

Using network analysis to advance understanding and integration of knowledge domains in agroforestry research

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Overview

- 1) Why agroforestry?
- 2) Agroforestry evidence gap map
- 3) Bibliometric and network analysis
- 4) Conclusions and future directions for research



What is agroforestry?

- **Agroforestry** is the **intentional integration** of woody vegetation, such as trees and shrubs, with crops and/or livestock.



Types of agroforestry practices:

Agrisilviculture (or silvoarable):

- trees integrated with cropping systems

Silvopasture:

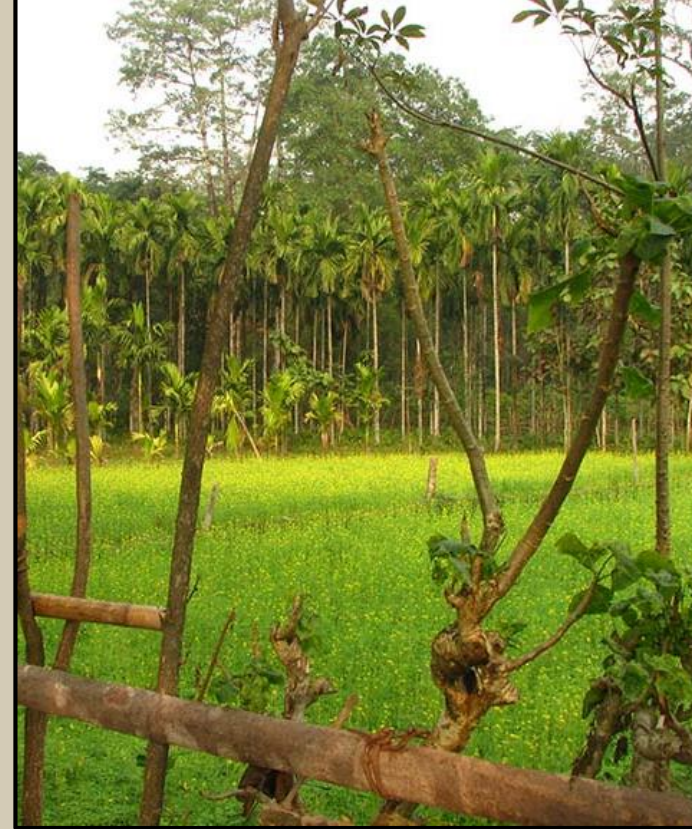
- trees integrated with livestock systems

Agrosilvipasture:

- trees integrated with both crops and livestock as a system

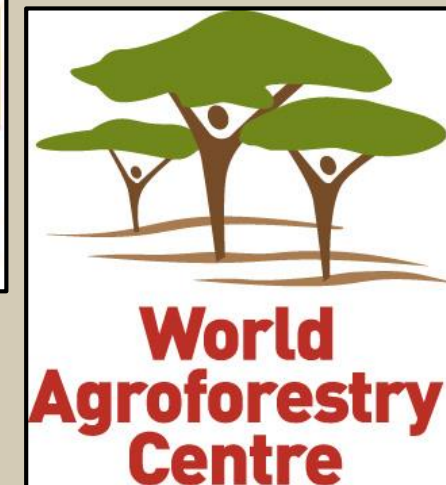
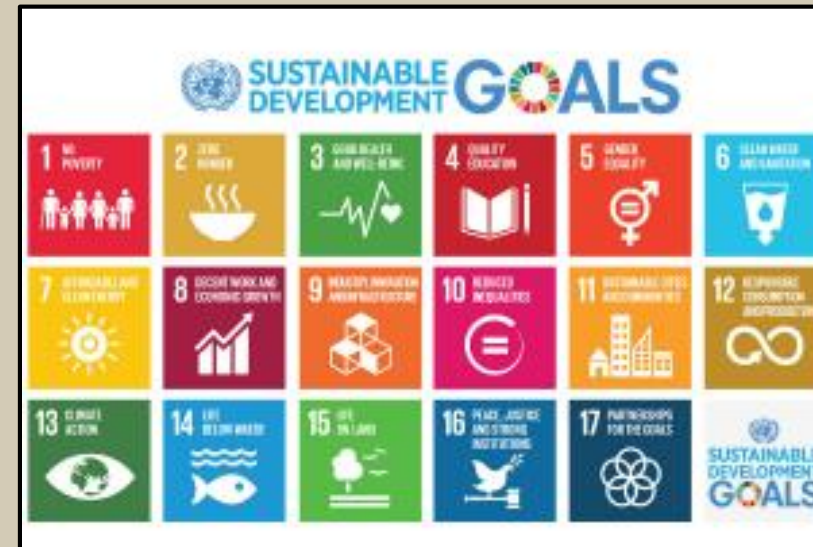
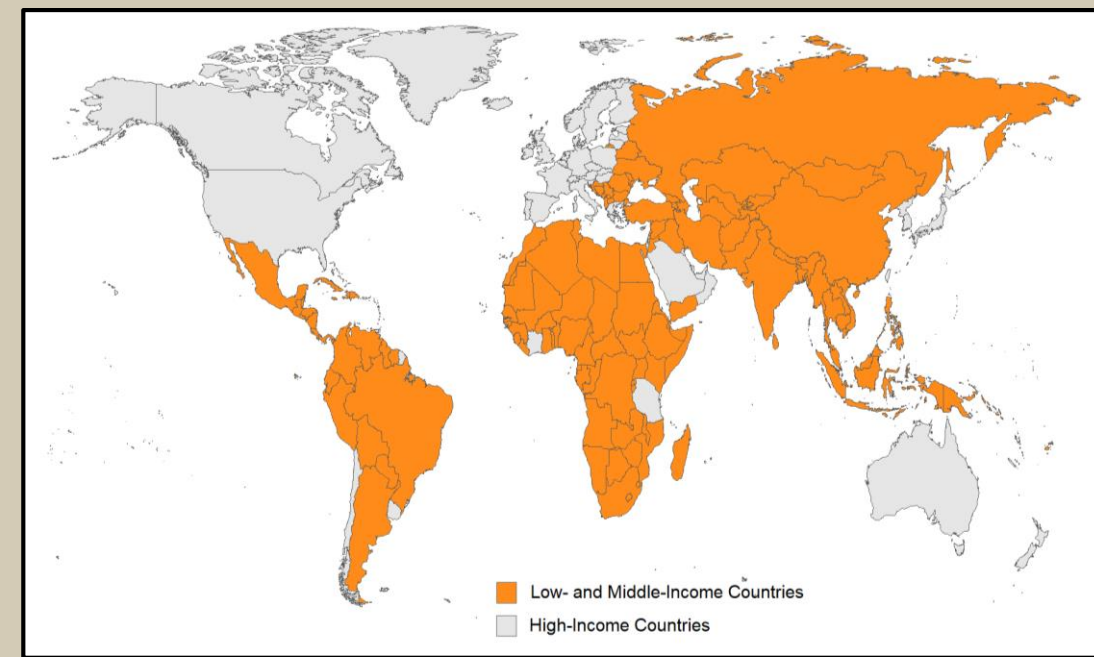
Other types:

- such as integrating trees in fisheries or beekeeping operations



Agroforestry in low-and middle-income countries

- Agroforestry is widespread across low-and middle-income countries (L&MICs, World Bank).
- Agroforestry is seen as a key means to advance the 2030 UN Sustainable Development Goals.
- Policies in many L&MICs now explicitly promote agroforestry, and aid donors have invested billions of dollars in agroforestry interventions.



