# Social-learning from Farmers' Experience and Behavior: A Triple-loop Analysis on ClimateChange Awareness, Perceived Impacts, and Adaptation

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**Abstract**

Climate change tends to be addressed by accurate statistics and modelling, but it is generally perceived abstractly, being considered a distant psychological risk in which impacts and effects are spatially and temporally differentiated. In other words, people's attitude towards climate change is that it will impact other individuals and communities that are geographically, temporally, and even generationally removed from themselves. However, due to the hybrid nature of climate change as both a physical and social phenomenon, individuals are not 'blank slates' receiving information and facing climate change. Many have argued that deepening personal experience could be the first step for reducing individual and community psychological distance of climate change while increasing the potential for behavior change. Considering that agriculture affects and is affected by climate change in several ways, farmers can provide first-hand observations of climate change impacts and testing different adaptation options. This contribution provides an overview of the intellectual structure of farmers' behavior on climate change awareness, perceived risks, and adaptation capacity. A portfolio of 108 survey studies published in the last decade was selected for a comprehensive analysis. Exploratory variables such as farmers' socio-demographic characteristics, level of climate change awareness, major perceived impacts, and adaptation measures, parameters, and barriers have been reported. In addition to the bibliographic analysis, the first results from a survey conducted in different irrigation systems in northern Italy will be tested to identify(dis)similar trends in farmers' behavior. The identification of not only farmers' behavior gaps but also their causing reasons will contribute to focus attention on most concerning issues and provide more accurate bottom-up knowledge to managers and decision-makers.

# Social Learning from Farmers' Experience and Behavior: a Triple-Loop Analysis on Climate Change Awareness, Perceived Impacts, and Adaptation

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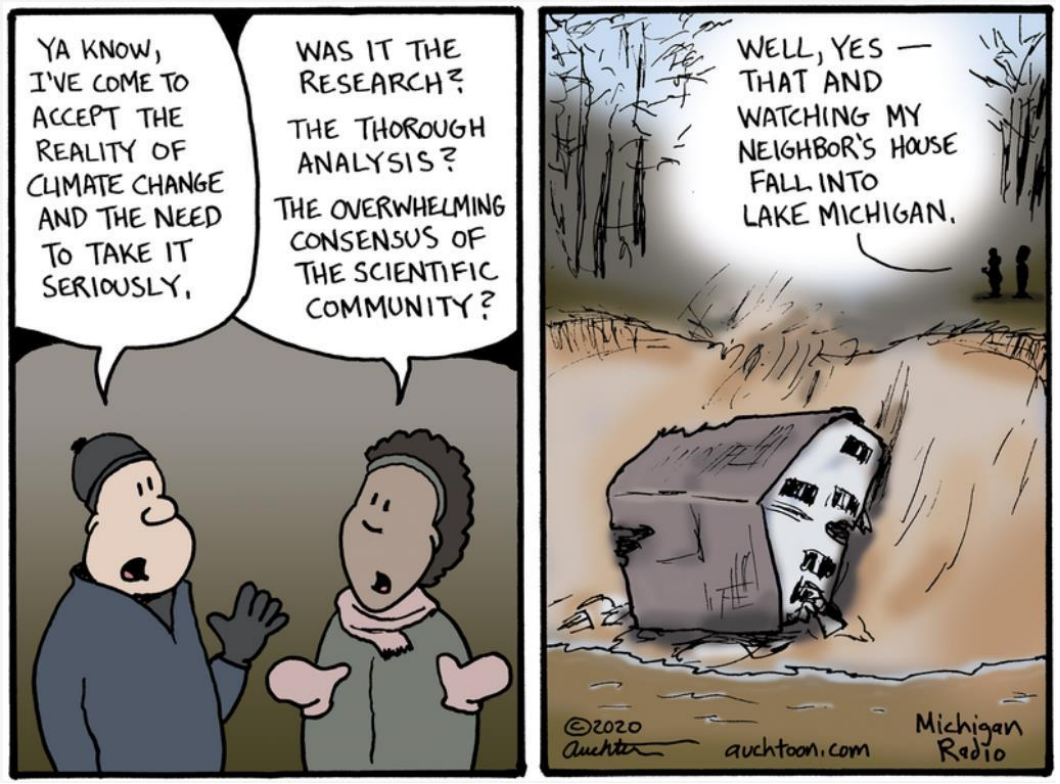
# MOTIVATION

