Working Group 4: Redesigning cropping systems for zero chemical pesticide use based on functional biodiversity and agroecological principles

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T0P-AGRI-Network Management Committee Meeting
Zagreb 2024-05-21

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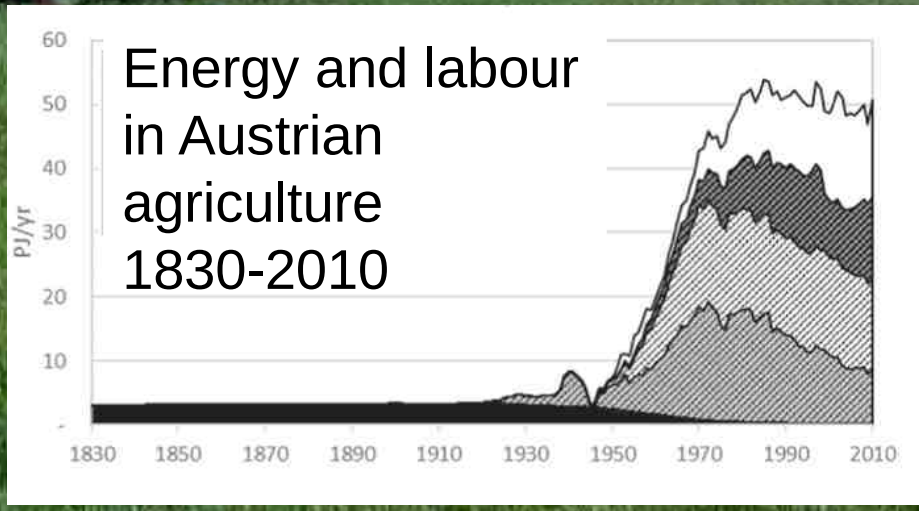
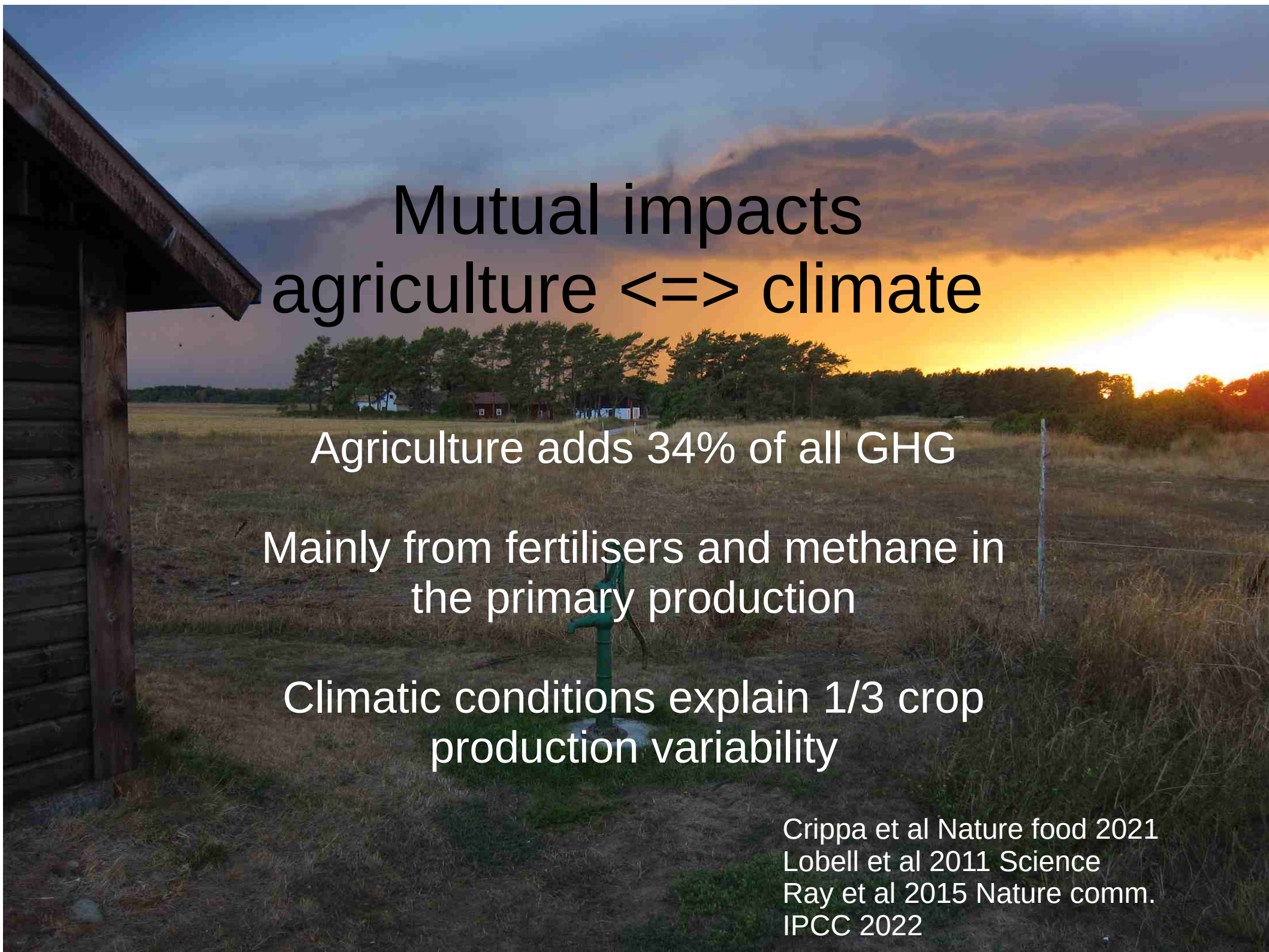


