

How do farmers respond to climate change risk?¹

Headlines: This brief outlines the findings and policy implications of research projects on the livelihood adaptation of farmers in China and Uganda to climate risk. Farmers perceived a change in their local climate. They had changed farming practices to cope with climate risk, partly with the support of Government agricultural extension services. A strong institutional environment to support adaptation with a focus on farmer-led participation over vertical multi-scales was important. Adaptation policy should be mainstreamed into other policy agendas and should incorporate farmers' livelihood priorities and their adaptive capacity to avoid mal-adaptation and to reduce risks from climate change.

Implications for policy

- 1) It is important to **account for farmers' perceptions of climate risks when developing adaptation policy**. Farmers' perception of climate risk affects their livelihood choices and is influenced by their access to capital assets. Ignoring farmers' views will result in misguided, ineffectual policy outcomes.
- 2) **Mainstreaming adaptation policy into other government policies** such as economic and social policies, not only those directly related to the environment and development. Risk from the climate was not perceived by farmers as the greatest source of vulnerability to their livelihoods, probably because of the complex nature of direct and indirect impacts of climate change which will affect countries and their livelihood systems. Mainstreaming adaptation policy will reduce the possibility of mal-adaptation and improve institutional responses to change.
- 3) **Farmers have a significant capacity to adapt to changing weather patterns** and circumstances and policy needs to reflect this. This capacity varies between individuals, households and communities, thus adaptation policy needs to account for these inequalities using novel ways to promote farmer participation and accountability within

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the system. Failure to do so will result in farmers becoming increasingly marginalised and their adaptive capacity being reduced.

4) A strong institutional environment is vital to support adaptation, therefore:

- i. Adaptation policy and government services should acknowledge the importance of informal platforms of knowledge transfer and livelihood learning in reaching more marginal farmers. Many farmers do not have the resources or social status to access formal organisations or government services and rely on informal means of communication to obtain livelihood information.
- ii. Farmers, particularly those with strong leadership skills and the ability to stimulate learning and self-organisation in their communities, need to be included in and involved with the policy of adaptation. Farmers with these capabilities are able to motivate and inspire adaptive behaviour in other members of their communities, resulting in more effective adaptation.
- iii. Vertical multi-scale communication of knowledge from farmers at the local scale must improve for this knowledge to be incorporated into policy at the national scale. Farmers' needs at lower scales will otherwise not be reflected in policy, which itself will be less flexible to deal with the changes presented by the climate and other circumstances.
- iv. Integration and trust between government departments must improve to enhance communication and the ability to coordinate policy objectives. This will reduce priority conflicts and improve the coordination and outcomes of policy objectives.

Background

There is little disputing the urgency needed to act in the face of climate change. The risks from leaving this phenomenon unmanaged are projected to be immense and will have significant unforeseen consequences [1, 7]. Changes in temperature and rainfall are highly probable and of significant concern are the adverse changes and effects on our life support systems, such as the availability of freshwater, food supply systems, biodiversity, natural ecosystems and consequences on our health and social systems [7]. With mounting evidence supporting the inevitability of climate change, the need to adapt has become imperative [4, 11].

The Intergovernmental Panel on Climate Change (IPCC) define adaptation as: “the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effect, which moderates harm or exploits beneficial opportunities” [5].

The extent and pervasive nature of climate change will result in every system having to adapt to some degree [10]. Adaptations can contextually differ according to such factors as: action, actors of interest, scale, social sector and cost and ease of implementation [9]. The capacity to adapt may also differ between individuals, societies, countries etc. according to

factors such as resource availability, cognitive perceptions and behaviour, access to technological options, institutional capacity and approaches to risk, resulting in some being more vulnerable than others [2].

Agriculture is extremely vulnerable to climate change due to its dependence on natural resources. This has increased significance for those countries in which it is the dominant economic activity [6, 11, 13]. Increases in temperature and rainfall variability and extreme events will have adverse effects on both crop and livestock production, and are set to have far-reaching implications for the food, water and livelihood security of rural-dependent populations [11, 14].

Effective adaptation is dependent on current research into how farmers presently respond to climate risk. Studies show farmers have developed many innovative responses and strategies to adapt to difficult, marginal environmental conditions and research into these actions provide insight for adaptation policy and how adaptation could potentially manifest [3]. This policy brief identifies key processes and strategies which may have implications for the adaptation process in both countries.