- 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…*

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# AIM AND METHODS

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

**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

WoS and Scopus databases

2010-2020

Awareness

Impacts

Adaptation

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# RESULTS – BIBLIOMETRICS

435 papers

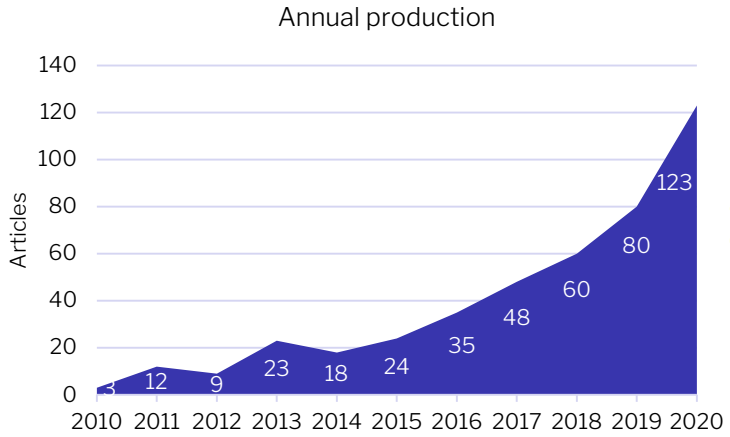
## Authors & Sources

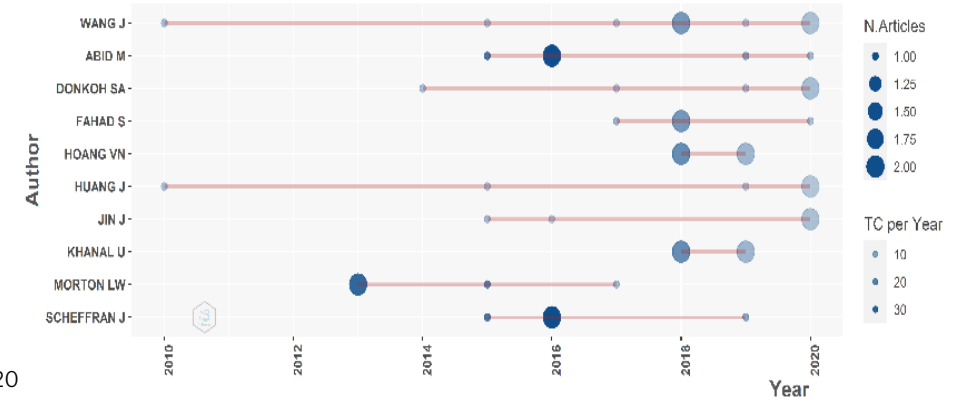
- 1,428 **authors**
- 669 **institutions**
- 65 **countries**

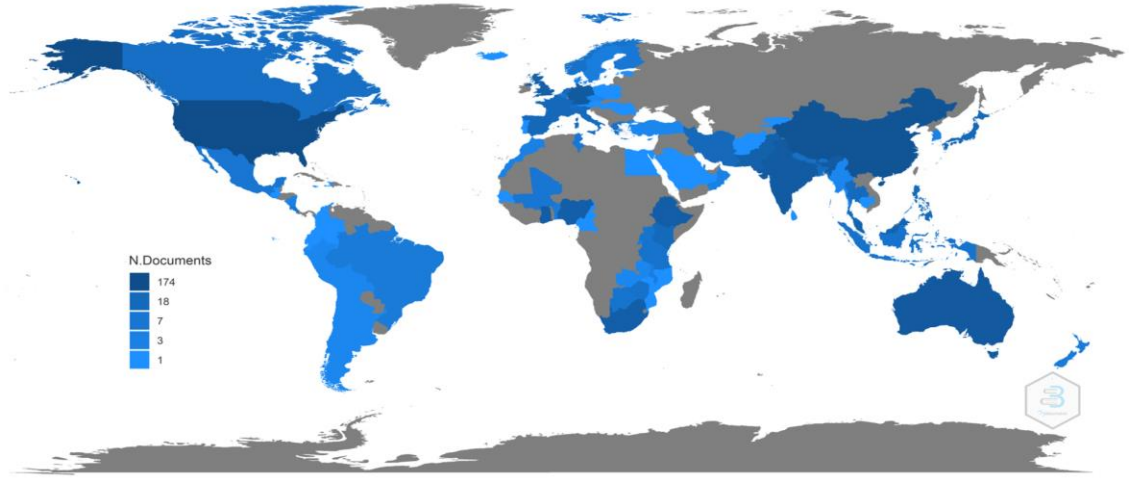
- 174 **journals:** climatic sciences, sustainable development & natural resources management

