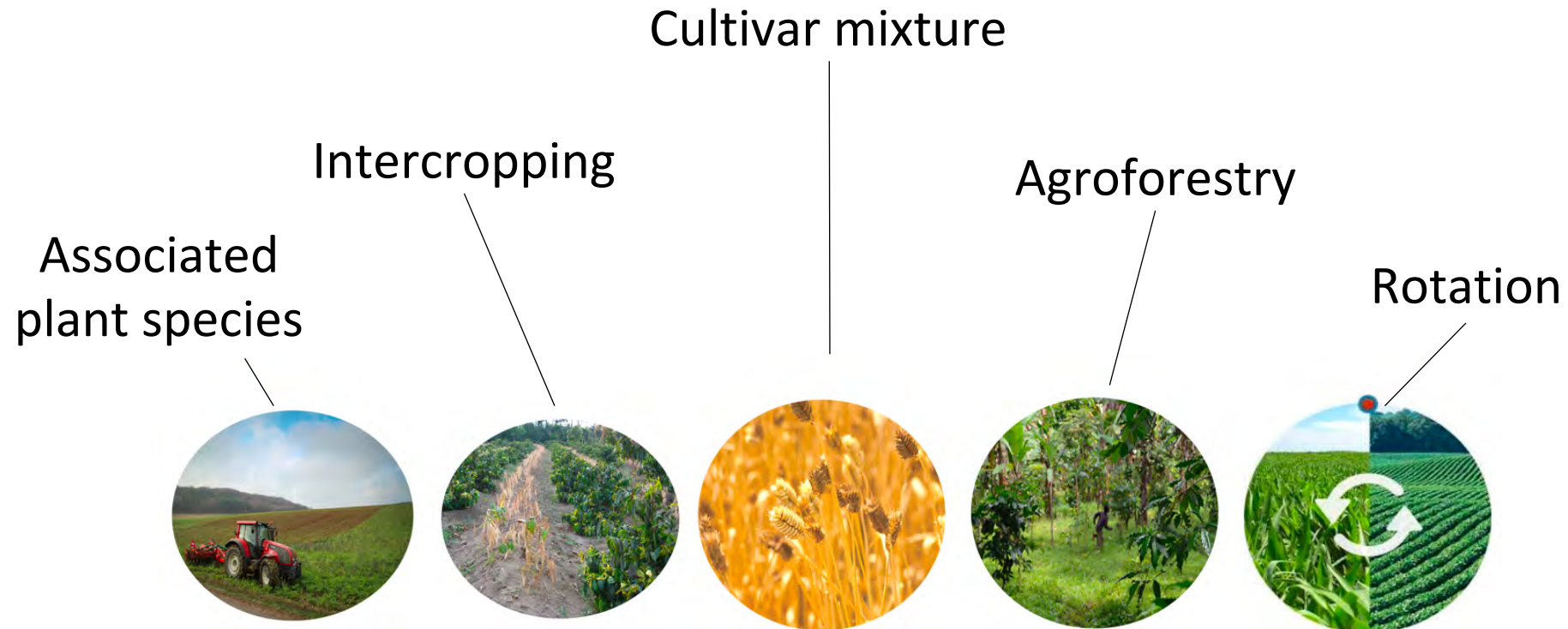


Effect of crop diversification strategies at the global scale

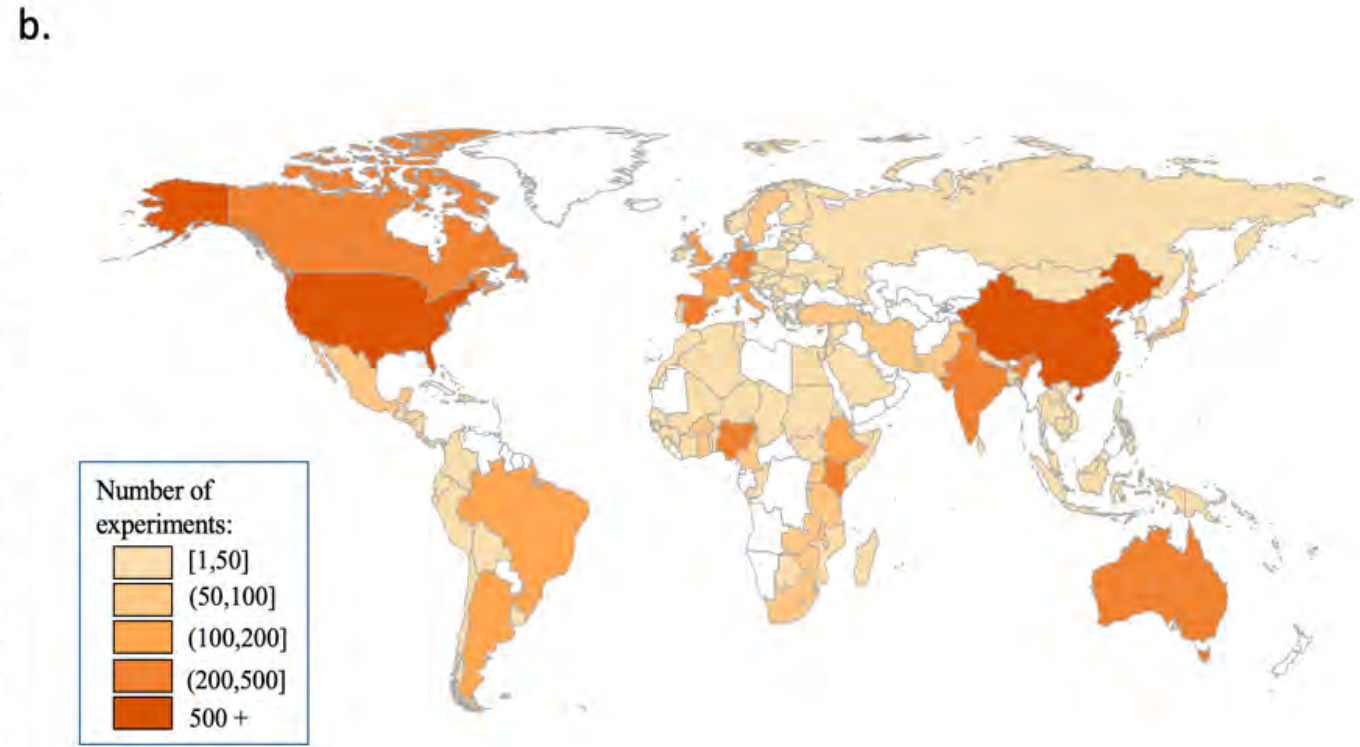
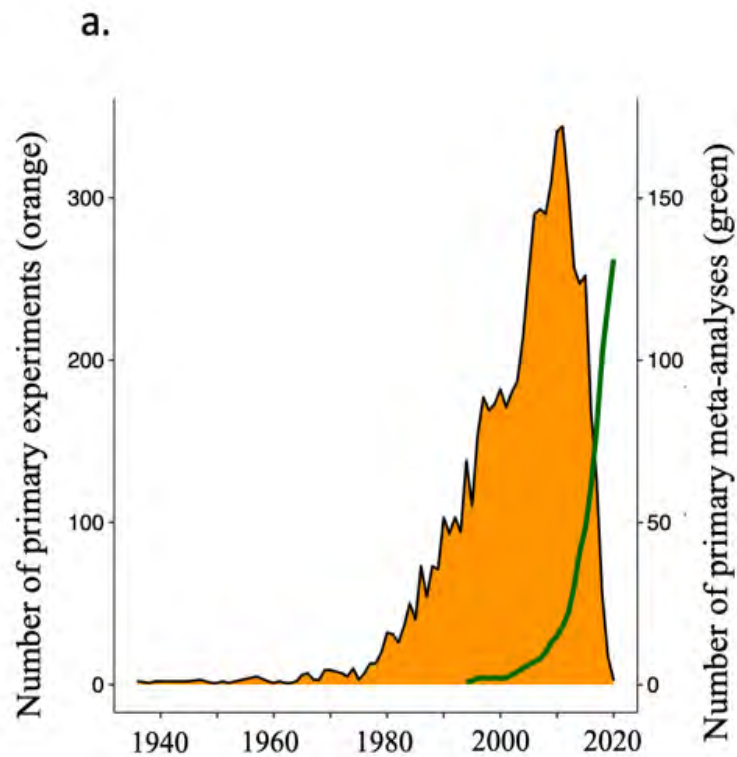
Numerous strategies of crop diversification

Include a wide range of practices aiming at incorporating (crop) diversity across multiple spatial and/or temporal scales (Redliech et al., 2018)



Many studies available

Over 35,000 experimental results have been published on crop diversification between January 1990 and May 2020 in agronomy peer-reviewed journals



