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Adaptive capacity deficits and adaptive capacity of economic systems in climate change vulnerability assessment ☆

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ABSTRACT

This paper considers two ways that economic concepts inform adaptive capacity assessments within the context of climate change vulnerability analysis. First, using an economics framework, there are rational and logical reasons why different individuals and different organized human systems have different levels of adaptive capacity and these differences do not necessarily correlate to differences in vulnerability. An alternative approach is to determine where there are factors leading to socially inequitable or economically sub-optimal investment in adaptive capacity assets or reduced effectiveness of adaptive capacity assets resulting in adaptive capacity deficits. Factors contributing to adaptive capacity deficits include cases of irrational agent behaviour and cases where there are political, social, and economic system failures. A second way current adaptive capacity constructs can be enhanced is by taking explicit account of the adaptive capacity of economic systems. Economic system properties such as scale, diversity, relative mix of the private and public sectors, innovation, organizational/managerial capital, substitutability of inputs, factor mobility, liquidity of assets, etc. will affect the capacity of economic systems to adapt.

1. Introduction

Climate change has important implications for forests and organized human systems that are associated with forest resources (Williamson et al., 2009). Adaptation has the potential to reduce impacts; however, before adaptation can proceed an understanding of forest sector vulnerabilities is required (Johnston and Williamson, 2007). The vulnerability of organized human systems to current and future climate change is a function of exposure, sensitivity, and adaptive capacity (Fussel and Klein, 2006). This paper explores two areas where economics can inform and enhance current approaches to determining and interpreting adaptive capacity in the context of climate change vulnerability assessment. First, the paper proposes a complementary construct — namely, adaptive capacity deficits. Adaptive capacity deficits are an extension of the concept of adaptation deficit proposed by Burton (2004) and Burton and May (2004). Different human systems have different levels of adaptive capacity and these differences are normal and expected. Differences in adaptive capacity can arise because of differences in requirement (or demand), supply (or cost), and income. Therefore, determinations of relatively high or low adaptive capacity for a particular system does not necessarily mean that the system is relatively less or more vulnerable to climate change effects compared to other systems. A more direct approach is to determine where circumstances result in socially unacceptable distributions of adaptive capacity, or economically sub-optimal investment in adaptive capacity, or reduced efficacy of current adaptive capacity assets. Inequity, economic inefficiency, and reduced efficacy are symptoms of a system that is experiencing an adaptive capacity deficit. Adaptive capacity deficits are caused by irrational choices and system (economic, social, institutional, political) failures and it is the manifestation of adaptive capacity deficits that causes a system to be vulnerable.

A second area where economics can contribute to current approaches is by more directly incorporating properties affecting the adaptive capacity of economic systems into broader adaptive capacity constructs. The current focus of adaptive/community capacity approaches is mainly on social determinants and socially organized systems (e.g. resource-based communities). However, local economies will also be impacted by climate change and the response of economies and their inherent capacity to adapt will have a significant effect on the overall adaptive capacity of integrated social and economic systems. However, features and properties of economies that affect their capacity to adapt (e.g. relative roles of markets vs. public intervention, market efficiency and failure, economic diversity, the nature of technologies, substitution elasticity, scale, flexibility, location or remoteness, potential differences between short- and long-term adaptive capacity) are generally not included in current constructs.

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2. Current constructs for adaptive capacity assessment

The Intergovernmental Panel on Climate Change defines adaptive capacity as "…the degree to which adjustments in practices, processes, or structures can moderate or offset the potential for damage or take advantage of opportunities created by a given change in climate" (IPCC, 2001). This definition is relatively unambiguous. There are, however, various approaches pertaining to how adaptive capacity and community capacity are applied and measured. Current mainstream constructs can arguably be grouped into two broad categories: the general approach and the community capacity approach.

2.1. General approach

The Intergovernmental Panel on Climate Change Third and Fourth Assessment reports (Smit and Pilifosova, 2001; Adger et al., 2007; Klein et al., 2007) present a general approach to adaptive capacity assessment that relies on the assessment of determinants.

Smit and Pilifosova (2001) suggest that economic resources, availability of technological options, information capture and management skills, infrastructure, institutions, and equity constitute the key determinants of adaptive capacity. Numerous authors have proposed additional and/or alternative measures and indicators of adaptive capacity. Adger et al. (2004), for example, suggest that specific indicators and measures of adaptive capacity include wealth, inequality, educational commitment, isolation of rural communities, quality of basic infrastructure, political influence, willingness to invest in adaptation, and environmental sustainability measures. Yohe and Tol (2002) introduce human and social capital, access to risk spreading mechanisms, and perceptions of risk as determinants of adaptive capacity.

