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# Targeting, out-scaling and prioritising climate-smart interventions in agricultural systems: Lessons from applying a generic framework to the livestock sector in sub-Saharan Africa

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ABSTRACT

As a result of population growth, urbanization and climate change, agricultural systems around the world face enormous pressure on the use of resources. There is a pressing need for wide-scale innovation leading to development that improves the livelihoods and food security of the world's population while at the same time addressing climate change adaptation and mitigation. A variety of promising climate-smart interventions have been identified. However, what remains is the prioritization of interventions for investment and broad dissemination.
The suitability and adoption of interventions depends on a variety of bio-physical and socio-economic factors. Also their impacts, when adopted and out-scaled, are likely to be highly heterogeneous. This heterogeneity expresses itself not only spatially and temporally but also in terms of the stakeholders affected, some might win and some might lose. A mechanism that can facilitate a systematic, holistic assessment of the likely spread and consequential impact of potential interventions is one way of improving the selection and targeting of such options.
In this paper we provide climate smart agriculture (CSA) planners and implementers at all levels with a generic framework for evaluating and prioritising potential interventions. This entails an iterative process of mapping out recommendation domains, assessing adoption potential and estimating impacts. Through examples, related to livestock production in sub-Saharan Africa, we demonstrate each of the steps and how they are interlinked. The framework is applicable in many different forms, scales and settings. It has a wide applicability beyond the examples presented and we hope to stimulate readers to integrate the concepts in the planning process for climate-smart agriculture, which invariably involves multi-stakeholder, multi-scale and multi-objective decision-making.


## 1. Introduction

The UN Food and Agriculture Organisation (FAO) estimates that by 2050 farmers will have to produce 70% more food to meet the needs of the world's expected population of 9.1 billion people (FAO, 2009). The Intergovernmental Panel on Climate Change (IPCC), on the other hand, is warning that the global climate is changing and expected to continue to do so in the foreseeable future (IPCC, 2014). Agriculture will need to adapt to this looming challenge to maintain food security, economic activities and the livelihoods of many, especially in developing countries (Howden et al., 2007). Agriculture also contributes to climate change (CC), with the agriculture, forestry, and other land use sectors contributing 24% of anthropogenic global greenhouse gas emissions (Smith et al., 2014).

Keating et al. (2014) argued that changes in the agricultural sector are essential and proposed a three-pronged approach across the science and policy domains, complementing actions to increase the food production with interventions that sustain the productive capacity of the food system and others that aim at managing food demand. Around the same time, the Food and Agriculture Organisation of the United Nations (FAO) introduced CSA as an integrative approach to address the interlinked challenges of food security and climate change (FAO, 2013). CSA explicitly aims for three objectives:

- sustainably increasing agricultural productivity, to support equitable increases in farm incomes, food security and development;
- adapting and building resilience of agricultural and food security systems to climate change at multiple levels; and

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- reducing greenhouse gas emissions from agriculture (including crops, livestock and fisheries).

CSA incorporates technologies, policies, institutions and investment. It includes on-farm interventions, such as composting, mulching, intercropping, improved animal feeding, integration of drought-tolerant crop varieties and climate-risk insurance, as well as interventions beyond the farm, such as carbon financing, establishing efficient markets and better weather forecasting. It is equally about the issues as it is about the process to go about resolving them.

While a lot of work has been done in the solution space and promising interventions have been identified, one of the main issues remains the selection, targeting and prioritization of interventions. Substantial investments are being made in CSA, but to ensure that the resources are appropriately allocated, all relevant development actors need information on which interventions are suitable and likely to reach the greatest possible positive impact across the different objectives of food and nutrition security, CC mitigation and CC adaptation.

CSA investment decisions are, however, challenged by a three-fold complexity. First, CSA is multi-objective by nature. Ideally, all three goals of CSA would be achieved. In reality, such triple-win solutions are rare and trade-offs between the different objectives are often observed. Specialised farming, for example, might be highly productive, it is also sensitive to changes in climate and thus not satisfying the adaptation criterion. Second, the impacts of CSA interventions vary by scale, both in time and in space. Management decisions made at the household level have effects on the individual components of the household-level system, and can have aggregated effects at village, regional, watershed and landscape level (Klapwijk et al., 2014). These effects at lower or higher scales are often synergistic but this is unfortunately not always the case. Similarly, short term gains are often not sustained in the long term. Last, but not least, a wide range of stakeholders are influencing and/or affected by CSA decisions. These stakeholders' perception on what is important might differ and thus result in conflicting judgements (Nordström et al., 2012). There is thus a need for these different stakeholders to engage in a dialogue and negotiation process.

