



# A social science framework to guide multi-scale research for climate change adaptation strategies in agricultural communities

Climate Adaptation Flagship Working Paper #14

Liana J. Williams, Clemens M. Grünbühel, and Peter R. Brown  
January 2013



## National Library of Australia Cataloguing-in-Publication entry

Title:	A social science framework to guide multi-scale research into climate change adaptation strategies in agricultural communities / Liana J Williams
ISBN:	978-1-922173-36-2 (pdf)
Series:	CSIRO Climate Adaptation Flagship working paper series; 14
Other Authors/Contributors:	Clemens M Grünbühel, Asian Institute of Technology Peter R Brown, CSIRO Ecosystem Sciences Climate Adaptation Flagship

### Enquiries

Enquiries regarding this document should be addressed to:

Liana Williams

CSIRO Ecosystem Science

GPO Box 2583, Brisbane QLD 4001

[liana.williams@csiro.au](mailto:liana.williams@csiro.au)

Enquiries about the Climate Adaptation Flagship or the Working Paper series should be addressed to:

Working Paper Coordinator

CSIRO Climate Adaptation Flagship

[CAFworkingpapers@csiro.au](mailto:CAFworkingpapers@csiro.au)

### Citation

Williams, LJ., Grünbühel, CM. and Brown, PR. (2013). A social science framework to guide multi-scale research into climate change adaptation strategies in agricultural communities. CSIRO Climate Adaptation Flagship Working paper No. 14 <http://www.csiro.au/en/Organisation-Structure/Flagships/Climate-Adaptation-Flagship/CAF-working-papers.aspx>

### Copyright and disclaimer

© 2013 CSIRO To the extent permitted by law, all rights are reserved and no part of this publication covered by copyright may be reproduced or copied in any form or by any means except with the written permission of CSIRO.

### Important disclaimer

CSIRO advises that the information contained in this publication comprises general statements based on scientific research. The reader is advised and needs to be aware that such information may be incomplete or unable to be used in any specific situation. No reliance or actions must therefore be made on that information without seeking prior expert professional, scientific and technical advice. To the extent permitted by law, CSIRO (including its employees and consultants) excludes all liability to any person for any consequences, including but not limited to all losses, damages, costs, expenses and any other compensation, arising directly or indirectly from using this publication (in part or in whole) and any information or material contained in it.

## **The Climate Adaptation Flagship Working Paper series**

The CSIRO Climate Adaptation National Research Flagship has been created to address the urgent national challenge of enabling Australia to adapt more effectively to the impacts of climate change and variability.

This working paper series aims to:

- provide a quick and simple avenue to disseminate high-quality original research, based on work in progress
- generate discussion by distributing work for comment prior to formal publication.

The series is open to researchers working with the Climate Adaptation Flagship on any topic relevant to the Flagship's goals and scope.

Copies of Climate Adaptation Flagship Working Papers can be downloaded at:

[www.csiro.au/resources/CAF-working-papers](http://www.csiro.au/resources/CAF-working-papers)

*CSIRO initiated the National Research Flagships to provide science-based solutions in response to Australia's major research challenges and opportunities. The eleven Flagships form multidisciplinary teams with industry and the research community to deliver impact and benefits for Australia.*



# Contents

Preface.....	2
Executive Summary .....	3
Introduction.....	4
Theoretical framework .....	6
Methods .....	9
Closing remarks .....	14
References.....	15

## Figures

Figure 1: Understanding adaptation .....	6
Figure 2: Varied resources households access and apply in livelihood strategies .....	6
Figure 3: Comparison of household resource endowment.....	7
Figure 4: Social science research components, aim and relationship to broader project .....	9
Figure 5: Example of possible typology structure. Different levels in the typology represent different levels of detail.....	10
Figure 6: Example of scale used in workshop to value indicators.....	12

## Acknowledgments

Funding for this research is provided by the Australian Centre for International Agricultural Research (ACIAR LWR-2008-019 *Developing multi-scale climate change adaptation strategies for farming communities in Cambodia, Laos, Bangladesh and India*) and the CSIRO Climate Adaptation Flagship. The authors wish to thank Dr Christian Roth (CSIRO) for his support in the development of this research, and Heinz Schandl and Mark Stafford Smith (CSIRO) for reviewing earlier drafts of this paper.

# Preface

This working paper outlines the objectives, underpinning concepts and broad approach to guide research into the ability of rice farming households to adapt to climate variability and change in Cambodia, Laos, India and Bangladesh. It is one component of the research project *Developing multi-scale climate change adaptation strategies for farming communities in Cambodia, Laos, Bangladesh and India* funded by the Australian Centre for International Agricultural Research (ACIAR) and implemented by CSIRO's Climate Adaptation Flagship. It seeks to provide viable adaptation pathways for small-holder rice-farmers and derive policy recommendations by scaling up local insights and entering into a dialogue with key policy developers. One of the main challenges the research seeks to resolve is to scale up from highly contextualised, locally specific systems to sufficiently generic yet adequate characterisations of regions inhabited by rural populations dealing with current and future effects of climate change. This requires an integrated approach in which climate science, agronomy and social and economic science approaches are able to support and inform one another. The framework outlined in this document focuses on research questions and methodologies that require some consideration as to the integration of different approaches (see Roth et al for the broader integration framework, including biophysical research components).

This document was originally written in 2010 to guide continued discussion between social science research teams across the four countries that the project is working with. It outlined a broad approach in order to facilitate country-specific planning and method design. The framework is published here in order to make it available to, and engage with, a wider audience.

# Executive Summary

Rural households in developing countries are particularly dependent on natural resources to secure their livelihoods and particularly vulnerable to increasing climate variability and long term climate change. This paper presents a research framework designed to support the development of climate adaptation options for smallholders producing rice in rainfed conditions in parts of Cambodia, Laos, Bangladesh and India.

The aim of the research is to understand the process of household adaptation and translate this into useful information for policy makers who are looking to support adaptation in targeted ways.

Specific questions include:

- How does access to various types of resources influence or determine a household's ability to adapt?
- What different types of livelihood portfolios exist for rice farming households? How are they distinct or what are the defining characteristics of these types?
- How can the understanding of local rural systems be used to support and inform policy interventions for adaptation at higher administrative levels?
- What additional information, processes or filters need to be applied for local level research to be relevant and responsibly feed into district, provincial or regional level decision making and planning?