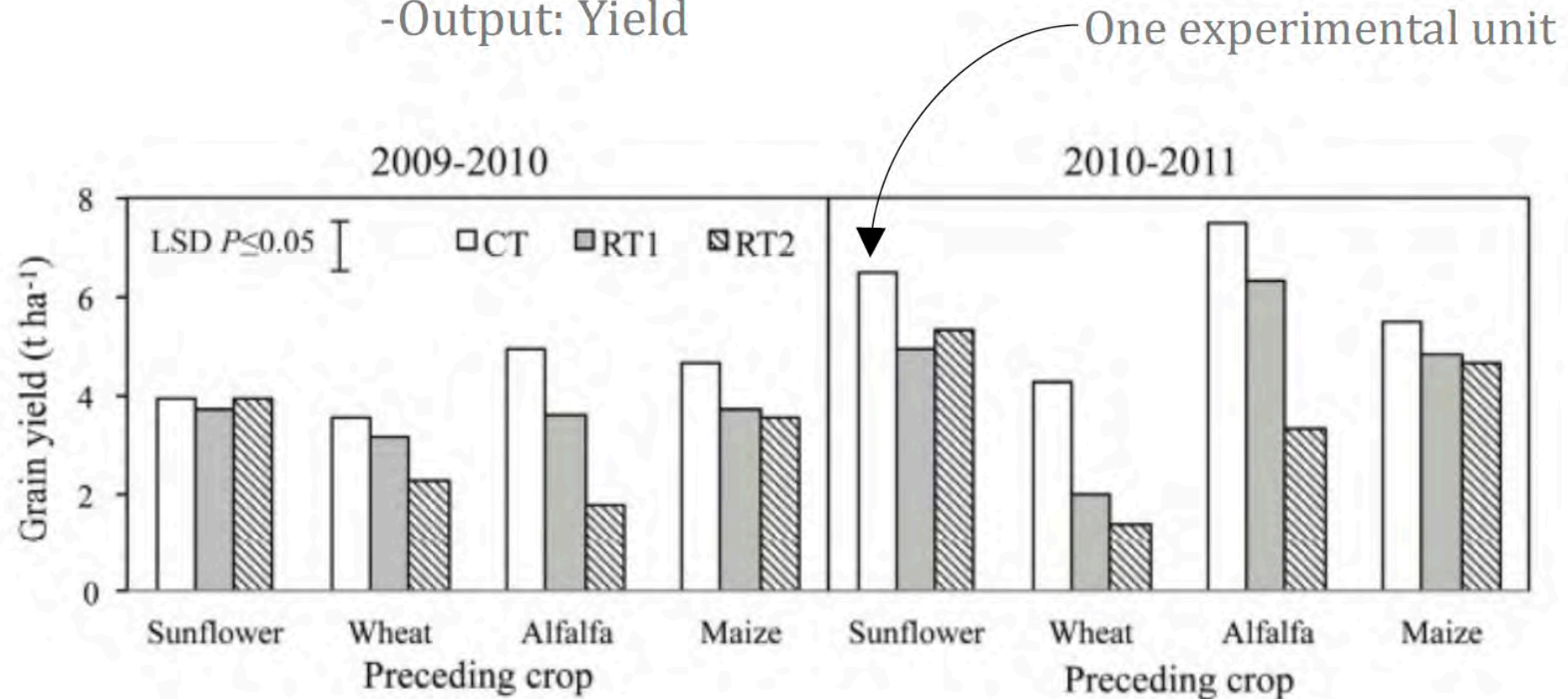
A difficulty in generalising from experimental results

◆ Example of individual experiments

-Strategie: Rotation

-Region: Italy

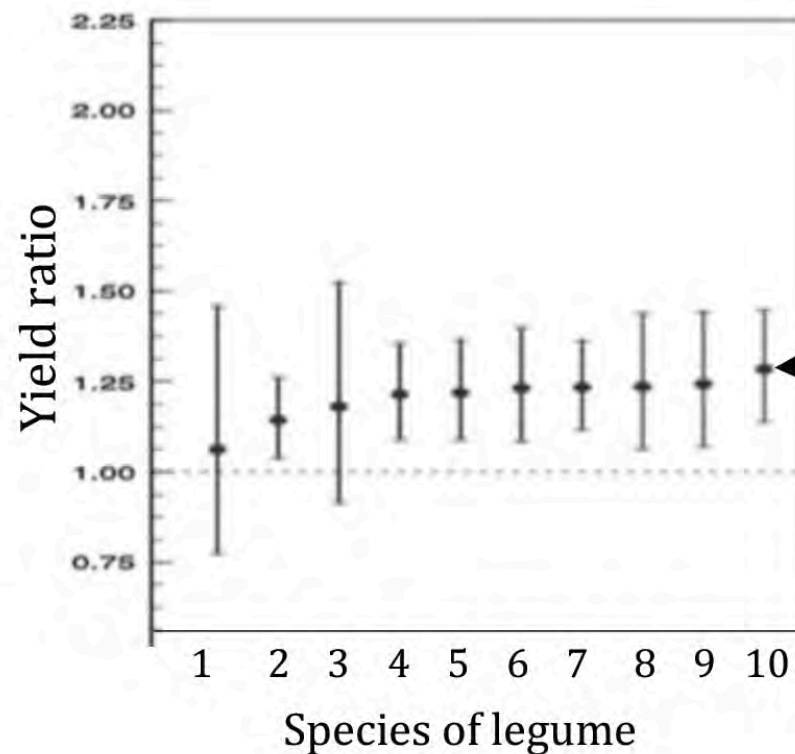
-Output: Yield



Synthesis of experimental results: meta-analyses

Example of MA : Cernay and *al*, 2017

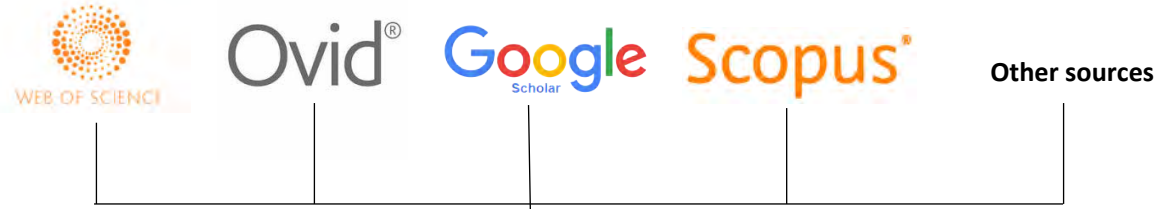
$$\text{Yield ratio} = \frac{\text{Yield of cereals cultivated after cereals}}{\text{Yield of cereals cultivated after legumes}}$$



