Building Adaptive Capacity to Climate Change in Less Developed Countries.

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I. Introduction

Around the world, the devastation of climate-related impacts has undermined livelihoods, threatened ecosystems, and stretched the capacity of sociopolitical institutions. Droughts, storms, and floods have often caused serious agricultural losses and human suffering: images of famines in Africa, human displacement in the Caribbean, and water-covered settlements in Bangladesh illustrate just some of the disastrous impacts of climate on vulnerable populations. In recent years, the possibility of more frequent and extreme events as a result of climate change has fueled new avenues of inquiry to understand and address the vulnerability of human and social systems to these events. As adaptation becomes prominent on the social and governmental agendas of both rich and poor countries, we need to understand better the factors that increase or constrain their adaptive capacity (AC), or the ability of different systems and agents to respond and recover from climate impact. Such an improved understanding is particularly important for less developed regions where these negative impacts will likely interact with and exacerbate other stressors already affecting those most vulnerable (Eakin and Lemos 2006; Wilbanks and Kates 2010).

In these regions, although climate change poses a grave and emerging threat, vulnerabilities are generally symptomatic of deep socio-economic and political inequalities that have historically characterized their social and political systems. Under these conditions, we argue that efforts to build adaptive capacity must simultaneously address climate threats and longstanding development needs. In other words, in addition to specifically mitigating and managing climate risk, building adaptive capacity will require a combination policies and interventions that also bolster asset development, reinforce institutional access, and take into consideration the structural inequalities that perpetuate vulnerability (Lemos, Boyd et al. 2007). Moreover, these interventions and policies will necessarily need to be carried out across different levels of government and across different sectors (Adger, Arnell et al. 2005; Wilbanks and Kates 2010). On the one hand, building adaptive capacity means designing and implementing policy that addresses structural deficits (which we call *generic* adaptive capacity) such as universal access to education and health; income and land distribution and redistribution (e.g. cash transfers and entitlements programs, land reform); political reform (e.g. increased accountability, democratic decision-making and transparency), and institutional and administrative capacity-building (e.g. greater enforcement of regulations and norms, investment in human capital, decreasing corruption and inefficiencies). On the other hand, it involves implementing risk management (which we call *specific* adaptive capacity) through investment in adaptation technology (e.g. public works for water storage and distribution, coastal protection, development of drought resistant crops), social innovation (e.g. disaster response, insurance, alert systems) and specific interventions that either mitigate exposure of different groups to particular climate threat (e.g. drought-related famine prevention, creation of early warning systems for storms, and relocation of vulnerable populations in the face of recurrent and unmanageable floods). However, the implications of the interaction between specific and generic AC and the relative importance of each in affecting the overall ability to respond and recover from climate change impact have received little empirical and theoretical attention (but see Adger and Vincent 2005). Only recently have scholars started to think about the specific ways in which adaptation interventions and development policies intersect and how existing interactions between them might contribute to or detract from long-term sustainability (Klein, Schipper et al. 2005; Bizikova, Robinson et al. 2007; Klein, Eriksen et al. 2007; Lemos 2007; Lemos, Boyd et al. 2007; PielkeJr., Prins et al. 2007; Halsinaes, Shukla et al. 2008; Jerneck and Olsson 2008; Brown 2011; Eriksen,

Aldunce et al. 2011).

In this article, we specifically discuss these interactions and theorize about different ways that generic and specific AC intersect and shape each other in the context of building AC in less developed regions. We hypothesize that in the best-case scenario, the combination of generic and specific adaptive capacity is synergistic, creating a virtuous cycle in which overall capacity is sustainably enhanced, fostering long-term adaptation (Lemos 2007; Lemos and Tompkins 2008). However, in less desirable scenarios, tensions in the relationship between generic and specific AC may lead to negative feedbacks such as those that foster "poverty or rigidity traps" or situations in which adaptation interventions can actually exacerbate inequalities or perpetuate maladaptation. For example, at the household level, the goal is to avoid an emphasis on interventions that focus on risk management without increasing the household's overall asset base. While such outcomes may allow for short term coping, they fail to assure long-term adaptation (Del Ninno, Dorosh et al. 2003; Nelson and Finan 2009). In contrast, targeted capacity building for specific subpopulations or sectors may result either in complacency or rigidity traps in which endogenous efforts at specific risk management are thwarted (Eakin, Perales et al. 2011; Murtinho 2011).