Gingrich Kraussmann 2018 Sci Tot



Mutual impacts agriculture <=> climate

Agriculture adds 34% of all GHG

Mainly from fertilisers and methane in the primary production

Climatic conditions explain 1/3 crop production variability

Crippa et al Nature food 2021
Lobell et al 2011 Science
Ray et al 2015 Nature comm.
IPCC 2022

Strategies for sustainable agriculture

Redesign the crop ecosystem
(including the landscape)

Substitute damaging inputs

Improve resource use efficiency

Titonell 2014, Bommarco et al 2013, Kremen & Merenlender 2018, Bommarco submitted

Cropping systems redesign aims to

Work *with* biodiversity (not replace it eg with pesticides and mineral fertilisers)

...strengthen ecological functions

...raise capture and use efficiency of on-farm resources

...increase autonomy in production

...maintain yields and environmental impact

...reduce risk and enhance stability

e.g. Bommarco et al 2013, Titonell 2014, Liebman & Davis 1999, Maeder et al 2002, Wezel et al 2014, Duru et al 2015...


Relay
cropping


Agroforestry


Biological pest control
(eg push-pull)


Reduce
disturbance


Integrated
crop-livestock


Cover the ground


Diversifed crop and
weed management

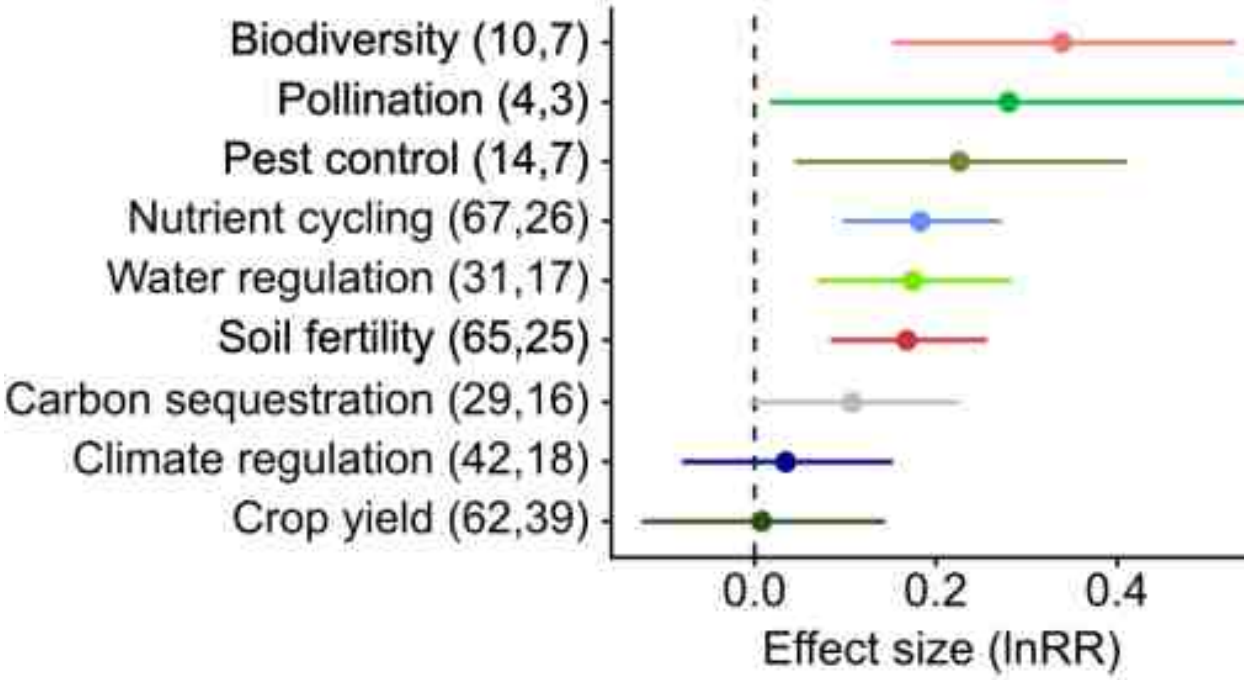

Diversified crop
genetics

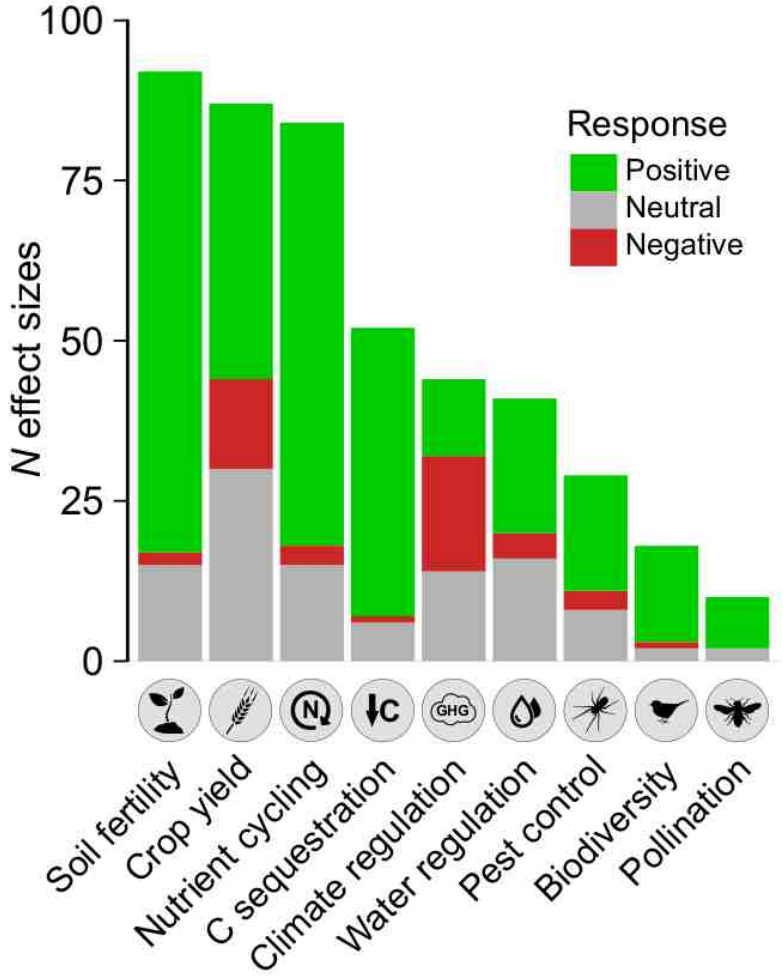
Landscape redesign

Kremen & Merenlender 2018 Science

Diversification gives multifunctional crop ecosystems

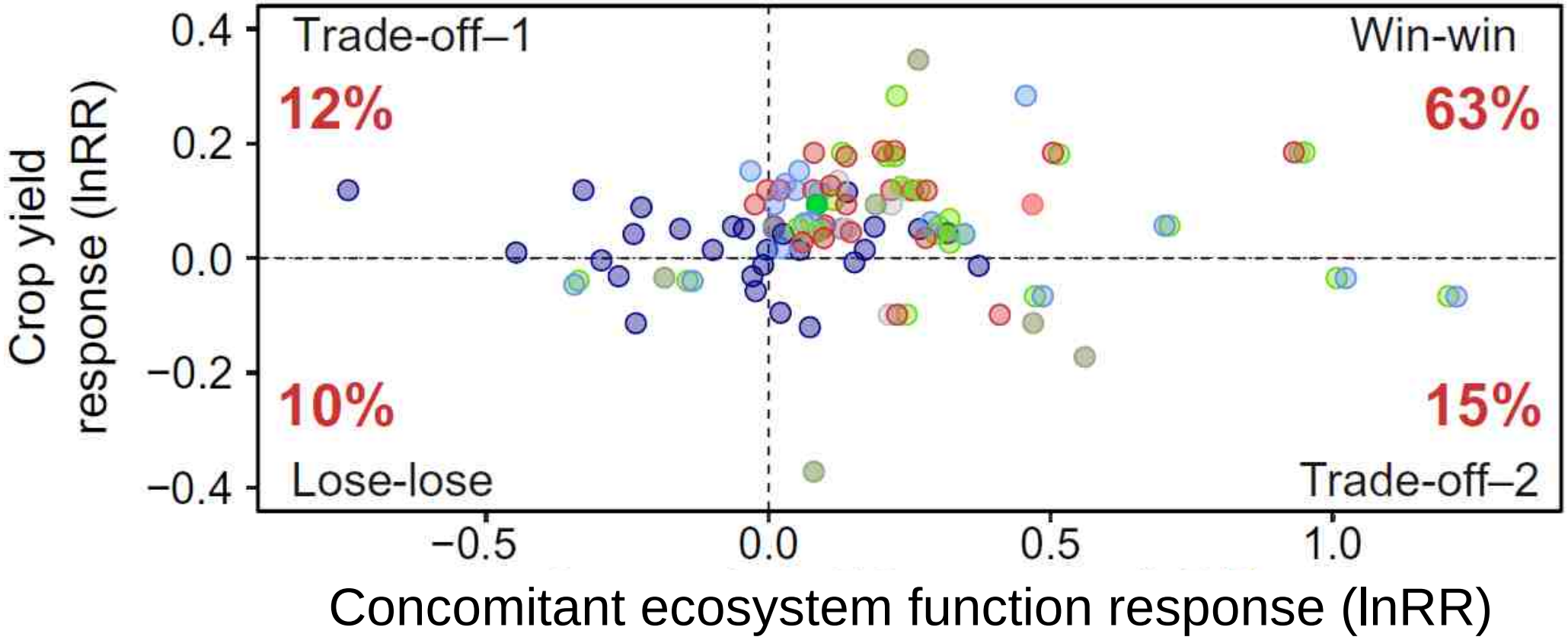
Meta-study based on ~42000 comparisons





Tamburini et al 2020 Science advances

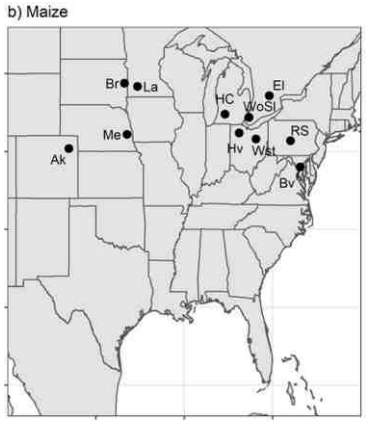
Diversification-crop yield can trade-off but win-wins dominate