The Case Studies



China	Uganda
Study site: Fengtai County, Anhui Province	Study site: Mbarara District
<p>Livelihoods: Agriculture predominant. Annual cycles of winter wheat followed by summer rice. Limited sorghum, sweet potato, soya bean. Farmers investing in greenhouses for vegetables. Also mushrooms and tree-planting for fruit.</p> <p>Climate:</p> <ul style="list-style-type: none"> • Irrigation widely available but limited in some areas • Experienced increased warming in winters since 1960s • Random and infrequent drought and heavy rainfall events experienced. 	<p>Livelihoods: Rural-subsistence, rain-fed agriculture. Perennial banana-coffee system with many farmers also planting annual crops and keeping livestock.</p> <p>Climate:</p> <ul style="list-style-type: none"> • Increase of temperature by 0.3°C per decade since 1961 [8] • Data does not indicate any change in rainfall trends but demonstrates significant intra-annual variability • Farmers report frequent extreme events such as heavy rainfall events and drought.

Research Findings

1) Farmers do not perceive the climate as being the biggest risk and livelihood decisions may be based on other drivers of vulnerability.

Both studies assessed the perceived vulnerability of farmers to risk from the climate. Farmers in both case studies recognised they were vulnerable to unfavourable weather conditions but farmers in China perceived issues relating to the irrigation structure, such as its extent, quality and efficiency, the cost of agricultural inputs (seeds, fertiliser, pesticides, fuel), the need for new pesticides and more effective pest control and advice on livestock maintenance as being of more concern than the climate itself or climate change.

This was also evident with Ugandan farmers who were more concerned with lack of income, land and clean, available water. Farmers in both case studies had experienced changes in the weather patterns. Farmers in China did not perceive 'global climate change' as being related to these changes, despite increased exposure to television. Many farmers in Uganda had a 'localised' perception on climate change (i.e. blaming local deforestation) concerning perceived changes in local climate.

Therefore, adaptation should be mainstreamed into other policy agendas to account for other drivers of vulnerability.

2) Farmers do have the capacity to change but this capacity and their perception of risk is affected by socio-economic factors and access to formal institutions

Ugandan farmers perceived changes in rainfall (increased variability and extreme events, decreased amount) and increased temperatures, but these perceptions did not match regional climate data, except for the perceived increase in temperature. Perception was influenced by factors determining the access and assimilation of knowledge, such as education, gender, contact with government extension services and age.

Perception of risk from a specific event was influenced by wealth, with wealthier farmers more likely to perceive drought than more marginal farmers, who were more likely to perceive extreme heavy rainfall events as a threat.

Farmers in both case studies demonstrated the ability to make changes to their livelihoods in response to changes in the climate. In China, farmers responded to greater numbers of pests in the spring (brought on by warmer winters and the susceptibility of their wheat crop to sudden cold spells in late spring) by adjusting seed rates and by sowing up to two weeks later in October than normal. In Uganda, farmers had improved their livelihood resilience to unfavourable weather conditions by storing food, maintaining livestock, investing in micro-credit schemes and strategic planting to cope with changeable seasons.

Factors influencing wealth, such as assets, income, off-farm employment, involvement with formal institutions such as agricultural extension, age, gender, household size and education all influenced their capacity to respond.

Therefore, these findings support the need to account for farmers' perception of climate risk when developing adaptation policy as they could result in misguided, ineffectual policy outcomes. They also highlight a need to counter inequality by using novel ways to promote farmer participation and accountability within the system.

3) Interaction of farmers with formal institutions such as government extension services was integral for farmers to communicate and receive knowledge and technological inputs to assist adaptation in their livelihoods.

In both case studies, farmers were most likely to ask the government extension services (or for Uganda the extension scheme) when seeking advice about their livelihoods. Farmers had

also benefited from technological inputs and regular training. In China, the increased prevalence of mobile phones among farmers had improved access to information from the extension services. In Uganda, the dissemination of information between farmers participating in extension and those not participating was important in transferring knowledge. Informal platforms such as the church, traditional ceremonies (weddings, burials, etc.) and village-level community meetings were important in this process.

Therefore, the institutional environment needs strengthening to support adaptation by i) communicating information through informal, as well as more formal, channels, ii) supporting strong leadership and self-organisation, iii) strengthening vertical communication channels from local to national scales and iv) improving communication and relations between government departments and other stakeholders.

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