MAPPING LOCAL KNOWLEDGE SYSTEMS ABOUT CACAO AGROFORESTRY MANAGEMENT

A comparison of two Colombian mountainous zones

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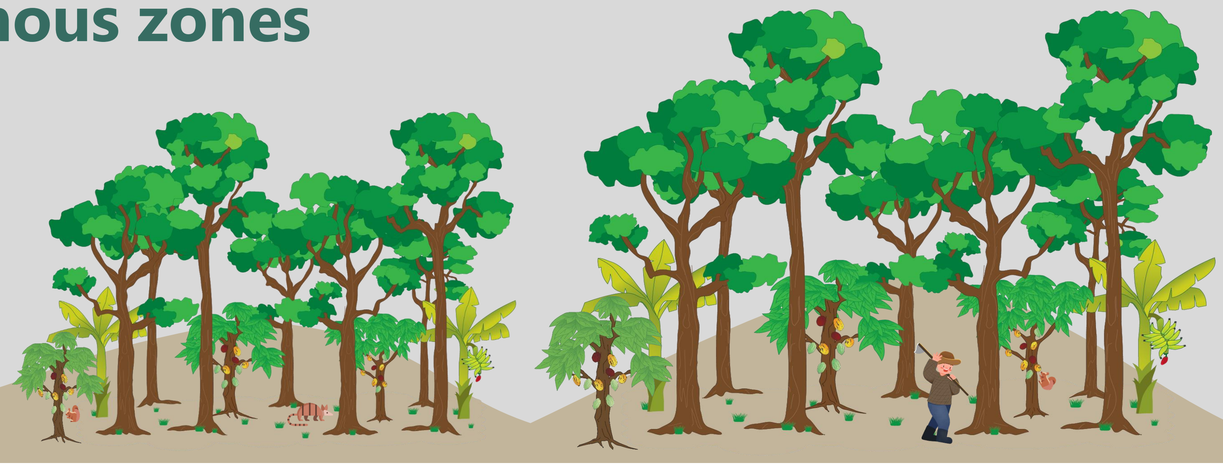


INTRODUCTION

- Agroforestry systems such as **cacao agroforestry systems (CAFS)** have been recognized as an alternative to support the social-ecological **transitions toward sustainable agriculture.**
- CAFS have been mainly promoted in tropical **mountain social-ecological systems (MtSES)** through a **restricted set of technological packages**, but detailed scientific data are lacking because of their **intrinsic complexity and diversity.**
- **Smallholder cacao farmers** adapt their CAFS management to local conditions under **uncertainty** based on their **own experimentation** and **local sources of information**.
- Representing such farmer knowledge and decisions not only informs on **the use and limitations of local knowledge and management** but also provides inputs for choosing and promoting **CAFS appropriate management options.**

MAIN RESEARCH QUESTION

What are the interdependent local variables influencing CAFS management by smallholder farmers in two mountainous zones of Colombia?

WHAT IS A COGNITIVE MAP?

It is a graphical representation of a complex system, consisting of **multiple variables (N)** and the causal relationships or **connections (C)** between them.

METHODS

1 SAMPLING
Purposive sampling to cover diverse agroecological zones in two municipalities
↓
Belén de los Andaquíes, Caquetá
8 interviews
La Paz, Cesar
10 interviews

2 PARTICIPATORY COGNITIVE MAPS
Conducting in-depth interviews with cacao smallholder farmers
↓
On-farm
Spanish
45 min ≤ Length ≤ 1 hour

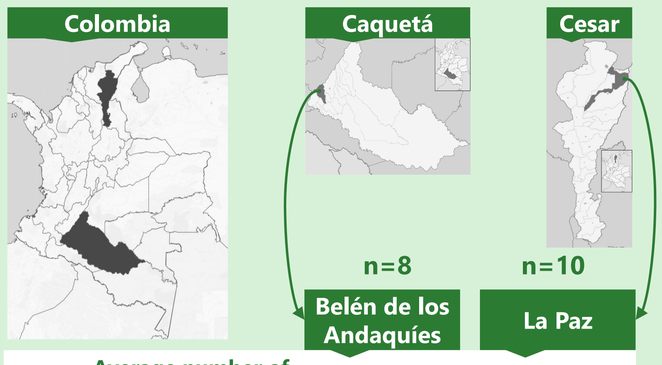
3 REFINEMENT OF COGNITIVE MAPS
Transcribing interviews
Content analysis
Adding missing variables and connections
↓
MAXQDA The Art of Data Analysis