For the purpose of this research, adaptive capacity is defined as a household's ability to make changes to its livelihood portfolio in order to secure or improve food security and income earning under changing environmental conditions.

The framework presented here combines the definition of a household typology, based on access to resources, relative quality and quantity of resources, and household strategies/perceptions of risk; as well as locally grounded community assessments of adaptive capacity which elicit household perspectives on potential for change, including supporting and constraining factors. The self assessment workshops approach the question from an inherently local and highly contextualised angle, while the typologies take a more abstracted, broad scale approach.

# Introduction

Households in developing countries often dependent on natural resources to secure their livelihoods, thus, the impact of climate change on agriculture, fisheries and forest resources is of key concern.

What makes for viable adaptation options, and the ability for actors to take advantage of these options, will vary depending on access to resources such as: information, finances, technology and more intangible resources like social networks, political influence and so on (Smit and Wandel 2006). This takes on particular significance in developing countries, where resources are limited and access is highly differentiated. In this context, Kates (2000) suggests previous adaptation methods are likely to cease being effective while governments and other institutions may not be well established to support households that are struggling.

The aim of the research is to understand the process of household adaptation and translate this into useful information for policy makers who are looking to support adaptation in targeted ways.

Specific questions include:

- How does access to various types of resources influence or determine a household's ability to adapt?
- What different types of livelihood portfolios exist for rice farming households? How are they distinct or what are the defining characteristics of these types?
- How can the understanding of local rural systems be used to support and inform policy interventions for adaptation at higher administrative levels?
- What additional information, processes or filters need to be applied for local level research to be relevant and responsibly feed into district, provincial or regional level decision making and planning?

In answering these questions, and in conjunction with the climate and crop modelling components in the project, a range of adaptation options will be assessed that take into account the integrated nature of household livelihoods, but are generalised enough to underpin design of policy to support household or community level adaptation.

The integrated approach of household typologies and self-assessment of adaptive capacity represent a significant step in approaches to assess and suggest pathways for adaptation. On the one hand, the household typologies define the limits and boundaries of the current farm and household systems which indicate possible options and limits for adaptation, while self assessment workshops explore adaptive capacity at a household level in greater depth. The findings from this research will shape scenarios that are modelled through APSIM and IAT<sup>1</sup> as viable and relevant for farming households. The adaptive capacity workshops ensure relevance to the specific case study sites, while the typology allows for abstraction and broader generalisation to similar socio-economic, geographic and climactic areas. An essential part of defining the typologies will be to test relevance in other areas.

## *Defining Adaptation*

Social science fields have long recognised human adaptation, although this body of work is seldom acknowledged or incorporated into contemporary concepts of adaptation in climate change research. Early modern theories on culture have stressed culture as the main vehicle to adaptation, yet at the same time being the result of adaptation to a particular environment (Cohen 1974). Adaptation is conceptualised as the changing relationship of a society with its environment, where either the environment is changed to

---

<sup>1</sup> Agricultural Production Systems Simulator (APSIM) and the Integrated Analysis Tool (IAT) will be used to model the possible effects of different farm-level adaptation options. Refer to Keating et al 2003 and Lisson et al 2010 for more details.



suit the society, or vice-versa (*ibid*). Cohen distinguishes between adaptations, which alter the relationship between societies and environments, and adjustments, which may support adaptations, but do not in themselves, suggest a substantive change in the relationship between a society and their environment.

In rural development, adaptation has been characterised as a process that has been a 'distinguishing feature' of survival strategies of the rural poor, as they shift and change livelihood activities (Ellis 2000). Still, this is a reflection of Julian Steward's theory of the "cultural core", in which the summation of subsistence (survival) strategies is central to a given social system (Steward 1972).

In more recent anthropological literature on climate adaptation, adaptation is seen as the adjustment of livelihood strategies according to existing (or perceived) external drivers—a shift in culture, which replaces dysfunctional cultural elements by new, functional ones (Crate & Nutall 2009; Crate 2009). Others (e.g., Magistro & Roncoli 2001) emphasise the importance of anthropological study for 'ground-truthing' climate models and for providing context for adaptation planning, through providing context, understanding risks, and mapping decisions leading to adaptation.

In climate change research, concepts of adaptive capacity are inextricably tied to vulnerability—that is, how exposed and sensitive people are to a particular threat, and how able they are able to cope with or compensate for that threat (Kelly and Adger 2000). Adger et al (2007 720, following IPCC) speak of 'adjustments to reduce vulnerability or enhance resilience in response to observed or expected changes in climate and associated extreme weather events'. Rather than focussing on possible impacts of external threats and drivers (e.g. extreme weather events) the approach suggested here takes stock of the community's ability to react to external drivers—thereby avoiding the potentially disempowering approach of vulnerability assessments (Roth et al 2010).

There is widespread consensus over the fact that the process of adaptation is ill-understood. Smit et al (2001, 88) argue that 'current knowledge of adaptation and adaptive capacity is insufficient for reliable prediction of adaptations; it also is insufficient for rigorous evaluation of planned adaptation options, measures, and policies of governments.' Most conceptualisations—including those in anthropology and sustainability literature—understand adaptation as a co-evolutionary transition within a complex system, in which functional sub-systems adapt independently without being teleological (cf. Funtovicz & Ravetz 1993; Norgaard 1994; Rotmans et al 2001; Berkes et al. 2003; Giampietro 2004; Rammel et al. 2004 ).

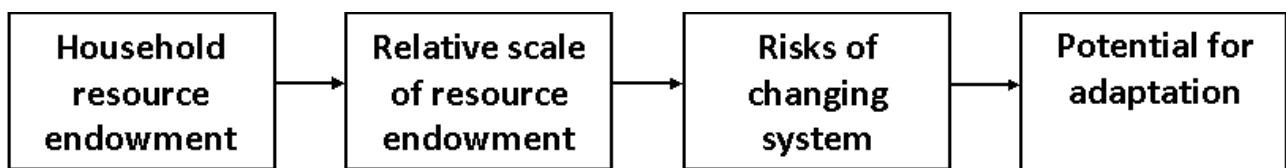
Drawing on livelihoods literature, adaptation strategies at the household level encompass a range of options, including short-term coping strategies, diversification of income and food sources, and longer-term transformation of livelihood activities (Ellis 2000, Osbahr et al 2008). Adaptation, therefore, is more far reaching than changes to farm activities and includes a range of livelihood strategies (off farm and non-farm). Adaptation is not only a response to climate drivers, but focuses on securing and improving the household livelihood security and reducing poverty (Sabates-Wheeler et al. 2008).