Research questions



1) What is the evidence on the impacts of agroforestry on agricultural productivity, ecosystem services, and human well-being?



2) What are the gaps and concentrations in this evidence base?



3) What are the trends, how connected are the researchers, and how related are the different outcomes in agroforestry research?

Systematic mapping

Systematic mapping is a method of collecting, compiling, and displaying relevant information on a given subject using a rigorous, systematic process.

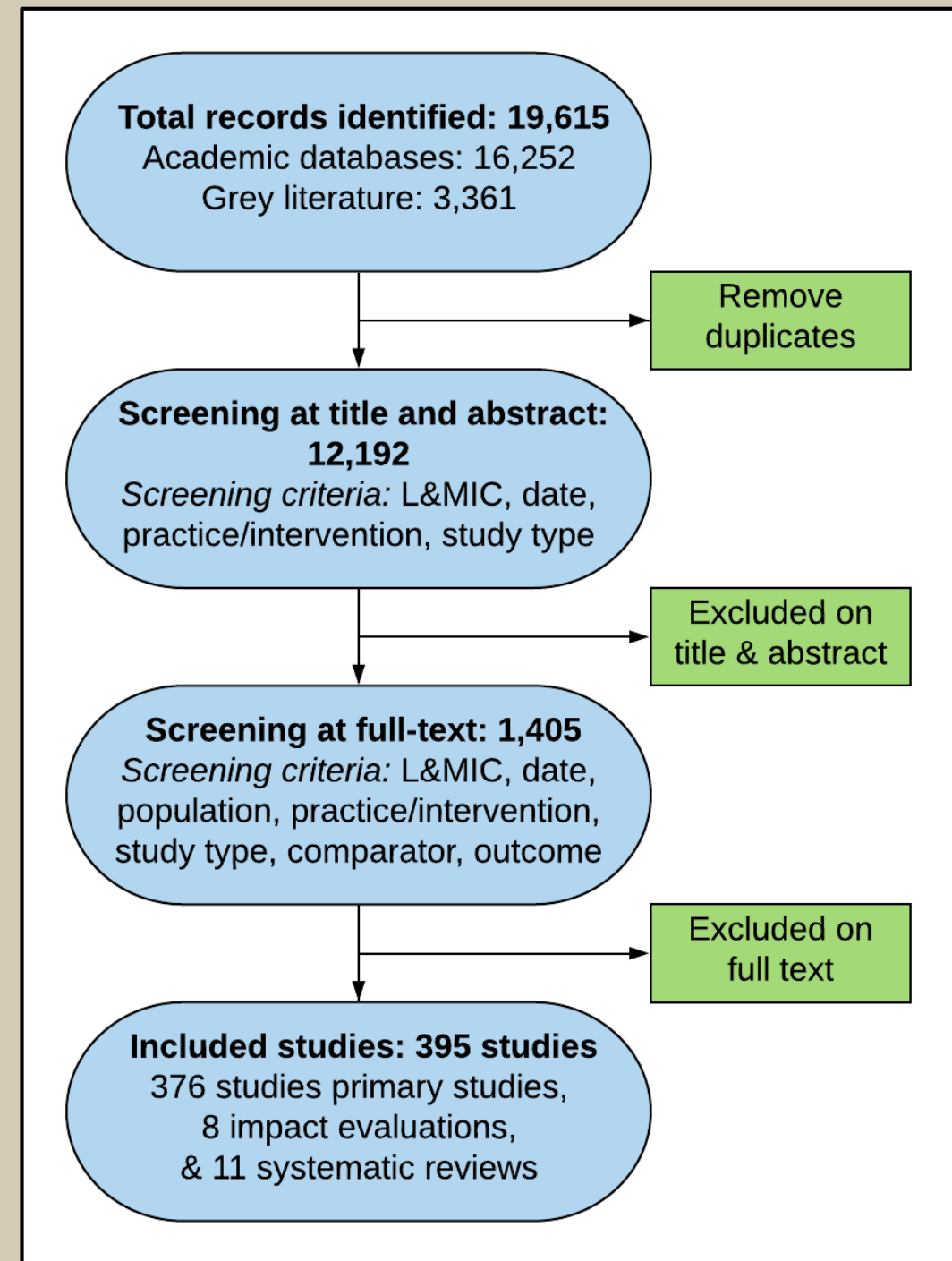
- Problem: literature in field is fragmented and dispersed (difficult to find, understand, and assess)
- Solution: assemble a database of studies specifically on the research topic.



CEE Guidelines for Systematic Maps:
www.environmentalevidence.org/information-for-authors

