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Development of an assessment method for vulnerability to climate change of maize farming systems

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ESA Conference, August 2022

VACCARM !



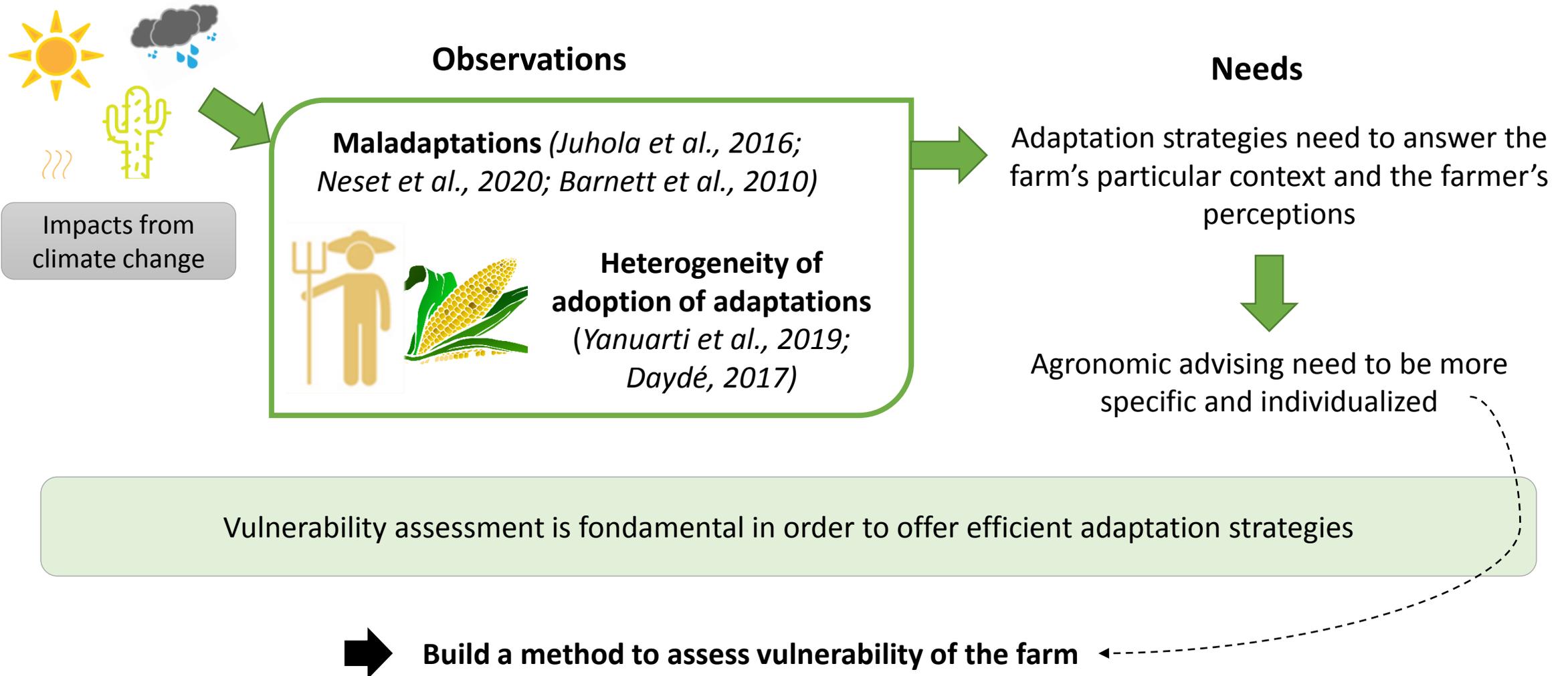
Development of an assessment method for vulnerability to climate change of maize farming systems

