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Cocoa agroforestry systems versus monocultures: a multi-dimensional meta-analysis

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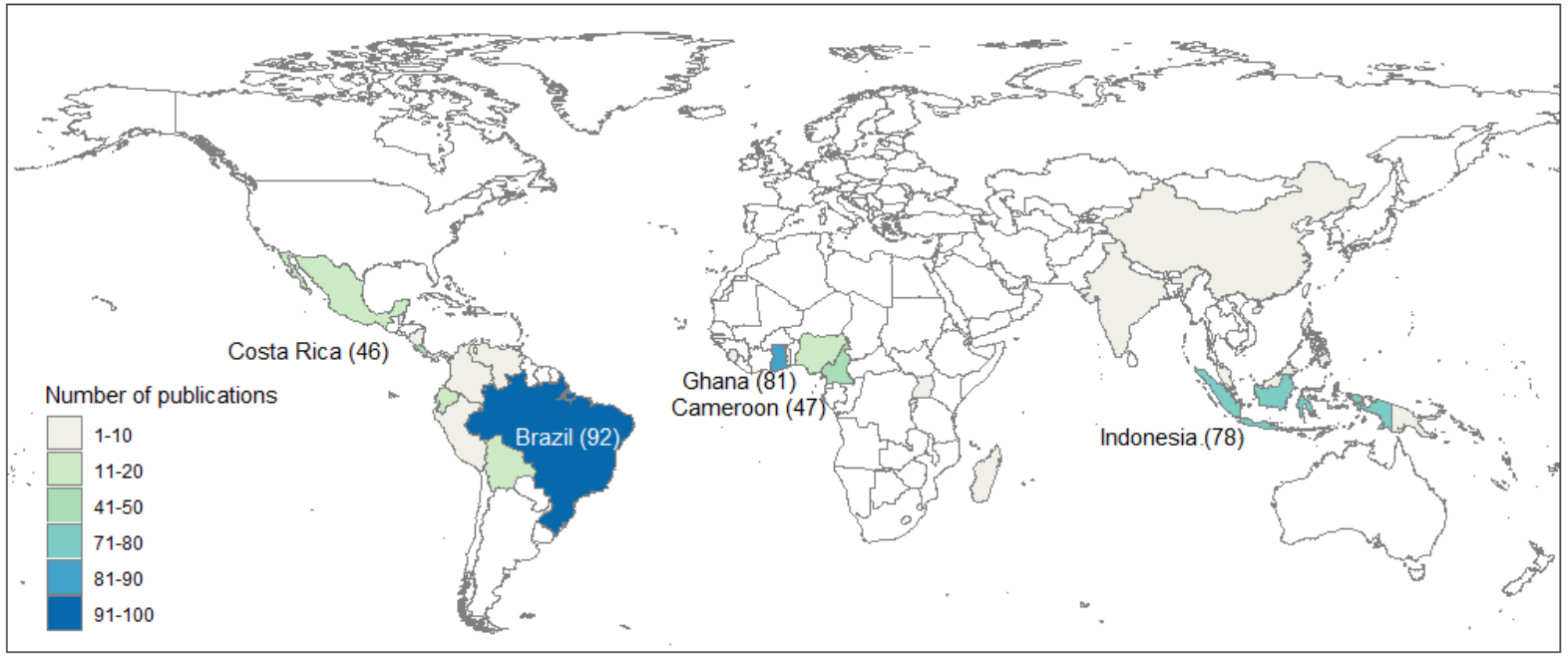
Meta-analysis: comparing

AGROFORESTRY SYSTEMS and MONOCULTURES

Cocoa agroforestry system (image: W. Niether)

Cocoa monoculture (image: J. Jacobi)