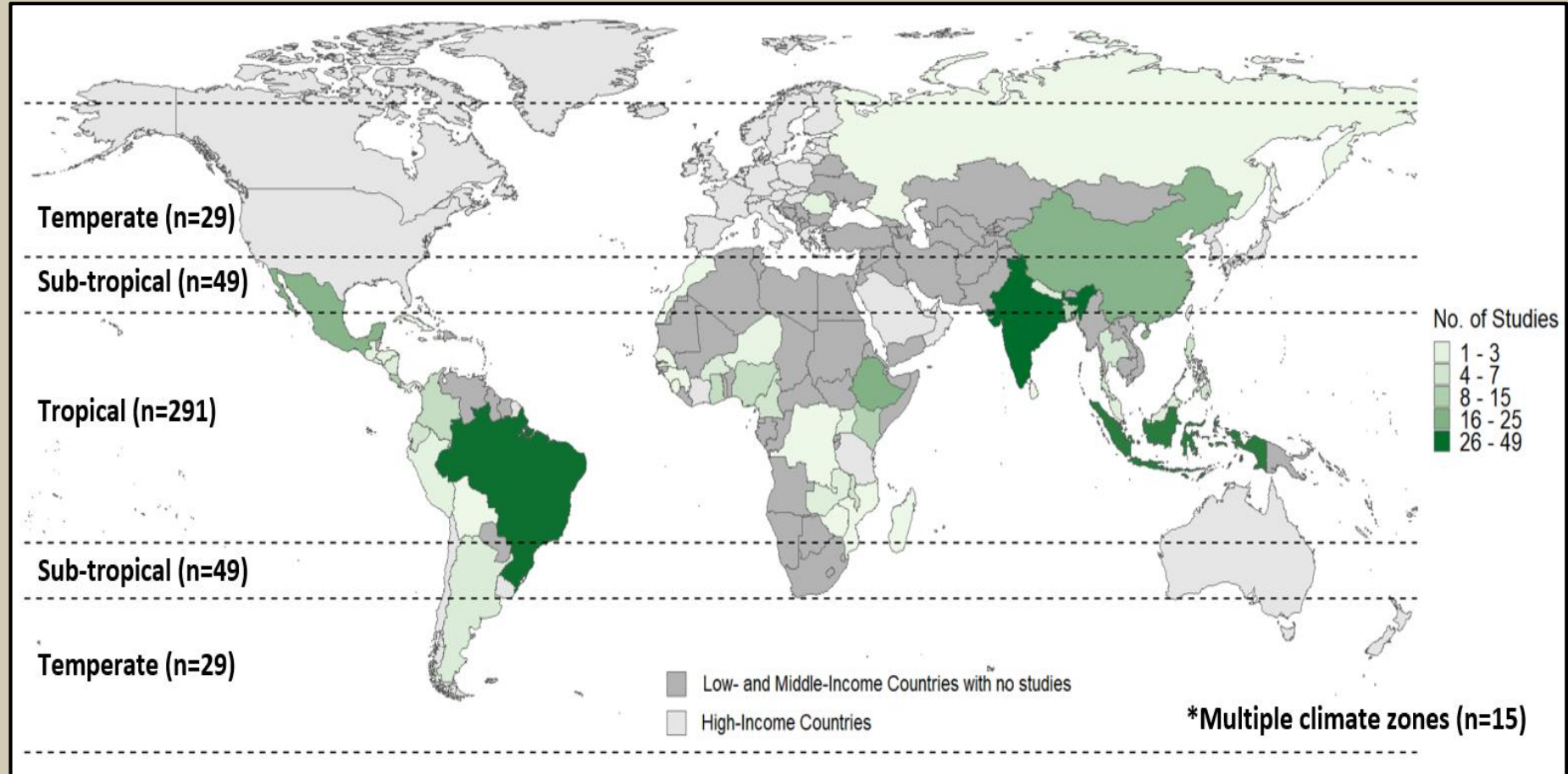
Systematic mapping process

- 1) Database and grey literature search
- 2) Title/abstract screening
- 3) Full text screening and extraction
- 4) Mapping and analysis
- 5) Final map: 395 studies included

