations are indicated by an asterisk in the "Reference town" column.

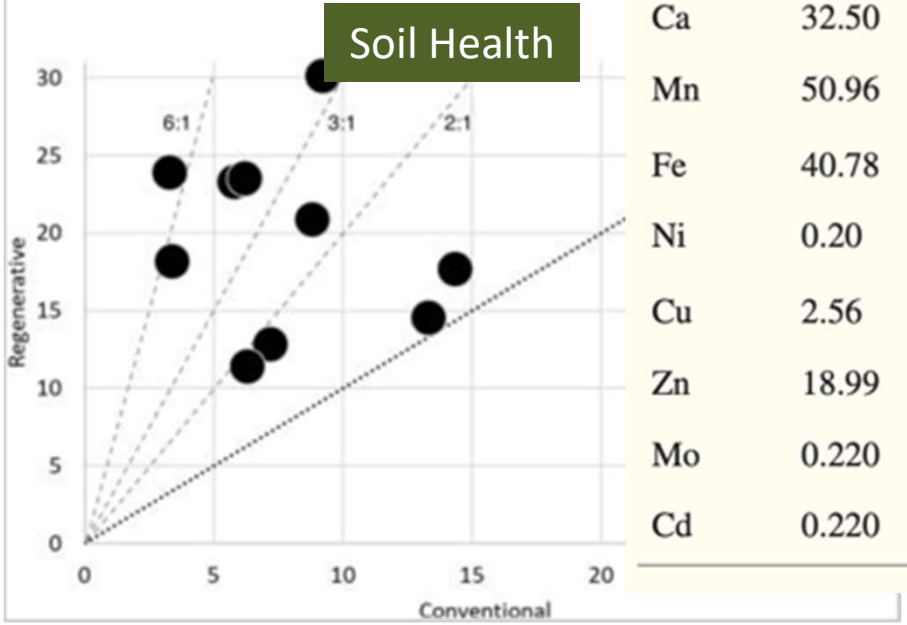
DOI: 10.7717/peerj.4428/table-1

Soil health and nutrient density: preliminary comparison of regenerative and conventional farming

Soil OM



Soil Health



Crop nutrient concentration ratios (R:C)

Nutrient	All crops	Cabbage	Peas	Soy	Corn	Sorghum
Vitamin K	**1.34**	**1.41**	**1.57**	1.10	-	**1.38**

Wheat mineral density comparisons.

R C

Element	mean (ppm)	±Sd	mean (ppm)	±Sd	CC/NC	*p* value
B	0.90	0.03	0.64	0.10	**1.41**	0.017
Na	13.12	0.69	13.20	3.13	0.99	0.064
Mg	1439	54	1112	181	**1.29**	0.040
K	7219	197	5750	1002	*1.26*	0.067
Ca	32.50	2.26	21.92	3.91	**1.48**	0.051
Mn	50.96	3.84	37.66	9.57	*1.35*	0.089
Fe	40.78	1.19	34.10	5.92	1.20	0.128
Ni	0.20	0.01	0.30	0.06	*0.67*	0.055
Cu	2.56	0.16	2.17	0.40	1.18	0.202
Zn	18.99	0.59	12.21	3.10	**1.56**	0.021
Mo	0.220	0.060	0.053	0.010	**4.15**	0.011
Cd	0.220	0.000	0.023	0.010	0.87	0.373

Montgomery DR, Biklé A, Archuleta R, Brown P, Jordan J. Soil health and nutrient density: preliminary comparison of regenerative and conventional farming. PeerJ. 2022 Jan 27;10:e12848. doi: 10.7717/peerj.12848. PMID: 35127297; PMCID: PMC8801175.

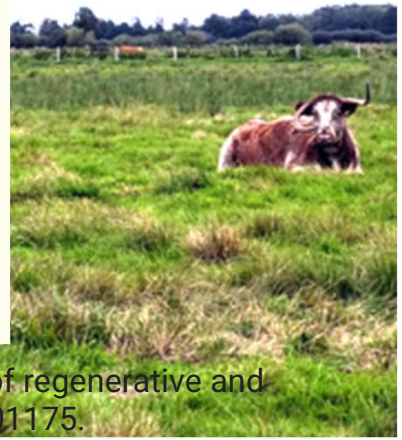
Soil health and nutrient density: preliminary comparison of regenerative

Pork fatty acid comparison.

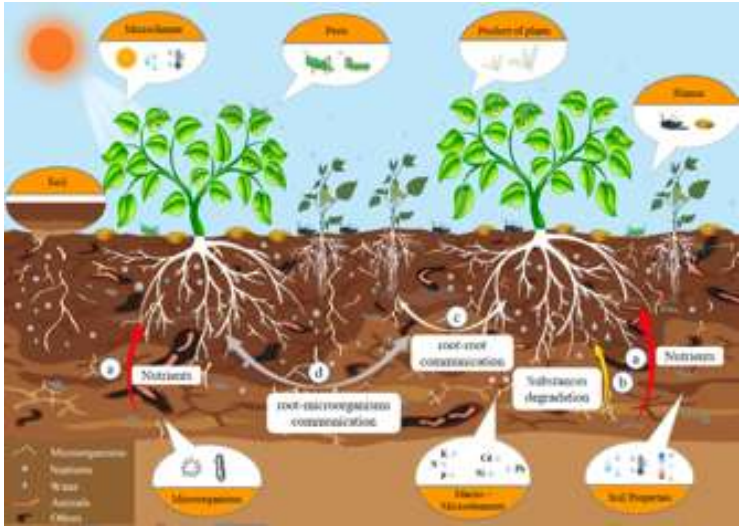
Fatty acid	Regen. (g/100 g)	Regional (g/100 g)	Conv. (g/100 g)	Ratio (Regen/Conv)
Conventional				
Alpha linolenic (ALA)	0.1537	0.0717	0.0136	11.3
Eicosapentaenoic (EPA)	0.0021	0.0015	0.0011	1.9
Docosapentaenoic (DPA)	0.0197	0.0126	0.0062	3.2
Docosahexaenoic (DHA)	0.0054	0.0021	0.0012	4.5
Total omega-3	0.2131	0.0982	0.0229	9.3
Total omega-6	1.6964	1.0804	0.5605	3.0
Omega-6/Omega-3	7.9610	11.0060	24.4306	0.3