Marine Albert, PhD student at INRAE UMR AGIR

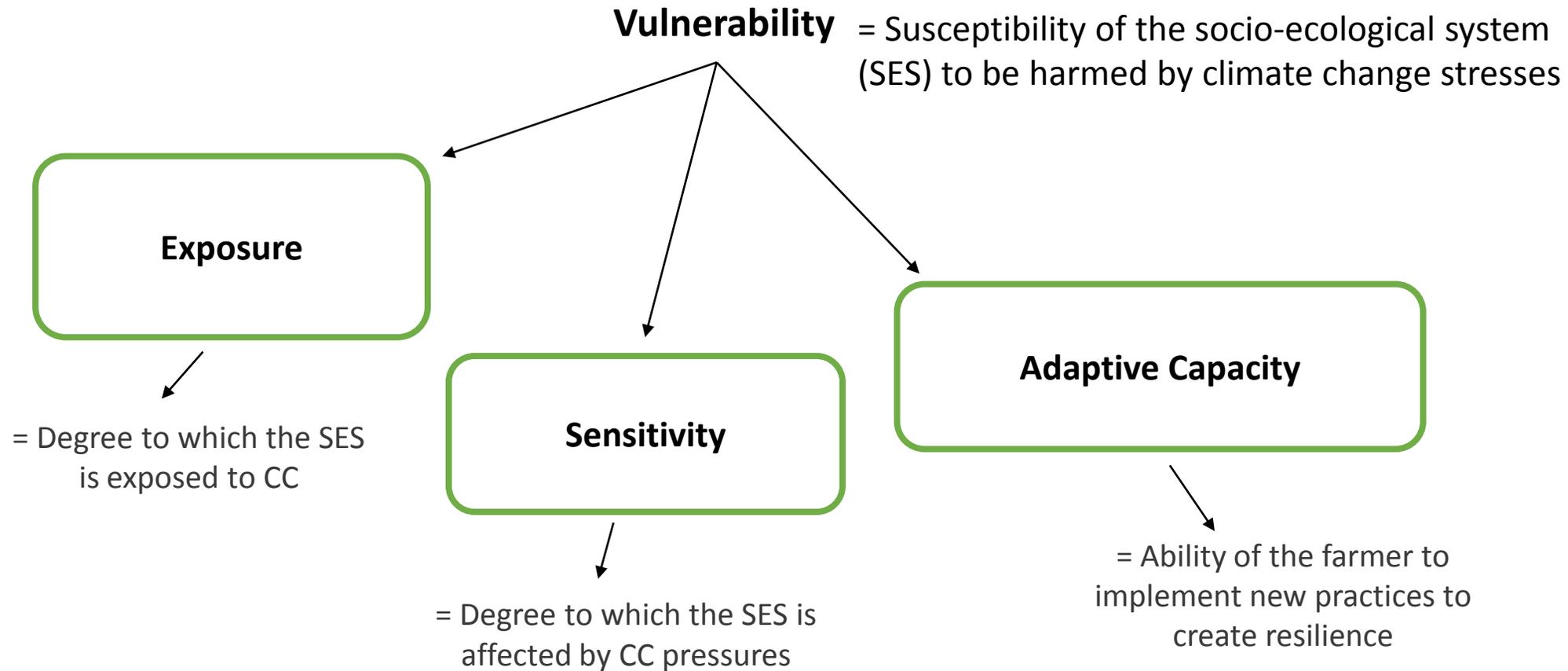
Jacques-Eric Bergez, Stéphane Couture, Magali Willaume, Johanna Alkan-Olsson