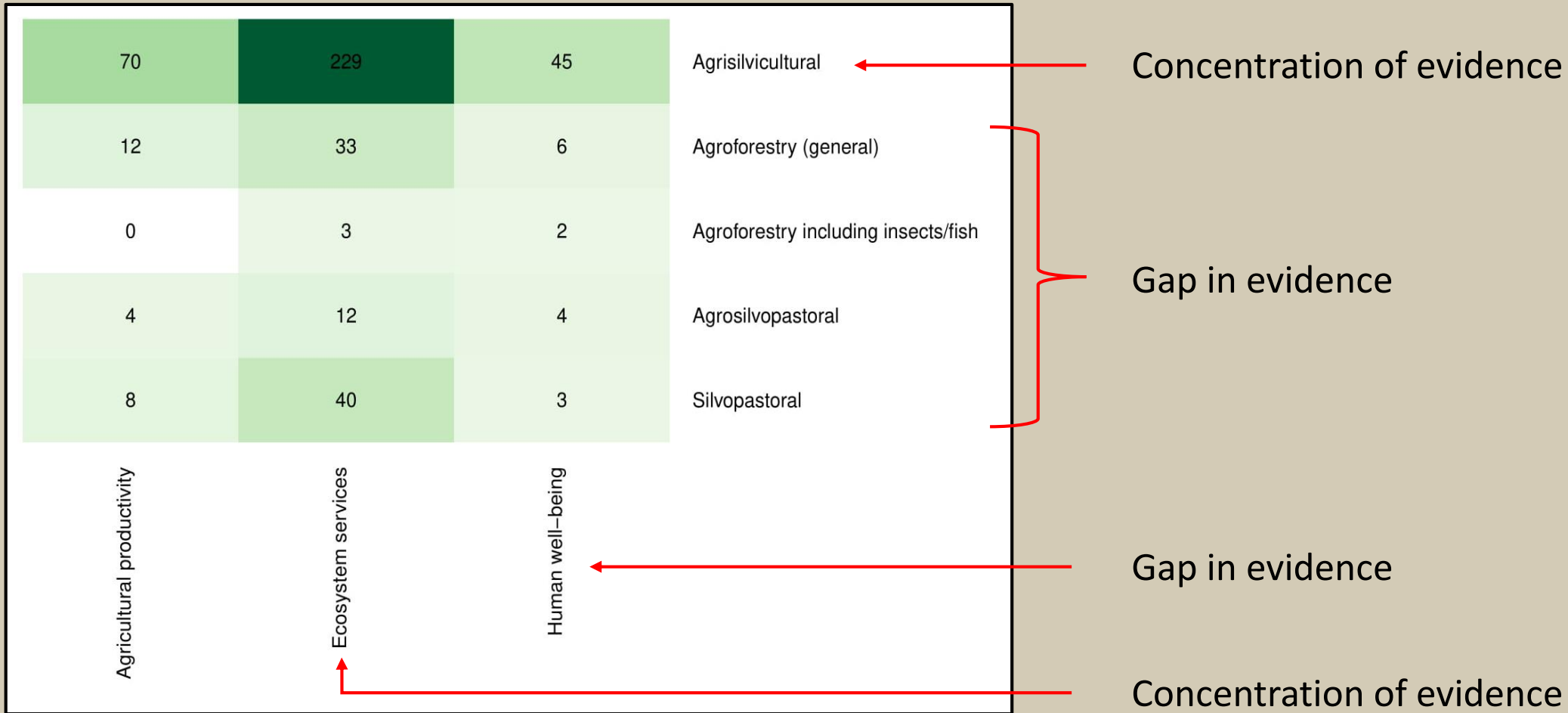


Geographic distribution of evidence on agroforestry impacts

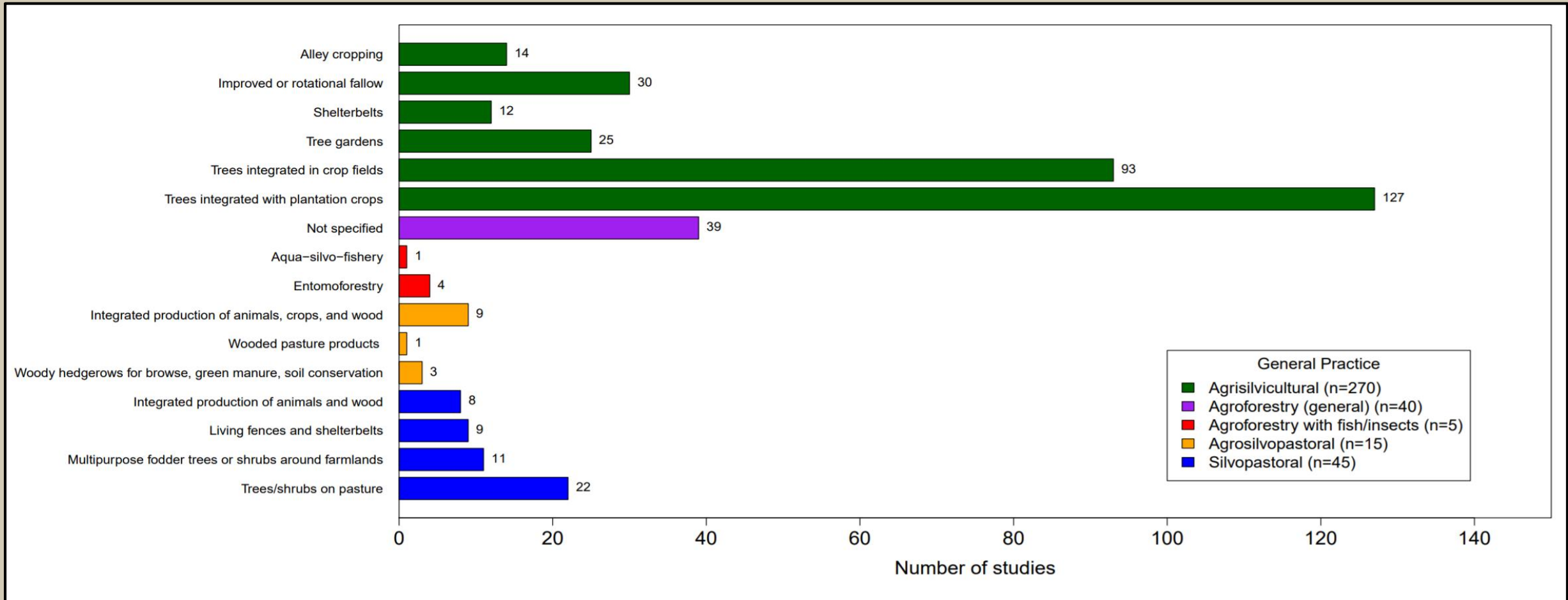
- Concentrations of research in:
 - India (n=49)
 - Brazil (n=48)
 - Indonesia (n=44),
 - Ethiopia (n=25)
 - China (n=24)
 - Mexico (n=24).
- There were 89 L&MICs where no studies have been conducted that were included in our EGM.



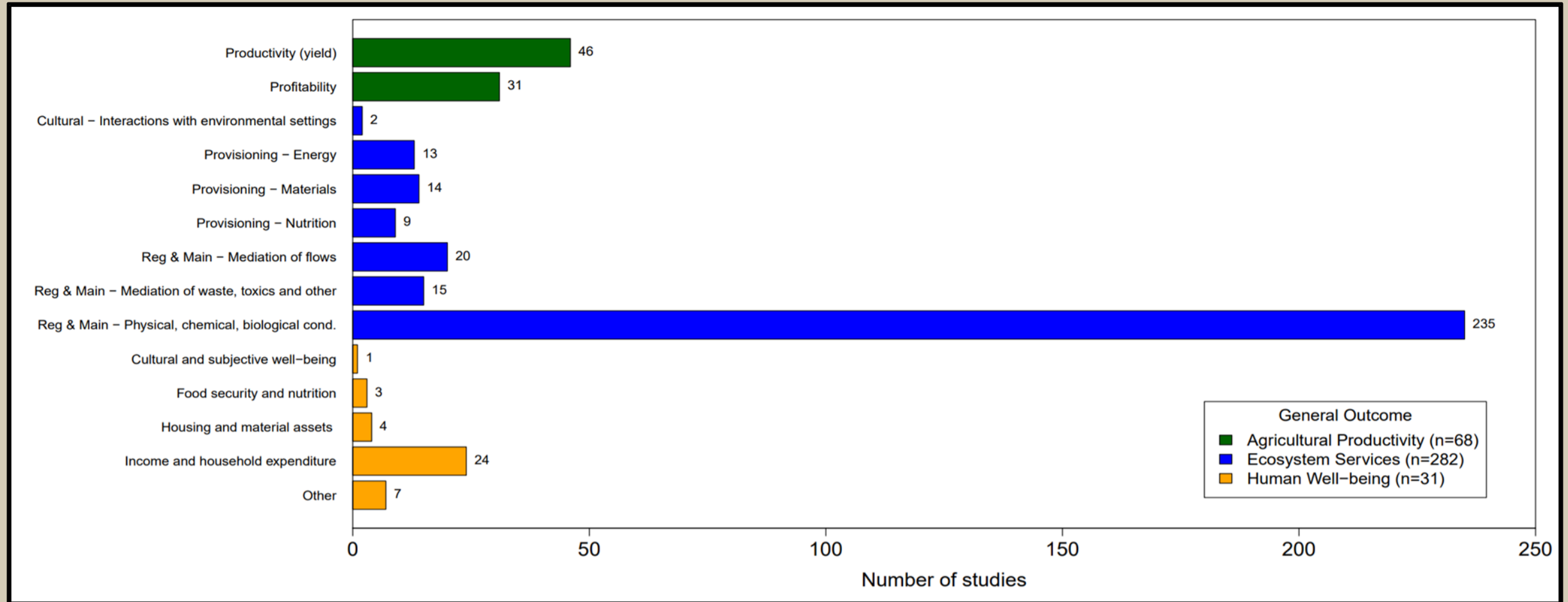
Concentrations and gaps in agroforestry research – General Practices & Outcomes



Concentrations and gaps in agroforestry research – Specific Practices



Concentrations and gaps in agroforestry research – Specific Outcomes



Evaluations

(Experimental or quasi-experimental design)

Total: 8 Impact
Evaluation Studies
(each evaluates one or
more intervention type
and outcome measure)

Type of outcome			Type of intervention
Agricultural productivity	Ecosystem services	Human well-being	
4	3	3	Community-level campaigning and advocacy
5	3	7	Enhancing access to tree germplasm
11	7	13	Farmer capacity development
3	4	5	Incentive provision
2	0	1	Institutional and policy change
0	0	1	Market linkage facilitation

What to do
with this
systematic
map?

Recall our Research Questions:

1) What is the evidence on the impacts of agroforestry on agricultural productivity, ecosystem services, and human well-being?

2) What are the gaps and concentrations in the evidence base?

3) What are the trends, how connected are the researchers, and how related are the different outcomes in agroforestry research?

What to do with this systematic map?