Regen = regenerative (100% grass fed), Regional = regional health promoting brand (outdoor, non-GMO), Conv. = conventional (confined, grain-fed).

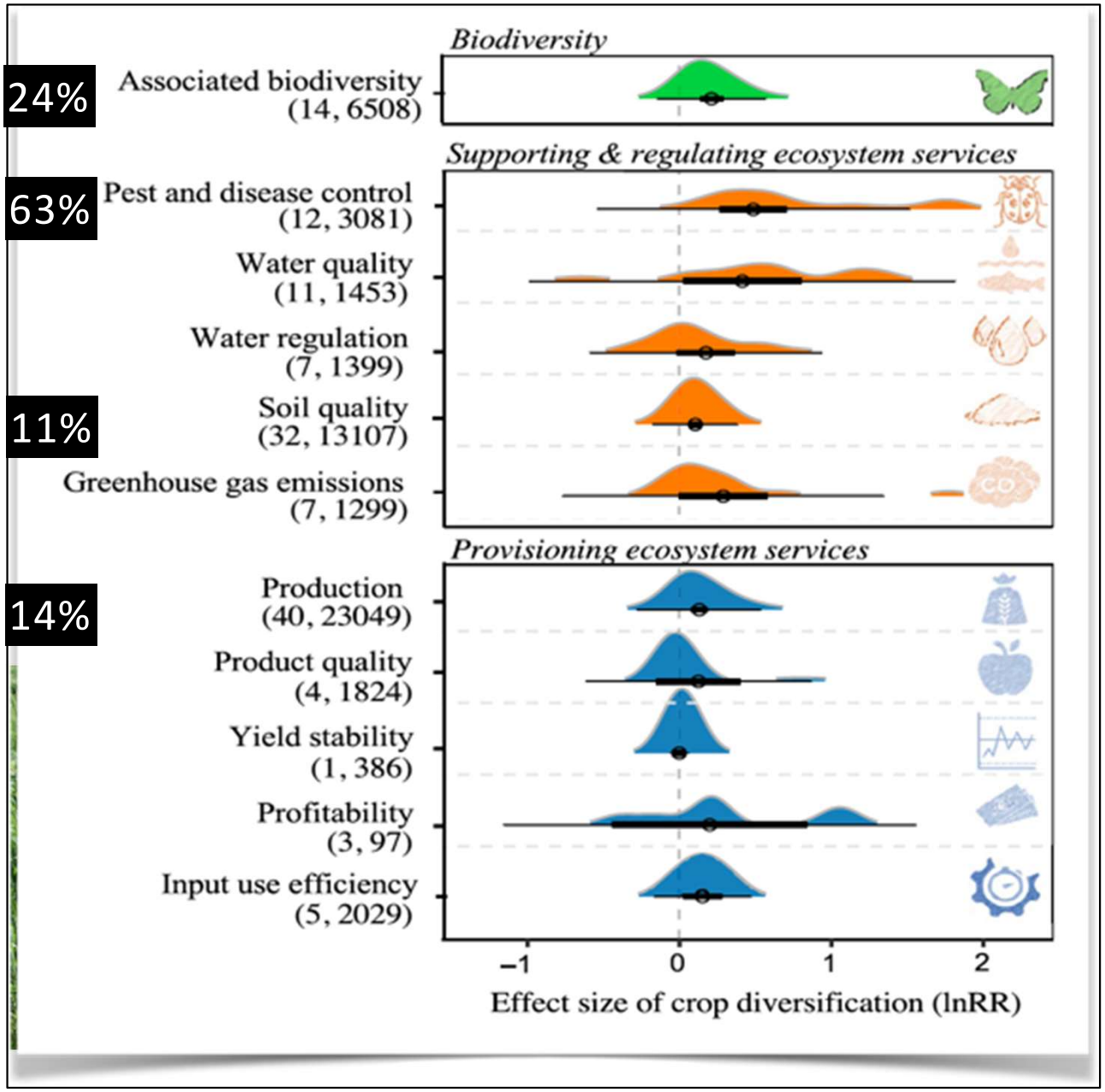
Values are per 100 g of homogenized meat.



Montgomery DR, Biklé A, Archuleta R, Brown P, Jordan J. Soil health and nutrient density: preliminary comparison of regenerative and conventional farming. PeerJ. 2022 Jan 27;10:e12848. doi: 10.7717/peerj.12848. PMID: 35127297; PMCID: PMC8801175.

