

# Many shades of grey

## The context-dependent performance of organic agriculture

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# SUSTAINABLE AGRICULTURE





# Current conventional agriculture







**ORGANIC**

What do we know about organic performance?





# LETTER

doi:10.1038/nature11069

## Comparing the yields of organic and conventional agriculture

Verena Seufert<sup>1</sup>, Navin Ramankutty<sup>1</sup> & Jonathan A. Foley<sup>2</sup>



Seeing the forest for the trees



# AVERAGE ORGANIC YIELD GAP

BOP

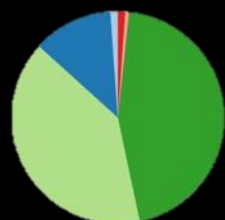
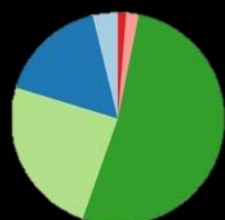
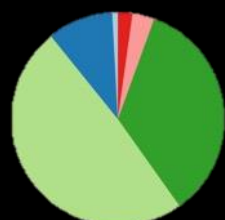


USA

Europe

## Continents

- Africa
- Asia
- Europe
- North America
- Oceania
- South America



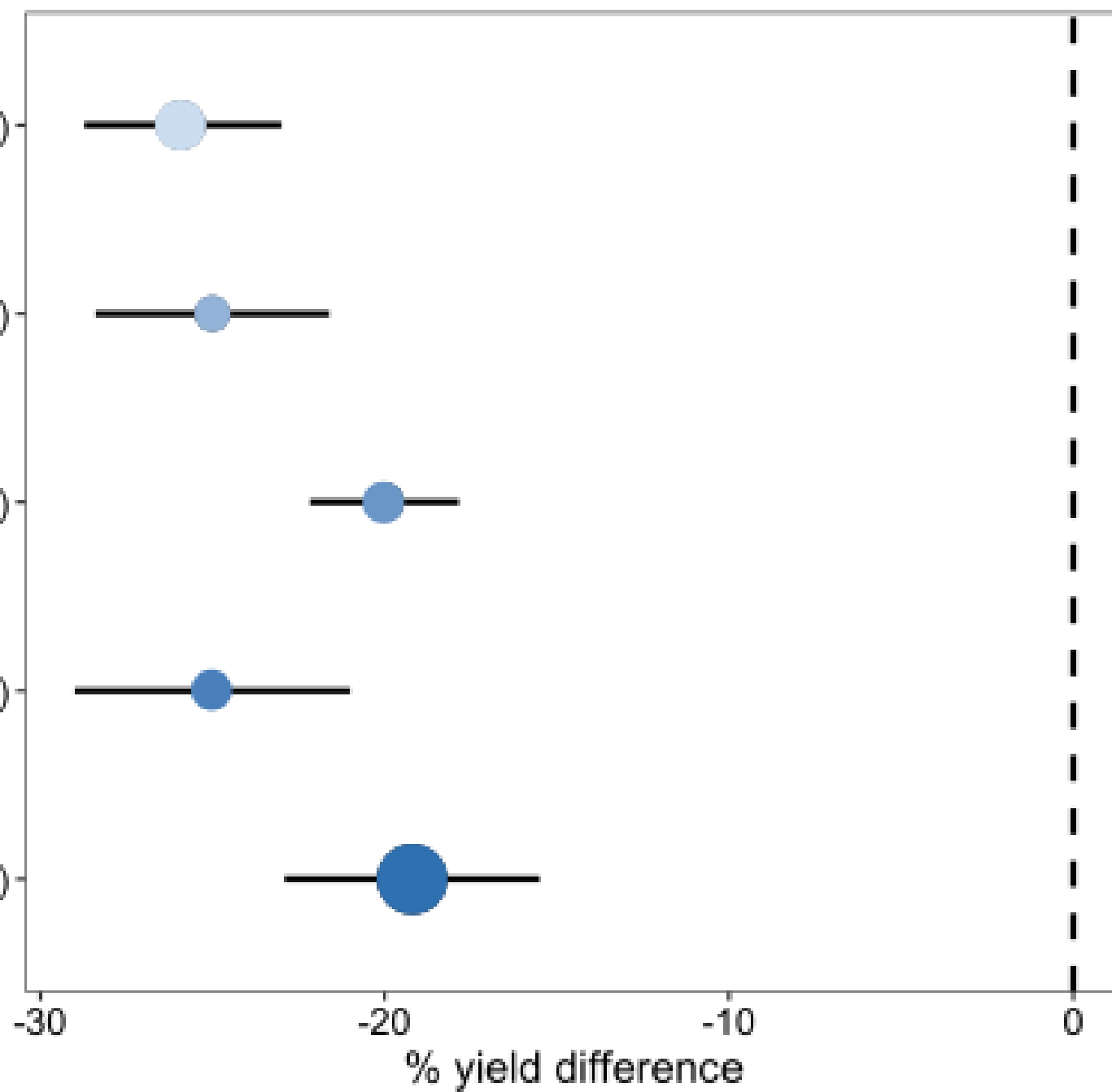
Kniss et al. (2016)