Bibliometric analysis

- Demonstrate the evolution, trends, and key figures of a growing field
- Provide insight into the nature of collaboration networks across researchers, institutions, and countries
- Assess the scope of subjects through keyword analysis

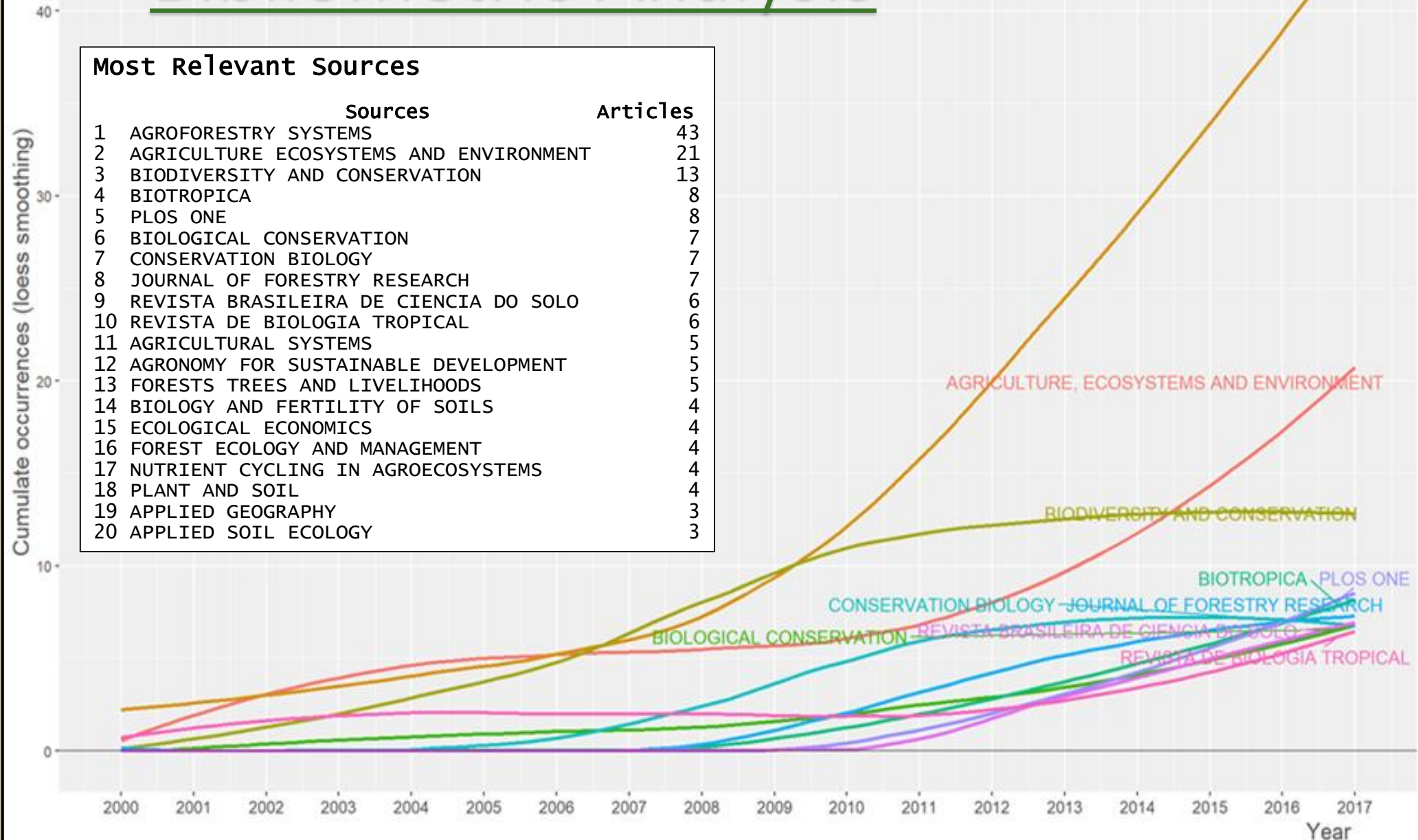
Network analysis

- Compare and evaluate the structure of collaboration networks
- Assess the connectivity and overlap across knowledge domains

Bibliometric Analysis

Most Relevant Sources

	Sources	Articles
1	AGROFORESTRY SYSTEMS	43
2	AGRICULTURE ECOSYSTEMS AND ENVIRONMENT	21
3	BIODIVERSITY AND CONSERVATION	13
4	BIOTROPICA	8
5	PLOS ONE	8
6	BIOLOGICAL CONSERVATION	7
7	CONSERVATION BIOLOGY	7
8	JOURNAL OF FORESTRY RESEARCH	7
9	REVISTA BRASILEIRA DE CIENCIA DO SOLO	6
10	REVISTA DE BIOLOGIA TROPICAL	6
11	AGRICULTURAL SYSTEMS	5
12	AGRONOMY FOR SUSTAINABLE DEVELOPMENT	5
13	FORESTS TREES AND LIVELIHOODS	5
14	BIOLOGY AND FERTILITY OF SOILS	4
15	ECOLOGICAL ECONOMICS	4
16	FOREST ECOLOGY AND MANAGEMENT	4
17	NUTRIENT CYCLING IN AGROECOSYSTEMS	4
18	PLANT AND SOIL	4
19	APPLIED GEOGRAPHY	3
20	APPLIED SOIL ECOLOGY	3