Mean of all individual studies
(for legume #10)
95% Confidence intervals

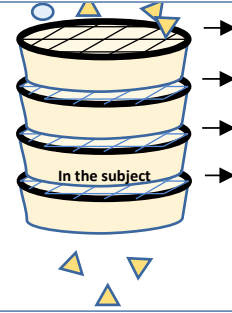
- What are the quantitative effects of crop diversification on biodiversity and ecosystem services?
- What are the knowledge gaps?

1. IDENTIFICATION OF THE STUDIES



1010 potential studies

2. SELECTION OF THE STUDIES



- Excluded duplicated studies
- Excluded studies not related to crop diversification
- Excluded studies that are not meta-analyses
- Quantification: ratio

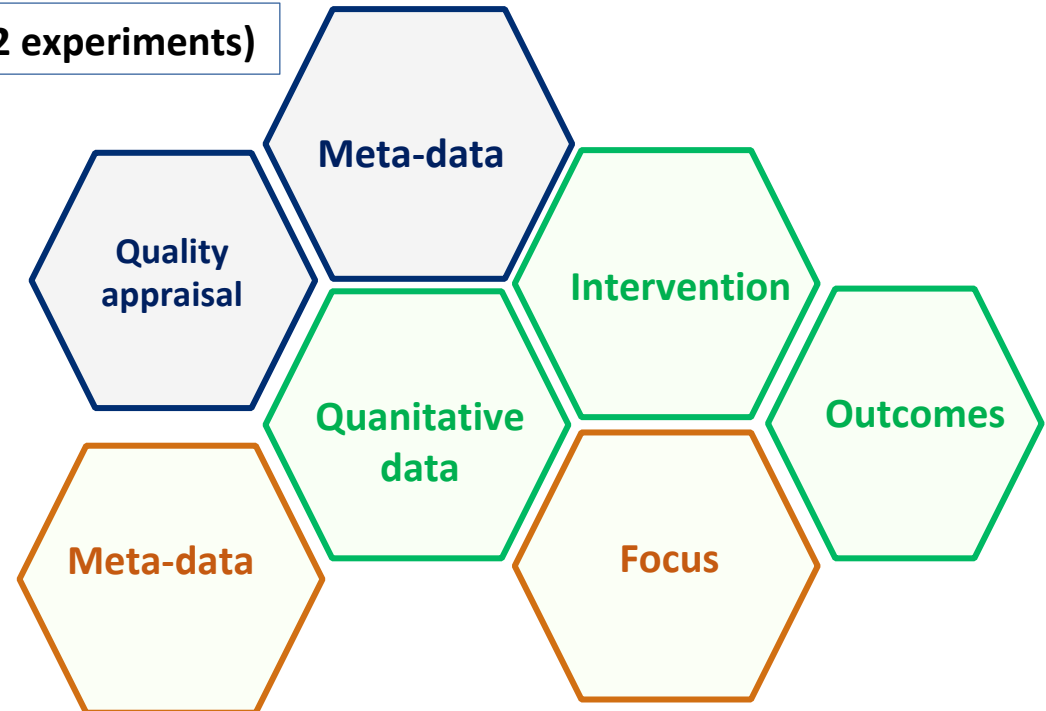
95 meta-analyses (5262 experiments)