Need for Vulnerability assessment



Concept of Vulnerability



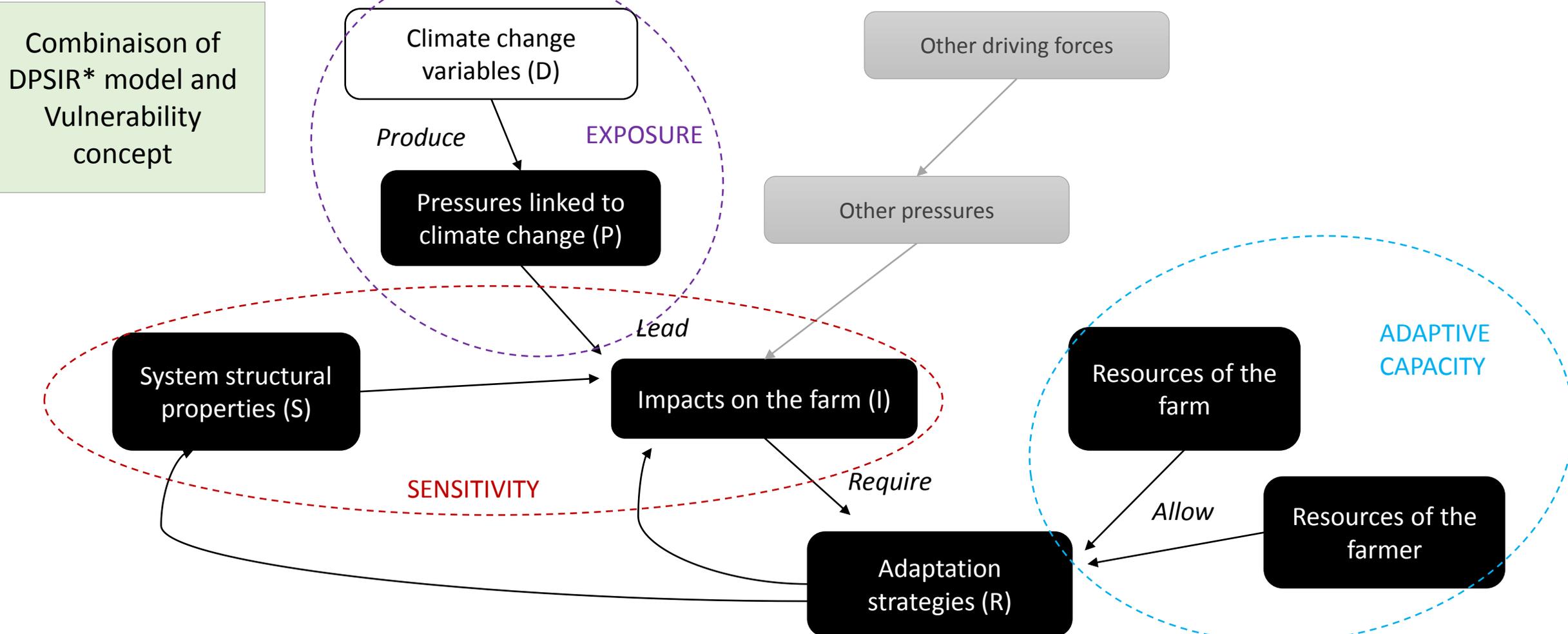
Overview of our method

Dardonville et al., 2021; Urruty et al., 2016; Gil et al., 2017; Durham et al., 2010

- **A participative, systemic and interdisciplinary approach**
 - **Predefined properties based on expert perceptions**