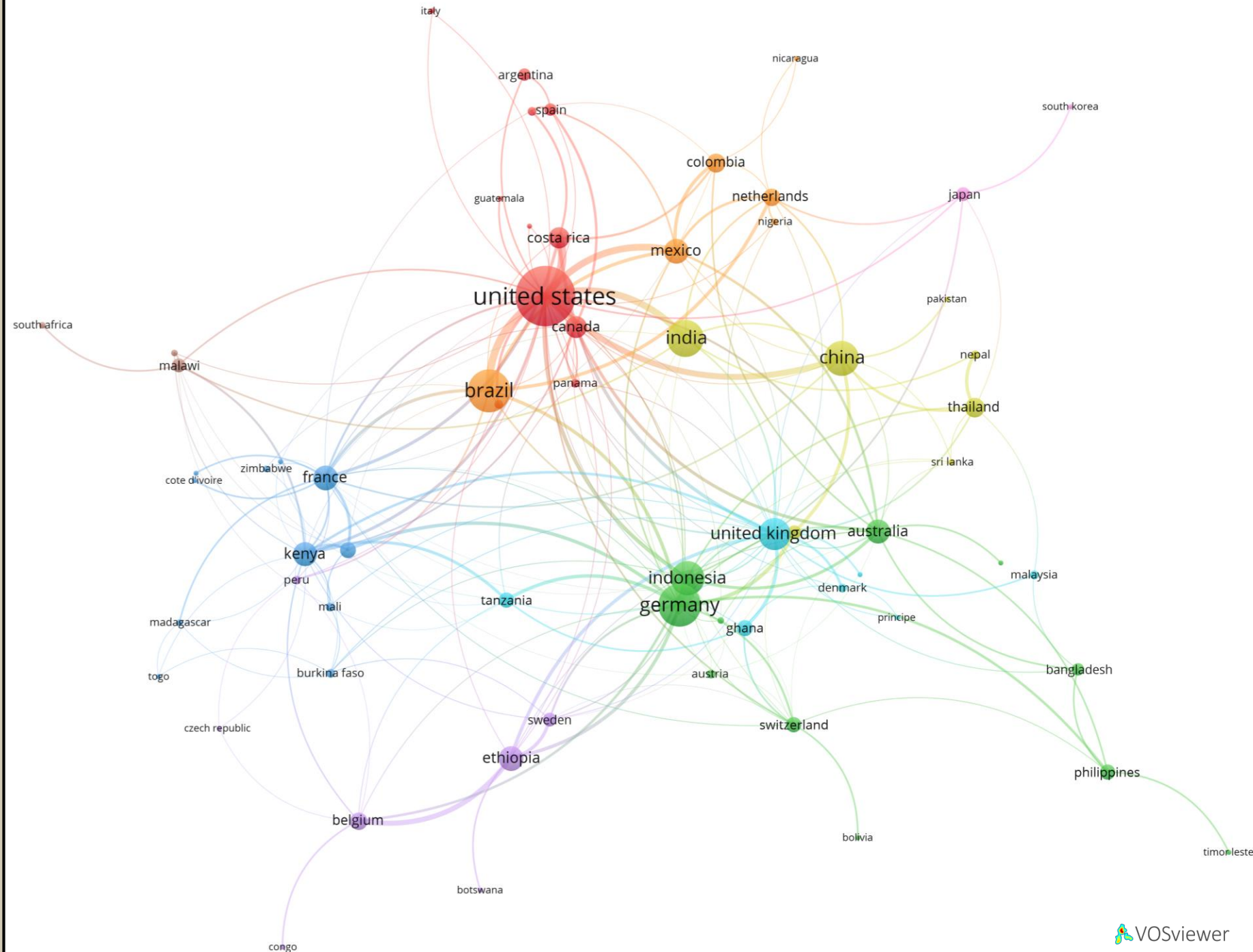


- 50% of the publication sources are disconnected from the main body of literature.



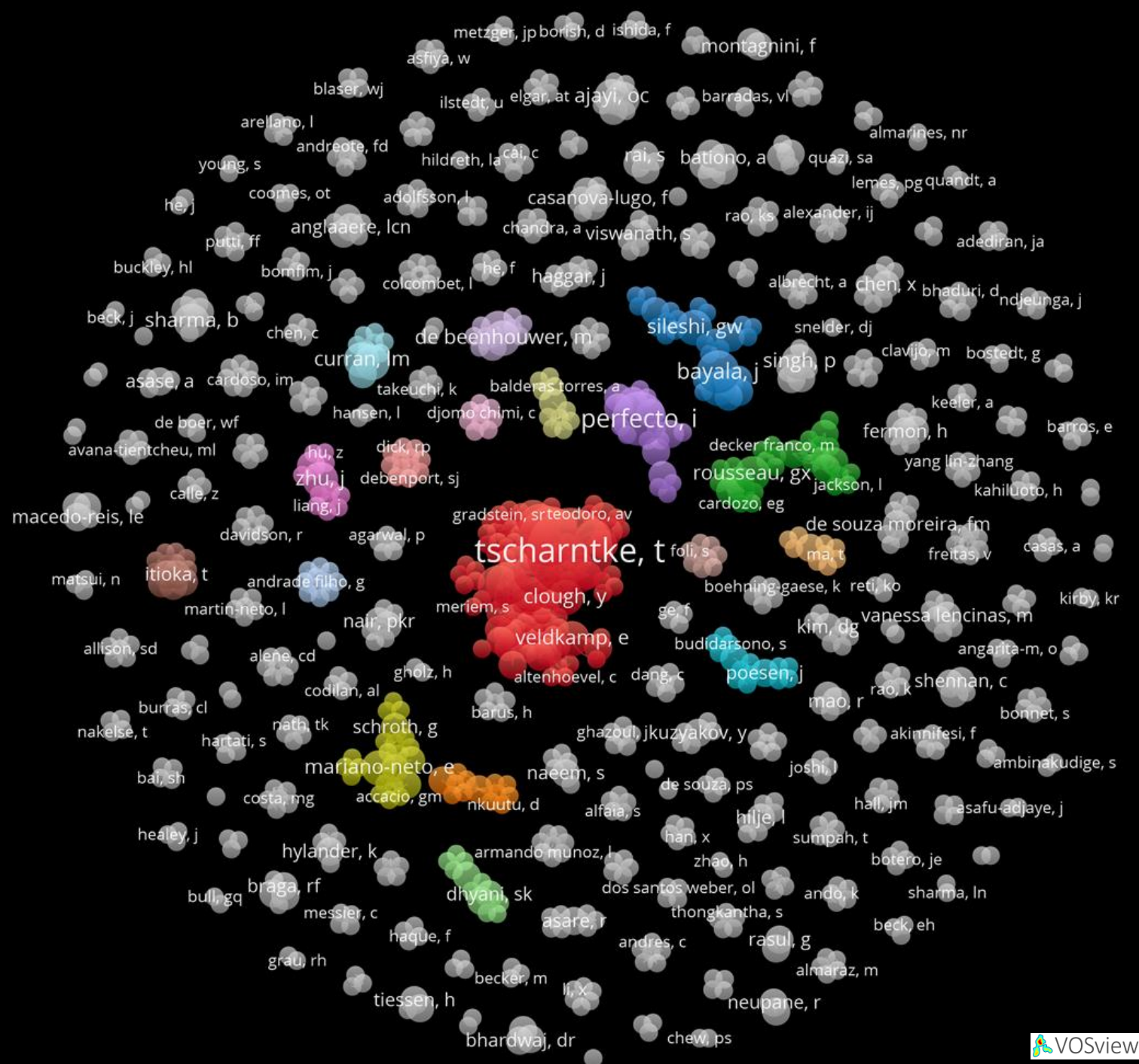
Country Co-author Network

- Country collaboration across low-and middle-income countries and high-income countries.
- USA, Brazil, Germany, China, and India are top players.
- Clusters by world region.