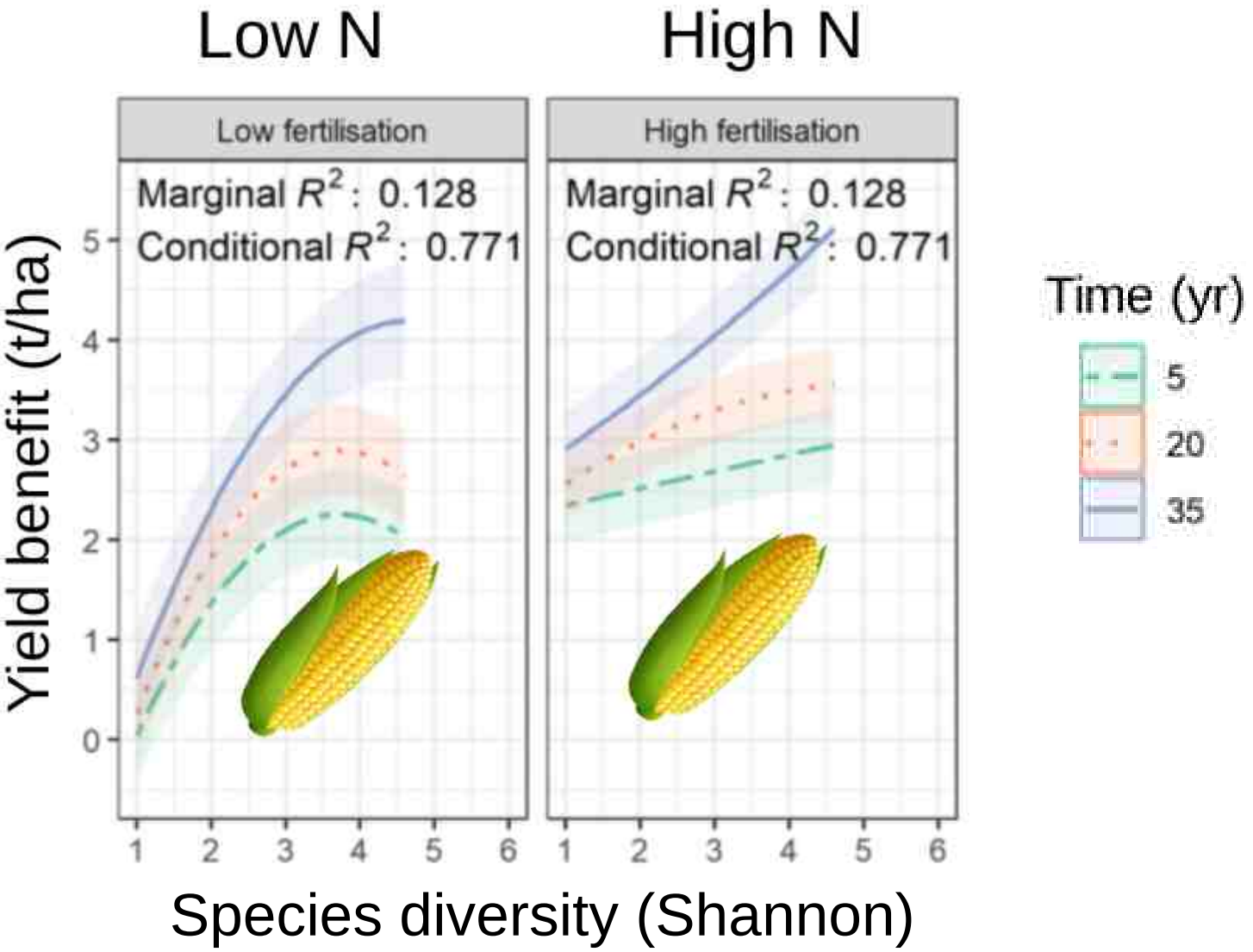


Tamburini et al 2020 Science advances

Diversified crop rotations

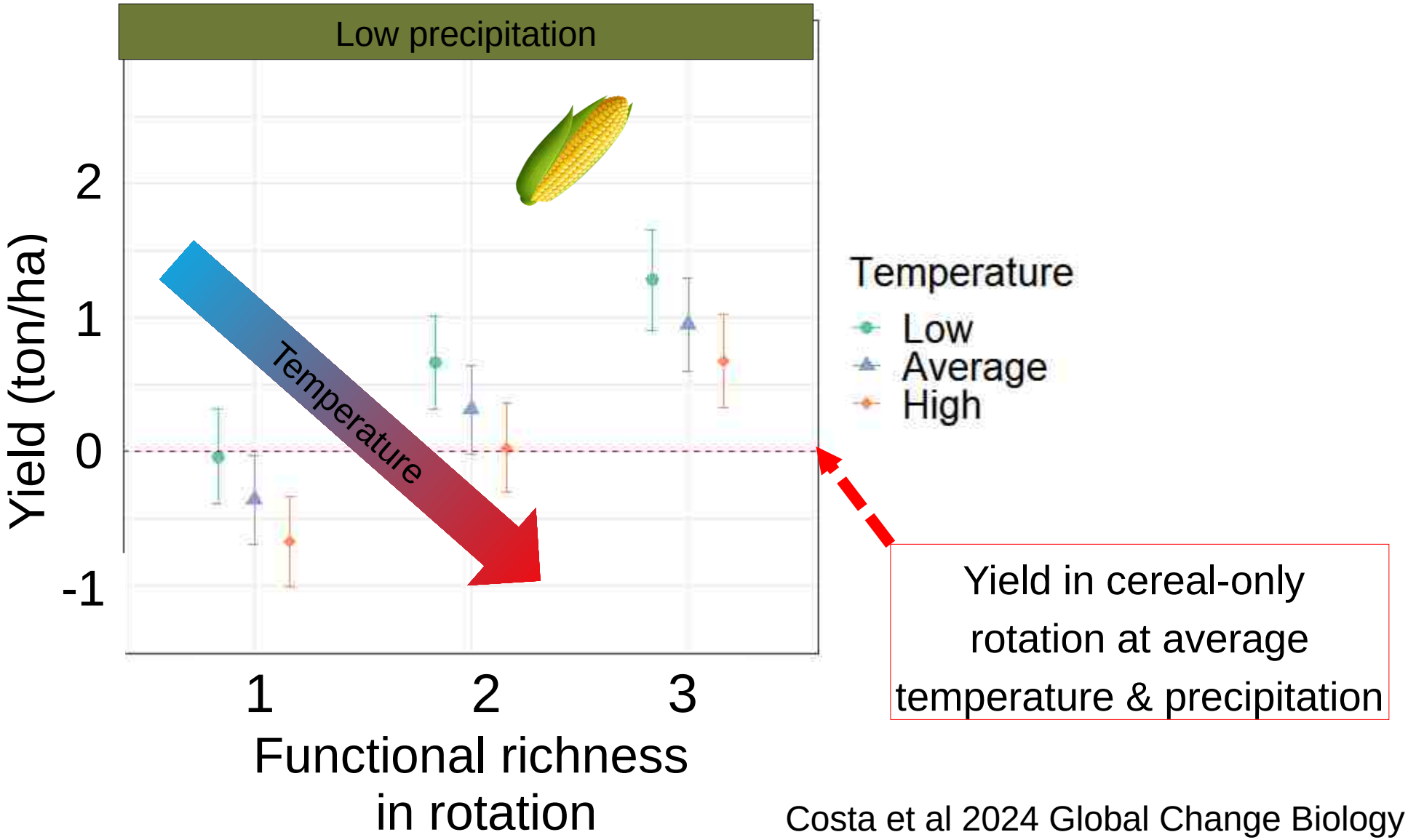
Crop rotational diversity benefits cereal yield





Smith et al 2023 Comm Earth Environ
See also Maclaren et al 2022 Nature Sust
Bowles et al 2020 One Earth

Crop rotational diversity over-compensates yield losses under adverse climatic conditions



Costa et al 2024 Global Change Biology

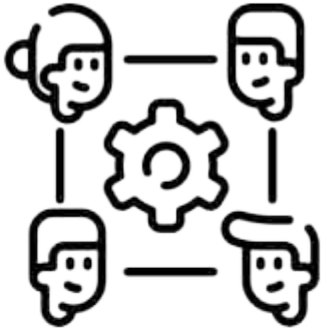
WG4 Focus topic

Redesign requirements of annual grain and viticulture farming systems under a zero pesticide scenario