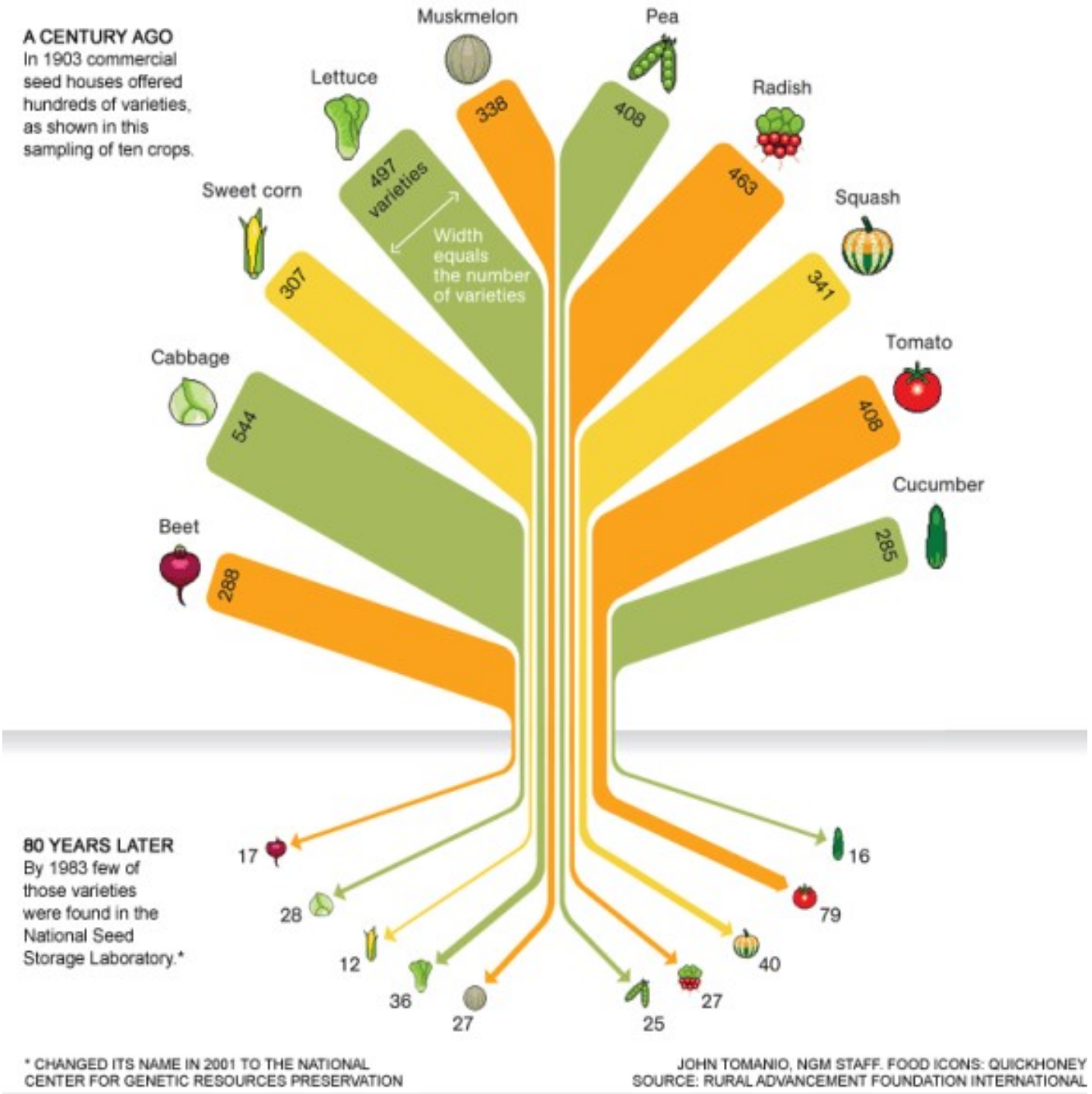


Crop diversification



Beillouin et al 2021Global Change Biology

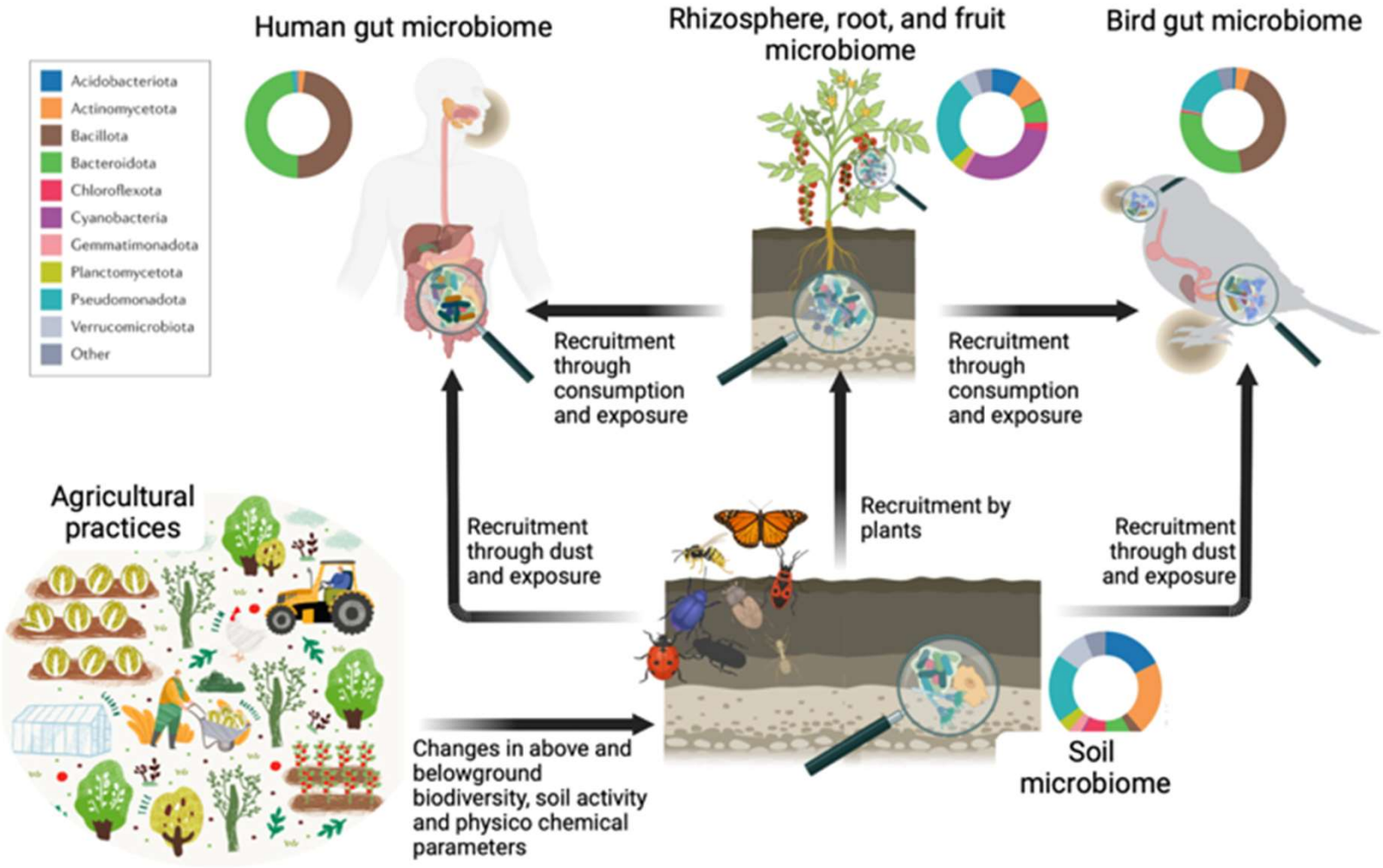
Loss of crop diversity



The microbiome

the soil-food-human nexus

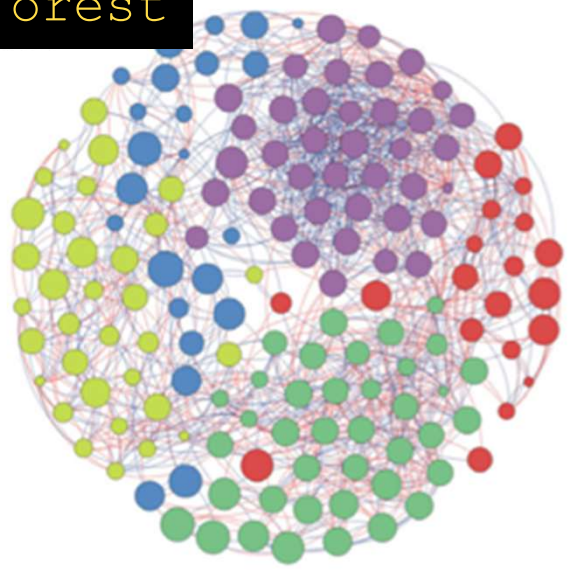
Microbiome as the link between soil-plants-animals-humans