Adaptive capacity therefore can be understood as a household's ability to make changes to its livelihood portfolio in order to secure or improve food security and income earning under changing environmental conditions.

This definition focuses on the household being the smallest social unit of economic cooperation. The household as a basic unit of analysis reflects interdependencies of individual members within a household, and the subsequent construction of livelihoods as a household, rather than individual endeavour (Netting 1993; Ellis 2000; Bouahom et al. 2004). While the project does aim to 'up-scale' findings to support policy, the household remains the primary point of data generation.

# Theoretical framework

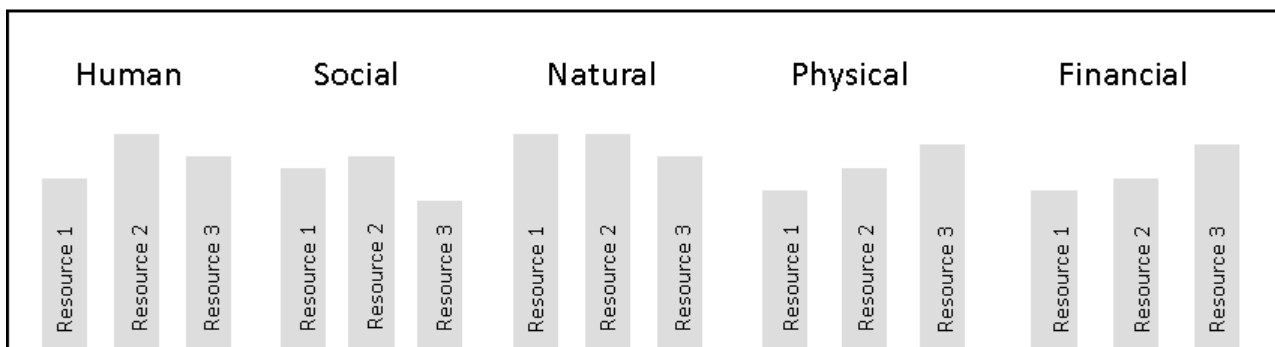
Drawing on a range of approaches (cf. Ellis 2000; Grothmann and Patt 2005; Adger et al. 2009) the following framework will be used to understand adaptive capacity (Figure 1). We assume that the farming household makes well-founded decisions depending on (a) available resources and (b) perceived levels of risk. The range of resources available to the household defines relevant livelihood *options* to the household; however, options become realistic *alternatives* to the household—or become options not considered by the household—only in relation to the risks and perceived advantages associated with different resource investments.



**Figure 1: Understanding adaptation**

## Household Resource Endowment

The resources people (co-)own or have access to largely determine the options they have to make a living (Ellis 2000).



**Figure 2: Varied resources households access and apply in livelihood strategies**

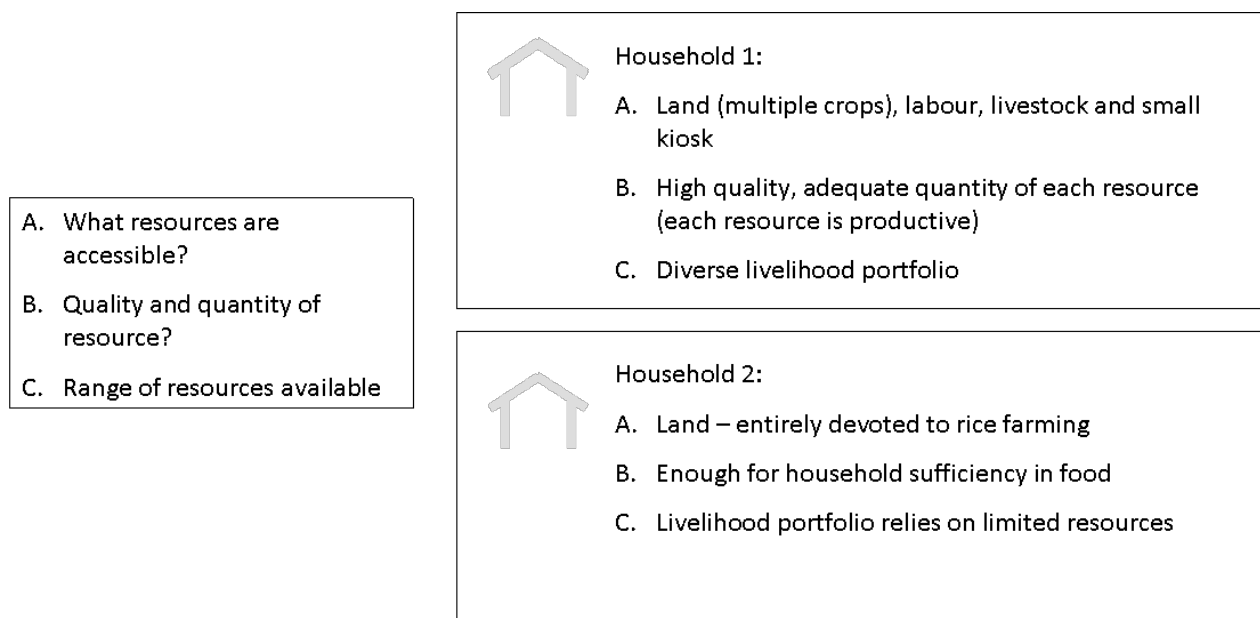
Rural livelihoods are often diversified and contain a range of activities undertaken by various members of the household (e.g. crop production; livestock rearing; provision of services; kiosks etc). We draw on the sustainable livelihoods framework (Ellis 2000)<sup>2</sup> which emphasises five broad categories of resources that households draw on to secure their livelihoods: social, physical, financial, human and natural. The term ‘resource’ in this sense is used broadly and refers to material resources (e.g. land) and immaterial resources (e.g. time, money, social networks). Depending on accessibility, resource types are not always fixed, and the range of resources is equally important as the existence of any one particular type of resource. Some resources can be substituted by others, e.g. labour with money; some can be utilised to increase or improve another, e.g. selling of equipment to pay for school fees; others still cannot be substituted, e.g.,

<sup>2</sup> Note that while we draw on the principles of Ellis’ sustainable livelihoods framework as it pertains to how access to resources and household priorities relating to risk influence livelihood activities, we do not deploy the framework in its entirety, which has a different aim / emphasis than what is required here.

social resources such as networks of reciprocity cannot be purchased or offset by an increase in physical resources.