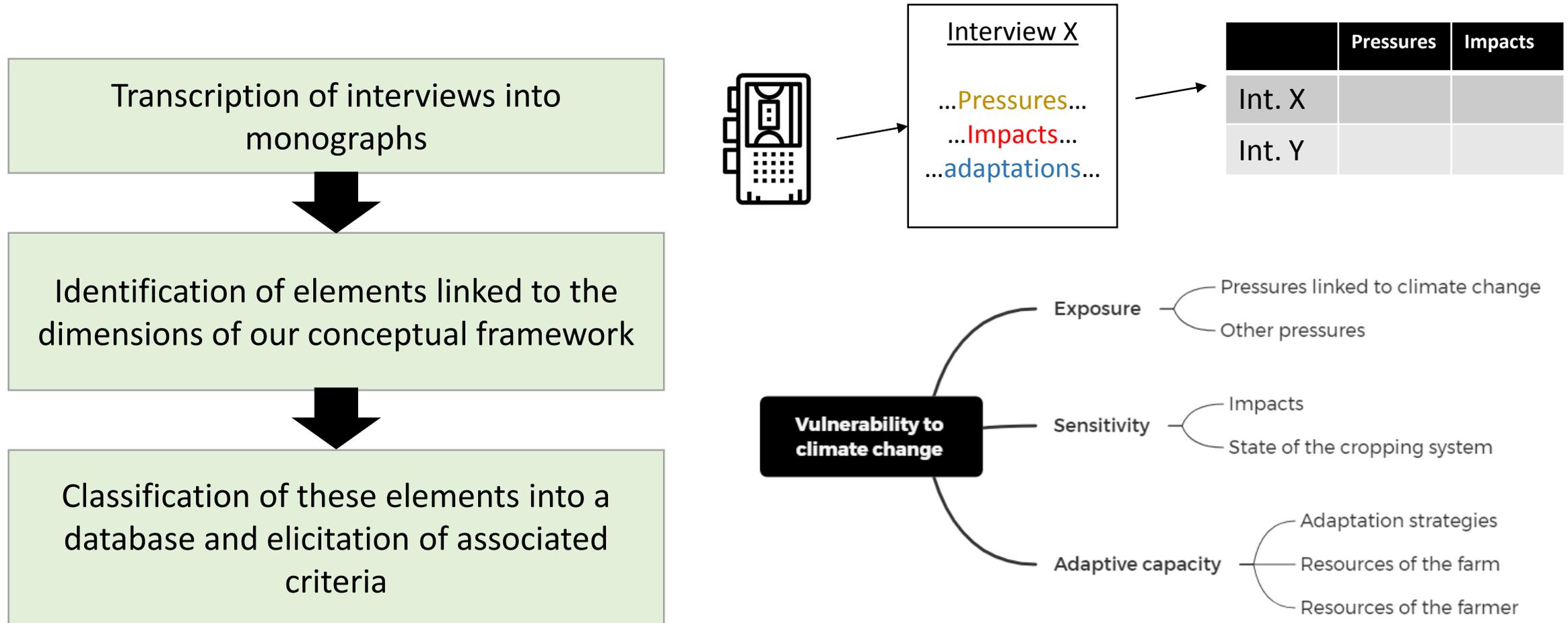
1. Build the conceptual framework
2. Elicitation of indicators
3. Selection of indicators
4. Design the tool

