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Developing local adaptation strategies for climate change in agriculture: A priority-setting approach with application to Latin America

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ABSTRACT

Even with substantially increased attention to climate adaptation in developing countries in recent years, there are a number of important remaining research needs: better incorporating stakeholder input; using replicable methodologies to provide comparability across different settings; assuring that stakeholder input reflects the results of climate science, not simply perceptions; and effectively linking stakeholder input with the regional and national levels at which policy changes are made. This study reports the results of a methodology for identifying and prioritizing local, stakeholder-driven response options to climate change in agriculture. The approach is based on multi-criteria scoring methods previously applied to research planning and priority-setting in agricultural and natural resource management research, public health, and other areas. The methodology is a sequential approach built around needs assessments by local stakeholders; the incorporation of climate science results; the sharing of these results and climate adaption response options with stakeholders at a series of workshops; stakeholder priority-setting exercises using multi-criteria scoring; and validation with policymakers. The application is to three diverse agroecosystems in Mexico, Peru and Uruguay. Among the many findings is that, notwithstanding the wide diversity of agro-ecosystems, there are numerous similarities in the agricultural adaptation responses prioritized by local stakeholders.

1. Introduction

Climate adaptation practices, programs and policies have assumed an increasingly prominent place on the agenda of policymakers and practitioners in recent years (Pielke et al., 2007; Adger et al., 2009; Nelson et al., 2009; Evans et al., 2014; IPCC, 2014). No sector has more at stake with regard to successful adaptation strategies than does agriculture, as do the many rural households and communities that depend on it. Agriculture is inherently tied to the underlying climate and natural resource base which supports it, thus the many sources of climatic change and environmental vulnerability have a direct impact on agricultural productivity and its future potential. Moreover, agriculture is the principal livelihood of most of the world's poor (World Resources Institute, 2005; FAO, 2006), making them especially vulnerable to climate change. For the rural poor – many of whose livelihoods are already precarious – maintaining a viable, productive agricultural sector resilient to climatic changes is crucial to rural poverty alleviation (World Bank, 2007). Finally, "good development policy is good adaptation policy" (de la Torre et al., 2009). This is true at many levels. There is great scope for reducing the adverse impacts of climate change with informed, fully implemented adaptation strategies (Mendelsohn and Dinar, 1999; Moser and Boykoff, 2013; IPCC, 2014). This is not only true at the local level where climatic change directly affects farmers and households; given the many spatial and intertemporal externalities that are involved with

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climate change, institutional coordination and collaboration is critical to generating more efficient and sustainable outcomes that would otherwise result from unilateral actions. And in areas where public goods are involved – assuring adequate water supplies, reducing air and water pollution, maintaining climatic regulatory processes – the public sector has a critical role to play.

Policy and institutional changes to address climate change are commonly formulated at the national and international levels, where formal collective action is required and where regulatory and legal frameworks are frequently available. Particularly for climate mitigation efforts, national-level policies are necessary and inevitable. However, as emphasized in numerous recent wide-ranging assessments, the impacts of climate change in agriculture are location- and context-specific (Christensen et al., 2007; World Bank, 2008; Padgham, 2009; Verner, 2010). Accordingly, successful adaptation responses to climate change must respond to distinct local and regional needs, vulnerabilities, copying strategies and adaptive capacities (Lobo, 2011; UNDP-UNEP, 2011). Ultimately, it is the individual farmers, households and resource managers operating at the micro-level who make most of the key land use and resource allocation decisions to adapt to the threats and opportunities posed by a changing climate. Thus, it is imperative that the views and priorities of the local stakeholders who significantly influence land, water and other resource use decisions be considered in formulating adaptation responses. These perspectives are frequently given inadequate attention at the national policymaking level where climate change policies are developed.

