

A region wide assessment of land system resilience and climate robustness in the agricultural frontline of Sahel (LaSyRe-Sahel): *the triple exposure of local livelihood strategies and food provision to climate change, population pressure and globalization*

This project has been carried out in the years from 2009–2013. The research specifically aimed at exploring the situation in the Sahelian land use systems, which border the Saharan desert. Hence, while the Sahelian zone, by traditional definitions, encompasses the nation states in the semi-arid zone from Senegal to Chad (or Ethiopia), this research effort focused on the drier parts of these countries only, approximately limited to the zone between 100 and 400 mm of yearly rainfall. These parts of the Sahel will a priori be specifically vulnerable to climate fluctuations because of their marginal location. On the one hand, they have to provide for a rapidly growing population. On the other hand, they face specifically severe challenges when it comes to a possible economic development driven by agricultural production because of the low population density and hence the lack of nearby markets.

The ambitions of the project were to provide a knowledge platform concerning these agricultural frontline regions across the Sahel by

- Employing most recent, satellite based methodology to provide a regional overview of local variations and development trends in the agro-ecological potential
- Documenting plausible links between regional patterns of land use systems and perceived drives of land use change (e.g. population pressure, market access, ethnics, environmental resources, national policies)
- Providing up-to date empirical verification of land use changes to challenge the popular narrative that describes agricultural expansion to be a serious challenge for environmental sustainability
- Developing novel ways of exploring human-environmental interaction - suited to assess vulnerability and resilience of local agro-ecological systems.

Five institutions with a long tradition within the field of natural resource management in the Sahel worked together to achieve these goals, i.e. the geography departments at the Universities of Ouagadougou and Niamey, the environmental science department at the University of Dakar, the major agricultural research institution INERA in Ouagadougou, and the geography section at the University of Copenhagen.

The work was carried out in a way that combined, a) extensive exploration of written material, including the wealth of frequently overlooked project reports and policy documents at local documentation centres, b) cutting edge advancements within remote sensing analysis of the bio-physical environment, c) in-depth field work campaigns in selected sites in northern Burkina Faso, eastern Niger, and northern Senegal, and d) novel ways to conceptualize land system dynamics that enable exploration of vulnerability and resilience to external stressors such as climate changes, population pressure and globalization.

The research was conducted by a mix of senior staff, PhD students from Burkina Faso, Niger and Denmark as well as a number of master students. The work was planned and coordinated in a kick-off and a mid-term workshop held at the INERA facilities outside Ouagadougou, with invited representation from the Danish Embassy.

The field work, the analyses, and the writing and communication were often performed as group work including people across the participating institutions in order to facilitate transfer of knowledge and ideas.

The findings of the project were deliberately channelled through a set of different publication types. Rigorous scientific advancements were published in high ranking international journals. The prominent issues presented here were advancements within the remote sensing based monitoring of environmental change and conceptual advancements of importance for studies of resilience and vulnerability. A working paper series was established to accommodate material of interest for a broader community but without immediate appeal to a publisher. The systematic literature review, for example, was initially presented here and then later communicated through a scientific journal as well. Finally, a few compelling messages that could be drawn from the research activities have been condensed and presented in four research briefs meant for consultants and policy makers.

Out of the larger set of observations and recommendations presented in 'LaSyRe Research Briefs', a few deserve to be mentioned as examples here:

- Trends in vegetation greenness in the Sahel have in most areas been positive over the period for which a homogenous satellite data is available (1981-). Overall, there is a positive correlation between changes in vegetation greenness and annual rainfall, implying that the positive trend in greenness is partly controlled by rainfall.
- In reality, local communities' ability to meet peoples' daily food demand has increasingly been decoupled from the local crop production – local livelihoods are more and more based on income from other sources than subsistence agriculture. Hence, the notions of 'carrying capacity' and 'overpopulation' need to be reviewed.
- The possible mismatch between regional development policies and local peoples' visions often fails to be appropriately acknowledged - agriculture is an important part of the culture, but less and less important in the local livelihood portfolio

Our partners from the region have specifically noted that the novel approaches and methods underpinning, for example, the PhD dissertation work constitute a specifically interesting contribution to the local development community (NGO as well as Government) inasmuch as they deal with the important notion of resilience of social systems.

On this background, our closer look at a few, but seminal, environmental policy initiatives is rather disappointing with regard to how the most recent scientific knowledge has been communicated to the policy domain. The NEAP process in the 1980s could be criticized for tending to reinforce the creation of easily recognizable patterns of explanations accepted by influential policy actors, even though new scientific knowledge was beginning to challenge the mainstream narratives. Although much more knowledge has been generated since then, recent policy documents, like the NAPAs and the Great Green Wall initiative, seem to replicate many of the basic narratives and implicit understandings that were already presented decades ago.

Hence, there is a huge scope for progress in developing mechanisms that foster a genuine interest among policy makers in adopting new insight from the scientific community. Apparently, neither the production of materials, such as the LaSyRe briefs, nor the minor briefings of the local case study sites that we held, sufficed alone; the recipient part at the policy implementation level needs to be given incentives to receive and use the information as well.

Finally, two observations of importance for the assessment of outcomes of a joint research project like LaSyRe seem important to underline. Firstly, the results of PhD education have been praised by their local universities which stress that support for such candidates help creating employment opportunities for these excellent candidates, while at the same time enhancing the capacity of the host department significantly. The emphasis on publications is an important asset to the southern partners because it allows them to advance in the academic evaluation structure (CAMES). Secondly, the seemingly trivial scrutinizing of local literature that was performed was highly praised at an international conference because it alerted to a wealth of knowledge that was left unused because it was not immediately available. It was recommended by the partners from the region to find support for a systematic compilation of this huge pool of knowledge in order to avoid to initiate new searches for knowledge that has already been generated.

Website: www.lasyresahel.ku.dk