1. Our conceptual framework



*Driving forces, Pressures, State, Impacts, Response

2. Elicitation of indicators from maize farmers

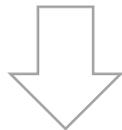


2. Add indicators from literature

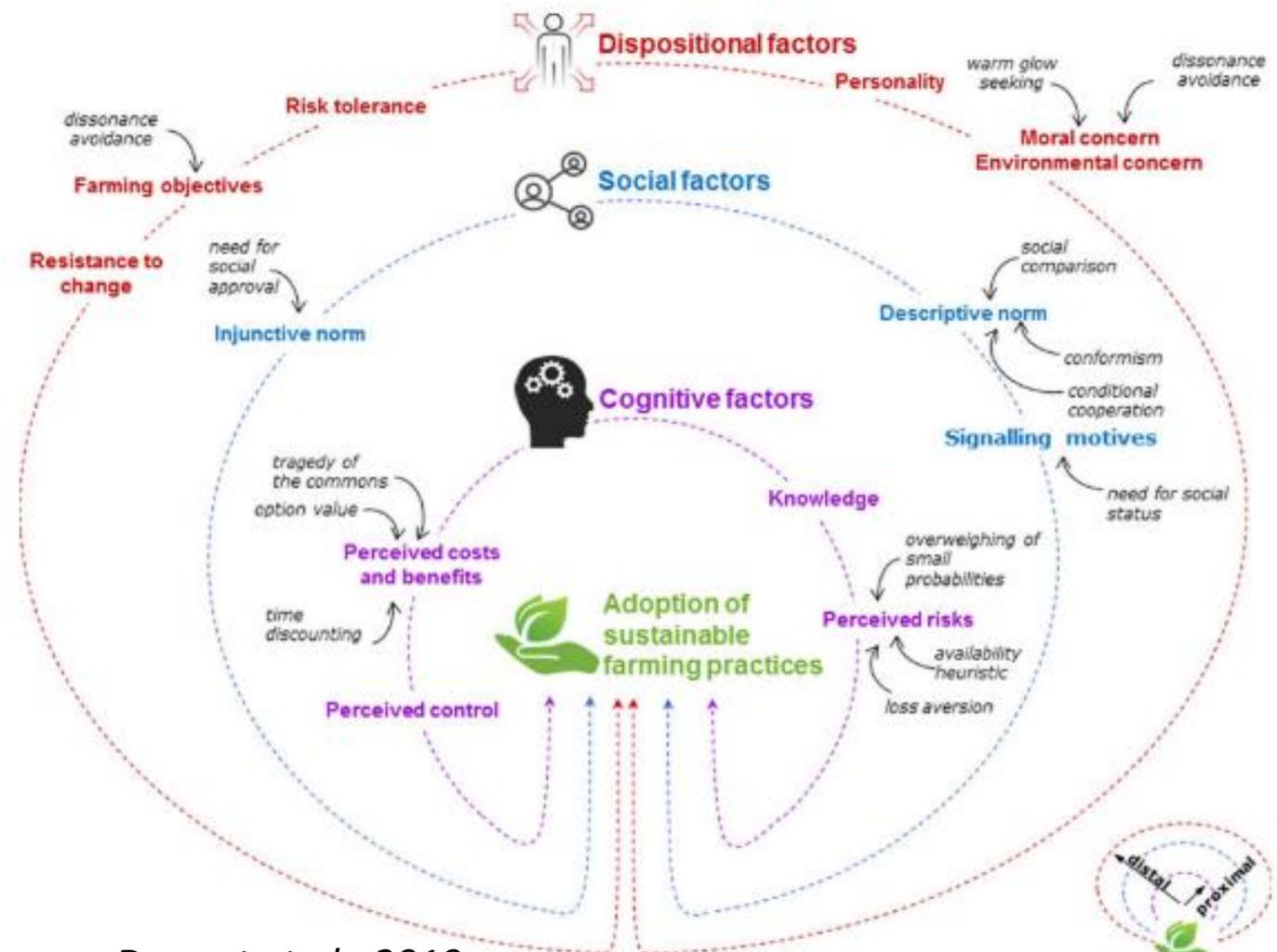
Literature on behavioural factors influencing adoption of practices

X

Maize growers interviews



- Farmers' characteristics
- Information sources
- Cognitive factors
- Dispositional factors