Although there is growing consensus that adaptation policy must take into consideration structural deficits and long-term sustainability, addressing inequalities that create and sustain poverty and propagate vulnerabilities will likely require policies that profoundly challenge the existing distribution of power and assets (Lemos and Boyd 2009; Pelling 2009). At best, implementation of such structural changes has been slow and incremental in most countries, while virtually impossible in others. In this context, it is not surprising that adaptation interventions so far have mostly been technical and palliative (Lemos 2003). In some respect, linking progress on climate change adaptation to development goals can risk bogging adaptation policy down in the same politics of resource access and distribution that have impeded social development for decades (Eakin and Patt 2011). On the other hand, failing to integrate adaptation and development policy may result in distortions and inefficiencies that threaten sustainability in the long-run (Huq, Rahman et al. 2003; Agrawala 2004; Bizikova, Robinson et al. 2007). However, the magnitude and accelerated rate of climate change along with the possibility of catastrophic impacts may force political and policy systems to imagine and seek out potentially transformative approaches that include radical and paradigmatic shifts towards social-ecological integration and sustainability (Lemos and Boyd 2009).

Currently, there is debate among academics and practitioners regarding the best actions to reduce the risk of harm from extreme events, particularly in the developing world where losses are expected to be significant. To foster development that addresses climate change risk in the context of multiple stressors and enables adaptation, policy makers must decide whether it is more effective to invest in measures that will reduce vulnerability to a broad range of both climatic and non-climatic stressors, or whether it is best to focus on enhancing specific capacities to manage particular hazards. In terms of the livelihood framework, policy-makers must decide which types of livelihood assets should be strengthened through public investment and support. In this sense, understanding the relationship between generic and specific adaptive capacity at different scales of governance is a critical component of informing policy-making and planning to respond to climate change impact. In the next sections, we review the literature focusing on adaptive capacity and develop a conceptual model theorizing the relationship between generic and specific AC across scales in the context of less developed regions.

Understanding Adaptive Capacity:

The concept of adaptive capacity has existed for decades (Parsons 1964; Chakravarthy 1982; Staber and Sydow 2002). Current conceptual underpinnings of adaptive capacity are most closely associated with the Intergovernmental Panel on Climate Change's (IPCC) characterization of *adaptation* as an "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects" (Parry, Canziani et al. 2007). Successful adaptation should result in an equal or improved situation when compared with the initial condition while less successful responses (such as coping) would allow for short term recovery but continued vulnerability. But what ultimately determines the success or failure of adaptation is a system's adaptive capacity, for it describes the ability of a system, group, or individual to mobilize resources to prepare for and respond to current or perceived stresses. Table 1 summarizes the determinants of AC often found in the literature.

Understanding what influences adaptive capacity is rooted in the IPCC's categorization of the determinants of adaptive capacity: economic resources, technology, information and skills, infrastructure, institutions, and equity (Smit, Pilifosova et al. 2001). A number of scholars have expanded on and redefined this initial list of six categories. For example, some research suggests that communities are limited in their capacity to adapt by their ability to act collectively. Here, social capital, trust, and organizations greatly influence this capability (Adger and Neil 2003; Pelling and High 2005). Others narrow in on institutions, governance, and management as critical influences on a system or individual's capacity adapt to climate change (Yohe and Tol 2002; Brooks, Adger et al. 2005; Haddad 2005; Eakin and Lemos 2006; Agrawal 2008; Brown,

Determinant:	Encompasses:
Human capital	Knowledge (scientific, "local", technical, political), education levels, health, individual risk perception, labor
Information & Technology	Communication networks, freedom of expression, technology transfer and data exchange, innovation capacity, early warning systems, technological relevance
Material resources and infrastructure	Transport, water infrastructure, buildings, sanitation, energy supply and management, environmental quality
Organization and social capital	State-civil society relations, local coping networks, social mobilization, density of institutional relationships
Political capital	Modes of governance, leadership legitimacy, participation, decentralization, decision and management capacity, sovereignty
Wealth & financial capital	Income and wealth distribution, economic marginalization, accessibility and availability of financial instruments (insurance, credit), fiscal incentives for risk management
Institutions and entitlements	Informal and formal rules for resource conservation, risk management, regional planning, participation, information dissemination, technological innovation, property rights and risk sharing mechanisms

Table 1: Determinants of AC.
Source: Eakin and Lemos 2006 (based on Smit et al. 2001 and Yohe and Tol 2002).

Nkem et al. 2010; Engle and Lemos 2010; Gupta, Termeer et al. 2010). Research also suggests that adaptive capacity is far from equally distributed (Adger, Agrawala et al. 2007), and specifically in the area of development, important questions have been raised regarding the inequalities of adaptive capacity between developed and developing populations and within communities (Dow, Kasperson et al. 2006).