### Relative Scale of Resource Endowment

When analysing the resources available to a household, consideration needs to be given to the quality and quantity of an individual resource type as well as the distribution of available resources.<sup>3</sup> In this way we can understand the relative scale of resource endowment as a method to compare different households.



**Figure 3: Comparison of household resource endowment**

For example, if we imagine a household that owns land suitable for cropping, we would look at how much land the household owns (quantity) as well as whether the soil is fertile or marginal (quality). However we also have to consider the range of resources a household has access to. The idea here is that the more diverse the resource base, the less dependent the household will be on only one resource, and the less risk there is should one resource fail or become unavailable. In this manner we are able to compare the resource endowments of different households (Figure 3).

### Risk

Depending on the resource endowment of a household and subsequent livelihood strategy, there will be different levels of risk to income and food security by making changes to livelihood activities / strategies (or not making changes).

The influence of risk and household perceptions of risk in decisions regarding farming system change has long been acknowledged, yet remains poorly captured, largely due to difficulties in measuring a judgement made intuitively, through ‘quick and emotional unconscious thought’ (Greiner et al. 2009, 89).

Analysis of risk by households entails both the perception of risk (subjective statement) as well as the attitude to risk (the extent to which risk is tolerated) (Ogustov et al 2008). That is, while a household may have a range of options based on their resources, how certain decisions may expose or protect against risk, and the extent to which households are comfortable to expose themselves to risk, shape what options are eventually considered as viable alternatives.

<sup>3</sup> It is important to consider the broader cultural setting in which resource access and use is determined. Local institutions and cultural norms for example, may constrain access or use of resources by some people, or set the bounds of what is considered possible or desirable in terms of particular livelihoods.

At the broad level of the framework, it is difficult to deal directly with subjective risk as perceived by the household due to the highly personal and often unconscious determinations by different households. Good knowledge of local culture and an assessment of possible risks involved drawn from statements of household members will support interpretation of household decisions.

While there are many ways in which risk can be interpreted (risk to food or income security, cultural risk in terms of deviating from accepted norms) we have focused on risk to household food security and income. In particular risks may take the form of:

- risks of not adapting (failure of current livelihood strategies)
- risks of adaptation options failing<sup>4</sup>

For example, if we look at Household 1 in Figure 3, we could say that it potentially has good access to a large quantity of resources in a diverse portfolio (rice production, livestock, paid work, kiosk income). It is then reasonable to assume that a change to one aspect of their livelihood portfolio (e.g. rice farming) is not overly risky, because there are enough resources to compensate should the proposed change fail to result in improvements.

Alternatively, if we look at Household 2 in Figure 3, which engages in a single productive activity (ie. rice production). Not only is it less diversified than Household 1 but the transaction cost to change the system is higher – and there are higher levels of risk associated with such change. If the system change fails the household may end up not being able to meet subsistence needs. Such a technical *lock-in* makes it difficult for highly specialised household to engage in system changes even though they might face ever-increasing inputs and declining yields.

In the example of Household 2 a risk in not changing the system may be perceived by the members of the household. Whether perceived or not, path dependency of high transaction costs and risk may force the household to remain on its pathway of unsustainable production.

If a household has a small number of low quality resources, and the household is dependant on only these, then we could interpret risk in two ways—either that they are just scraping by and ensuring livelihoods, so changes are high risk—or that the security offered by such resources is so low, that a change to the system may be considered less risky than continuing in the same way (a ‘what do I have to lose?’ mentality).

### *Potential for Adaptation*

The understanding of a household’s resource endowment, perceived risks and livelihood strategies allow us to assess its potential for adaptation.

Regardless of what we observe, a household will make its own assessment of necessity to adapt to climate change based on an evaluation of pressing threats to its current livelihood (Grothmann and Patt 2005). While an objective assessment may indicate what a household *could* do we assume that the perceived adaptive capacity (self assessment) is often lower than external assessments (*ibid.*).