3. CHARACTERIZATION

OF THE META-ANALYSES

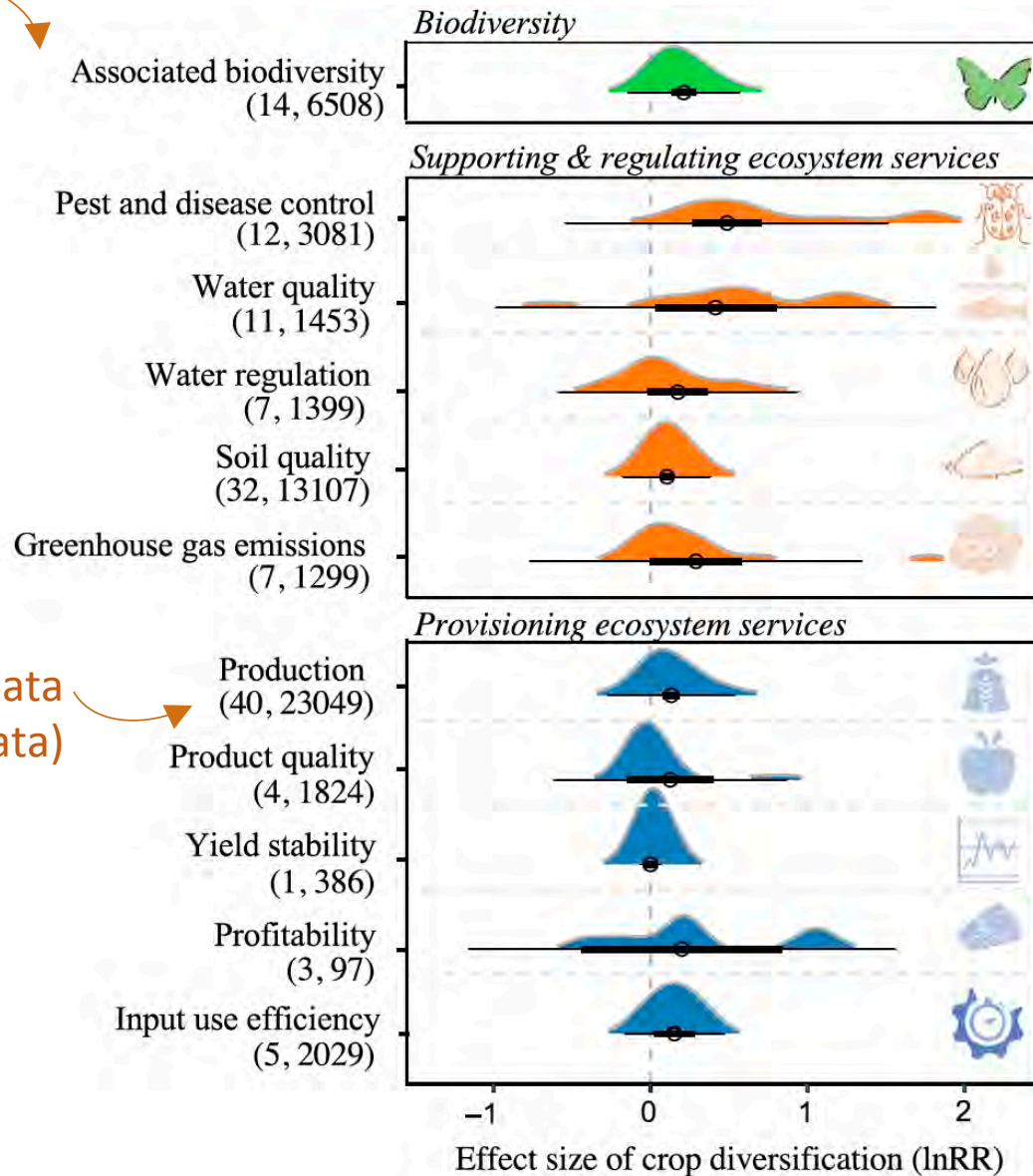
OF THE EFFECT-SIZES

OF THE PRIMARY STUDIES



Positive, but variable effects of crop diversification

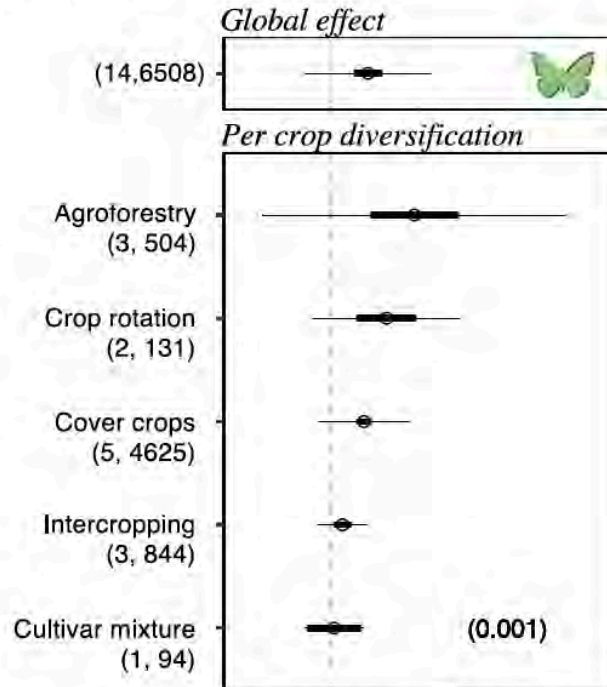
Ecosystem services



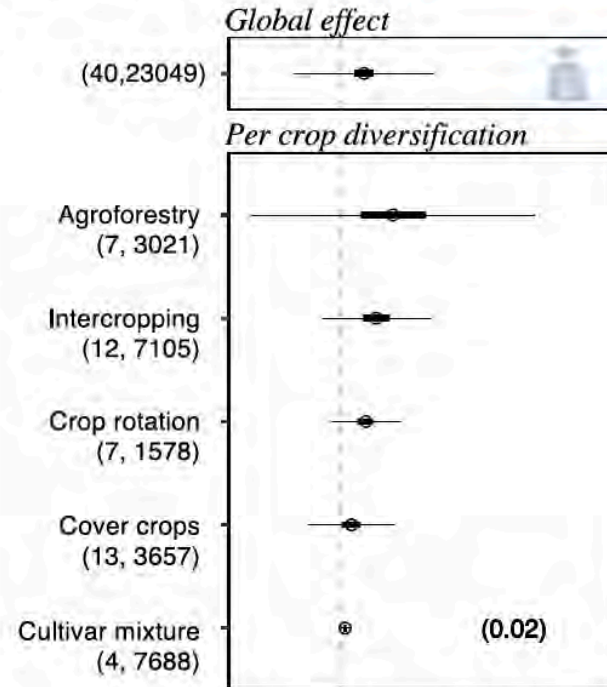
Number of data
(#meta-analyses, # paired-data)