Despite a long conceptual history and increasing emphasis in climate and sustainability literatures, adaptive capacity has yet to receive sustained empirical examination and particularly, analysis that moves from a normative and theoretical understanding of adaptive capacity to analysis that tests and unpacks the theorized determinants of adaptive capacity (Hill and Engle, in review). Moreover, it is increasingly evident that focusing on adaptive capacity can have practical and theoretical benefits. Not only is AC an integral concept to both vulnerability and resilience studies uniquely positioned to draw from the benefits of both frameworks, but it also better resonates with practitioners and policy makers than concepts such as resilience and sensitivity (Engle 2011).

Adaptive capacity affects vulnerability by modulating exposure and sensitivity (Yohe and Tol 2002; Adger, Agrawala et al. 2007) and influencing both the biophysical and social elements of a system (Eakin and Luers 2006). In resilience studies, adaptive capacity, or adaptability, is the capacity of actors in the system to manage and influence resilience (Walker, Holling et al. 2004; Walker, Gunderson et al. 2006). Thus, the more adaptive capacity within a system, the greater the likelihood is that the system will be resilient in the face of climate stress. These two perspectives, vulnerability and resilience, combine to suggest that there are two important temporal aspects of adaptive capacity. First, AC is important for a system or for the actor(s) that constitute that system to cope in the short-term so as to maintain the status quo (i.e., resilience). Second, AC is important to facilitate transitions and transformations—the long-term adaptation directed to more desirable states (Nelson, Adger et al. 2007). Yet high AC does not necessarily translate into long-term adaptation. Rather than being discrete processes, resilience, transitions and transformations are part of a continuum to which most adaptation action can contribute. What differentiates between them is the quality of the outcome, with transformation leading to highly desirable political, social and rights regimes (Pelling 2009). And while 'desirability' is defined by those within a given system (i.e., as negotiated between actors and various interests), the greater the adaptive capacity, the more likely the system or actor(s) will wind up in a 'desirable' situation in the face of a climate variability and change. However, it is important to take into consideration that 1) different actors within a system may have competing and even conflicting interests and preferences, and 2) these actors may have different levels of power to pursue their interests and these power asymmetries do not necessarily lead to overall desirable outcomes. Moreover, we suggest that there may be tradeoffs between these two elements of adaptive capacity (short-term coping and long-term adaptation) as well as with other aspects of adaptation implementation. For example, synergy between coping and adaptation to one population may mean failure in adaptation for others. In this context, policy makers and decision makers should focus efforts on aligning development initiatives and goals in a manner that can make building AC synergistic, rather than leading to competing or incompatible outcomes. In this pursuit, it is important that we improve understanding of what builds adaptive capacity and/or functions as barriers or limits to adaptation through more systematic empirical evaluations (Adger et al., 2009; Engle, 2011).

Generic and Specific Adaptive Capacity:

What factors make human, social and political systems less vulnerable to climate-related phenomena? In this article, we seek to address the factors that answer this question by focusing on two conceptualizations of adaptive capacity: generic and specific (Sharma and Patwardhan 2008). Generic adaptive capacity is defined as those assets and entitlements that build the ability of different systems to cope and respond with a range of stressors. This conceptualization considers that stressors rarely affect systems alone, especially in less developed regions (Wilbanks and Kates 2010). As discussed above, poor households are usually vulnerable to a number of overlapping and interdependent disturbances that shape their overall vulnerability. For example, in India, agricultural households are affected not only by climate impacts but also by globalization that shapes their access to markets and incomes—that is, they are double exposed to climate impacts and globalization processes (O'Brien, Leichenko et al. 2004). Specific adaptive capacity refers to conditions that prepare systems to cope and recover from a particular event, in this case, climate-related impact such as drought, flooding, or extreme weather (hurricane, tornado, etc.). In practice, it refers to the range of risk management mechanisms put in place by governments and private organizations to decrease vulnerability (exposure and sensitivity) to climate impact. Examples are drought emergency response plans, hurricane warning systems, design and construction of protective infrastructure and public works (e.g. levies, walls, dams, reservoirs), evacuation plans, etc.