Literature search

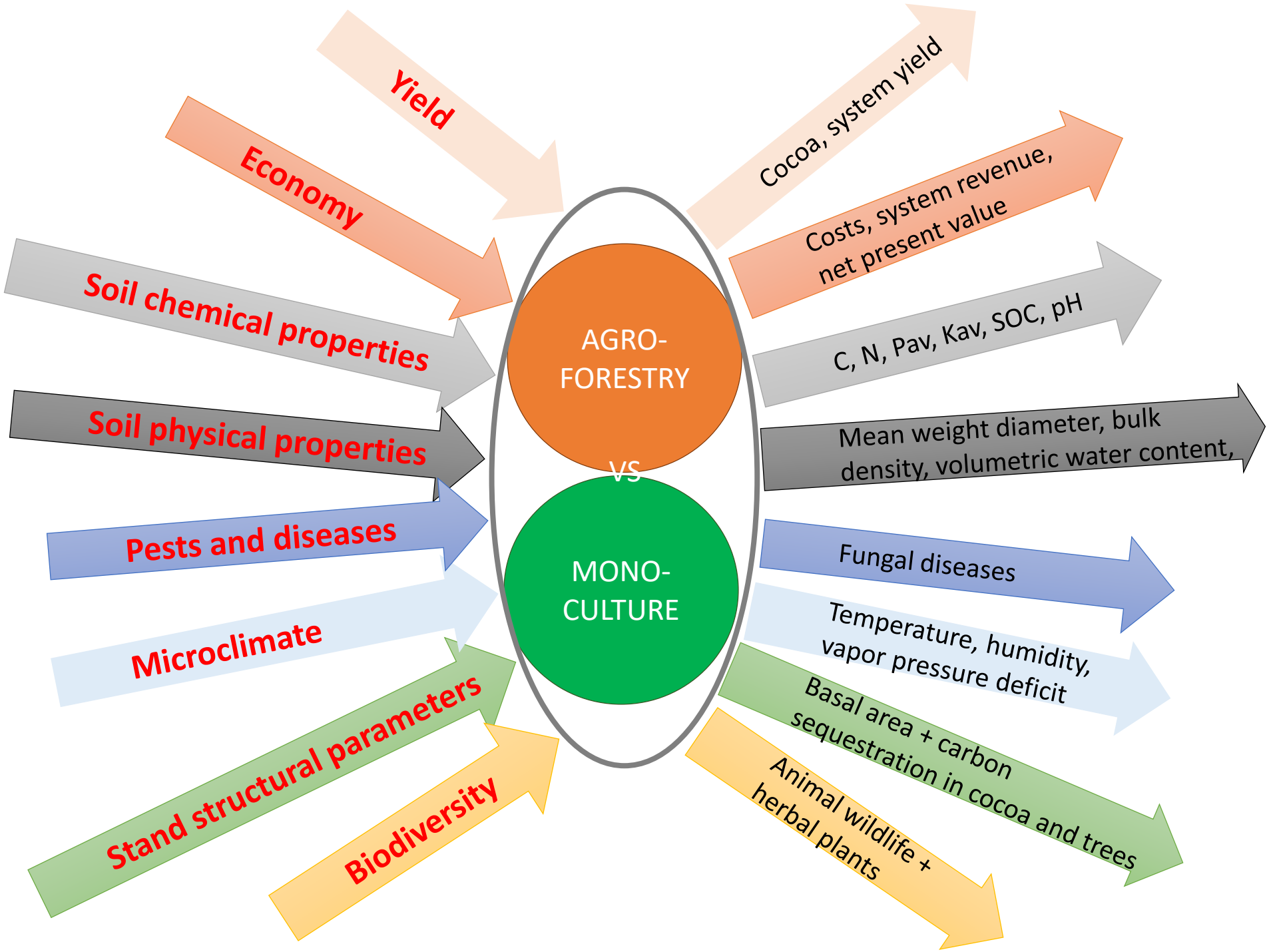


World map: research on cocoa agroforestry per country

→**52 articles** with direct comparisons

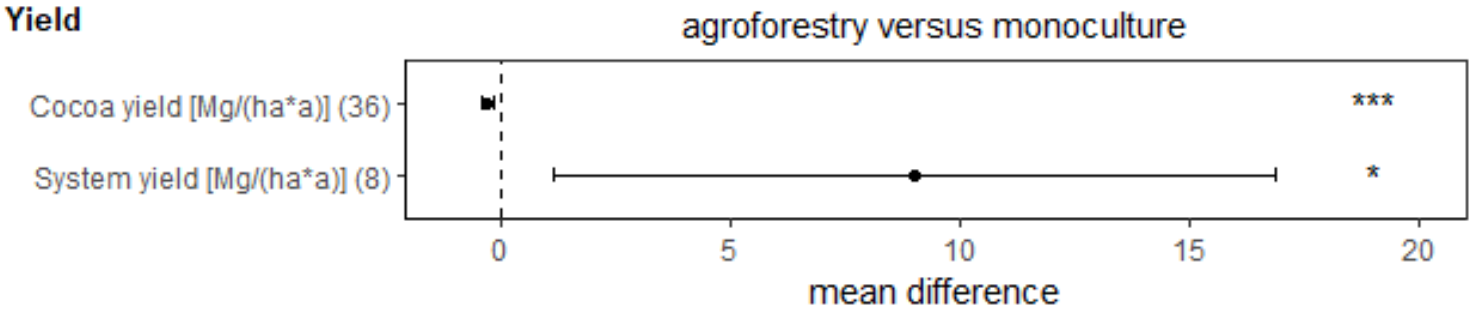
→**144 sub-studies**

→**93 data pairs** (independent pairwise comparisons)


Yield
Economy
Soil chemical properties
Soil physical properties
Pests and diseases
Microclimate
Stand structural parameters
Biodiversity
AGRO-FORESTRY
VS
MONO-CULTURE
Cocoa, system yield
Costs, system revenue, net present value
C, N, Pav, Kav, SOC, pH
Mean weight diameter, bulk density, volumetric water content,
Fungal diseases
Temperature, humidity, vapor pressure deficit
Basal area + carbon sequestration in cocoa and trees
Animal wildlife + herbal plants

AGROFORESTRY SYSTEM MONOCULTURE

Results: Yield



→ Higher cocoa yield in monocultures
→ Higher system yield in agroforestry systems

