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SOCIAL LEARNING FROM FARMERS' EXPERIENCE AND BEHAVIOR: A TRIPLE-LOOP ANALYSIS ON CLIMATE CHANGE AWARENESS, PERCEIVED IMPACTS, AND ADAPTATION

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AGU FALL
MEETING

SCIENCE
is SOCIETY





MOTIVATION

- Climate change is often seen as a **distant** psychological risk
- Individuals are not ‘**blank slates**’ receiving information about climate change
- Individuals and communities **socially construct** risk perception
- Social-learning is fundamental for **behavioral transformation**
- **Re-think** local and regional policies, especially in climate change **hotspots**



Farmers can provide first-hand observations

Seeing is believing...





AIM AND METHODS

RQ1: What is the current publication trend?

Bibliometrics

Bibliometrix R-package
VOSviewer (1.6.17)

435 publications



RQ2: What is the farmers' intellectual structure?

Systematic
Literature Review

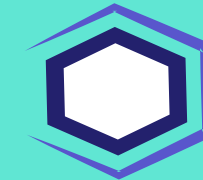
*Exploratory – protocol
& clusters*

108 publications

A triple-loop overview of farmers' perception
on climate change



Awareness



Impacts



Adaptation

WoS and Scopus
databases
2010-2020

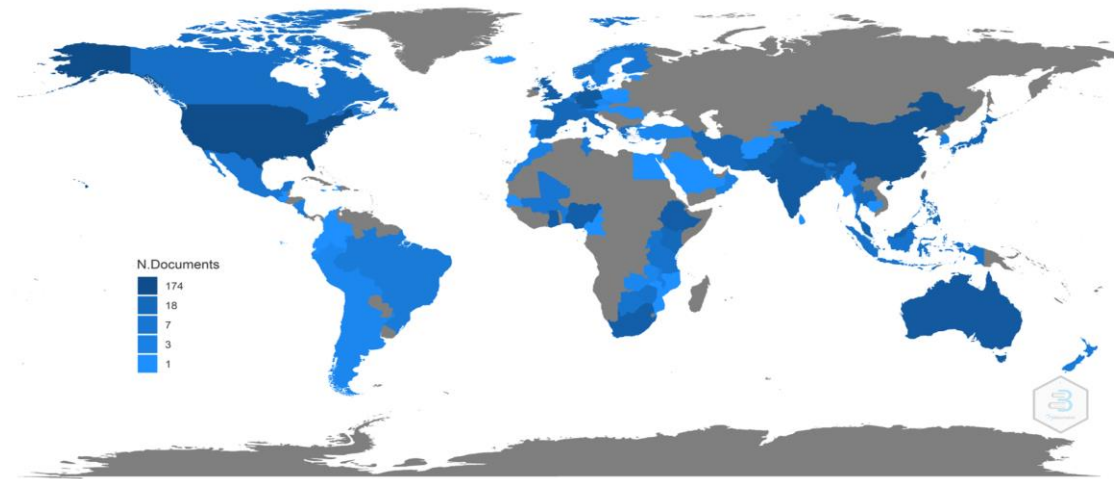
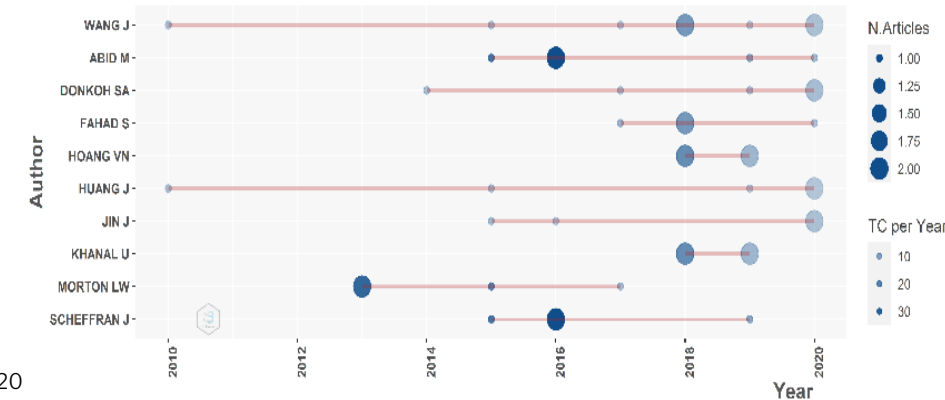
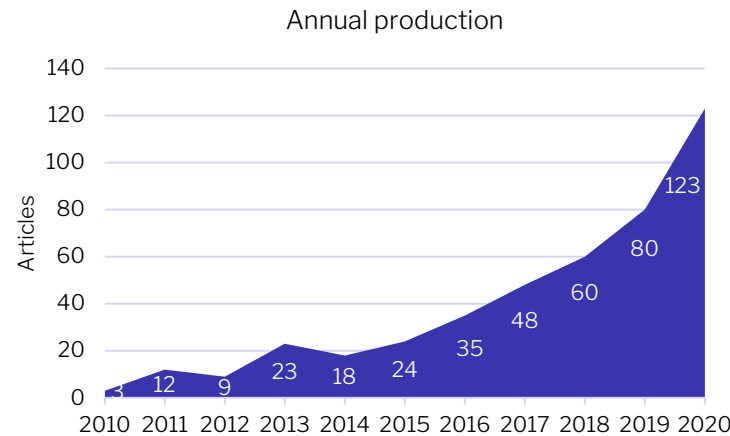