Tuomisto et al. (2012)

de Ponti et al. (2012)

Seufert et al. (2012)

Ponisio et al. (2015)





		Seufert	Ponisio	De Ponti
Region	Developing			
	Asia			
	Europe			
Management	Rainfed			
	Higher org N inputs			
	Longer organic rotations			
	Organic polycultures			
Study type	Experimental stations			
	> 3 years			

# CONTEXT-DEPENDENCY OF YIELD GAP

BOP



		Seufert	Ponisio	De Ponti
Region	Developing	↓	→	→
	Asia	↓	/	↑
	Europe	↓	/	↓
Management	Rainfed	↑	→	/
	Higher org N inputs	↑	↑	/
	Longer organic rotations	→	↑	/
	Organic polycultures	→	↑	/
Study type	Experimental stations	→	→	↓
	> 3 years	↑	→	/



**<0.1% of ag research funding!**

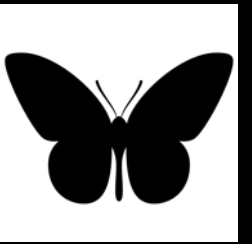


**THE  
MILLION  
DOLLAR  
QUESTIONS**

Can organic management increase yields in low-input systems in countries of the Global South?

What drives differences in the organic yield gap?

How can we close the organic yield gap?



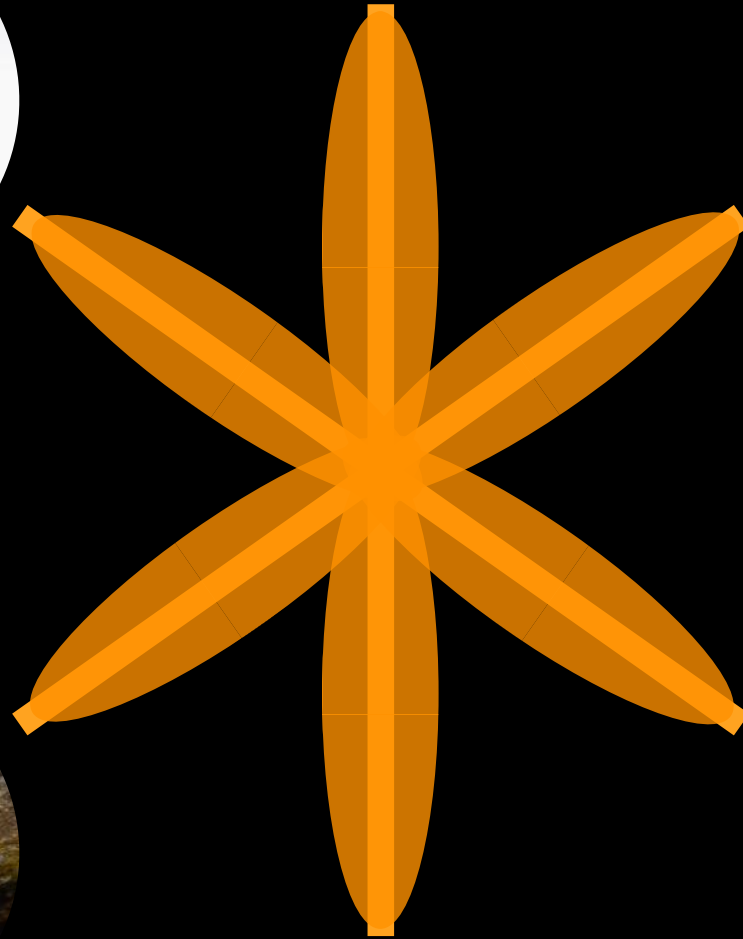
Water quantity



Biodiversity



Water quality



Soil

Climate



Seufert & Ramankutty (2017),  
*Science Advances*



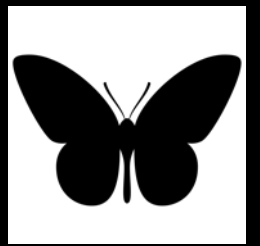


Per unit area





# Organic compared to conventional...

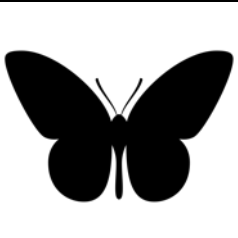


per unit area



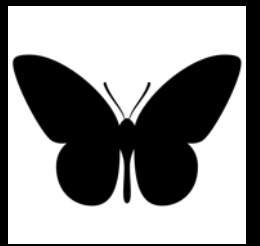
Seufert & Ramankutty (2017),  
*Science Advances*