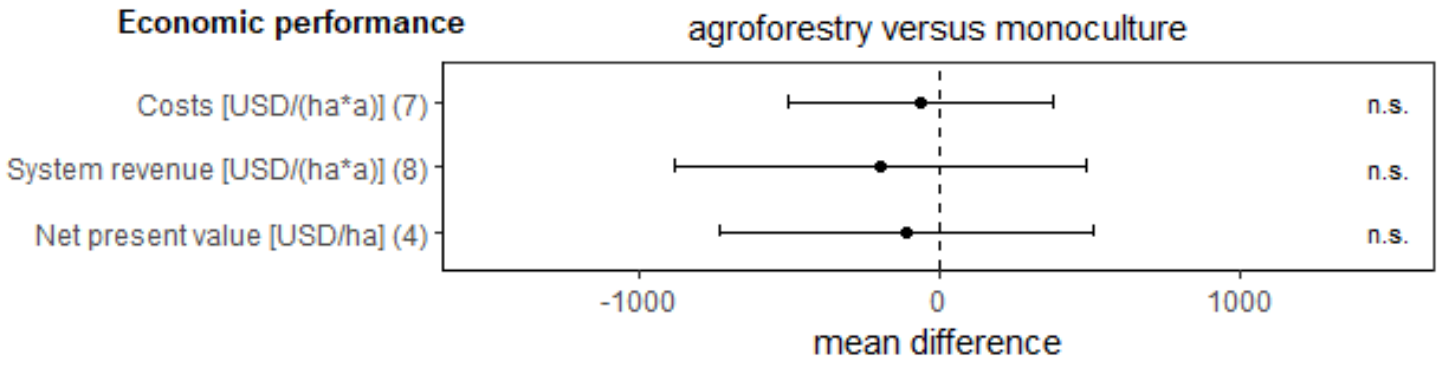
AGROFORESTRY SYSTEM MONOCULTURE

Cocoa yield

Total system yield

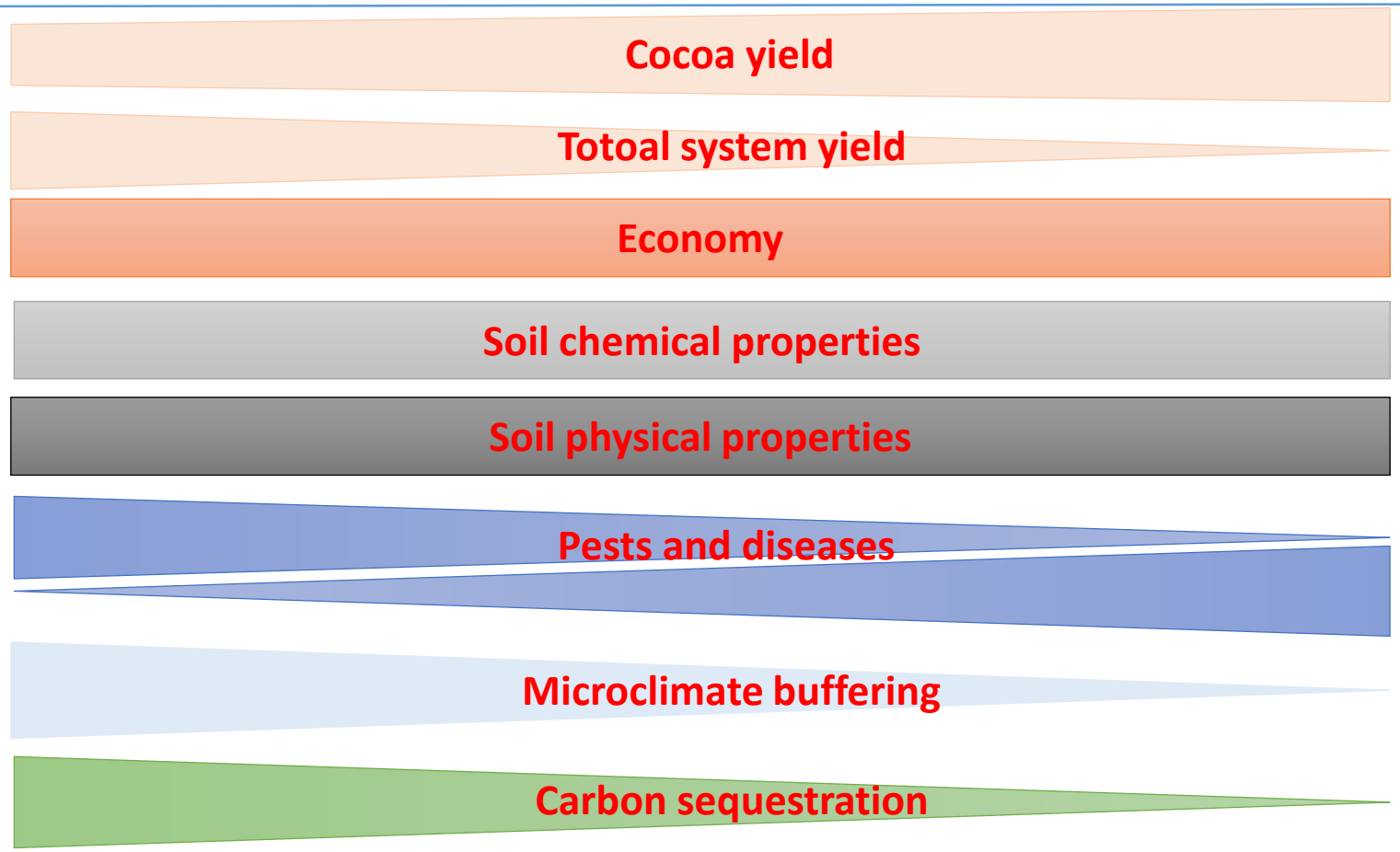
AGROFORESTRY SYSTEM MONOCULTURE