In their conceptualization of adaptive capacity, Cutter et al. (2008) argue that some characteristics "influence both vulnerability and resilience (socio-economic status, education, and insurance, for example)" while others are more akin to the ability of systems to respond to specific hazards/vulnerabilities. Here, resilience and vulnerability refer to different but overlapping parts of system's ability to recover from both biophysical and social disturbance. Moreover, based on limited case-study evidence, Lemos and her colleagues (Lemos 2007; Tompkins, Lemos and Boyd 2009) have argued that building adaptive capacity is a dialectic, two-tiered process in which risk management (specific AC) and deeper level socioeconomic and political reform (generic AC) iterate to shape overall vulnerability. In principle, risk management approaches can create positive synergies across the state-society divide through participatory and transparent approaches (such as participatory vulnerability mapping or local disaster relief committees) that empower local households and institutions, which in turn mobilize for further socio-political reform (Lemos 2007; Nelson, Folhes et al. 2009). Similarly, by increasing households' overall adaptive capacity, anti-poverty programs (especially those that couple with education programs) may positively influence their ability to better take advantage of risk management mechanisms (e.g. access to social programs and insurance, identification of effective drought response)

Yet, empirically, the distinction between generic and specific adaptive capacity has received little attention despite widespread recognition of its critical implications for policy choice and design. These policy implications are twofold. First, as mentioned above, policymakers in less developed regions and development scholars increasingly argue that it makes little sense to design policy to build adaptive capacity to climate stressors that ignore the multitude of other factors at the root of different systems' vulnerability. In this sense, this scholarship argues that adaptation policy needs to be *mainstreamed* into development policy to be effective (Huq, Yamin et al. 2005; Jerneck and Olsson 2008; Kok, Metz et al. 2008). Second, some scholars argue that the concept of generic adaptive capacity can only take us so far. Some variables are

not generalizable between different stresses and systems (Adger and Vincent 2005), and there is the suggestion that the prospect of adaptive capacity across a range of stresses is essentially a myth (Tol and Yohe 2007). In the next two sections we discuss the relationship between generic and specific AC first at the national level, and second, at the household level. We use the concept of adaptive development (Agrawal and Lemos, in review) to argue for a new paradigm of development that takes into consideration climate risk in policy-making and planning so as to enable national states to respond and recover from current and projected negative impacts of climate change. Formally integrating generic and specific capacity through an adaptive development approach at the national level could effectively balance climatic and developmental challenges. Using a livelihood approach at the household level, we theorize the relationship between generic and specific AC and propose a simple conceptual model of potential synergies and trade-offs between the two.

Box 1: Disaster Risk Reduction in Bangladesh

Bangladesh lowland's exposure to climate-related disasters is well-documented; between 1970-2004 around 0.7 million people have been killed and economic losses in excess of 5.5 billion dollars have been incurred as a result of cyclones and flooding (Chowdhury, Bhuyia et al. 1993; del Ninno, Dorosh et al. 2002). Perhaps the worst climate related disaster was the 1970 Bhola cyclone that hit then East Pakistan (now Bangladesh), killing over half a million people. As recently as 1991, another cyclone, this one hitting at night, killed over 130,000 people and negatively affected other 5 million. Despite early warning (15 hours ahead) and greater availability of shelters (built after the Bhola cyclone by public and private organizations), 67,000 died on impact and property worth US$ 2.4 billion was destroyed (Financial Indicators Bangladesh, 1991 cited by Chowdhury, Bhuyia et al. 1993). Human-induced climate change is expected to exacerbate the problem; projected half-meter sea-level rise by 2050 is likely to permanently inundate about 11% of Bangladesh territory (IPCC 2001b). Bangladesh is the most densely populated country in the world with more than 1,000 people per sq. km (World Bank 2004). Agriculture, which provides about a quarter of the country's GDP, is largely nature-dependent due to heavy reliance on favorable seasonal conditions, particularly on monsoon rainfall.

Building adaptive capacity in Bangladesh has involved developing both generic and specific capacities. Over the past 30 years, Bangladesh has significantly reduced poverty. While the proportion of population living below the poverty line was as high as 74% in 1973–74, between 1991–92 and 2000, the incidence of national poverty declined from 50% to 40%, indicating a reduction rate of 1% per year (Sen 2003). However, a significant portion of the population remains vulnerable, especially in areas of low ''geographic capital''. In these locations, social and geographical disadvantage overlap and residents derive few benefits from the economic and social opportunities created by economic growth. Natural resources crisis (including disasters) are especially threatening in these areas, being responsible for 15% of the reasons for descending households (Sen 2003).