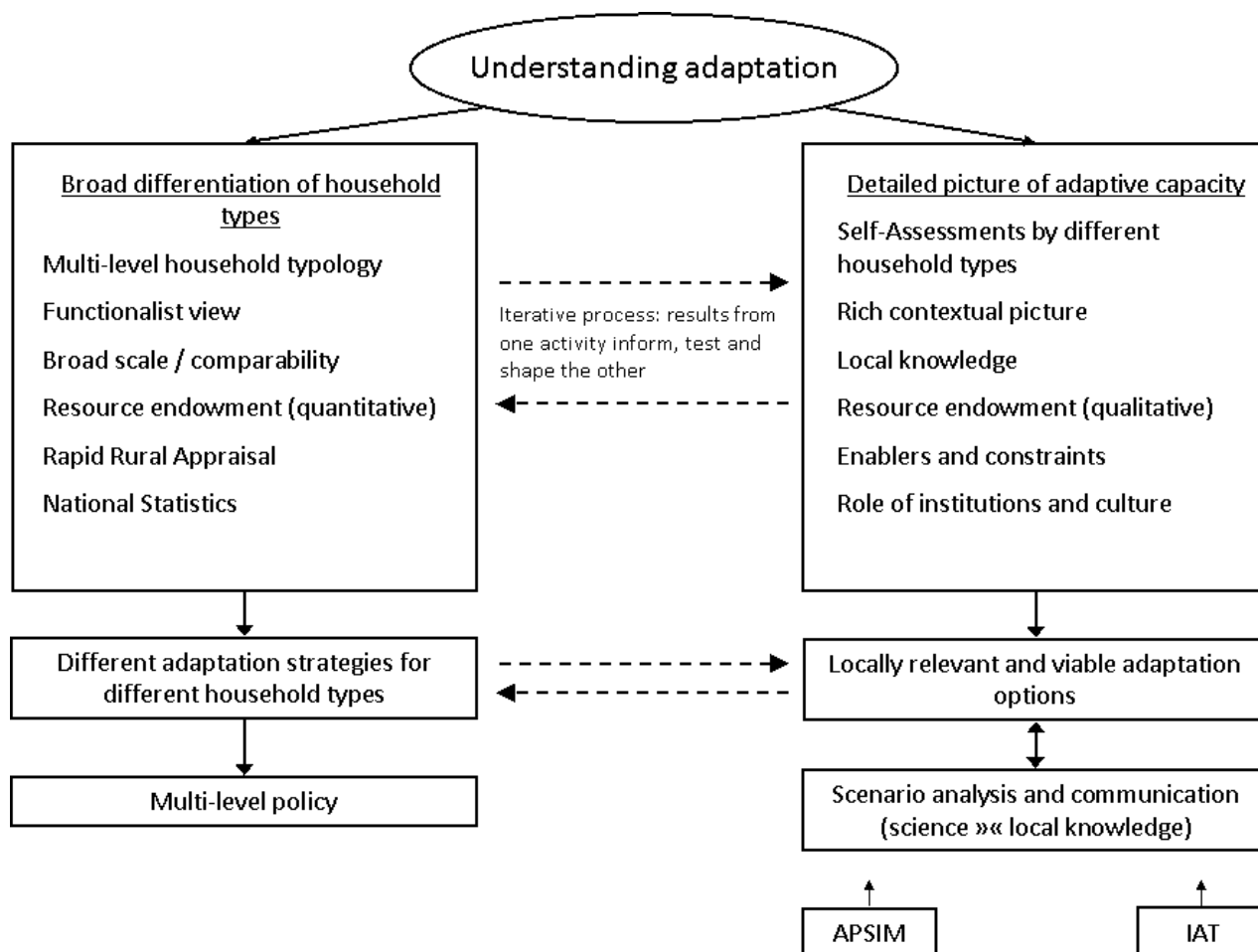
---

<sup>4</sup> Note that we refer to *perceived* risks because only those are taken into account when decisions are evaluated by households. “Objective” risks – whether such a thing exists or not – are not taken into account in decisions if not perceived by the respective household (cf. Douglas and Wildavsky 1983).

# Methods

The framework described above provides a theoretical structure for research into climate adaptation. It is best understood as a frame that guides our articulation, understanding and analysis of research questions and data. In the following sections of this document, we will outline the two approaches: (1) household typologies and (2) self-assessments of adaptive capacity.

The features of and relationship between the household typology development and adaptive capacity assessment are presented in Figure 4.



**Figure 4: Social science research components, aim and relationship to broader project**

The two sides of Figure 4 observe an identical phenomenon from different angles by asking different questions. The left side attempts to categorise livelihoods and describe them by using comparable indicators; the right side provides local context in order to understand adaptations options and resource limitations as perceived by the household. The latter will inform us on the decision space of the household while the former will provide a characterisation of the household economy.

## Household typology

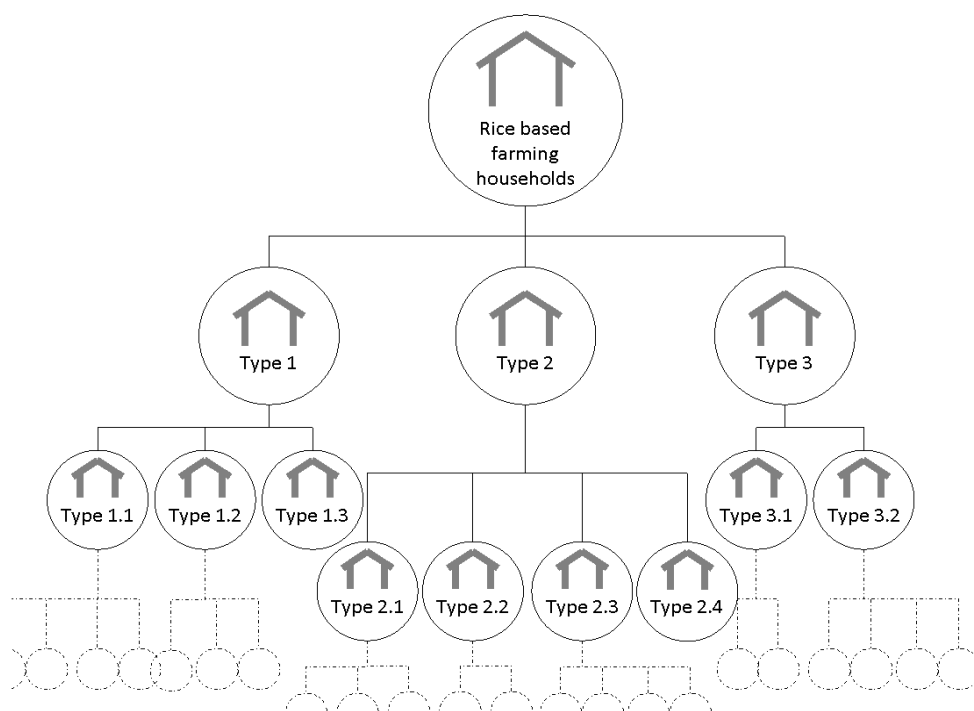
The use of typologies as a mechanism to assist in the targeting of policies, interventions and adoption of technologies is widespread, and well established (Kostrowicki 1977; Rajkomar et al. 1996; Cramb et al. 2004; Senthilkumar et al. 2009; Tittonell et al. 2010). The types defined in this project will be focused on farm systems, but in the context of the broader livelihood portfolio, social and cultural systems in which households live. It is important to recognise that farming is one of several livelihood options for farmers

and that farmers tend to weigh their options according to what they perceive as being most beneficial to them, which may be based on different values, norms and priorities than those of external researchers.