1) Identify redesign options for cropping systems in the case of no access to chemical pesticides using a common methodology
2) Focus on grain and viticulture cropping systems
3) Collect this information from a representative sample of regions and agricultural contexts and from the literature
4) Collect material for future common scientific publications

WG4 Activities

Protocol developed



National workshops
grain or viticulture

Summarising national
workshop outcomes

Workshop with
workshop leaders

Writing report and
publication

WG4 Activities

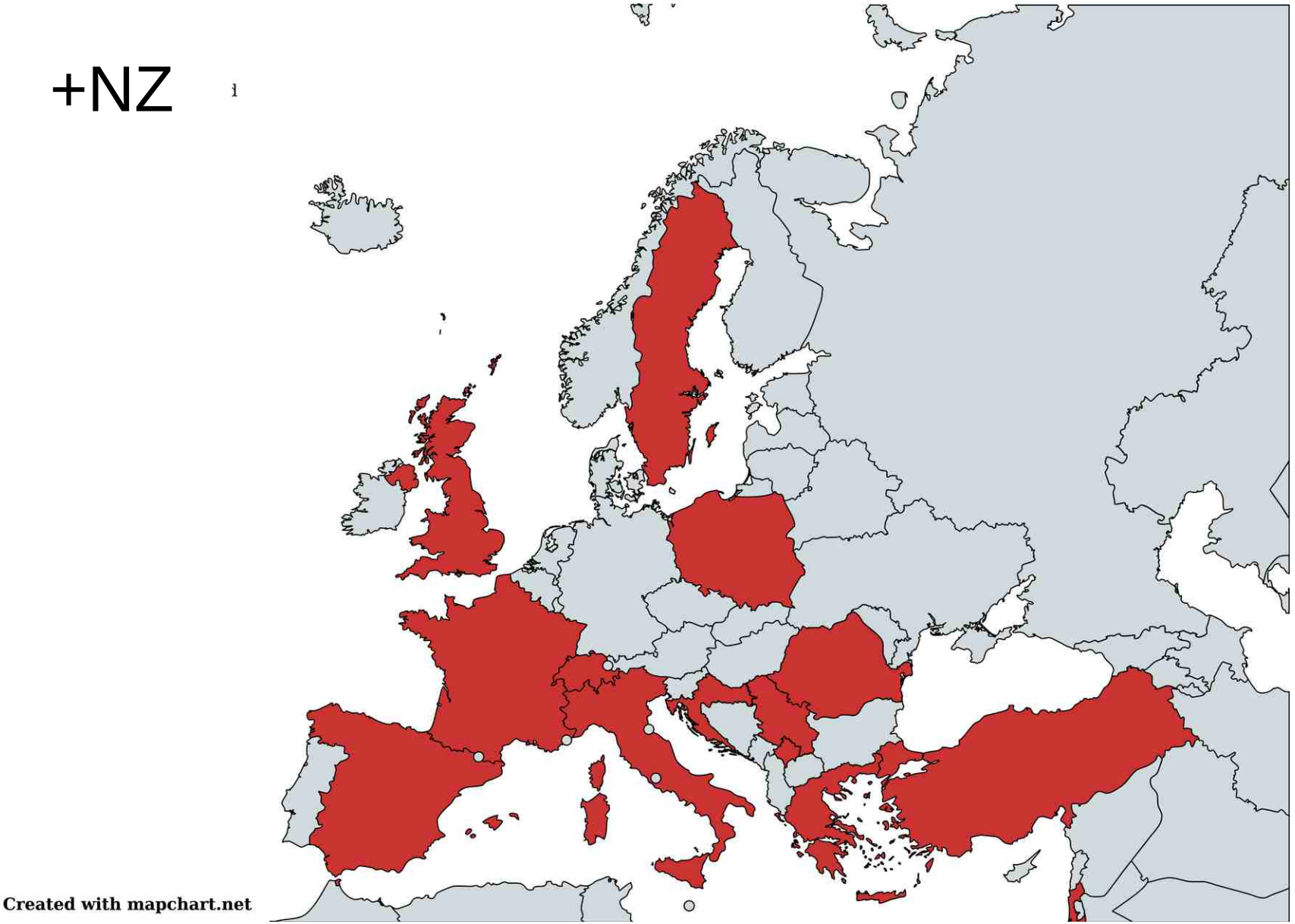
- Regional Concept-knowledge (C-K) workshop April-November 2024 - with non-academic partners and end-users with broad knowledge on the chosen cropping system, e.g. advisors, farmer representatives, agricultural scientists and farming specialists.
- International C-K Workshop 3-5 February 2025, Germany
- Synthesis paper late 2025 (Deliverable 4.1)
- Short Term Scientific Missions 2025 (STSM)
- Training school in 2025