Results: Economic performance



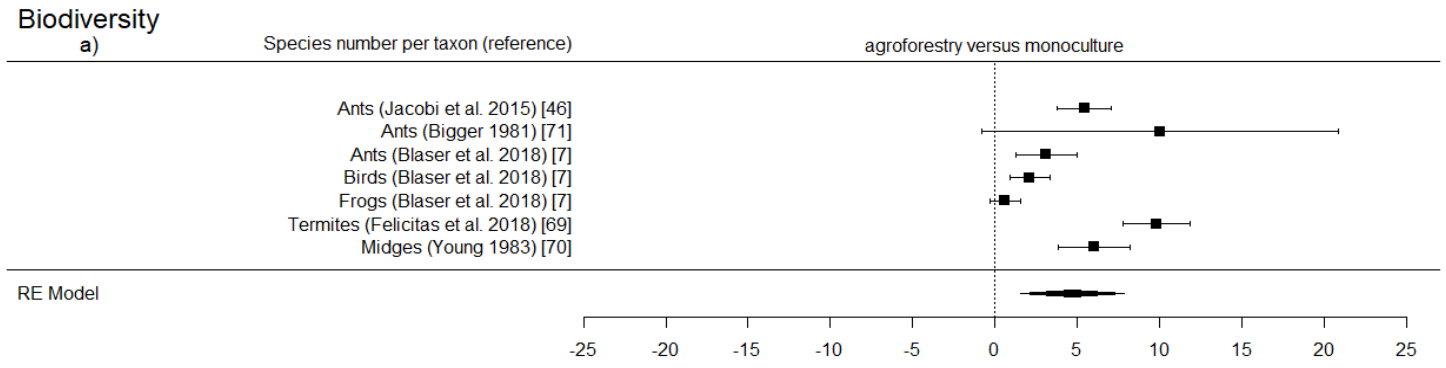
→ Non-significant differences between monocultures and agroforestry systems