The household typology has two functions. The first is to clearly identify households with different resources, livelihood portfolios, and therefore different options and potential for adaptation. The second function is as a mechanism or tool to scale up from farm and community level findings to support policy development at provincial or district levels.

The typology structure varies between country case studies and was generated through an iterative process, with the initial aim of building a hierarchy or multi-level typology (Figure 5). At the highest level, we consider our target group, i.e., rice-based farming households as the focus of the typology.<sup>5</sup> We aim at identifying key characteristics of drivers that differentiate between these households to different levels of detail.

Higher level types will present a picture of households that is highly stylised and abstracted, however as we move down the levels, we see an increasingly rich and complex picture based on field data as the differentiations become more nuanced. For example, in Figure 5, the critical difference between type 1, 2 and 3 may be access to water (fully irrigated, limited supplementary irrigation or rain-fed) or land type (forest paddy, plain or mixed). At the level of types 1.1, 1.2 and so on, considerations of land size, labour availability and other social, economic or biophysical factors will be included as appropriate. In identifying the critical difference between types, we look for the key variables that determine rice farming options and the surrounding livelihood portfolio.



**Figure 5: Example of possible typology structure. Different levels in the typology represent different levels of detail.**

The highest level types set the frame for adaptation options. In the earlier example of water access, it is easy to imagine distinctly different priorities for adaptation between households with and without

<sup>5</sup> The focus of the research is on rice-farming households; however, for a majority of households, rice farming is only one part of their livelihood portfolio.

irrigation. At the lower level types, we can see or test in more detail how different options may affect or be feasible for different types of households (for example, with different access to sources of labour or alternative income sources). In this way we hope to ensure the adaptation strategies proposed are relevant, viable and realistic in the eyes of the households we hope will use them, while providing policy makers with clear guidance on how to support adaptation tailored to the specific needs of different households.

Data to inform the typology was sourced from secondary data (ie. village and district statistics) as well as household surveys or focus groups in case study villages. Methods used to generate the types were agreed with research partners in each country, considering of data availability and disciplinary expertise in each country. For example, in Cambodia, the process built on existing participatory rural appraisal planning processes used by the Department of Agricultural Extension. However in Laos, where no such process exists, a combination of household surveys and focus group discussions was used.

There are two things to keep in mind here. First this is an example of how the typology may be structured—it is likely to be far more complex than the diagram suggests. While broadly similar, defining variables in each country are slightly different to reflect the unique cultural contexts.

Second, the typology will show a snapshot in time of the household situation. Through time (days, weeks, seasons) the resources that households have access to varies. While we can only provide a picture in time, households themselves will not sit statically in any one type, instead they are likely to shift between, and perhaps outside of our types altogether.<sup>6</sup> The boundaries between types are also likely to be blurred—that is, there will be characteristics or adaptation options that are common among certain types.

The typology of rice farming households provides a picture of resource endowment for different households. To understand what different levels and combinations of resource endowment actually means for households, a self-assessment of adaptive capacity will be used.

#### *Self-assessment of Adaptive Capacity<sup>7</sup>*

This method draws heavily on the Sustainable Livelihoods Framework, outlined by (Ellis 2000) to understand how and why people adapt to climate change and variability. In contrast to the typologies, which quantify different resources available, this method investigates the household's perspective on their available resources and how these resources help or hinder their ability to adapt to different circumstances. This is important to ensure the adaptation strategies that are being tested in the agronomic section of the project are going to be relevant, viable and valuable to farming households.

The self assessments are conducted in focus group discussions with farmers in each village. Each focus group was conducted based on an initial definition of the household types structured by land size.

The general aims of the self-assessments were to identify:

- What resources or drivers support, and what resources or drivers limit, a household or community's ability to respond to different circumstances?
- Which areas need to be targeted to improve adaptive capacity (e.g. is it a higher priority to focus on infrastructure (physical) or education (human)?)
- What actions could be taken to improve adaptive capacity? By whom?

This is achieved through a focus group discussion, which covers the following key areas in the same process:

- Historical events and changes and how/what adaptations have been made;
- Definition of indicators workshop participations feel are important markers of their ability to respond to climate variability (for each type of capital: human, physical, financial, social and natural);

---

<sup>6</sup> For example, if household members migrate to cities to engage in factory or construction labour, or chose to leave agriculture all together.

<sup>7</sup> This method has been used in Australia and piloted in India and Bangladesh, for a more comprehensive account, see Brown et al (2010) and Reddy et al (2010)

- Current state of each indicator for the group (see Figure 6);
- Identification of collective actions to address current limitations to adaptive capacity.

Focus group discussions were followed up with in-depth household interviews which examined livelihood decisions, coping and adaptation strategies in more detail.

The key finding that the assessments reveal is the locally perceived possibility for change. Participants in the focus group discussions discuss the resources and assets that they feel are necessary to manage their farms for change and secure their livelihoods. This may or may not match the perceptions of local extension workers or policy makers. Where perceptions of different groups (e.g. farmers and policy makers) do not match, it may indicate alternative approaches are necessary to support adaptation.

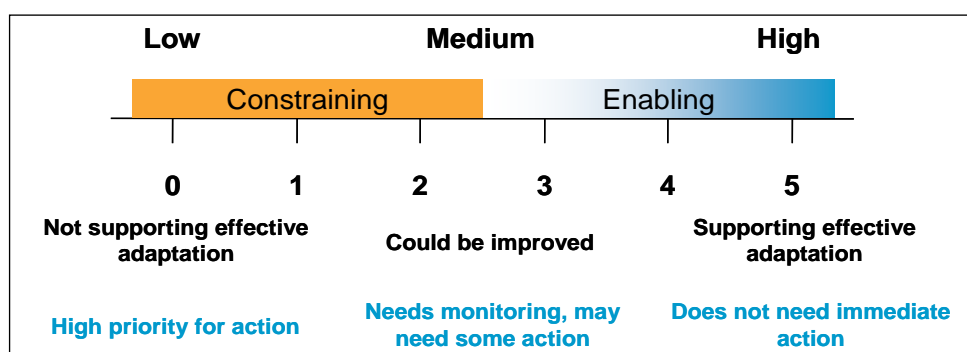


Figure 6: Example of scale used in workshop to value indicators

This information informs and guides the design of adaptation options. There is a significant possibility that many priorities or actions for supporting adaptation are not directly related to farm management and therefore out of direct scope of the options being explored as part of the project (i.e. farm management) (Reddy et al. 2010). However, this information remains important in the broader policy context of supporting adaptation – e.g. if actions related to needs for improved information, training or farmer collectives, this relates to how appropriate strategies should be delivered/promoted to households.