- **Growing interest:** 85% papers in 2015–2020

- A ratio of 1 to 9 in favor of **Global South studies**

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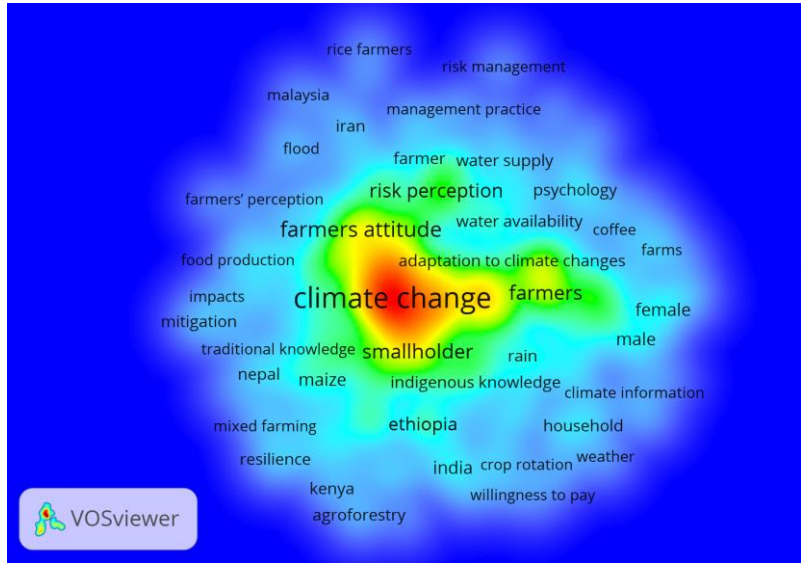
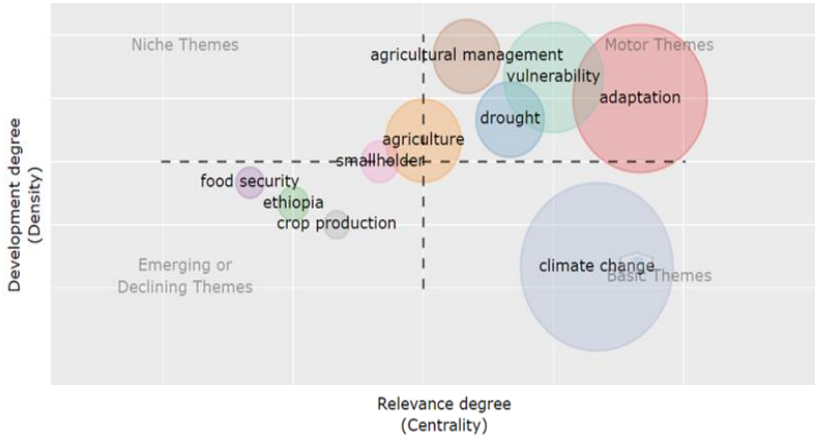
# RESULTS – BIBLIOMETRICS