AGROFORESTRY SYSTEM MONOCULTURE



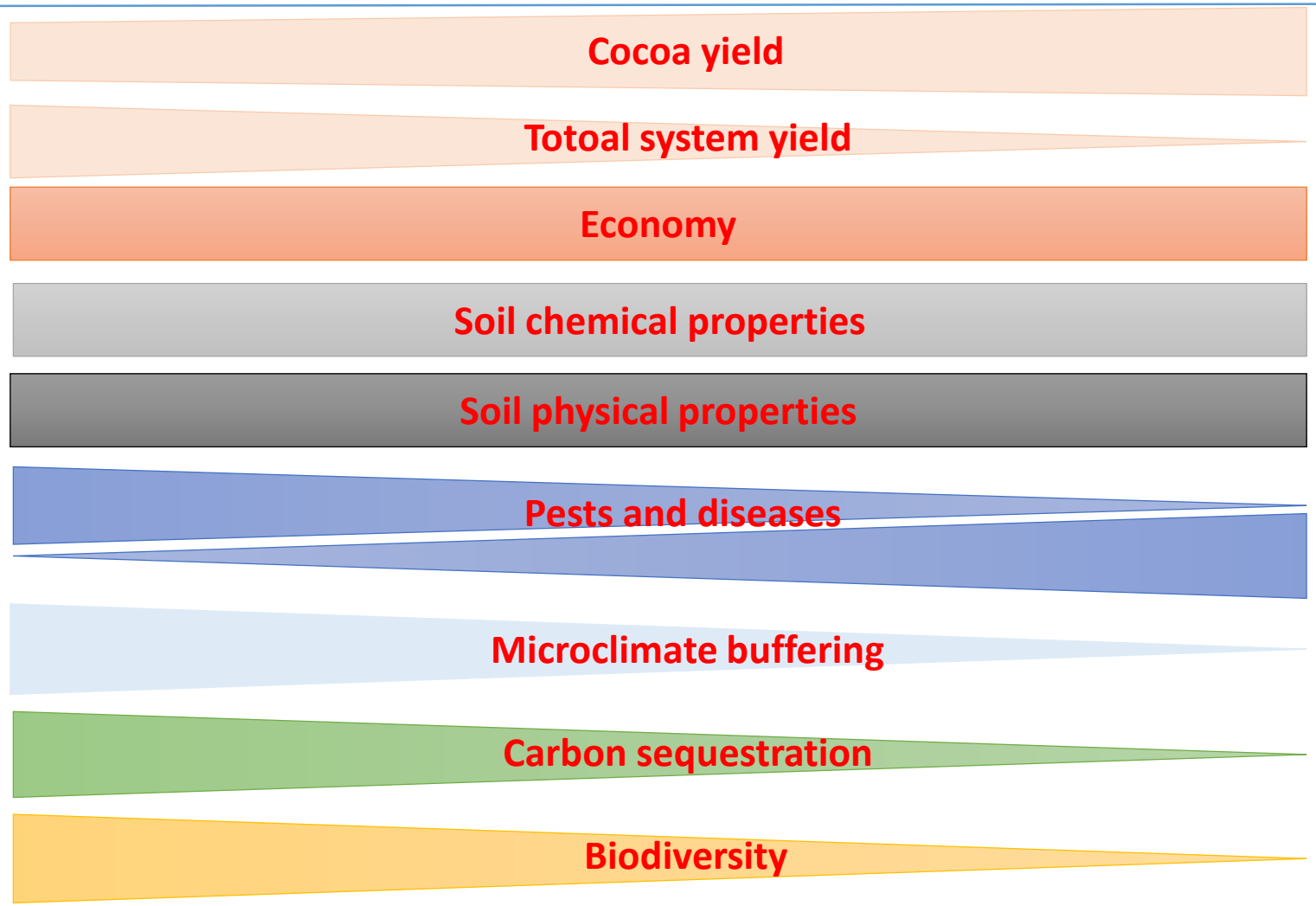
AGROFORESTRY SYSTEM MONOCULTURE

Results: Biodiversity

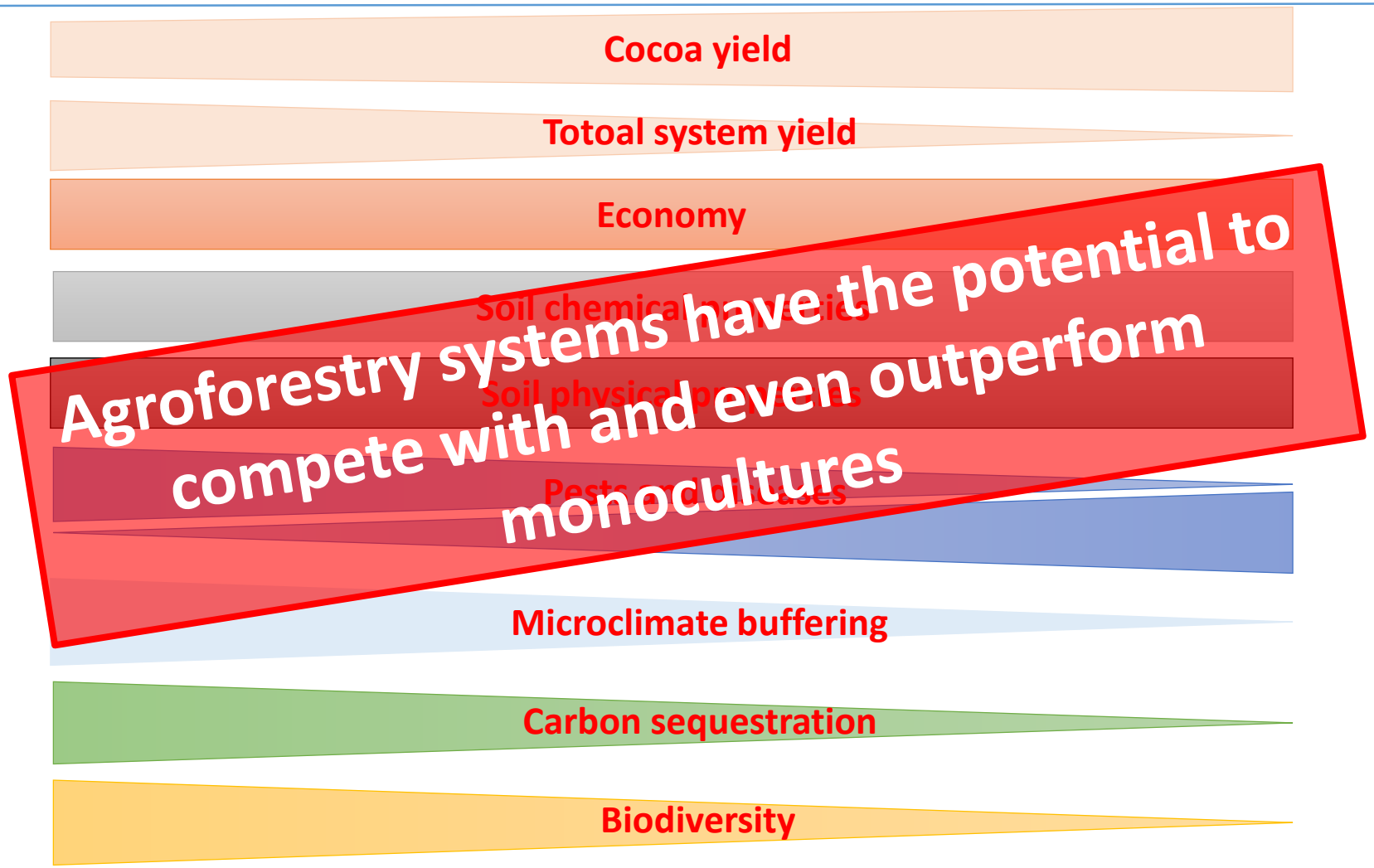


→ Higher species number in agroforestry systems

AGROFORESTRY SYSTEM MONOCULTURE



AGROFORESTRY SYSTEM MONOCULTURE



Agroforestry systems have the potential to compete with and even outperform monocultures