The Fourth Assessment Report (FAR) (Adger et al., 2007; Klein et al., 2007) reflects a growing literature on adaptive capacity and presents a more comprehensive approach for adaptive capacity assessment. The method, frameworks, approaches, and concepts described in the FAR move toward the community capacity approach outlined in the next section. For example, the FAR states: "The capacity to adapt is dynamic and influenced by economic and natural resources, social networks, entitlements, institutions and governance, human resources, and technology." (Adger et al., 2007, p. 719). The FAR summarizes their assessment of adaptive capacity as follows: "In summary, empirical research carried out since the TAR has shown that there are rarely simple cause–effect relationships between climate change risks and the capacity to adapt. Adaptive capacity can vary over time and is affected by multiple processes of change. In general, the emerging literatures show that the distribution of adaptive capacity within and across societies represents a major challenge for development and a major constraint to the effectiveness of any adaptation strategy." Chapter 17 of the FAR identifies limits and barriers to adaptation. They identify physical and ecological limits, technological limits, financial barriers, informational and cognitive barriers, and social and cultural barriers as key areas that may limit adaptation.

The general approach to adaptive capacity assessment is useful because it has broad applicability and it is practical, straightforward, and intuitive. It leads to assessment and measurement approaches that are feasible, tractable for policy analysis, and intuitive. The general approach for adaptive capacity assessment can result in policy-relevant assessments of current capacity to adapt and potentially about the adaptive capacity requirements of systems. A drawback of this approach is that it is difficult to interpret whether current adaptive capacity level is socially optimal — and if not why. Another drawback is that there is inconsistency in application and a lack of comparability across studies. Inconsistency and incomparability is in part due to a lack of consensus about determinants of adaptive capacity (Adger et al., 2007). Finally, there is no recognition of interrelations between determinants and there is no systematic assessment to evaluate the optimal mix of determinants or analysis to identify where investment in particular determinants would yield the highest return.

2.2. Community capacity

The community capacity approach is based on the notion that access to, and ownership of resources and assets enhance a community's general capacity to respond to sudden impacts and contribute to long-term community sustainability. The community capacity approach is also bottom-up in nature. Donoghue and Sturtevant (2007) assess various social science constructs of community capacity used recently in ecosystem assessments in the US. They find although there are areas of similarity, they vary in some fundamental ways.

Beckley et al. (2002) describe an approach for assessment of community capacity. They define community capacity as "the collective ability of a group (or community) to combine various forms of capital within institutional and relational contexts to produce desired results or outcomes" (Beckley et al., 2002 p. 7) (see also Kusel, 2001). Forms of assets that contribute to community capacity include

- Natural capital: natural resources and environmental services such as clean air and water
- Human capital: skill, education, and health of individuals that contribute to the skill base and economic performance of the community
- Economic capital: local industrial base, physical infrastructure such as roads and buildings, financial capital such as organizational budgets and household savings
- Social capital: the relationships between and among community members that contribute to collective action

Various authors allude to other forms of capital. For example, Flora and Emery (2006) include cultural and political capital as determinants of community capacity.

Social scientists have also separately studied specific individual determinants of community capacity frameworks in considerable depth. For example, social capital is viewed as an important determinant of community capacity. Social capital refers to the interrelations and networks of individuals, organizations, and community leaders (Matthews, 2003). Networks are defined in terms of size, density, and diversity and they can take different forms (e.g. bonding, bridging, and linking) (Franke, 2005). Social capital provides individuals and groups with access to information and resources that they might not otherwise have access to. Thus, social capital contributes to the ability of individuals to deal with shocks and to adapt and adjust to change generally (Matthews, 2003; Franke, 2005) and to climate change in particular (Adger, 2003).

Social capital also exists at higher levels. For example a community's collective social capital is measured in terms of numbers of organizations in a community, number of members in these organizations, and interrelations between organizations (Franke, 2005). Also, community leaders have social networks that may benefit the overall community. A high level of social capital in a community contributes to adaptive capacity because it supports collective action by the community. It also contributes to actions or decisions that contribute to overall community health and well-being.

Perception of climate risk affects the willingness of individuals to adapt (McDaniels et al., 1996; O'Connor et al., 1999). Understanding perceptions of climate change risk contributes to vulnerability assessment in two ways. First, individual perceptions provide new information that complements technical risk assessments because such perceptions may be based on local observations that are too subtle to be reflected in technical risk assessments. Second, there are often features or characteristics of climate related risks and/or risk perceivers themselves (i.e. individuals, communities, or policy actors) that may result in differences between perceived risk and objective risk (Slovic, 1987; Slovic, 2000; McDaniels et al., 1995; Khaneman et al., 1982).