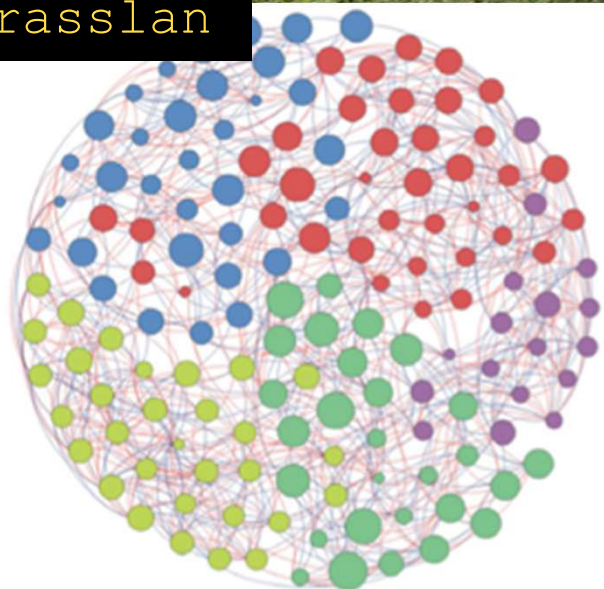


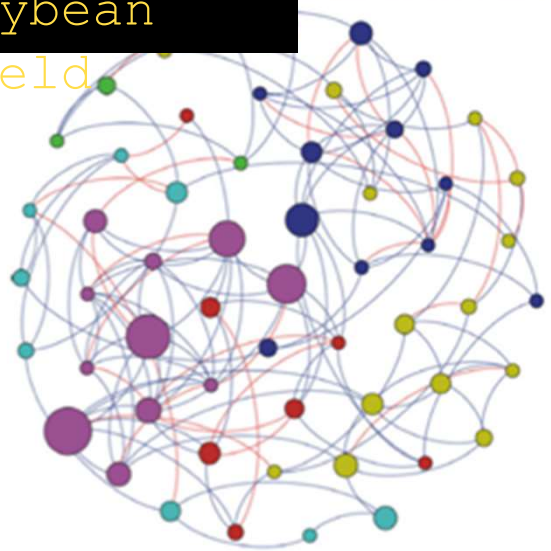

Forest


Grasslan
d

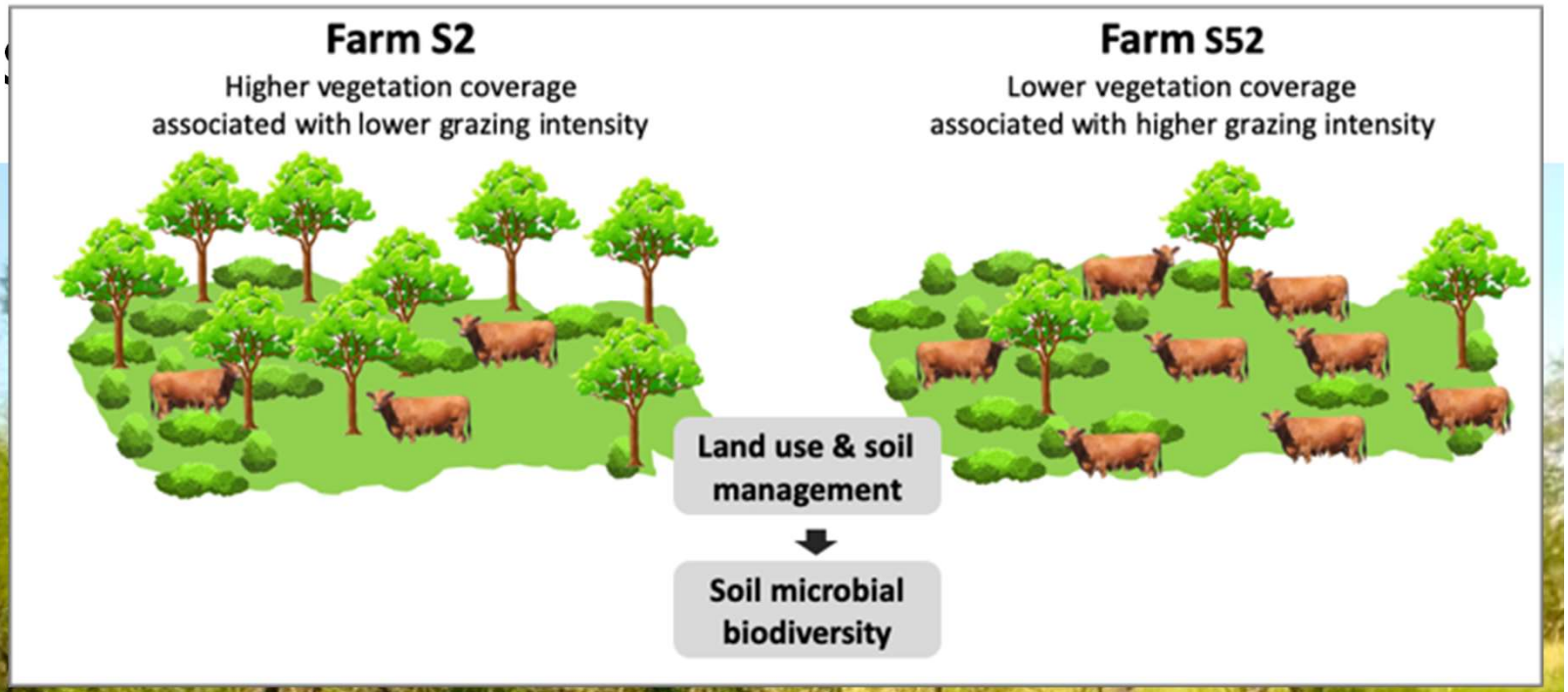

Lupatini et al, 2014
Soybean
field

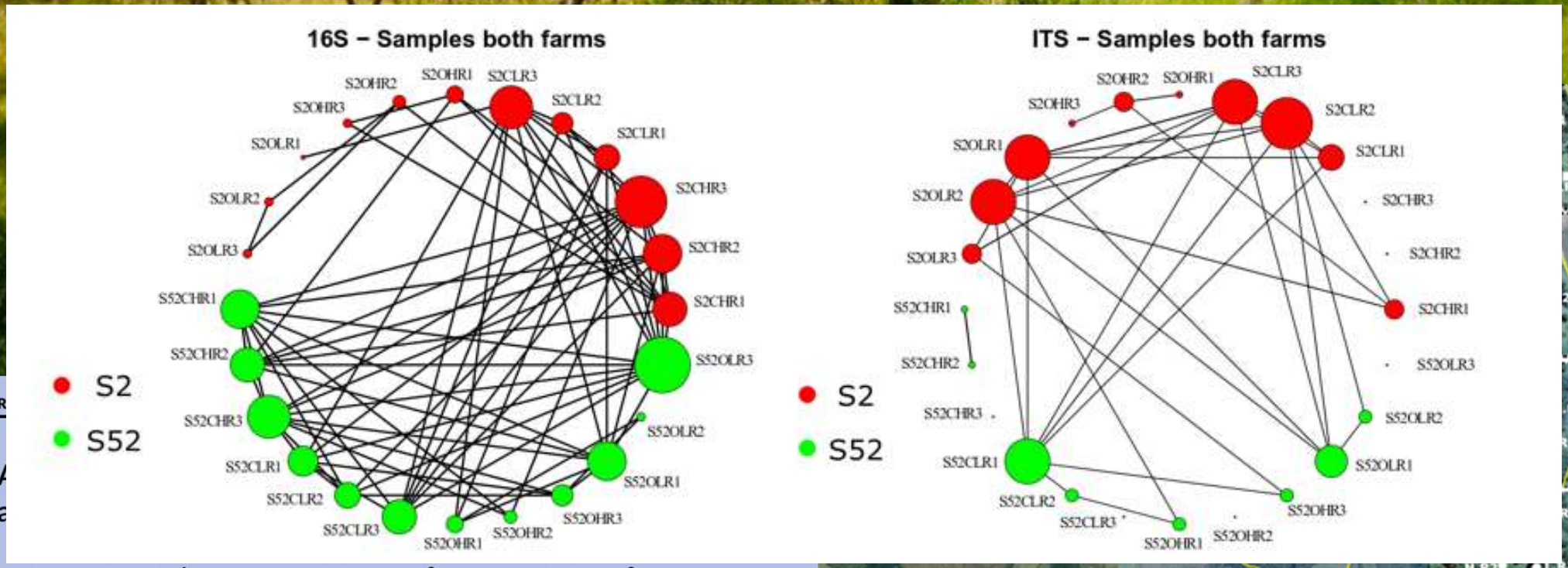






Networks a



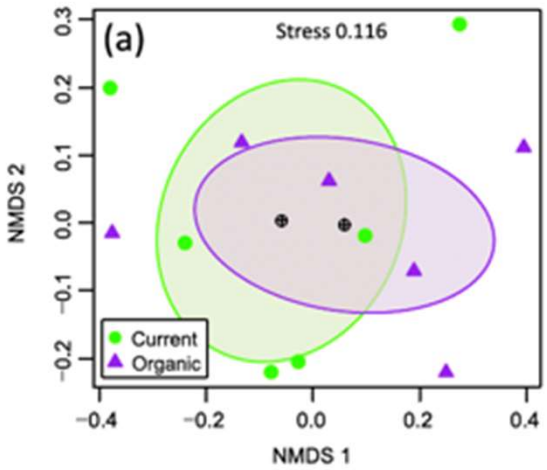


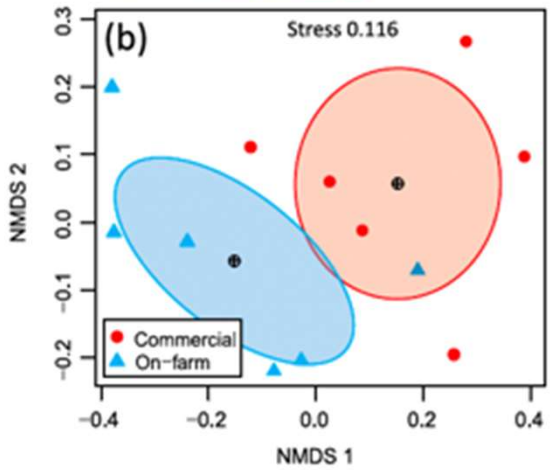
Verónica A. El Mujtar[1] | Viviana C. Gregorutti[2] | Roxana P. Eclesia[2] | Ana Wingeyer[2] | Lucrecia Lezana[2] | Sonia B. Canavelli[2] | Pablo Tittonell[1]