This study reports the results of a priority-setting methodology for identifying and prioritizing local, stakeholder-driven response options to climate change in agriculture. The approach employs a participatory priority-setting framework previously developed for use in areas such as agricultural research and public health interventions, here modified to deal with climate adaptation. The priority response options that result form the basis of local Action Plans that can be used to address agricultural adaptations to climate change. The applications are to three highly diverse regional agroecoystems in Mexico, Peru and Uruguay. The study has three major objectives. The first is to adapt a methodology for assessing agricultural vulnerability to climate change and for formulating response strategies to inform private and public sector decisions in the Latin America region. The pilot methodology translates local knowledge about weather variability, expected climate changes and agricultural systems into a coherent framework for local and regional decision-making. The second objective is to formulate preliminary recommendations for investments in the selected agroecosystems in areas such as agricultural technology adaptation, infrastructure investments, public and private sectoral support activities, and institutional and policy changes. The "bottom-up" focus of this research assures that the input of farmers and other local stakeholders is incorporated in the design of adaptation measures from the outset. The final objective is to strengthen the emphasis on action in the formulation of climate adaptation measures in agriculture. The approach developed here can potentially be used by governments and development organizations in helping define response strategies, signing related investment projects, and formulating policy changes.

2. Climate change and agriculture in Latin America

Latin America – and the livelihoods of its people – is likely to be significantly affected by climate change. In agriculture specifically, projected effects include: declining productivity of important crop and livestock systems, with adverse impacts on food security; changes in precipitation patterns and the disappearance of glaciers, in turn affecting water availability for agriculture, human consumption and energy generation; degradation (and loss) of coastal farming systems; and an overall rise in the number of people at risk of hunger (IPCC, 2007; Padgham, 2009). Recent comprehensive studies of climate change impacts on Latin American agriculture by the World Bank (de la Torre et al., 2009; Fernandes et al., 2012) suggest that the sum effects of these impacts are likely to be highly deleterious, including a "precipitous fall" in agricultural productivity in many regions, with resultant adverse – though highly regionally-specific – impacts on GDP and rural poverty (de la Torre et al., 2009).

Coping with climatic variability is nothing new to farmers, who have long made behavioral and management changes in response to changes in precipitation patterns, soil moisture conditions, and growing conditions (FAO, 2007; Adger et al., 2007; Smith and Malik, 2012). To maintain production levels and yields, farmers commonly adjust planting dates, crop varieties, cattle stocking rates and water use, among other factors, in response to short-term climatic variability. In addition to these autonomous adjustments, as climatic changes become more severe and pervasive, long-term planned adaptations will become increasingly important in helping anticipate and minimize the effects of adverse conditions and long-run climate changes (Fankhauser et al., 1999; FAO, 2007; Howden et al., 2007). These longer term adaptations include those directly relevant at the farm level – new technologies and management techniques, increasing efficiency of water use and distribution systems, changes in inputs and practices (fertilizer, tillage methods, irrigation) – but also include wider public investments, policy changes and other strategies for fostering adaptation. While the focus of this study is on agricultural adaptation specifically, climate change is a complex phenomenon, simultaneously incorporating multiple stressors and sources of risk and vulnerability – sometimes in areas that appear peripheral but that ultimately can be critically important (O'Brien et al., 2009). Accordingly, efforts to build broad ecosystem resilience to better cope with climate variability are increasingly viewed as a vital first step toward adapting to future climate challenges (Cooper et al., 2008; World Bank, 2009a; Meybeck et al., 2012).

All three of the countries represented in this study have in recent years made major strides in planning their national responses to climate change (World Bank, 2009c). Mexico released a National Climate Change Strategy (ENACC) in 2007, identifying opportunities for emissions reductions on a voluntary basis and proposed adaptation and mitigation measures for many sectors; a Special Climate Change Program (PECC) followed in 2009. Measures to address climate change were also identified as strategic priorities in Mexico's Agricultural Sector Program 2007–2012 and the National Water Program 2007–2012. Most recently, a General Climate Change Law was passed in 2012 and a revised national strategy the following year (IMCC, 2013). Peru formulated its National Climate Change Strategy (ENCC) in 2003 to develop policies and measures to enhance adaptation capacity; this national strategy was subsequently revised in 2009. Peru's measures built on a 2002 law requiring each region to develop a Regional Climate Change Strategy. The Regional Government of Junín, within which our study site, the Mantaro Valley, is located, was the first in Peru to elaborate such a strategy in 2007. Uruguay formulated a national climate change program, the General Program for Mitigation and Adaptation (PMEGEMA), in 2004, proposing a set of response measures for climate change mitigation and adaptation in key economic sectors, including agriculture, forestry, water resources, fisheries and biodiversity. The Uruguayan National Response Plan to Climate Change (PNRCC) followed in 2010, identifying key sources of climate vulnerability in the country and priority adaptation measures. Notwithstanding these positive developments, there remains much to be done to