It is important to note, however, that the workshops are locally specific. That is, it is difficult to compare the experiences and needs reflected in one village with a different workshop in the same village, or in a different village. Not only are the issues and priorities for action likely to be different, but the perceptions of where different indicators sit on a scale of action are also likely to be different.

#### Linking the typology and self assessments

As illustrated in Figure 4, the typology and self assessment workshops represent two approaches to answering the same questions relating to household adaptation and ability to adapt to climate variability. The self assessment workshops approach the question from an inherently local and highly contextualised angle, while the typologies take a more abstracted, broad scale approach.

The ultimate goal of the household typology is a description of different types of households that is simultaneously locally relevant (to the extent that farmers can relate their own livelihood conditions to one type) and regionally relevant (that is, types can be extrapolated to similar geographical areas). This cannot be achieved without the use of adaptive capacity self assessments—without which the types would remain a quantitative measurement, removed from local meaning.

A coarse definition of the typology forms the basis of a stratified sampling strategy for the adaptive capacity self assessments. In this way the workshops test and compare if the conceptualisation of the typologies is relevant and compare the extent to which different types have different adaptive capacity. These insights as well as the rich descriptions and household perceptions underpin a revision and further articulation of the household typology. For example, while household surveys may suggest particular patterns of resource access and livelihood strategy, qualitative data from the self-assessment workshops will provide insight into the relationship between resources and livelihood strategies, as well as feasible options for change.



The aim of linking the self assessments with the typologies is to be able to go beyond the local scale and make statements on regions and nations without losing the relation to household decision making. At the same time we have to take into account emerging properties and supra-local drivers that may arise as we move up the scales. As scales we define administrative units of respective countries, e.g. communes, districts, provinces, regions, etc. We assume that national statistics are collected along those same scales and the household types can be related to variables found in the official statistics reports.

This research is designed to link in with farm-level scenarios using crop models and on-farm trials. Ideally, such scenarios relate to an individual household type and are thus relevant to farmers that identify with such a type. In this way we can produce options for groups of farmers without having to develop individualised solutions but keeping them relevant to the end users concerned.

By describing the household types using quantifiable variables and relating those to available statistics, the research will support the communication of adaptation options to policy makers. When abstracted from the local context the types make sense to regional planning processes and provide relevant information to those familiar with thinking in terms of a simplified set of abstract variables.

Note that this method has been suggested in the literature but has not, to our knowledge, been applied to climate adaptation (c.f., Giampietro 2004). The proposition for the method is based on current trends in cross-scale multi-criteria analysis. However, when used in the particular context of such research we need to brace for adaptations and innovations to suit our purposes.

## Closing remarks

In presenting an approach to adaptive capacity that has the potential to bridge across scales, the framework defined in this paper seeks to redress some of the key limitations confronting communities, policy makers and researchers in climate change research. At the same time, we have sought to cast a broad net around concepts of adaptive capacity, which recognise the broader context of household livelihood security and the multi-faceted nature of adaptation. In this context, it is important to recognise that adaptation options will be as varied as the households they seek to target.

## References

- Adger, W., S. Dessai, M. Goulden, M. Hulme, I. Lorenzoni, D. Nelson, L. Naess, J. Wolf and A. Wreford (2009). "Are there social limits to adaptation to climate change?" *Climatic Change* **93**(3): 335-354
- Adger, N.W., Agrawala, S., Mirza, M., Conde, C., O'Brien, K., Pulhin, R., Pulwarty, R., Smit, B. and Takahashi, K. (2007). Assessment of adaptation practices, options, constraints and capacity. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden and C. E. Hanson. Cambridge, UK, Cambridge University Press: 717-743.
- Berkes, F., J. Colding, C. Folke (2003). *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Cambridge Uni.Pr.: Cambridge
- Bhandari, B. S. and M. Grant (2007). "Analysis of livelihood security: A case study in the Kali-Khola watershed of Nepal." *Journal of Environmental Management* **85**(1): 17-26.
- Bouahom, B., L. Douangsavanh and J. Rigg (2004). "Building sustainable livelihoods in Laos: untangling farm from non-farm, progress from distress." *Geoforum* **35**(5): 607-619.
- Brown, P.R., Nelson, R., Jacobs, B., Kokic, P., Tracey, J., Ahmed, M. and DeVoil, P. (2010). "Enabling natural resource managers to self assess their adaptive capacity." *Agricultural Systems* **103**: 562-568.
- Cramb, R. A., T. Purcell and T. C. S. Ho (2004). "Participatory assessment of rural livelihoods in the Central Highlands of Vietnam." *Agricultural Systems* **81**(3): 255-272.
- Crate, S.A., M. Nutall (2009). "Introduction: Anthropology and Climate Change" in: S.A. Crate and M. Nutall "Anthropology and Climate Change. From Encounters to Actions" Left Coast Pr.: Walnut Creek, p9-36
- Crate, S.A. (2009). "Gone the Bull of Winter? Contemplating Climate Change's Cultural Implications in Northeastern Siberia, Russia" in: S.A. Crate and M. Nutall "Anthropology and Climate Change. From Encounters to Actions" Left Coast Pr.: Walnut Creek, p139-152
- Douglas, M and A. Wildavsky (1983). "Risk and culture: an essay on the selection of technical and environmental dangers" University of California Press.
- Ellis, F. (2000). *Rural livelihoods and diversity in developing countries*, Oxford University Press.
- Funtowicz S, and Ravetz JR 1993: "Science for the Post-Normal Age", *Futures* 25:735-755.
- Giampietro, M. (2004). *Multi-scale integrated analysis of agroecosystems*. Florida, CRC Press.
- Grothmann, T. and A. Patt (2005). "Adaptive capacity and human cognition: The process of individual adaptation to climate change." *Global Environmental Change Part A* **15**(3): 199-213.
- Head, L. (2009). "Cultural ecology: adaptation - retrofitting a concept?" *Progress in Human Geography* **34**(2): 234-242.
- Keating BA, Carberry, PC, Hammer, GL, Probert, ME, Robertson, MJ, Holzworth, D, Huth, NI, Hargreaves, JNG, Meinke, H, Hochman, Z, McLean, G, Verburg, K, Snow, V, Dimes, JP, Silburn, M, Wang, E, Brown, S, Bristow, KL, Asseng, S, Chapman, S, McCown, RL, Freebairn, DM and Smith, CJ. 2003. An overview of APSIM, a model designed for farming systems simulation. *European Journal of Agronomy*. 18: 267-288.
- Kelly, P. M. and N. W. Adger (2000). "Theory and practice in assessing vulnerability to climate change and facilitating adaptation." *Climatic Change* **47**(47): 325-352.
- Kostrowicki, J. (1977). "Agricultural typology concept and method." *Agricultural Systems* **2**(1): 33-45.