Agroforestry: a promising strategy? (1)

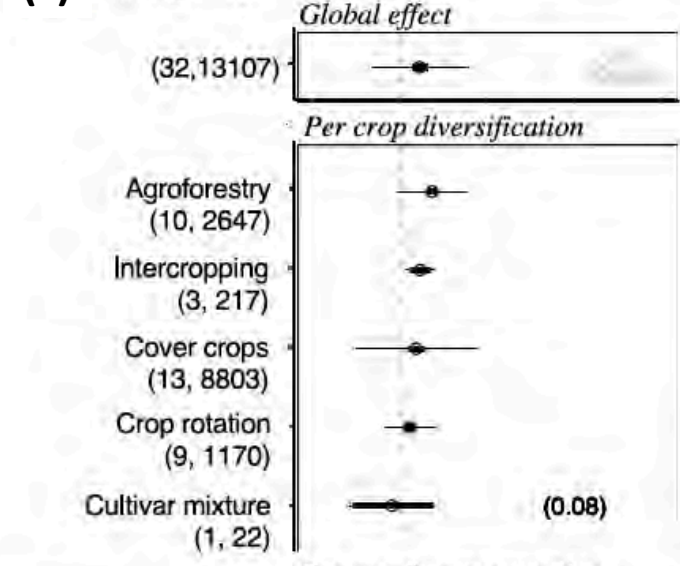
(a) Associated biodiversity



(b) Agricultural production



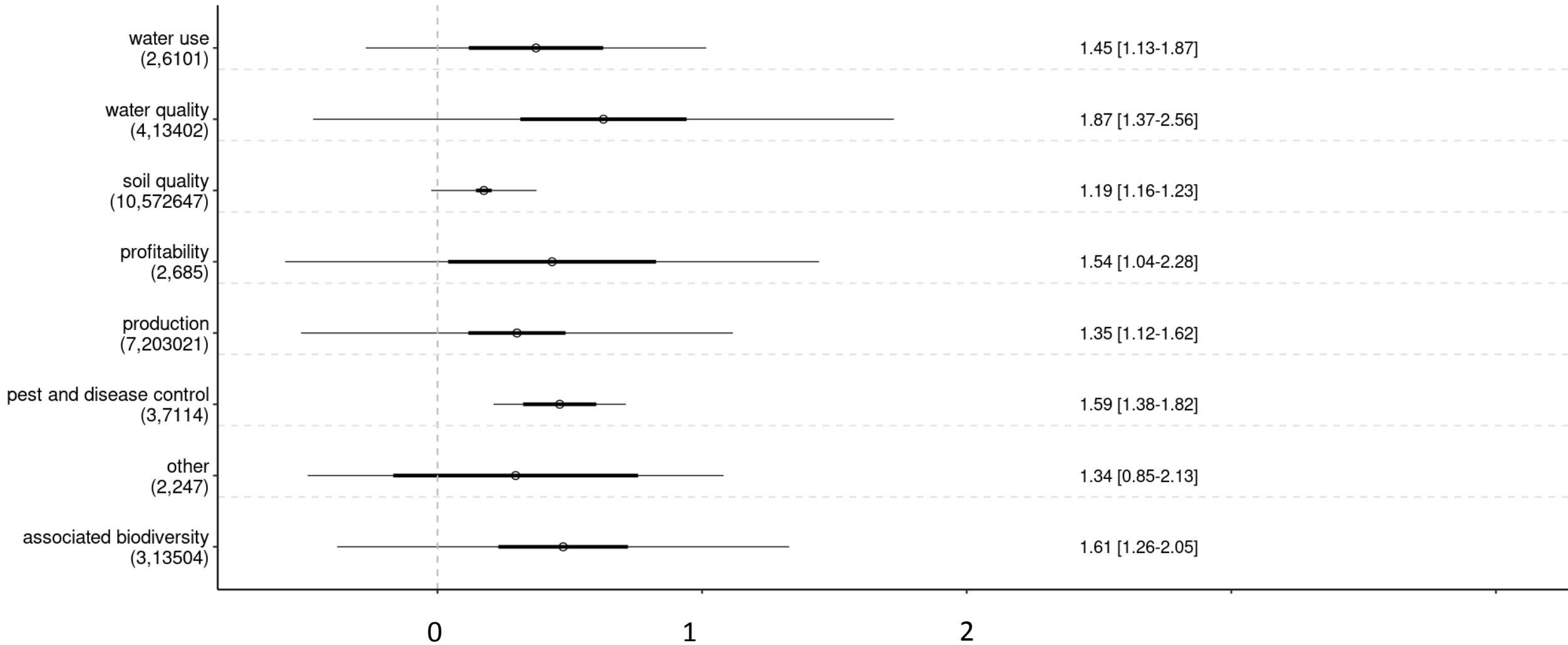
(c) Soil Quality



Agroforestry: a promising strategy? (2)