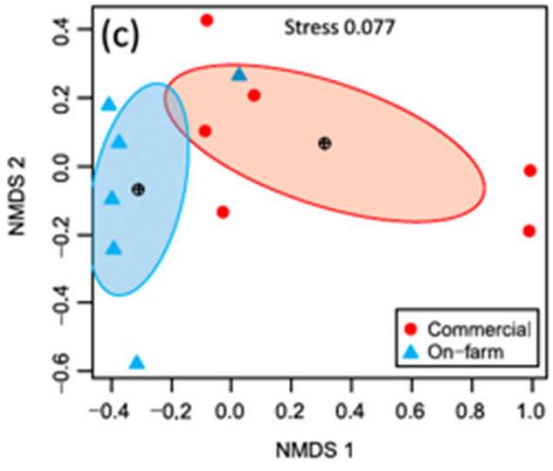
Nutrient source, management system and the age of the plantation affect soil biodiversity and chemical properties in raspberry production

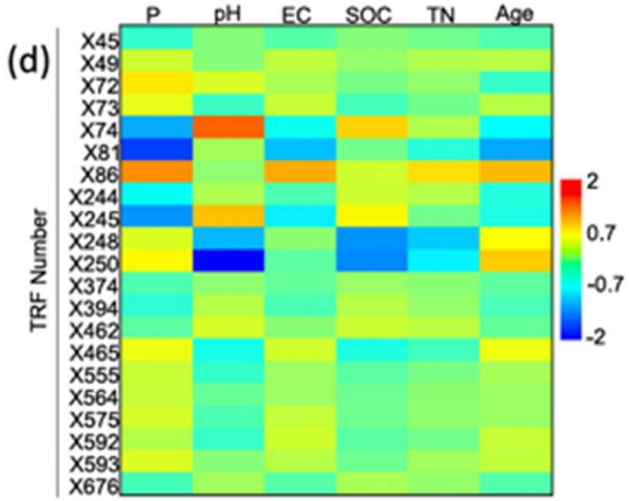
Barbara Prack McCormick [a,*], Verónica A. El Mujtar [b], Andrea Cardozo [c], Valeria E. Álvarez [b], Hernán A. Rodríguez [a], Pablo A. Tittonell [b,d,e]