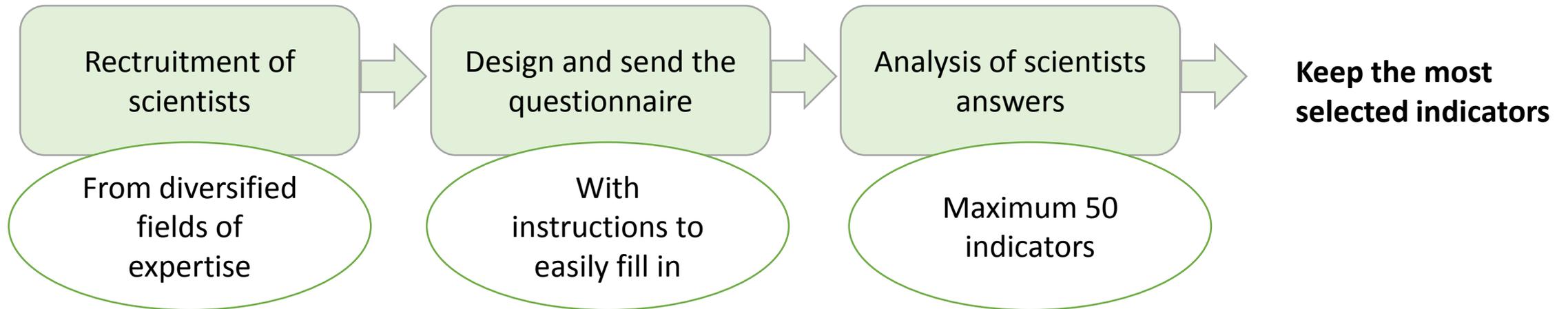
Dessart et al., 2019

3. Selection of indicators by scientists



Need to reduce the number of indicators in order to build an operational tool

SMART criteria of selection (Doran et al., 1981)
→ **Specific, Measurable, Achievable, Relevant, Timely**



4. Design the tool

Part 1

Set of indicators → qualitative assessment by the farmer and his advisor

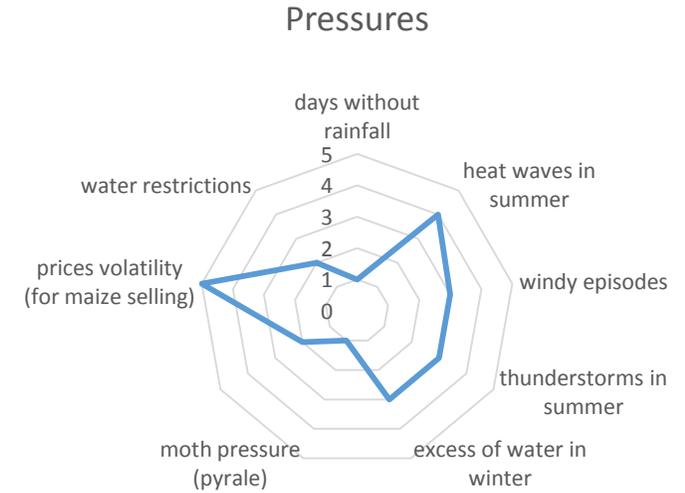
Userform

Indicators	Qualitative assessment
Excess of water in winter	High pressure
Compaction of soil	Very high impact

