Approaches, Methods and Tools for Climate Change Impact, Vulnerability and Adaptation Assessment

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Summary

Over the past two decades, a multitude of studies have been conducted aimed at analysing the possible effects of climate change on a range of natural and social systems, and at identifying and evaluating options to respond to these effects. These studies have highlighted differences in what is termed "vulnerability" to climate change between systems, although without necessarily defining vulnerability. As shown by Füssel and Klein (2004), the use and meaning of the term "vulnerability" within the context of climate change has evolved over time. In the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), vulnerability to climate change was described as "a function of the character, magnitude and rate of climate variation to which a system is exposed, its sensitivity and its adaptive capacity" (McCarthy *et al.*, 2001). Straightforward as this may seem, this conceptualisation of vulnerability appears at odds with those developed and used outside the climate change community.

Two communities with their own well-developed fields of research on vulnerability are the food security community and the natural hazards community. These communities do not rely on global or regional scenarios and models to inform their vulnerability assessments; instead the major source of information is the vulnerable community itself. Studies are typically place-based and consider the rich variety of social, cultural, economic, institutional and other factors that define vulnerability. A second, more fundamental difference with climate change vulnerability assessment is that for the food security and natural hazards communities, vulnerability is a starting point of their analysis, as opposed to an outcome (O'Brien *et al.*, 2004).

It is increasingly argued that many climate change vulnerability studies, whilst effective in alerting policymakers to the possible effects of climate change, have had limited usefulness in providing local-scale guidance on adaptation, and that the climate change community should learn from experiences gained in food security and natural hazards studies. It is clear that climate change, food security and natural hazards are related. In some areas, climate change could threaten food security, whilst in many areas the frequency and intensity of weather-related natural hazards are likely to increase. However, there are also important differences, which make the exchange of methods and tools between different communities less straightforward than is sometimes suggested. They include the relative complexity of the processes that cause vulnerability, the availability of data, uncertainty, and the temporal and spatial scales under consideration (for more information see Ribot, 1995; Dilley and Boudreau, 2001; Downing and Patwardhan, 2004; Patt *et al.*, 2004). This presentation focuses on scale issues, and on the extent to which methods and tools typically recommended for adaptation assessment can in fact support adaptation activities.

Both temporal and spatial scales are relevant when considering differences between the three communities. Differences in the time frame of analysis are reflected in the communities' respective approaches to vulnerability assessment. The natural hazard community is concerned about the event that could occur at any time: tomorrow, next year and within the coming decades. Assessing the vulnerability to natural hazards means examining the system as it exists today, and suggesting changes to that system in order to make it less prone to damage. Thus, the starting

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point for the changes is the system's current design. Planning for food security is not too different, although it does often require some consideration of the trends that may be making people in a given place more vulnerable to famine, such as population growth or the loss of arable land. The analysis begins with the recognition that vulnerability exists today, vulnerability that will not disappear on its own and may indeed be growing, and with the desire to make active interventions to reduce the vulnerability.

In contrast, the starting point for climate change vulnerability assessment has been the recognition that over time, an increase in atmospheric greenhouse gas concentrations could lead to changes in temperature, precipitation and sea level and in the frequency and intensity of extreme events (UNFCCC, 2003). These changes may negatively affect a system during the entire period of change or they may begin to have an effect once they surpass a particular threshold. The issue of uncertainty then becomes crucial, as our understanding of many systems is insufficient to predict accurately the effects of climate change over time. In addition, there is uncertainty regarding future levels of greenhouse gas concentrations and about the rate and magnitude of the ensuing climatic changes. The use of simulation models in combination with multiple climate and socio-economic scenarios can offer insights into what the future may look like and may thus contribute to the development of robust strategies.

However, the value of such models and scenarios decreases with increasing spatial scale. Even the most recent sophisticated scenario-based assessments of impacts and vulnerability, such as ATEAM, ACIA and DINAS-COAST[2], are regional or global in scope. On a local scale, their results may enhance awareness of the need to adapt; yet they provide local decision-makers with little information about the most efficient or effective way to adapt. Such information can only be based on local knowledge, and the development of local knowledge requires different approaches, methods and tools. In addition, regional and global assessments do not provide the level of detail and precision that would allow local decision-makers to assess the relative importance of climate change compared to other, non-climate risks that they face, and thus set priorities for action. Finally, they do not assess the local viability and feasibility of any possible adaptation options. This would require information on the extent to which adaptation options are socially acceptable, compatible with existing policies and institutions, and fit within the cultural context, as well as on the extent to which their implementation would face financial, institutional, technological, human resource or other constraints.

The process of adaptation comprises a number of different activities, carried out by different public and private actors. Most simply put, one can distinguish between facilitating adaptation and implementing adaptation. Facilitating adaptation includes developing information and raising awareness, removing barriers to adaptation, making available financial and other resources for adaptation and otherwise enhancing adaptive capacity. Implementing adaptation includes making the actual changes in operational practices and behaviour, and installing and operating new technologies.

When going from the global to the local level, the responsibility of relevant actors shifts from facilitating adaptation to implementing adaptation. For example, at the international level, the Global Environment Facility provides funding for measures that facilitate adaptation, including the National Adaptation Programmes of Action (NAPAs), which are aimed at setting priorities for adaptation in the least-developed countries. In turn, the NAPAs themselves can be seen as an instrument that could facilitate the implementation of adaptation at the sectoral and local levels. Actors most involved in implementing adaptation include local communities, natural resource managers, farmers, private firms, households, public health workers and so on, although they can also include national governments. Methods and tools for supporting the process of building adaptive capacity at the local level (*i.e.*, facilitating adaptation) are different from the ones used for assessing impacts, vulnerability and adaptation on regional and global scales.

[2] ATEAM: Advanced Terrestrial Ecosystem Analysis and Modelling; ACIA: Arctic Climate Impact Assessment; DINAS-COAST: Dynamic and Interactive Assessment of National, Regional and Global Vulnerability of Coastal Zones to Climate Change and Sea-Level Rise

A dual dilemma then becomes apparent. First, as a result of uncertainty and model resolution, information on future climate change has relatively little value at the local level, where the implementation of most adaptation will take place. Thus, there is a need to complement this type of information with relevant local knowledge. Second, however, the focus of international climate policy has been to facilitate adaptation at the national level, as the UNFCCC mandate and the principle of subsidiarity may preclude fostering the development of methods and tools that consider a broader, non-climate context and thus support the implementation of local adaptation decisions.

The food security and natural hazards communities can be a source of information and inspiration on how to connect global and local scales. However, there are important differences between the issues addressed by these communities on the one hand, and climate change on the other, including the relative complexity of the processes that cause vulnerability, the availability of data, uncertainty, and the temporal and spatial scales under consideration, all of which require further analysis.

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