RESULTS – BIBLIOMETRICS

435 papers

Authors & Sources

- 1,428 authors
- 669 institutions
- 65 countries
- 174 journals: climatic sciences, sustainable development & natural resources management
- Growing interest: 85% papers in 2015–2020
- A ratio of 1 to 9 in favor of Global South studies



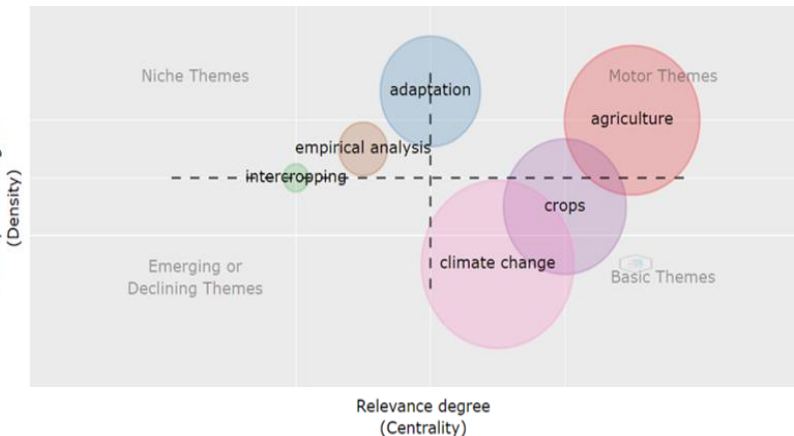
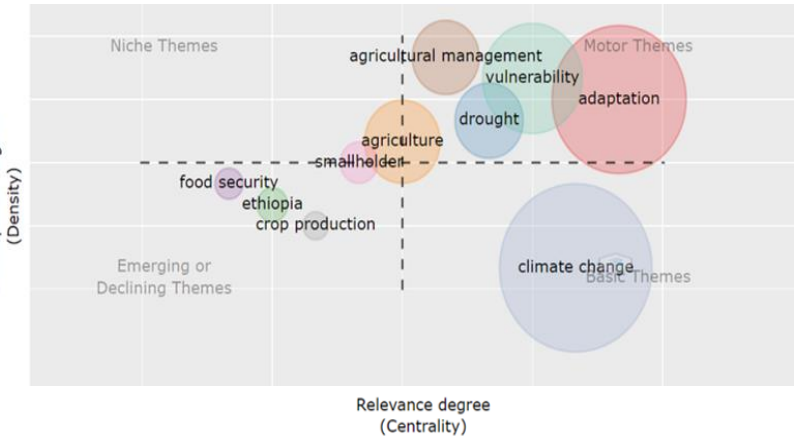
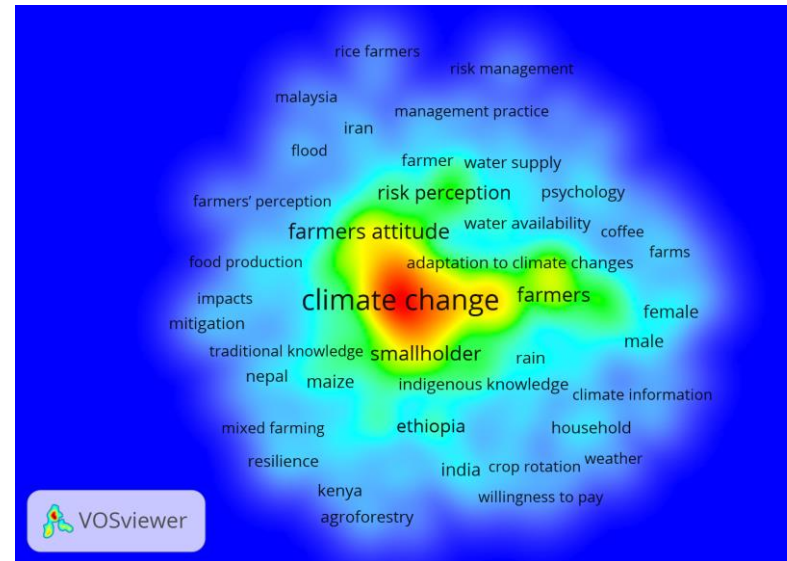


