MACSUR case studies across Europe: opportunities and challenges for farming systems

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Climate change, adaptation and mitigation in agriculture across Europe
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Research questions

• how to design effective adaptive pathways to address CC impacts under uncertainty in different EU-Agri contexts?

• how to integrate the stakeholders perceptions and attitudes in the design praxis?

• what are the convergent outcomes for action emerging from the stakeholder engagement process in different contexts?
Wait until certainty will be too late...

- Uncertainty reduction is not needed to design adaptive responses
  - PMs accustomed to take decisions under uncertainty

- Science can address uncertainty to assist adaptation planning for agriculture

- For managing wicked issues, SHs trust & agreement can well integrate hi-level science and low uncertainty
Addressing adaptation

- Integrated modelling assessment

- Stakeholder based process

Vermeulen et al 2014 PNAS
Adaptation modes

- Transformational adaptation:
  - Transformation from landuse or distribution change
  - New products such as ecosystem services

- Systems adaptation:
  - Climate change-ready crops
  - Climate-sensitive precision-agric
  - Diversification and risk management

- Incremental adaptation:
  - Varieties, planting times, spacing
  - Stubble, water, nutrient and canopy management etc
Generalized global scale studies

- Generalities too non specific for regional/local action
- Case studies too specific or not comparable to transfer

Complex set of case studies without generalization

Figure 9.3: The need to seek necessary but sufficient complexity to inform decisions between generalised, large-scale studies with little local relevance and complex sets of local studies that are difficult to generalise.

Howden et al 2010 Greenhouse 2009 conference CSIRO
Hypotheses

- Integrated analysis tools can assist decision making for short and long time frames
- Stakeholder processes are crucial to address wicked issues such as CC adaptation
- Predictive models can identify relevant uncertainties in specific timeframes and situations
- Uncertainty does not preclude robust decisions on adapt-actions
- Exploring uncertainty can assist decision making
Objectives

• Summarize lessons learned from SH engagement about CC adaptation in case studies

• Stimulate the debate on how to address CC adaptation challenges for food security in EU

• Discuss implications for research and policy developments
Stakeholder engagement approaches

- Co-researching with farmers (field experiments) + modeling
- Semi-structured and structured surveys
- Quantitative assessment of adaptive capacity through fuzzy analyses
- Expert surveys
- Re-staging traditional forms of conflict mediation
Site specific outcomes

North Savo (FI)

- **Climate**
  - increased temperature
  - increased rainfall and rainy days

- **Impacts**
  - soil compaction, poor drainage
  - pest and diseases
  - potential for higher yields and NUE

- **Actions**
  - crop diversification *(systemic)*
  - shift to protein crops *(systemic)*
  - improve drainage and soil structure
  - intensification on best fields, very low input in marginal land *(systemic)*

- **Constraints**
  - current ag-policy system does not fit farmers’ ideas

Sardinia (IT)

- **Climate:**
  - drought, extreme rainfall
  - increased heat wave frequency

- **Impacts:**
  - animal feeding systems
  - animal and plant pests and diseases, weeds
  - soil erosion on slopes
  - lower hay and pasture production (rainfed)
  - higher crop production under irrigation (rice)

- **Actions**
  - change animal breed *(systemic)*
  - crop diversification *(systemic)*
  - change crop *(systemic)*
  - improve irrigation systems *(incremental)*
  - improve animal diet, health and welfare *(incremental)*

- **Constraints:**
  - poor water governance (overlapping of competence)
  - slow and bureaucratic ag-policy implementation
  - nitrate directive
Assessing adaptive capacity

Indicators, thresholds and weights are based on interviews or literature data.

In our case many default indicators were negligible.
Framework used to develop the adaptive capacity model

- 4 macro-areas
- 21 priorities
- 21 indicators

(Metzger et al., 2006)
Following the framework proposed by Metzger et al. 2006. Agric. Ecosys. Environ.: 

- Each indicator was aggregated into determinants
- Each determinant was aggregated into components

+ Reception/Sensitivity
Indexing adaptive capacity

Bellocchi et al in prep

<table>
<thead>
<tr>
<th>Determinant</th>
<th>Component</th>
<th>Adaptive capacity</th>
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</thead>
<tbody>
<tr>
<td>Infrastructure = 0.6636</td>
<td>Ability = 0.7182</td>
<td></td>
</tr>
<tr>
<td>Technology = 0.7000</td>
<td>Action = 0.6929</td>
<td></td>
</tr>
<tr>
<td>Economic power = 0.8040</td>
<td>Awareness = 0.5114</td>
<td></td>
</tr>
<tr>
<td>Flexibility = 0.5111</td>
<td>AC = 0.6062</td>
<td></td>
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<tr>
<td>Knowledge = 1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reception/Sensitivity = 0.3991</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social capital = 0.2696</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

not relevant for current AC

medium low

important for current AC
Outcomes from fuzzy logic analysis

- Current adaptive capacity index is medium-low
- Social capital index is one of the strongest determinants for current AC
  - civil activism, coop and associations
- Education index is very weak in the region
  - high school dropout
  - low rate of graduated
  - one of the most influential indicators
- Economic power determinant is weakest determinant
  - difficult access to credit
  - low ratio btw regional/national investments
  - low rural devp spending efficiency
Expert survey: will CC adaptation options (AO) affect soil functions?