Diagnosis of Vulnerability of the farm

Part 2

Results → radar graphs for each dimension of vulnerability



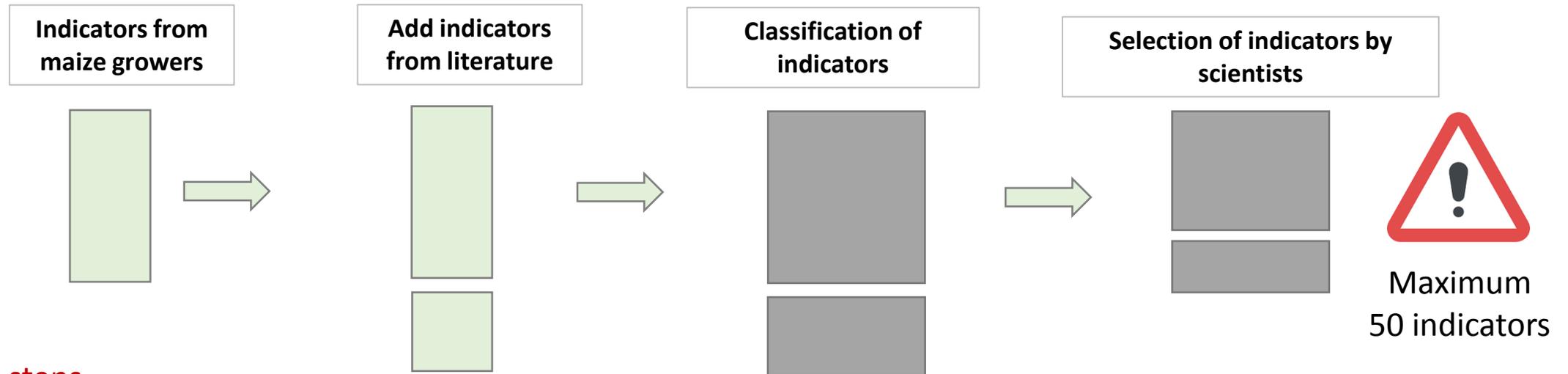
Part 3

Adaptations → The farmer choses adaptation strategies within a list

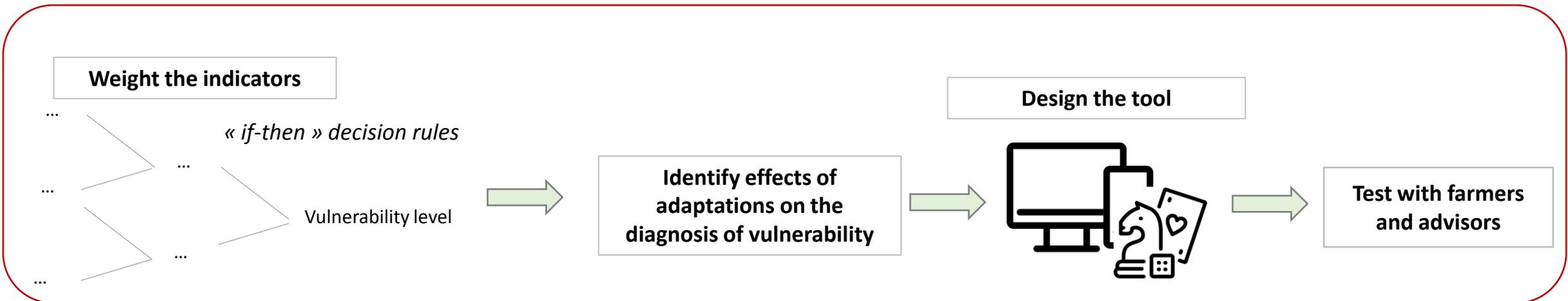
Modification of initial graphs thanks to adaptations