RESULTS – BIBLIOMETRICS

435 papers

Keywords & Themes

- **Methodological tools:** survey, interviews, risk assessment, cost-benefit analysis, indicators
- **Addressed topics:** impacts on food production, crops vulnerability, crops choice, and adaptation to extreme weather events



Less themes and diversity of topics

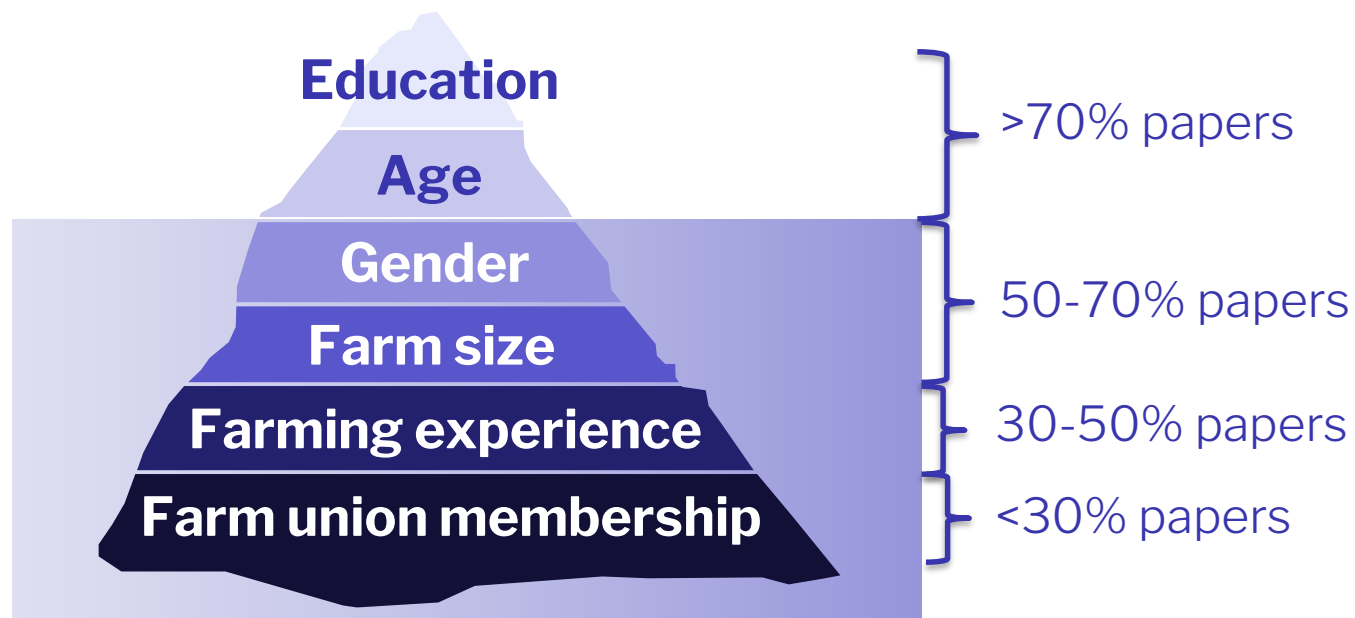
More focus on *climate change* (theme) & *perception* (sub-theme)