Soil microbiome is affected by management



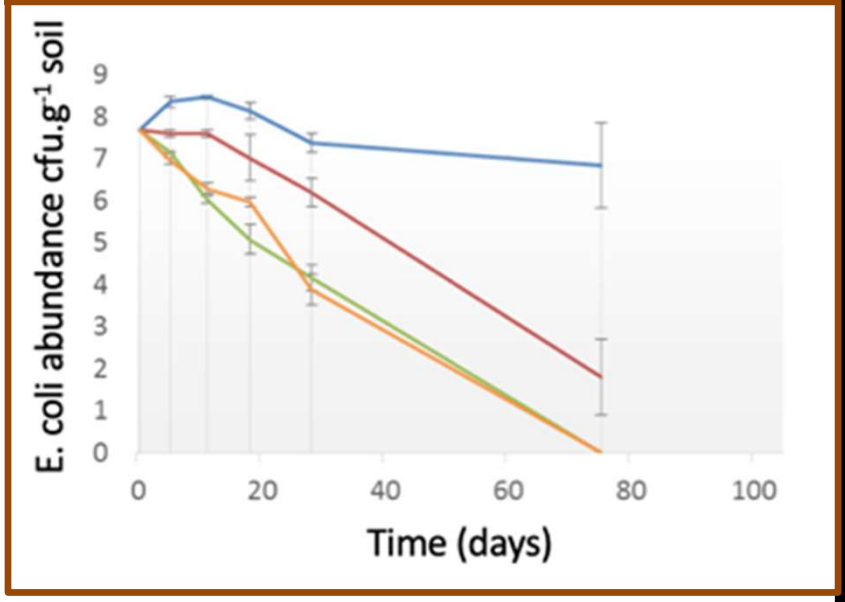


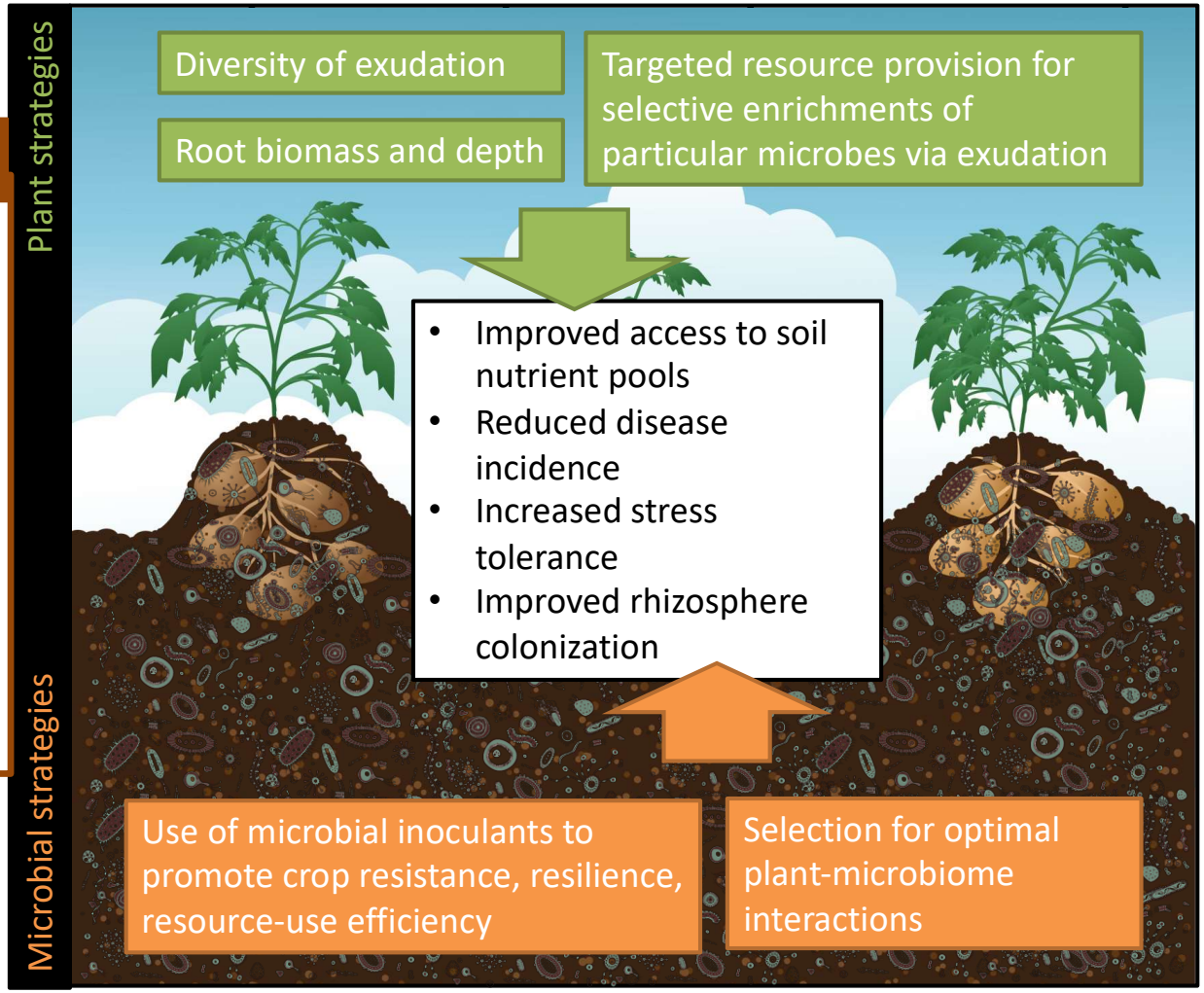




The crop microbiome

Resistance against pathogens





Salles et al, in prep

potatoMETAbiome

EUROPEAN RESEARCH AREA ON SUSTAINABLE CROP PRODUCTION

The ERA-Net Cofund SusCrop is funded by European Union's Horizon 2020 research and innovation programme under grant agreement No 771134

FACCE JPI SusCrop ERA-NET

Is regenerative agriculture the same as agroecology?