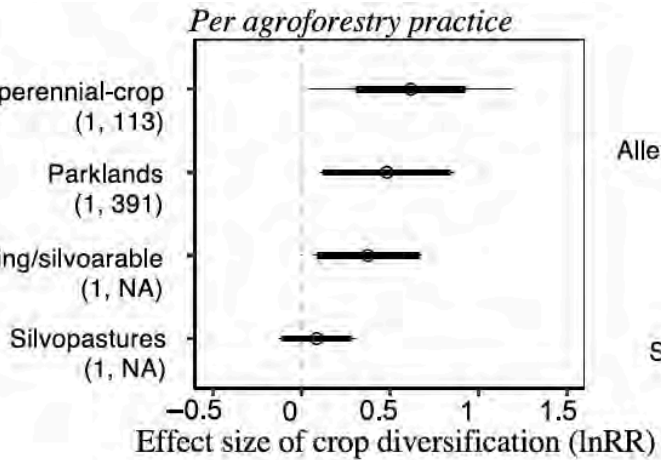


Agroforestry

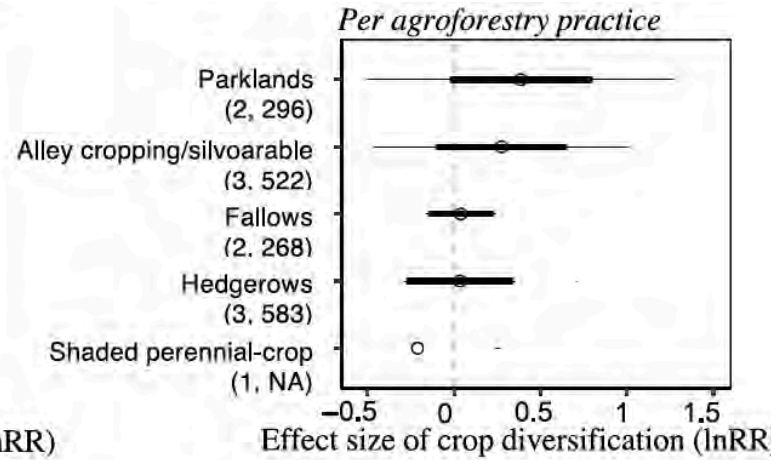


Agroforestry: a promising strategy? (3)