Per unit output

# Organic compared to conventional...



per unit output



Seufert & Ramankutty (2017),  
*Science Advances*





Consumers



Producers





Farm profitability



Food prices



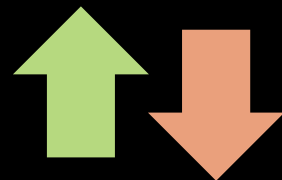
Resilience



Vitamin content



Autonomy



Mineral nutrients



Other benefits



Secondary metabolites



Farm worker health



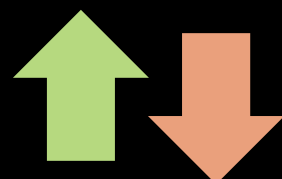
Low pesticide residues



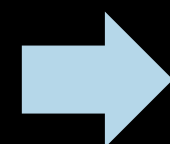
Rural employment



Farm wages

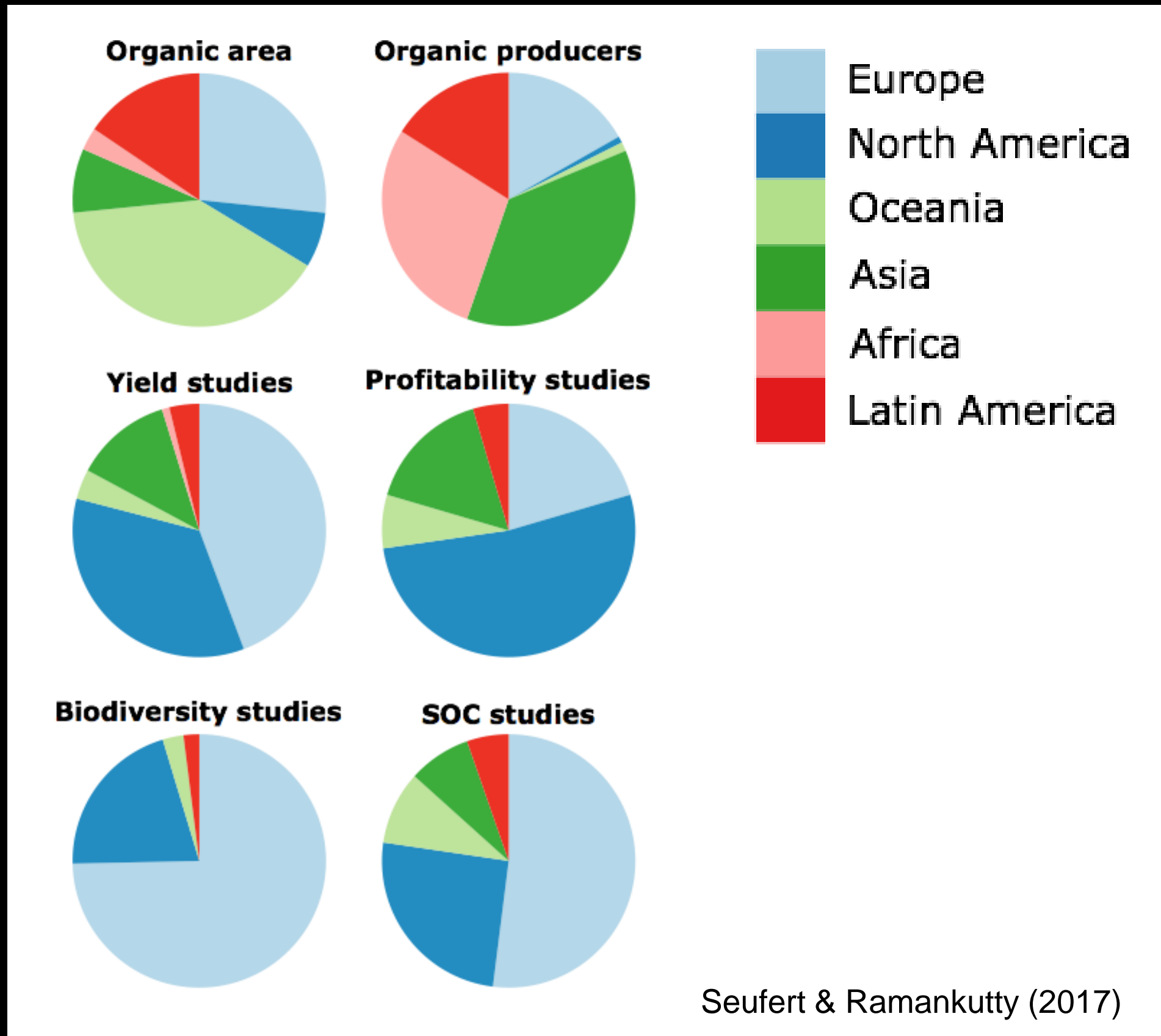


Labour conditions



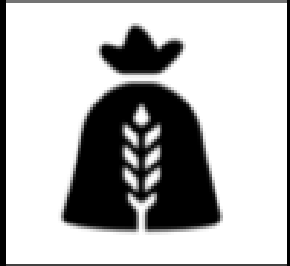


# What we don't know



Seufert & Ramankutty (2017)

# Conclusions on Organic



Lower, but depends on...



Higher per unit area,  
uncertain per unit output,  
depends on...



Mostly higher, but  
high uncertainties...  
depends on...



There is nothing black and white about organic agriculture



M. C. Escher, Day and Night





# Thank you!

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