4 CODIFICATION OF COGNITIVE MAPS
Transforming maps into adjacency matrices
↓

id	N1	N2	N3
N1	0	1	1
N2	0	0	-1
N3	0	-1	0

5 ANALYSIS OF COGNITIVE MAPS
Structure of individual maps with graph theory indices
↓
RStudio
Package FCMapper

RESULTS & DISCUSSION

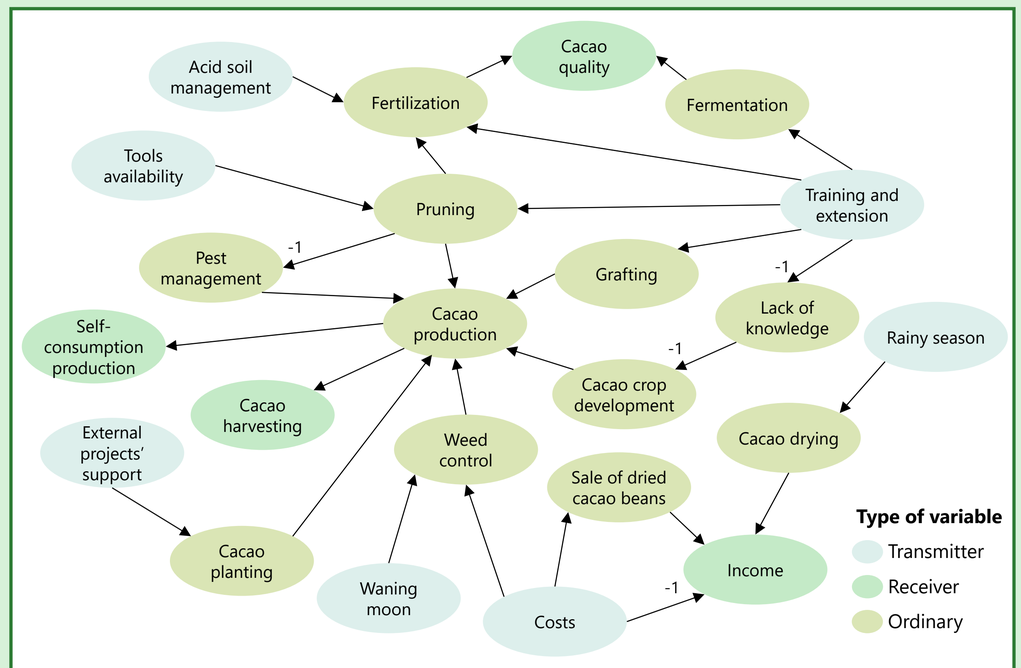


	Belén de los Andaquíes	La Paz
Average number of connections (C)	36.88 ± 6.38	39.3 ± 5.12
Average number of variables (N)	27 ± 3.3	30.7 ± 4
Average connection-to-variable ratio (C/N)	1.36 ± 0.15	1.28 ± 0.08
Average number of transmitter variables (T)	8.13 ± 1.55	8.9 ± 2.08
Average number of receiver variables (R)	4 ± 1.2	5.2 ± 2.3
Average number of ordinary variables (O)	14.88 ± 2.85	16.6 ± 1.9
Average complexity (R/T)	0.5 ± 0.13	0.61 ± 0.29

Graph theory indices based on adjacency matrices: mean ± SD.
Transmitter variables: *forcing functions, givens, inputs.*
Receiver variables: *utility, outcomes, implications.*
Ordinary variables: *means, adaptable practices.*

	Belén de los Andaquíes	La Paz
Total number of farmer-derived management variables	51	54

More variables and connections on average were identified in La Paz than in Belén. Similarly, 54 farmer-derived variables were identified in La Paz and 51 in Caquetá overall. *This may be associated with* ***more years of experience*** *in managing cacao crops in La Paz.*



Example of a fuzzy cognitive map. Interview 1, Belén de los Andaquíes, Caquetá. Nodes with text represent variables mentioned by individual farmers about CAFS management on their farms. Directed arrows represent causal relationships between variables and -1 indicated those negative relationships.

In both zones, maps show **more transmitter variables** than receiver variables, *which can suggest an understanding of the CAFS with* ***top-down*** *influences (Özesmi and Özesmi, 2004).* This argument is also supported by a highly mentioned transmitting variable common to both regions*:* **external projects' support**.

There was a **high similarity** across maps regarding the ratios C/N and R/T, which can suggest similar levels of **complexity** to manage CAFS in each zone.

The most **highly mentioned transmitter variables** in both zones have to do with **seasonality**, a factor beyond farmers' control. Dry season particularly affects CAFS management in La Paz.

While **grafting, pruning, and irrigation** are the most highly mentioned ordinary variables in La Paz, **fertilization** is in Belén.

TOP 3 HIGHLY MENTIONED TYPES OF VARIABLES

	1	2	3
Transmitter variables	Rainy season **(8)**	External projects' support **(6)**	Training and extension **(5)**
Receiver variables	Cacao quality Self-consumption production **(5)**	Sale of dried cacao beans Income **(4)**	Planting and regeneration of trees **(2)**
Ordinary variables	Fertilization **(8)**	Weed control Cacao drying Pest control **(7)**	Fermentation Pruning Grafting **(6)**

Top 3 highly mentioned transmitter, receiver, and ordinary variables Belén de los Andaquíes, Caquetá (n=8)

	1	2	3
Transmitter variables	Dry season Rainy season **(10)**	External projects' support **(8)**	Lack of infrastructure **(7)**
Receiver variables	Cacao quality **(8)**	Cacao production Self-consumption production Associativity **(4)**	Family integration Planting and regeneration of trees **(3)**
Ordinary variables	Grafting Pruning Irrigation **(9)**	Pest control Fermentation Weed control Cacao drying Cacao harvesting **(8)**	Fertilization Other crops management Cacao planting **(7)**

Top 3 highly mentioned transmitter, receiver, and ordinary variables La Paz, Cesar (n=10)

CONCLUSIONES

- Although smallholder farmers in both areas **adapt their CAFS management practices** based on localized knowledge, their decisions are strongly **influenced by external actors**, and their systems are highly **affected by external forces**. This jeopardizes the sustainability and the resilience of these tropical MtSES.
- Comparatively, CAFS management in each study zone is influenced by different interdependent variables. This highlights the need to **integrate local knowledge** into the **development and adaptation of AFS technologies and their extension services** to the intrinsic diversity of the tropical MtSES. The representation of local knowledge based on **cognitive mapp**ing could be used as a **starting point** for such integration.

KEY REFERENCES

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