Co-author network of authors

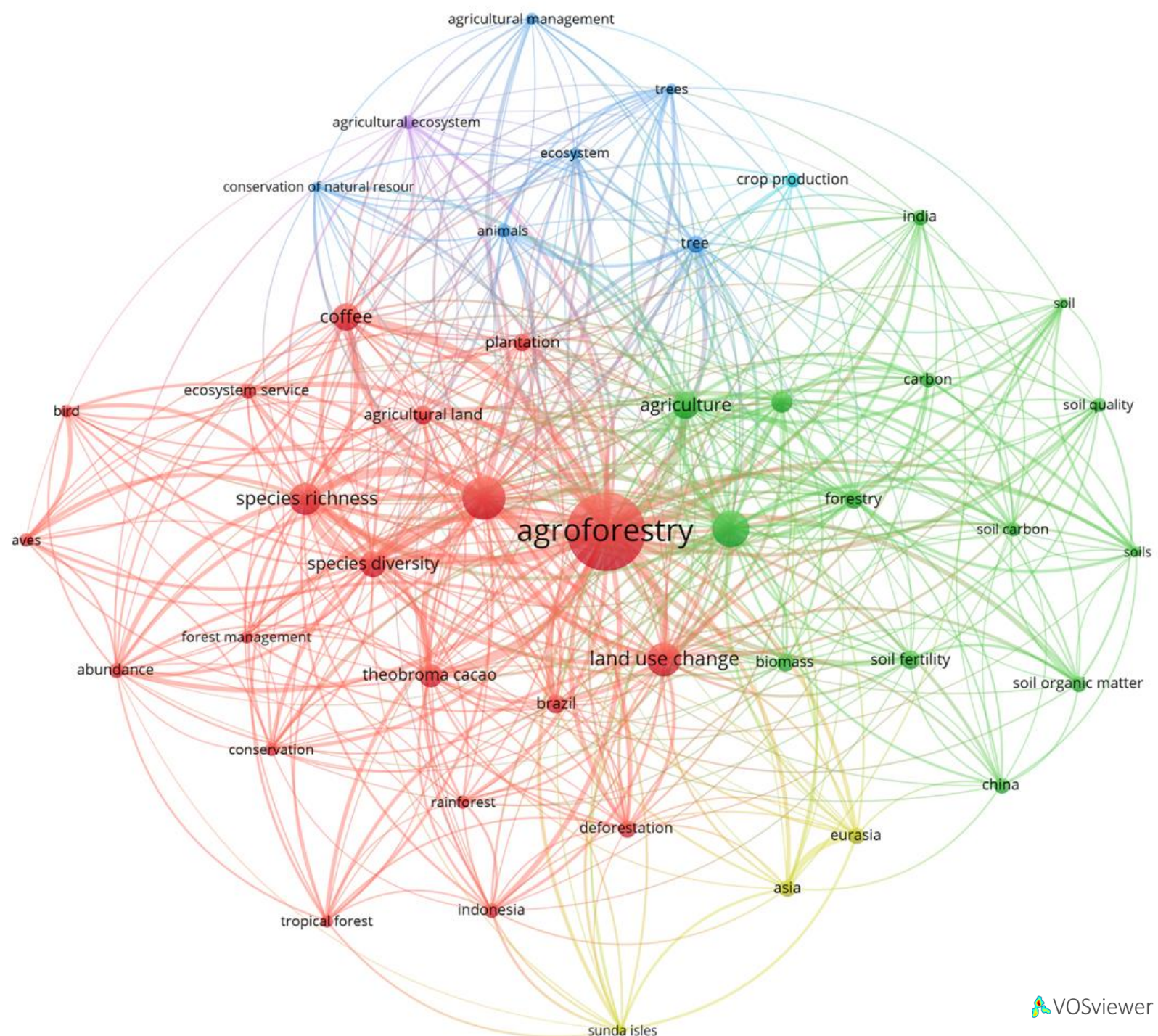
- Disconnected groups among researchers studying the impacts of agroforestry in L&MICs
- Co-authorship network consisting of 1,116 authors shown
- Largest Cluster: 10.7% of authors
- However, co-authorship is high (many small clusters)
- Co-Authors per Documents: 4.45



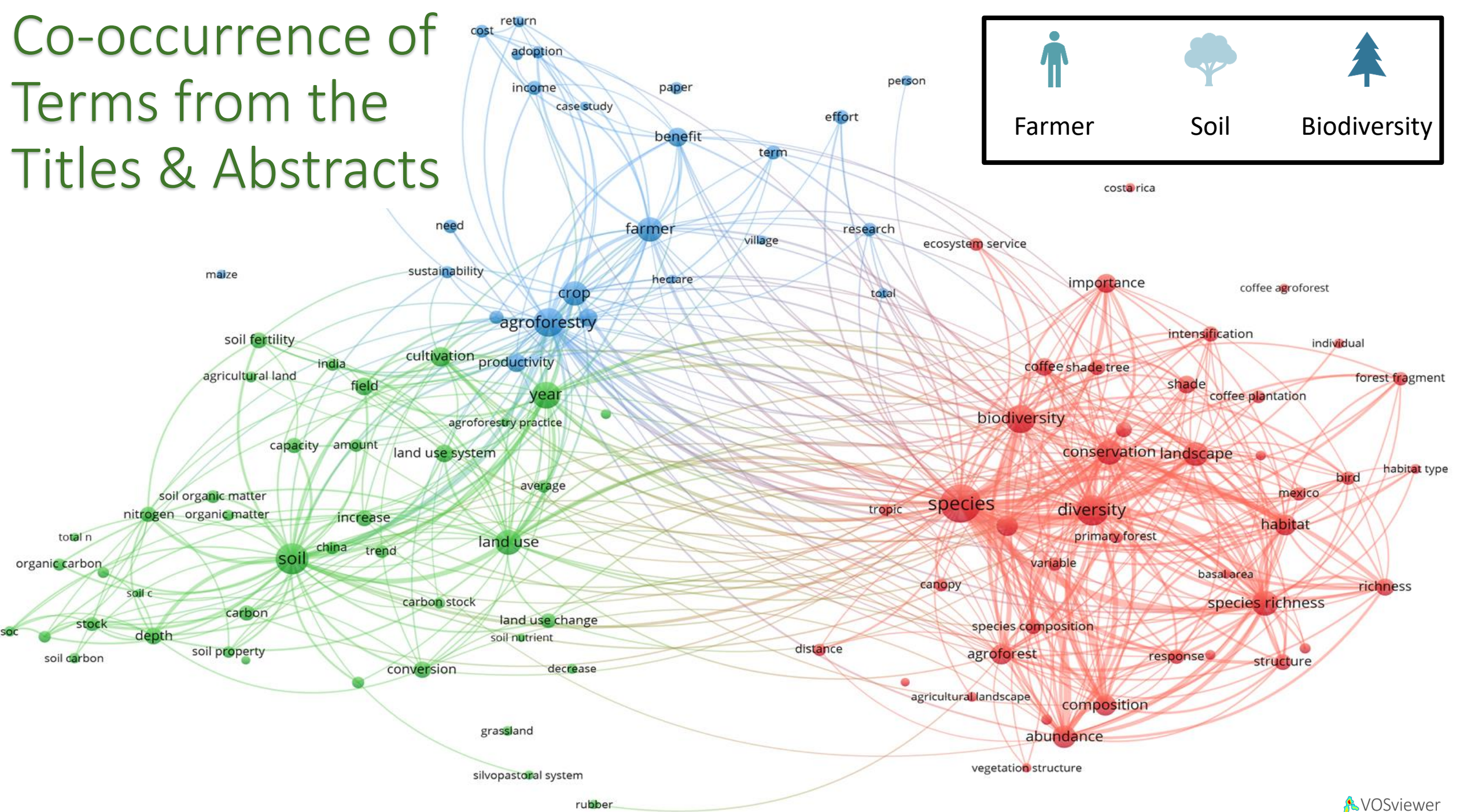
Keyword Co-occurrence Network

Keyword clustering on:

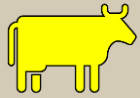
- Soil-carbon-forestry-land use (green)
- Biodiversity-ecosystem services-conservation (red)
- Crop production-animals-agriculture (blue)
- (Country keywords yellow cluster)



Co-occurrence of Terms from the Titles & Abstracts



Keyword Co-occurrence from Impact Evaluations



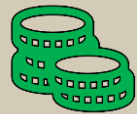
Production & Soil
Fertility



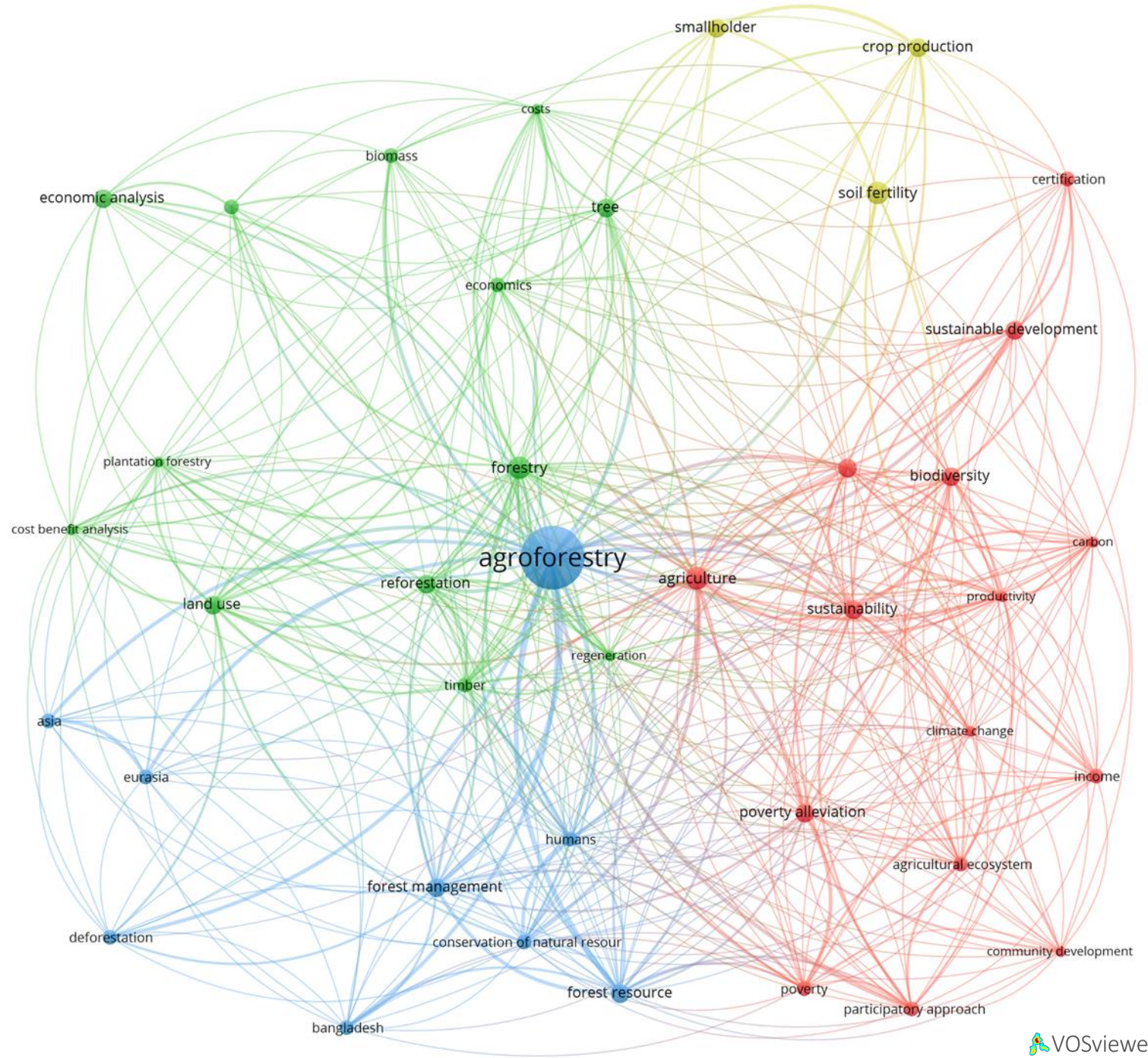
Sustainable
development



Forests &
Conservation



Economics



Summary

- **Identified gaps and concentrations in literature**
 - Agroforestry practices are well-studied but agroforestry interventions are not
 - Gaps in economic and human well-being outcomes
- **Visualized and analyzed current state of agroforestry research**
 - Fragmented and dispersed, but with concentration in a few journals
 - Multiple outcomes are interdependent and co-studied (win-win, tradeoffs)
 - Local publications often missed by larger body of research



Bringing Agroforestry to the Mainstream

- **Broaden Audience:** Frame agroforestry impact studies to publish in journals with more diverse readers
- **Extend Focus:** Bring attention to economic and social dimensions of agroforestry
- **Collaborative Engagement:** Bridge the gap between individual research groups and disciplines



Moving Forward

What's needed?

- **Systematic reviews** of available evidence
- **Impact evaluations** of agroforestry interventions
- Research on **economic and human well-being** outcomes
- **Integration** of local publication sources into larger body of literature
- Spread message through **high-impact** journals





References

- Collaboration for Environmental Evidence. 2018. Guidelines and Standards for Evidence synthesis in Environmental Management. Version 5.0 (AS Pullin, GK Frampton, B Livoreil & G Petrokofsky, Eds) www.environmentalevidence.org/information-for-authors. [16 Oct 2018]
- Miller, D., Ordonez, P., Brown, S., Forrest, S., Nava, N., et al. (in review). The Impacts of Agroforestry on Agricultural Productivity, Ecosystem Services, and Human Well-Being in Low- and Middle-Income Countries: An Evidence Gap Map. 3ie Evidence Gap Map Report. London: International Initiative for Impact Evaluation (3ie).
- Photo credit: National Agroforestry Center, World Agroforestry Center and Wikimedia Commons (<https://www.fs.usda.gov/nac/multimedia/photos.shtml>)



Thank you!

Questions?

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