24 Regional C-K workshops

#	Country	Lead	Mail	Cropping system
1	Kosova	Arben Mehmeti	"Arben Mehmeti" <arben.mehmeti@uni-pr.edu>	Viticulture
2	Poland	Agnieszka Syno	"Agnieszka Synowiec - UR Krakow" <agnieszka.synowiec@urk.edu.pl>	Grain
3	Poland	Agnieszka Syno	"Agnieszka Synowiec - UR Krakow" <agnieszka.synowiec@urk.edu.pl>	Grain
4	Israel	Murad Ghanim	"Murad Ghanim" <ghanim@volcani.agri.gov.il>	Grain
5	Israel	Murad Ghanim	"Murad Ghanim" <ghanim@volcani.agri.gov.il>	Viticulture
6	Serbia	Antonije Žunić	"Antonije Žunić" <antonije.zunic@polj.uns.ac.rs>	Grain
7	Serbia	Antonije Žunić	"Antonije Žunić" <antonije.zunic@polj.uns.ac.rs>	Viticulture
8	Turkey	Ersin Atay	Ersin ATAY <ersinatay@mehmetakif.edu.tr>	Viticulture
9	Spain	Jose V. Ros	Jose V. Ros <J.Vicente.Ros@uv.es>	Viticulture
10	Sweden	Anna Berlin	Anna.Berlin@slu.se	Grain
11	Greece	Maria Tsiafouli	"tsiafoul@bio.auth.gr" <tsiafoul@bio.auth.gr>	Viticulture
12	Italy	Daniele Antichi	daniele.antichi@unipi.it	Grain
13	Italy	Daniele Antichi	daniele.antichi@unipi.it	Viticulture
14	Switzerland	Mark Jennifer	Mark Jennifer <jennifer.mark@fibl.org>	Viticulture
15	Switzerland	Mark Jennifer	Mark Jennifer <jennifer.mark@fibl.org>	Grain
16	Croatia	Renata Bažok	Renata Bažok <rbazok@agr.hr>	Grain
17	Croatia	Renata Bažok	Renata Bažok <rbazok@agr.hr>	Viticulture
18	UK	Roy Kennedy	Roy Kennedy <rkennedy@warwickshire.ac.uk>	Grain
19	Romania	Ionel Mugurel Jit	mjitea@usamvcluj.ro	Viticulture
20	New Zealand	Virginia Marroni	Virginia Marroni <Virginia.Marroni@plantandfood.co.nz>	Grain
21	Serbia	Dragana Božić	dbozic@agrif.bg.ac.rs	Grain
22	Serbia	Dragana Božić	dbozic@agrif.bg.ac.rs	Viticulture
23	France	Thibaut Malausa	Thibaut Malausa <thibaut.malausa@inrae.fr>	Grain
24	France	Thibaut Malausa	Thibaut Malausa <thibaut.malausa@inrae.fr>	Viticulture

Workshops in 16 countries

+NZ



Regional C-K workshops

- More registrations are welcome
- Deadline for registration **15 June 2024**
- Financial suppport of 1500 Euro can be granted (for 9 workshops)
- CKW organisers are asked to send invitation and programme to Riccardo and Kathrin (OK in original language)
- Reporting early autumn is encouraged

International C-K workshop

- 3-5 February 2025 central Germany
- 3rd travel, 4th full and 5th half workday
- Max two organisers per Regional CKW are invited to participate (~30 persons)
- Synthesis paper based on these exchanges and literature review in 2025

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