Conclusions and implications (1)

There is no general definition of cocoa agroforestry beyond “inclusion of trees in cocoa plots”

→ A global recommendation for shade levels or shade tree species would not be accurate (high heterogeneity of environmental, climatic, soil and socio-cultural conditions)

→ But: Local and context-specific knowledge and recommendations for cocoa agroforestry design and management needed

→ Knowledge gaps on species-specific information on shade trees, management strategies, pricing policies, livelihood aspects need to be addressed

Farmer-to-farmer field course, Bolivia (image: J. Jacobi)

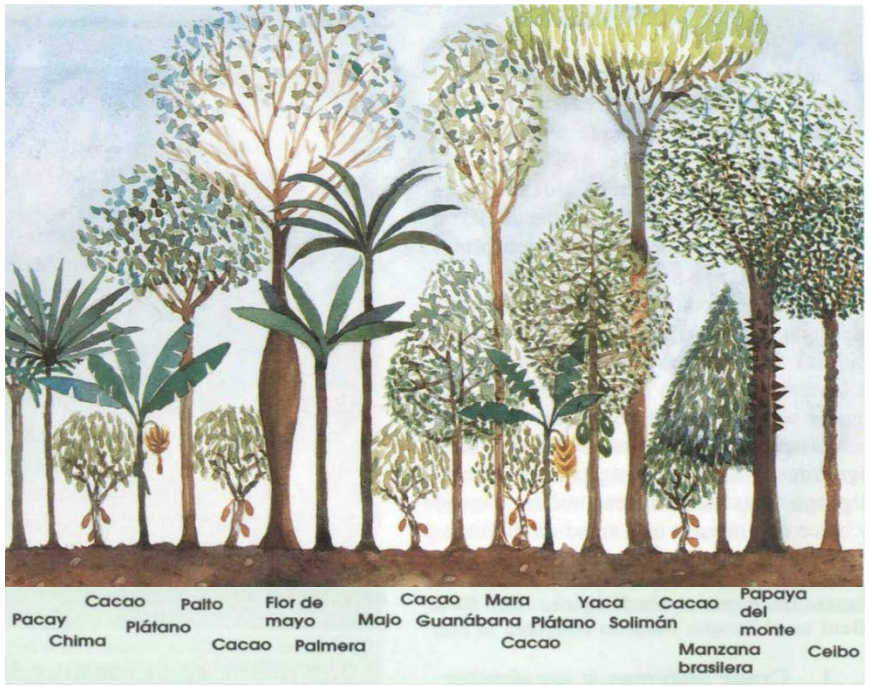
Conclusions and implications (2)

Even simple agroforestry systems can have positive effects. But they are not enough because:

I. food security and

II. environmental benefits need to be part of the calculation.

→ social-ecological system approaches are necessary



Diversified cocoa agroforestry system (image: J. Milz)

Conclusions and implications (3)

Management is crucial, but pesticides can threaten human health and environmental benefits

→ New study:

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Hand pollination, not pesticides or fertilizers, increases cocoa yields and farmer income

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ABSTRACT

Increasing demand for cocoa and climate-related yield declines have sparked a multi-stakeholder debate on

Conclusions and implications (4)

Building and enabling access to new alternative markets and value chains for agroforestry products

→ (Real) incentives for farmers to plant trees

Diversification of cocoa plots, El Ceibo, Bolivia (image: J. Jacobi)

Conclusions and implications (5)

Agroforestry for the restoration of degraded areas, not on deforested areas

→ Deforestation-free is a completely different topic

Thank you!

Diversification of cocoa plots, El Ceibo, Bolivia (image: J. Jacobi)

Swiss Platform for Sustainable Cocoa

We thank the Swiss Platform for Sustainable Cocoa for funding this study!

Cocoa agroforestry system versus cocoa monoculture (image: W.Niether)