Starting from the targeting framework described by Herrero et al. (2014), we developed a generic framework for targeting, out-scaling and prioritising CSA interventions in agricultural systems. The methodology entails a multi-stage and iterative process of (1) diagnosis and identification of alternative options, (2) characterisation of the options, (3) identification of the recommendation domains and out-scaling potential of these options, (4) assessing the impacts along different dimensions and on different groups of people. This paper describes how we applied these generic steps to CSA prioritization in livestock production systems in sub-Saharan Africa. We discuss lessons learnt and the implications for research for development.

## 2. Materials and methods

### *2.1. A framework for targeting, scaling out and prioritising interventions in agricultural systems*

#### *2.1.1. Introduction*

The framework for targeting, scaling out and prioritising CSA interventions explicitly integrates systems analysis, targeting and ex-ante impact assessment in the decision-making processes. Through the integration of comprehensive and reliable information as inputs into planning processes, it aims to contribute to informed CSA planning. Its target users are all those that are involved in CSA planning and implementation processes. The framework consists of four generic steps which are explained below (Fig. 1).

Though these four steps follow some logical order and represent the initial workflow, with information from one step feeding into the next step, the process of targeting and prioritising in not a linear task. It rather entails a multi-stage but iterative process with recurrent learning and refining of analysis and results. Going through the process with multiple feed-back and feed-forward loops, both within and between the four stages, allows for an increasingly deeper understanding and - if applied in a truly participatory way- increasing levels of trust and buy-in from stakeholders. Discrepancies between stakeholders' opinions is thereby likely to shift due to change of knowledge or interest (Brandt et al., 2015).

A multitude of participatory approaches that can be drawn upon exist, such as Rapid Rural Appraisal (RRA), Participatory Rural Appraisals (PRA), Participatory Video (PV) and Participatory Mapping (PGIS). In deciding which method to employ, one must take into account (i) the reasons for involvement and expected outcomes, (ii) the nature and scope of the issue, (iii) who is affected, interested or can contribute to solutions, (iv) amount of time available and (v) availability of resources (Slocum, 2003).

#### *2.1.2. Step 1: Diagnosis and identification of potential options*

A first step involves 'diagnosis and identification of potential options'. Depending on the local environment and current problems encountered in the landscape, a different set of interventions is needed. Farmers and livestock keepers face a wide variety of challenges, such as food insecurity, high poverty levels, low and variable yields, declining soil fertility and land degradation. Some of these challenges are wide spread, others can be found in selected locations only. This step consists of a description of the agricultural system in terms of issues and problems encountered as well as specific opportunities and potential solutions that exist. Agricultural systems are very complex; farmers and livestock keepers have differential access to human, financial, physical, natural and social resources and engage in a wide variety of livelihood strategies. In addition, the systems are not static nor do they operate in a vacuum. They influence, and are influenced by, the surrounding environment or context. Policies, norms, institutions, the economic climate and how they are changing thus all need to be taken into account in both the diagnostic and solution space. This step consists of an integrated and participatory process of combining, interpreting and communicating knowledge from diverse scientific disciplines to allow a better understanding of complex phenomena (Rotmans and Van Asselt, 1999). Guiding questions for this step are:

- What are the available resources (human, natural, financial, social and physical) and how are they organised for agricultural production?
- What are the current levels and trends of crop and livestock productivity, demand and consumption? Are there demand, yield or resource gaps that can/need to be addressed? What are appropriate options to address them?
- What are the different climate change scenarios and associated impacts; on the natural resource base as well as on the population? How much uncertainty is associated with these climate and impact scenarios?
- What/who is most vulnerable and why? How can their vulnerability be decreased?
- What are the main sources and sinks of greenhouse gasses (GHGs)? Where is there most potential to mitigate GHG emissions or capture carbon? And which interventions would this take?
- Who are the main stakeholders? Are there likely losers and winners? Who can influence the decision or wider context in which the agricultural production and potential CSA interventions are taking place?

#### *2.1.3. Step 2: Characterisation of options*

This step implies careful scrutiny and characterisation of the solutions being offered in Step 1. Due to the wide range of climatic conditions; cultural, institutional, and economic factors; and their

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