- Lisson, SN, MacLeod, ND, McDonald, CK, Corfield, JP, Pengelly, BC, Wirajaswadi, L, Rahman, R, Bahar, S, Padjung, R, Razak, N, Puspadi, K, Dahlanuddin, Sutaryono, Y, Saenong, S, Panjaitan, T, Hadiawati, L, Ash, A and Brennan, L. 2010. A participatory, farming systems research approach to improving Bali cattle production in the smallholder crop-livestock systems of Eastern Indonesia. *Agricultural Systems*. 103: 486-497.
- Magistro, J., C. Roncoli (2001) "Anthropological perspectives and policy implications of climate change research" *Climate Research* 19(2): 91-96.
- Marra, M., D. J. Pannell and A. Abadi Ghadim (2003). "The economics of risk, uncertainty and learning in the adoption of new agricultural technologies: where are we on the learning curve?" *Agricultural Systems* 75(2-3): 215-234.
- Netting, R. M. (1993). *Smallholders, householders: Farm families and the ecology of intensive, sustainable agriculture*. Stanford University Press.
- Norgaard R.B. (1994). *Development Betrayed: The End of Progress and a Coevolutionary Revisioning of the Future*. Routledge, New York.
- Ogurtsov, V. A., M. P. A. M. Van Asseldonk and R. B. M. Huirne (2008). "Assessing and modelling catastrophic risk perceptions and attitudes in agriculture: a review." *NJAS - Wageningen Journal of Life Sciences* 56(1-2): 39-58.
- Rajkomar, B., P. B. Berthelot, K. Mundil and N. Govinden (1996). "Agriculture in Rodrigues. III: typology of farmers." *Revue Agricole et Sucriere de l'île Maurice* 75(3): 15-21.
- Rammel, C., F. Hinterberger, U. Bechtold (2004). *Governing Sustainable Development. A co-evolutionary perspective on transitions and change*. GoSD Working Paper 1, <www.gosd.net>
- Reddy, V.R., Brown, P.R., Bandi, M., Chiranjeevi, T., Reddy, R.R. and Roth, C.R. (2010) *Adapting to climate variability in semi-arid regions: A study using sustainable livelihoods framework*. Hyderabad, Livelihoods and Natural Resource Management Institute.
- Roth, C. H., P. R. Brown, C. M. Grünbühel, L. J. Williams, N. D. MacLeod, M. van Wensveen and Z. Hochman (2010). An integration framework for social research and farming systems modelling to co-develop farmer-verified adaptation strategies in the context of climate change. *Advanced technologies of rice production for coping with climate change: 'no regret' options for adaptation and mitigation and their potential uptake*. R. Wassman. Los Baños, Philippines, International Rice Research Institute.
- Rotmans, J., R. Kemp, M. van Asselt (2001). More evolution than revolution. Transition management in public policy. *Forsight* 3(1): 15-31
- Sabates-Wheeler, R., T. Mitchell and F. Ellis (2008). "Avoiding Repetition: Time for CBA to Engage with the Livelihoods Literature?" *IDS Bulletin* 39(4): 53-59.
- Senthilkumar, K., P. S. Bindraban, W. de Boer, N. de Ridder, T. M. Thiyagarajan and K. E. Giller (2009). "Characterising rice-based farming systems to identify opportunities for adopting water efficient cultivation methods in Tamil Nadu, India." *Agricultural Water Management* 96(12): 1851-1860.
- Steward, J.H. (1972) *Theory of culture change: a methodology of multilineal evolution*, University of Illinois
- Smit, B, O. Pilifosova, I. Burton, B. Challenger, S. Huq, R.J.T. Klein, G. Yohe, N. Adger, T. Downing, E. Harvey, S. Kane, M. Parry, M. Skinner, J. Smith, J. Wandel (2001). "Adaptation to Climate Change in the Context of Sustainable Development and Equity" in: JJ. McCarthy, O.F. Canziani, N.A. Leary, D.J. Dokken, K.S. White (eds.) *Climate Change 2001: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge Univ. Pr: Cambridge: 877-912
- Tittonell, P., A. Muriuki, K. D. Shepherd, D. Mugendi, K. C. Kaizzi, J. Okeyo, L. Verchot, R. Coe and B. Vanlauwe (2010). "The diversity of rural livelihoods and their influence on soil fertility in agricultural systems of East Africa - A typology of smallholder farms." *Agricultural Systems* 103(2): 83-97.



#### CONTACT US

**t** 1300 363 400  
+61 3 9545 2176  
**e** [enquiries@csiro.au](mailto:enquiries@csiro.au)  
**w** [www.csiro.au](http://www.csiro.au)

#### YOUR CSIRO

Australia is founding its future on science and innovation. Its national science agency, CSIRO, is a powerhouse of ideas, technologies and skills for building prosperity, growth, health and sustainability. It serves governments, industries, business and communities across the nation.

#### FOR FURTHER INFORMATION

**CSIRO Ecosystem Sciences**  
Liana Williams  
**t** +61 7 3833 5748  
**e** [liana.williams@csiro.au](mailto:liana.williams@csiro.au)  
**w** [www.csiro.au/ca](http://www.csiro.au/ca)