• 20 regional case studies across EU + DIPSIR fmk
  – site-specific adaptation options vs soil threats and functions

Hamidov et al submitted to Land Degrad Dev
Expert survey: will CC adaptation options (AO) affect soil functions?

- in most cases AO reduced soil erosion and decelerated decline of OC but increased compaction
- most AO improved crop production, C sequestration and nutrient recycling capacities
- uncertain effects on soil biodiversity
- soil functions contribute to achieving SDG 2 (food security and sustainable agric) and 13 (climate action)
- uncertain contribution to SDG 15 (terrestrial ecosystems)
Climate adaptation and water governance

- Dialogical tool at the science-policy-SHs interfaces to enhance social learning
- Mediation of environmental conflicts at the interface between formal institutions and local actors
- Identify barriers & opportunities for effective governance practice
- Design informed by social learning theory

Ruiu et al, 2017, Water MDPI
La Rasgioni

- Context: nitrate vulnerable zone
- Vis-a-vis semi-structured interviews recorded and edited in 10 min video
- The water court
  - The judge (omu di mezzu, a honorary judge)
  - lawyers (alligadori, researchers)
  - witnesses
    - Entrepreneurs: producers coop board, farmers, agrifood industry, fishermen coop, professional practitioners
    - Institutions: Regional agricultural councillor, Water boards, Major, Province authorities, Regional water authority, University researchers
  - Public jury: the CADWAGO project team
  - Public
• La Rasgioni process
  – Song of Arborea (written on purpose)
  – Projection of the videos with interviews
  – Listening of witnesses both sides
  – Lawyers’ defense
  – Dinner all together
  – After dinner: verdict of the jury
  – Informal and relaxed atmosphere, like a theatrical play
  – Song of Arborea

• Location: theatre of Arborea

• Success factors and limitations
  – co-researching with local farmers’ coop for 10 years
  – Ideas and skills of a professional producer
  – Interdisciplinary international team of researchers (background theory)
  – one off event potentially breakthrough but requires resources for follow-up
La Rasgioni outcomes

- Critical institutional arrangement needed for addressing effective water governance under CC
- Unbalanced power relationships among SHs
- Few stakeholders aware of CC threats
- Increased awareness of interconnection between practices at different levels
- Need for more private-public synergies, proactive attitude, conducive policies and institutions
- Need for more informal learning spaces and less command-control approaches
- Replicated in UK by Loughborough University
Converging outcomes across case studies

Farmers climatic perceptions can be misleading...

- Policies assume farmers are aware of CC and actively seek for info
- Poor climate signal:noise ratio bias farmers’ perceptions
  - confuse CC with interannual variability
  - act relying on past experience (perceiving to learn)

- Farmers adapt-actions driven by socio-economic factors but also triggered by climatic signals
  - perceptions depend on farm typology, socio-economic & cultural factors
  - adverse interannual variability triggers change based on past experience (incremental, short term)

- Contextualized impact assessments and communication facilitate the understanding the nature of the issues (learning to perceive)

Nguyen et al 2016 Agric Sys
Convergent outcomes

• Implications for policy
  – Policy can enhance or constraint the private adaptation through the legal, policy and organization environment
    • farmers claim less bureaucracy
    • farmers complain about slow implementation of measures and payments
  – Private-public partnerships (e.g. EIP) may enhance learning to perceive and improve effective adaptive responses
  – Policies addressing farmers environmental self-identity and feeling of responsibility help (e.g. improve soil C)
  – Participatory monitoring and assessment is crucial but rare
    • e.g. monitoring crop practices and yields thus improving farmers’ skills and knowledge for improving productivity
Policy implementation level..

Shift from command-control to learning institutions
New conducive interfaces to connect science-policy-SHs

New procedures and bureaucracy
New payment modalities
New roles for organizations

New programs or directives
New measures

Vermeulen et al 2014 PNAS
Converging outcomes

Implications for research

• Understanding farmers’ perceptions relevant to design conducive policy frameworks and contextualized measures:
  – invest in the design of learning spaces for developing hybrid knowledge (Nguyen et al 2014 Int J Agr Sust)
  – address farmers’ perception and response-abilities (learning to perceive)
  – co-develop scenarios grounded on what farmers consider relevant/feasible

• Understanding how socio-cultural factors bias CC perceptions: integrate education and communication into adaptation research
  – focus also on motivating farmers’ volunteer behaviours through environment-friendly and financial measures to support systemic and transformational change

• Outcomes of modelling (ex ante assessment) and surveys (ex post) are often convergent in identifying adaptation options
For further information please visit: www.macsur.eu