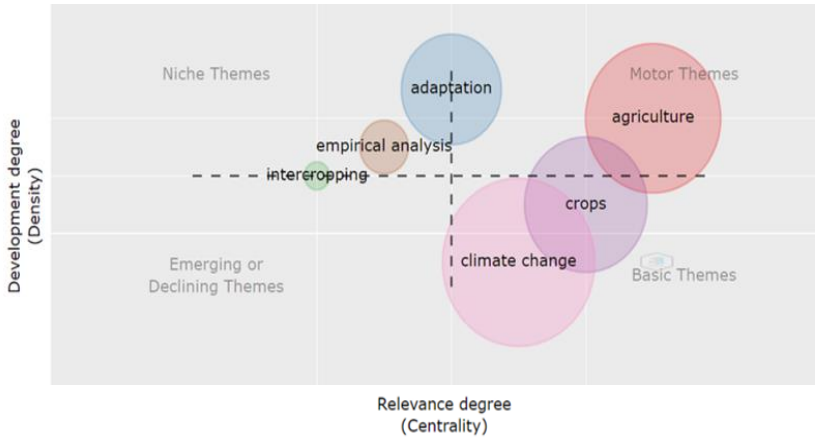
435 papers

## 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



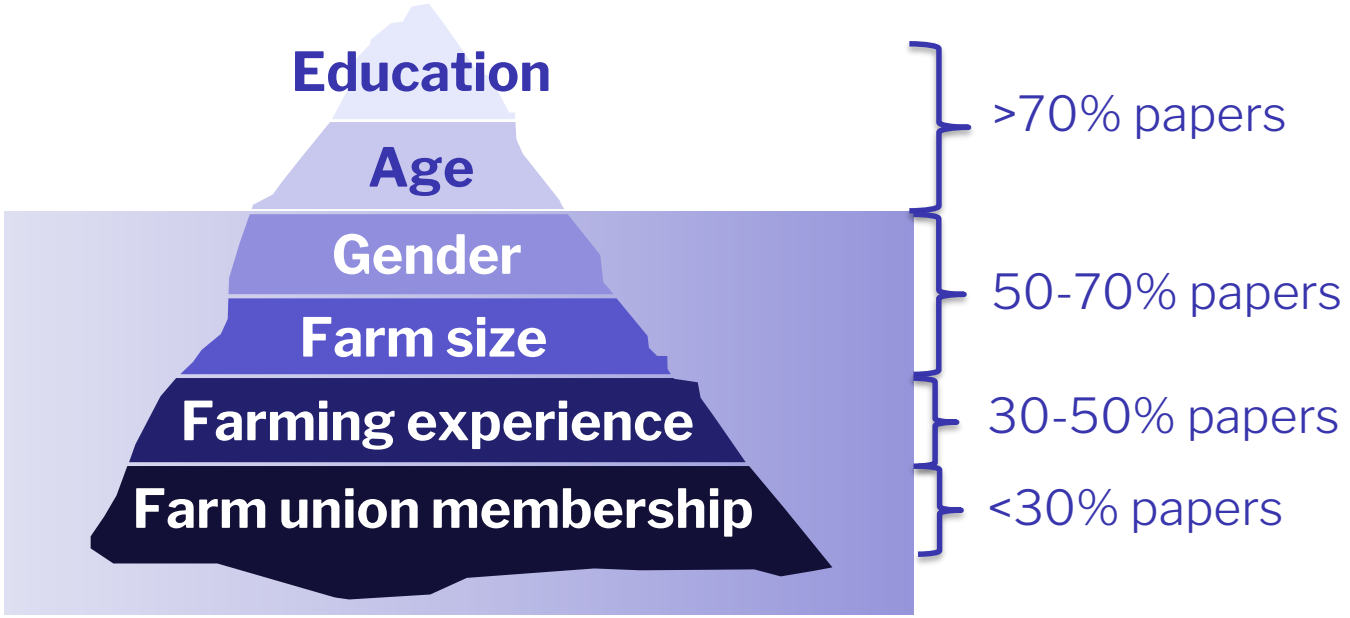




Less themes and diversity of topics
More focus on ***climate change*** (theme) & ***perception*** (sub-theme)

# 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.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# 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