agroecology

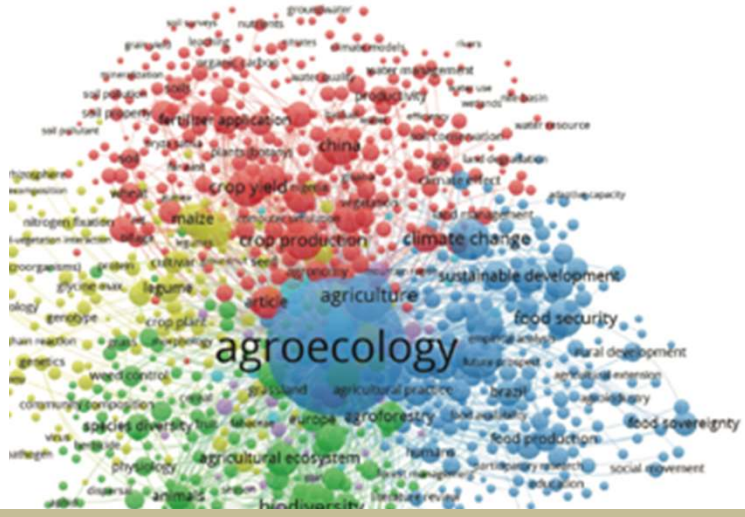
the application of ecological principles to the design and management of sustainable

10 elements that define agroecology (FAO Agroecology Knowledge Hub)

Nature-driven agriculture and food systems

Agroecology	Philosophy RA	Development RA	Corporate RA
Science, practice, movement: social and ecological principles, landscape approaches, bottom-up, different sources of knowledge	RA as adopted by individuals or networks, based on philosophical principles, close to permaculture or biodynamic approaches	RA as promoted by development organisations, social and ecological principles, landscape approaches, often top-down, close to organic and low input farming	RA as proclaimed by enterprises, based on practical agronomic principles and corporate sustainability approaches, close to conservation agriculture
Diversity			
Efficiency*			
Recycling			
Resilience			
Synergy			
Human and social values			
Co-creation and sharing of knowledge			
Food culture and traditions			
Circular and solidarity economy			
Responsible governance			

analysis of the scientific literature

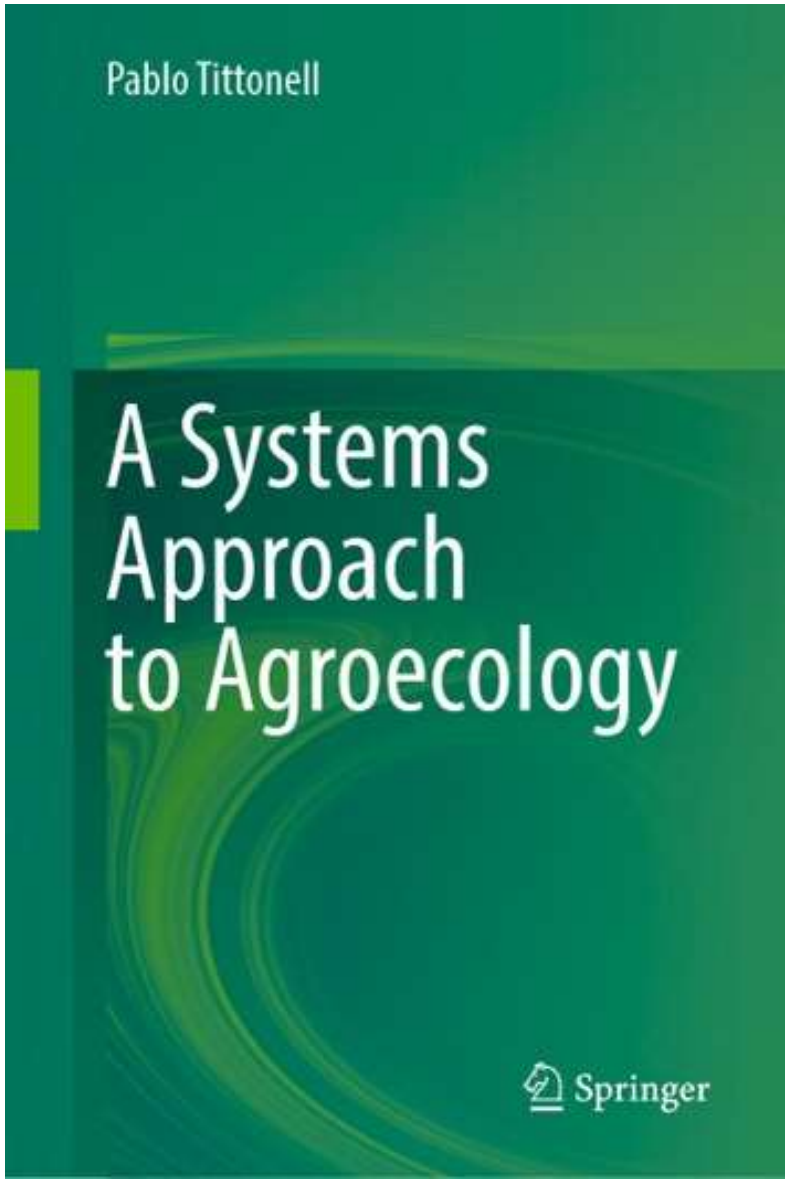


Top-10 sources after a Google search on 'Regenerative agriculture' in The Netherlands:

1. https://regenerationinternational.org
2. https://www.metabolic.nl
3. https://www.nrdc.org
4. https://ellenmacarthurfoundation.org
5. https://www.renature.co
6. https://www.unilever.com
7. https://www.earthday.org
8. https://www.nestle.com
9. https://www.cbf.org
10. https://www.cargill.com

Revisited on 16 May 2022

Thanks!



The Slow Blog

www.pablotittonell.org