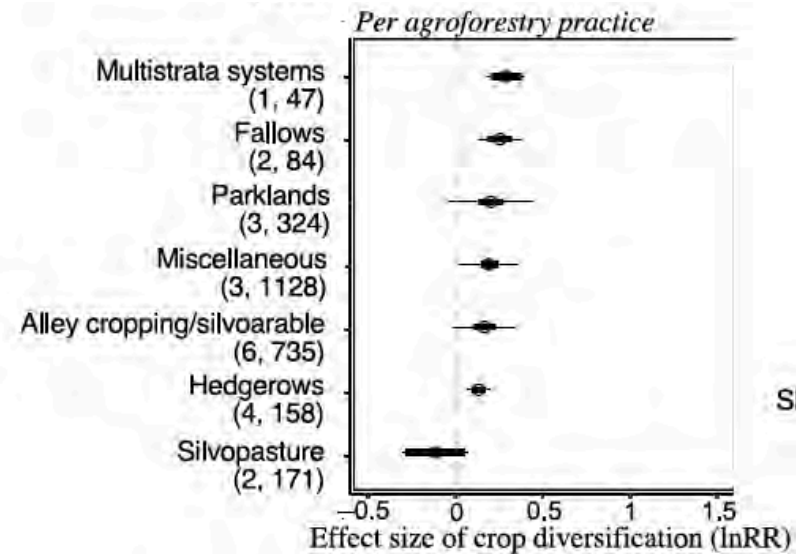
(a) Associated biodiversity



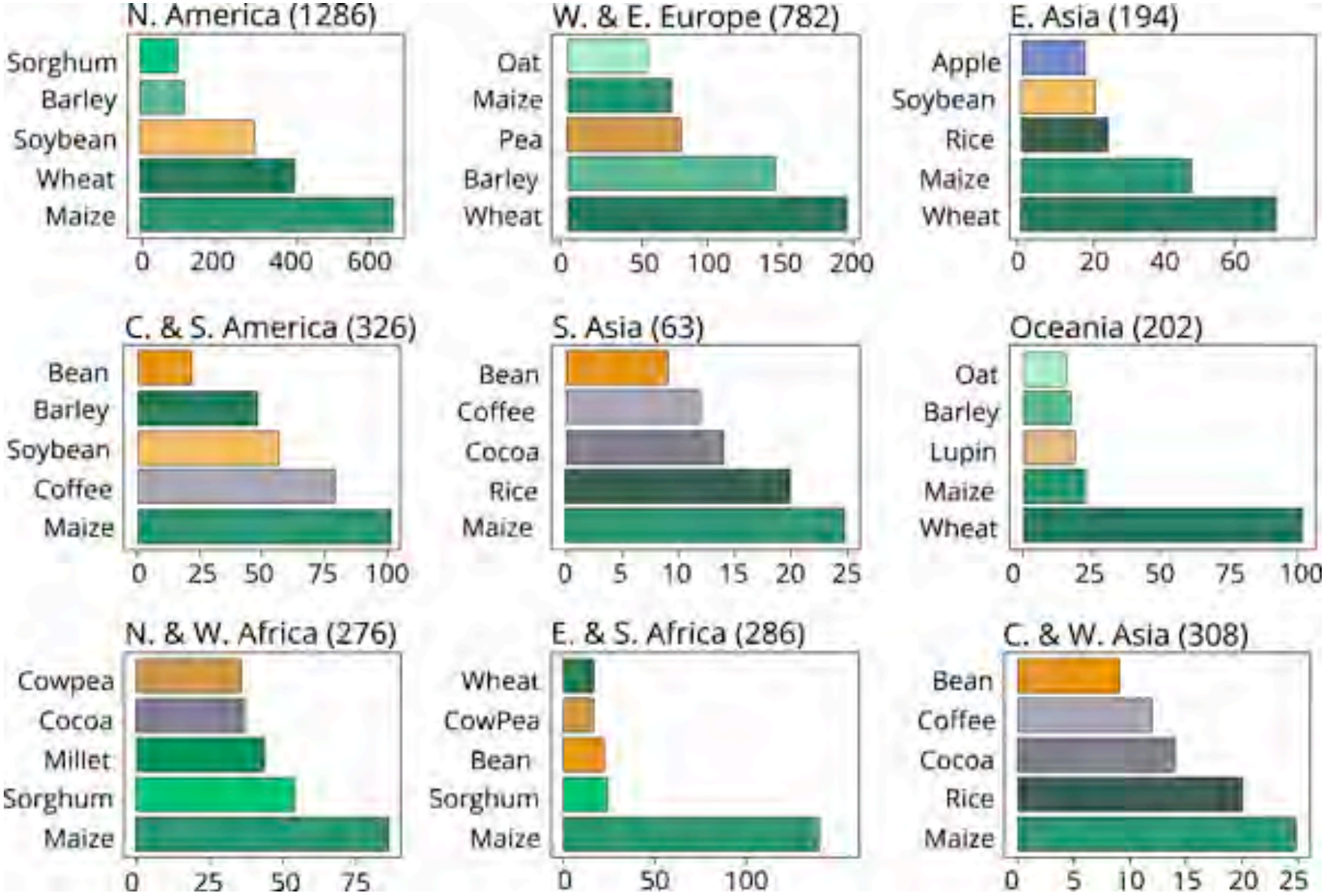
(b) Agricultural production



(c) Soil Quality



On which crops are these diversification strategies based?



Still numerous knowledge gaps

A.

	Two or more	Other	Rotation	Crop mixture	Landscape	Intercropping	Associated plants	Agroforestry
Yield	4 146(100)	1 61(100)	13 102(52)	4 229(72)		14 87(94)	12 48(100)	3 21(100)
Water use	1 19(100)						3 126(100)	
Water quality							7 172(100)	
Soil quality	2 193(100)		10 24(97)		1 74(100)		10 414(92)	8 72(100)
Profitability			3 82(100)			4 128(100)		1 19(100)
Products quality			1 22(100)			2 70(90)		
Production stability			1 609(100)			1 36(100)		
Pests and diseases		3 132(100)	1 48(100)	2 29(97)	1 46(100)	1 32(100)	3 180(99)	2 72(100)
Inputs use			1 50(100)				2 68(100)	
Greenhouses gas emission			1 157(97)			1 124(100)	3 119(94)	1 60(100)
Biodiv. assoc.	2 183(100)	6 26(98)	2 23(100)		5 173(98)	2 39(100)	4 205(100)	4 25(100)
ALL		1 61(100)					1 61(100)	1 24(100)

Detailed results

Beillouin, D., Ben-Ari, T., Makowski D. 2019. A dataset of meta-analyses on crop diversification at the global scale. *Data in Brief* 24, 103898.

Beillouin, D., Ben-Ari, T., Makowski D. 2019. Evidence map of crop diversification strategies at the global scale. *Environmental Research Letters*, in press. DOI: 10.1088/1748-9326/ab4449

Beillouin, D., Ben-Ari, T., Malezieux, E., Seufert, V. and Makowski, D., 2020. Benefits of crop diversification for biodiversity and ecosystem services. *Global Change Biology*.

https://cropdiversification.shinyapps.io/Crop_diversification_2020/

https://www.youtube.com/watch?v=QBR8tvfPa-E&t=1987s&ab_channel=CIREUMR8568