RESULTS – SYSTEMATIC LITERATURE REVIEW

435 papers

Factors conditioning adaptation



- **More education – more adaptation capacity:** A unit increase in the number of years increases by 2-3% of the likelihood of adopting measures
- **More age – more adaptation capacity:** An increase in age significantly influences the adoption of new crop varieties with a short growing cycle
- **Gender-biased:** Men and women choose different adaptation strategies
- **More farming experience – more doubts**



RESULTS – SYSTEMATIC LITERATURE REVIEW

108 papers

Awareness

- Is not neutral: it entails diverse **evaluations of climate impacts** (positive or negative) that determine the strategic intents of climate action.
- Is essential to **define** the problem, **attribute** responsibility appropriately, and **determine** specific attitudes to address it.
- Is understood as the **first step** prior to resilience-building process but also as a **requirement** to ensure climate change resilience.





RESULTS – SYSTEMATIC LITERATURE REVIEW

108 papers

Awareness

Studies reported 2 main issues

- Is climate changing? / Is climate change occurring?
 - ✓ No (lack of evidences)
 - ✓ Yes
- Is climate change occurring because of
 - ✓ natural changes
 - ✓ human activities
 - ✓ human activities & natural changes

- Most of farmers **agree with statements that the climate is changing**
- Most of them highlighted that **climate is changing because of human activity**
- **Few studies** mainly considered both causes of climate change

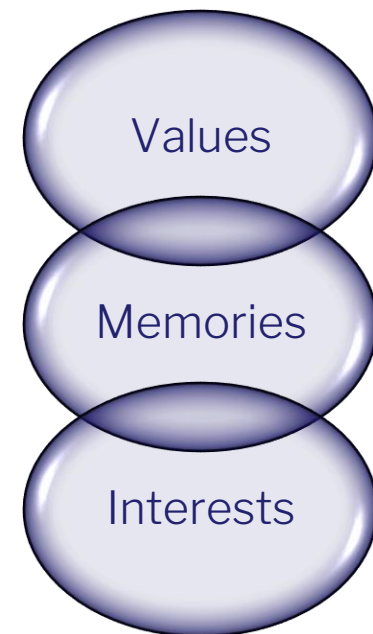
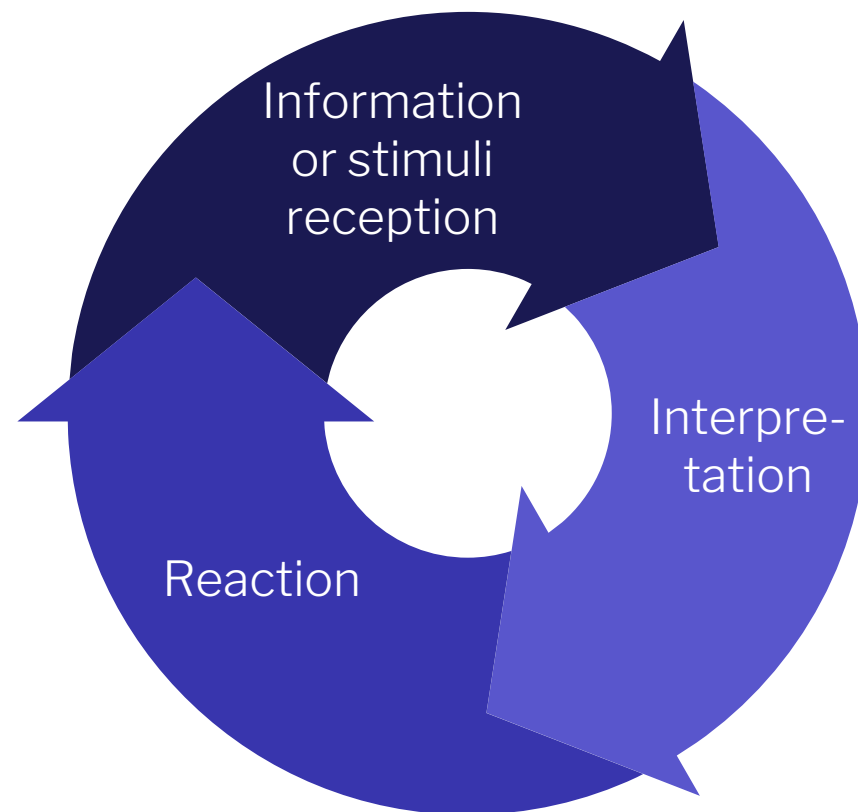