Test of adaptations to reduce Vulnerability of the farm

Recap of the process

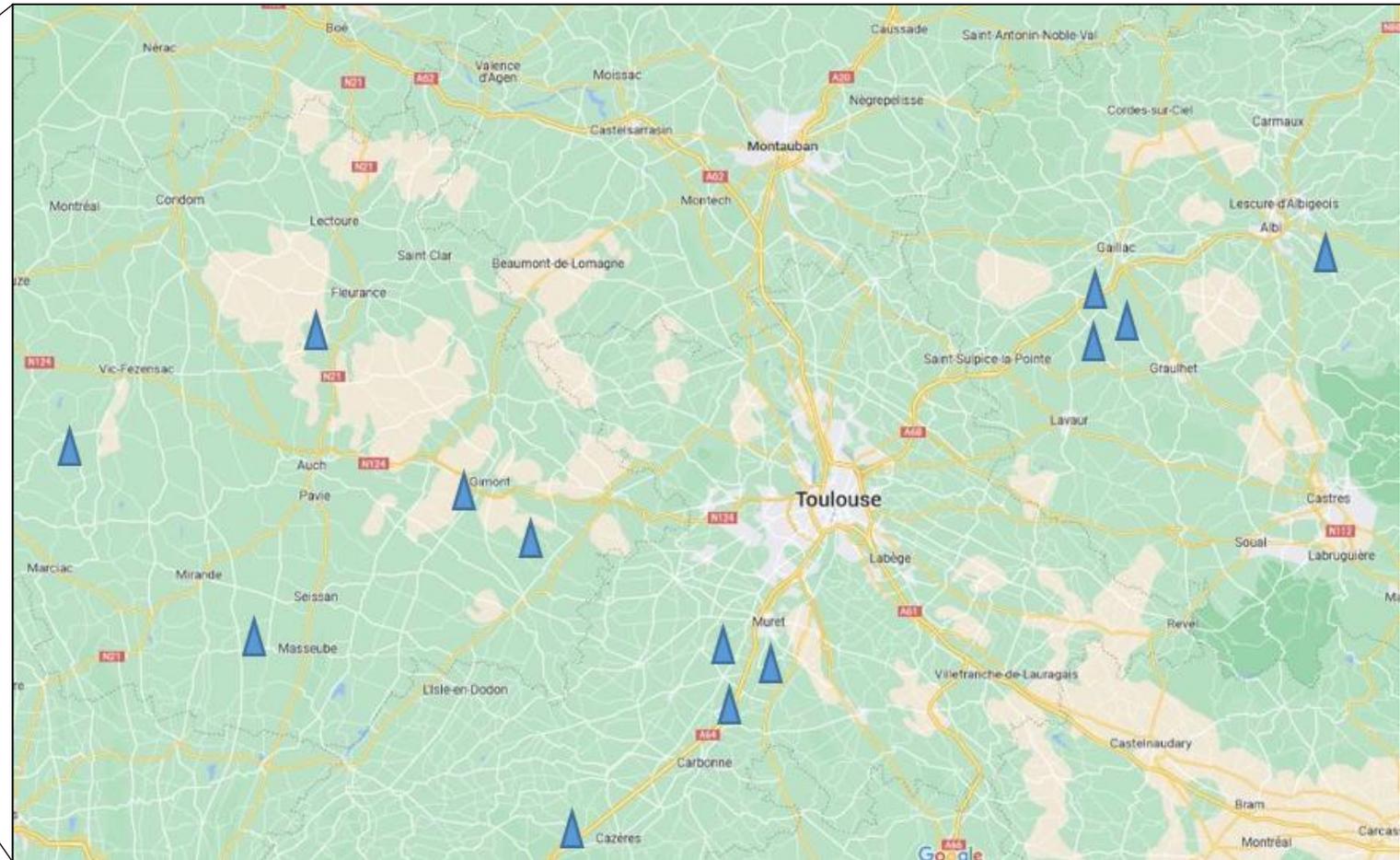


Next steps



Case study

Maize farming systems of SouthWestern France



Pressures

days without rainfall
heat waves in summer
windy episodes
thunderstorms in summer
excess of water in winter
moth pressure (pyrale)
increase in input and material prices
prices volatility (for maize selling)
water restrictions in summer

Impacts

Autan wind hinders irrigation
soil too dry to sow summer crops
soil too wet to sow winter crops
compaction of soils
erosion of soils
decrease irrigation capacity
yield decrease
hydric stress due to low humidity
water scarcity

Structural properties

watercourses management
topography
intra-plot heterogeneity (type of soil)
organic matter
porosity of soils
soil hydromorphy

Farm resources

diversification of buyers to spread risks
presence of on-farm storage facilities
cooperative for sharing equipment
intensity of work
irrigation capacity
weakness of water source
financial situation - debt
economic specialisation rate
irrigation costs

**A set of 48 indicators
distributed in the conceptual
framework**

Farmer resources

experience
farmer's network - collective
decision-aid tools
websites wheater consultation
learning - tests
observation of fields (crop, fauna, flora, soil)
risks preferences
perception of risks linked to climate change
resistance to change

Issues in the methodology

- Modeling requires simplification
 - Reducing the number of indicators
 - Simplify effects of adaptations on the diagnosis of vulnerability
- Need for SMART indicators → conflicts between experts
- Subjectivity in selection and weight of indicators

Toward a usefull tool for stakeholders

- **For farmers**

- Better knowledge of their farm, awareness of climate change and adaptations

- **For advisors**

- Awareness of farmers internal resources influencing adaptive capacity

- **For public policies**

- Provide data of practices implemented by farmers at a regional scale



Thank you for your attention

This study was funded by VACCARM from INRAE