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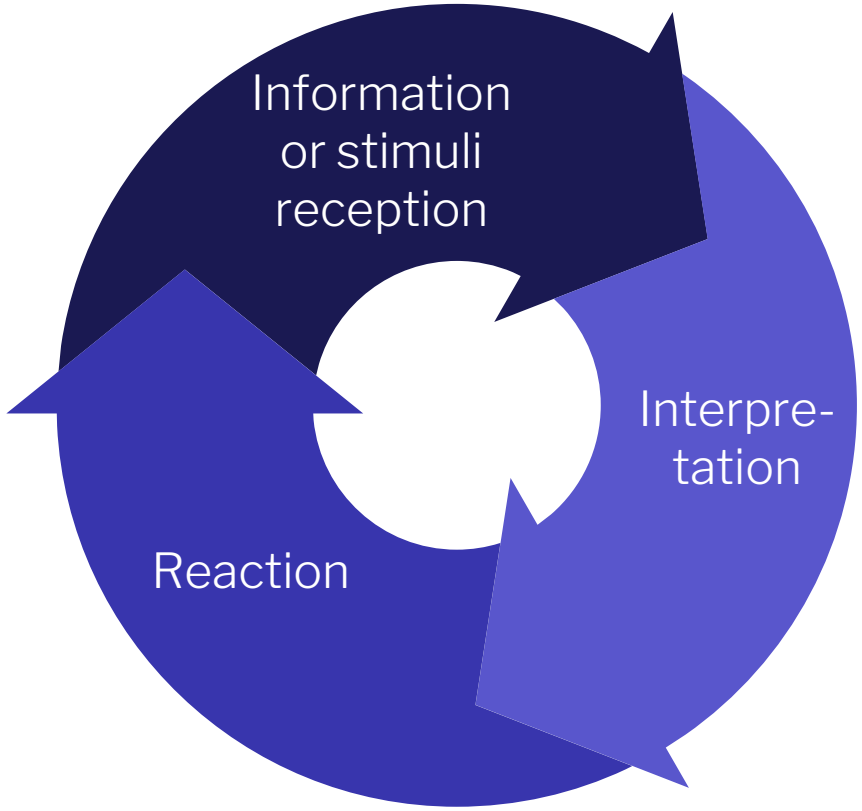
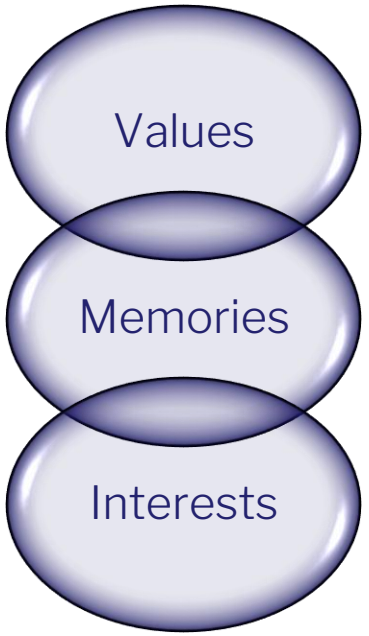
# RESULTS – SYSTEMATIC LITERATURE REVIEW

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.

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# 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

- 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

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

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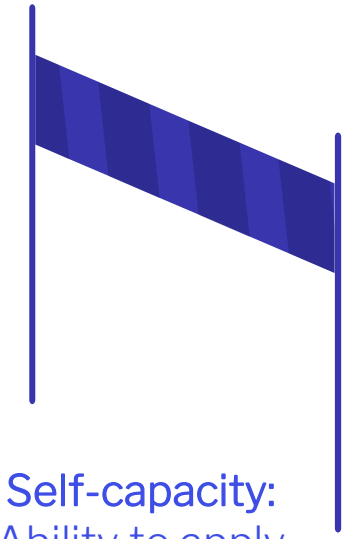
# RESULTS – SYSTEMATIC LITERATURE REVIEW

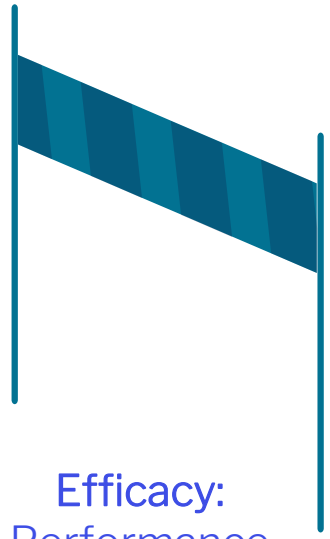
108 papers

## Adaptation capacity

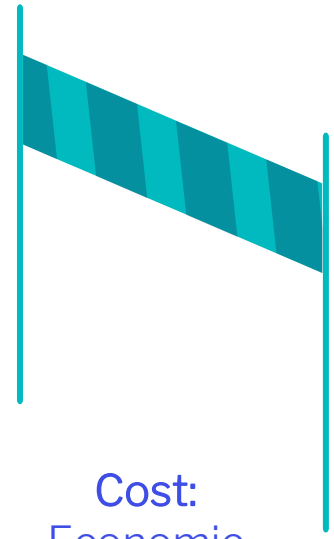
- **Perception** determines **adaptation intention** and **methods**.
- **Poor risk perception** may lead to **maladaptation** & **increase farmers' vulnerability** to climate change.
- **Accurate risk perception** increases **trust &** individual **responsibility.**



**Self-capacity:** Ability to apply for adaptive measures



**Efficacy:** Performance of applied measures



**Cost:** Economic effort & compensation

3-stage process

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# 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**

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# 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**

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# 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**

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# THANK YOU

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