RESULTS – SYSTEMATIC LITERATURE REVIEW

108 papers

Risk perception

- Is the individual or collective awareness about climate change through their senses.
- Risk perception refers to a **mental construct**, an individual's assessment of the **probability** of a particular event and its **consequences**, or a **subjective estimation** of the nature of a threat and its **severity**.
- Is formed through **experience & personality** within a cultural context of everyday life.





RESULTS – SYSTEMATIC LITERATURE REVIEW

108 papers

Risk perception

Studies reported **13 significant impacts**

Top 3

- Rising and extreme temperatures
- Changes in rainfall pattern
- Increase of drought periods and dry spells

Some studies compare **farmers' perceptions and meteorological observations** of temperature and rainfall

- Length of rainy season (stopped earlier)
- Flood frequency
- Rainfall amount intensity
- Rainfall season amplitude
- Length of summer season (started earlier)
- Windstorm and hailstorm
- Heatwaves and hot days
- Crop production
- Pest and diseases
- Soil fertility and land degradation



RESULTS – SYSTEMATIC LITERATURE REVIEW

108 papers

Adaptation capacity

- Perception determines adaptation intention and methods.
- Poor risk perception may lead to maladaptation & increase farmers' vulnerability to climate change.
- Accurate risk perception increases trust & individual responsibility.



3-stage process



RESULTS – SYSTEMATIC LITERATURE REVIEW

108 papers

Adaptation capacity

Studies reported **11 main measures**

Top 3

- Changing cropping patterns
- New crop varieties
- Soil and water conservation techniques



- Planting shaded trees (agroforestry)
- Organic fertilizers or pesticides
- Promote off-farm activities
- Frequent or supplementary irrigation
- Water harvesting and build infrastructures
- Migration to other areas
- Purchasing agriculture insurance
- Reduce cultivated area or livestock diversification

Some studies distinguished adaptation measures considering their **reactive** & **preventive** nature

Farmers apply adaptation methods **simultaneously**



RESULTS – SYSTEMATIC LITERATURE REVIEW

108 papers

Adaptation barriers

Top3 main constraints

- Lack of **information** about the potential impacts of climate change
- Limited **knowledge** of the available adaptation strategies
- Failure to weather forecasting **services** access

Farmers' profile

Literacy rate
Landholdings size
Land access
Land ownership

Facilities & Services

Financial support
Technical expertness
Extension services

Support & Information

Climatic data
Local strategies
Weather forecasting
Government inputs

Farmers require **different climate information** during **each stage** of the farming process



INSIDES AND FUTURE WORK

Understanding the triple-loop on **farmers' behavior** is fundamental to **increase their resilience** from an **attitude change**. It allows:

- **focusing** the specific behaviors to be changed
- **examining** the driving factors motivating those behaviors
- **defining** and **applying** different interventions
- **evaluating** the effects of these interventions on the resulting behaviors



Future work should move:

- ✓ From **cross-sectional analyses** (one-off and one-time farmers' surveys) to **over-time studies** to deepen **social-learning** and **behavioral change**
- ✓ From **global** (Global South – Global North) to **regional interdependencies** to check for best **replicable strategies**

THANK YOU



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