Specific AC has also been built through risk management programs, especially disaster response and anti-famine intervention. For example, since the 1970s a diverse network of shelters (including hundreds of one-story and two-stories concrete buildings, multi-purpose cyclone shelters and rehabilitating houses) have been built with the help of organizations such as the World Bank and NGOs. The government has also built 150 *killas* (artificial hills), mainly to protect household animals from flooding (Chowdhury, Bhuyia et al. 1993). In the 1998 "flood of the century", the government was able to avoid a famine crisis like the one that killed tens of thousand of people in 1974 through a combination of trade liberalization, importation of food and aid (Del Ninno, Dorosh et al. 2003). Moreover, following the initial flood period, immediate relief was available through the Gratuitous Relief program through which 35.7 per cent of severely flood-exposed households received direct relief. The overall handing of the crisis kept prices from rising despite larger losses in rice production than in 1974; indeed the government seems to have learned from successive droughts both in terms of preparedness (public stocks) and longer term planning (role of private markets) (Del Ninno, Dorosh et al. 2003).

However, vulnerability persisted as households remained sensitive (Del Ninno, Dorosh et al. 2003). After successful response in 1998, long-term negative impacts included lower calorie consumption, damage to infrastructure (houses) and negative health impacts. Rather than adapting, most households coped with the shock of the flood in several major ways, including reducing expenditures, selling assets and borrowing. While immediate post-disaster relief programs facilitated coping, they were small relative to the needs of households (only one-sixth to one-eighth the size of household borrowing). Borrowing from the private sector to purchase food and to fund other expenses such as education, health, farming, business, repayment of loans, marriage and dowry, purchases and mortgage of land or agricultural equipment constituted the main coping strategy, leaving many households in debt even a year after the event. Fifteen months after the flood, household debts still averaged 146% of one month's average consumption for the 64.2% of flood-exposed households in the bottom 40% of the expenditure distribution who were in debt (Del Ninno, Dorosh et al. 2003). Although debt declined with time, it still constituted a great part of household hardship and left them vulnerable to future shocks. The Bangladesh case suggests that while focusing on risk management greatly reduce casualties and facilitates coping in the short run, it fails to foster long-term adaptation.

Adaptive Development

Reinforcing adaptive capacity in the context of climatic shifts that threaten historical development gains is likely to require substantial attention to addressing risks and vulnerabilities in addition to promoting growth and reducing inequality. Historically, the failure of economic growth alone to solve pressing societal problems has encouraged the emergence of new approaches to development. For example, dominant development paradigms over the past five decades have included human and sustainable development as attempts to address respectively inequality and environmental degradation (Parpart and Veltmeyer 2004). As unprecedented risks represented by climate change impacts become more palpable, the next frontier of developmental policy-making will have to take into account not only past concerns but also climate adaptation.

In this sense, adaptive development is different from earlier development avatars because development strategies that do not explicitly take into account climate change-related risks may also fail in their other objectives owing to climate impacts. The effects of climate change will fall unequally and disproportionally, especially on poor communities, and will create greater stress around issues of sustainability (Adger, Brown et al. 2005; Parks and Roberts 2009). Impacts will also bring already stressed human and ecological systems closer to the thresholds of undesirable and irreversible changes. Climate change also enhances uncertainty in development planning,

such that intended economic and social outcomes of policy are potentially jeopardized if climate risks are not accounted for.

Hence, new approaches to help govern social and individual risks must explicitly consider the negative synergy between climate risks and structural deficits in its many forms. As mentioned above, poverty, lack of access to health and education, lack of political power, and social inequalities exacerbate vulnerability to climate impacts, and recurrent impacts (drought, storms, etc.) increase vulnerability (Heltberg, Siegela et al. 2009). By focusing on how risks can be reduced in the pursuit of development and vice-versa, it becomes possible to identify the essential difference between development in the face of climate change and development as growth, human development, and/or sustainable development. Yet, this distinction does not mean that we believe policy to address risk should not be to integrated and reconciled into other developmental policy; rather, we argue that adaptive development pays specific attention to how risk management intersects (positively and negatively) with policies aiming at economic growth, human and sustainable development. For example, in drought ravaged Northeast Brazil, risk management interventions such as crop insurance or emergency provision of drinking water can allow affected households to respond to short-term drought stress. However, the extent to which these interventions allow families to cope and also develop longer term adaptive capacity is likely to be predicated on the combination of specific risk management with generic anti-poverty programs such as the Zero Hunger or Family Fund initiative, which provide households with fungible cash resources and long-term access to education and health. In NE Brazil, such programs may be fundamentally changing the relationship between exposure and sensitivity to drought, and improving the ability of households to use monthly cash allowances for short-term survival while simultaneously engendering long-term resilience through better health and educational access.

When considered as a means to address risks faced by diverse populations, the concept of adaptive development provides a clear conceptual basis upon which to elaborate strategies aimed at improving the life chances of the poor and the long-term sustainability of ecosystems. Adaptive development strategies would work to reduce the riskiness of development choices, even as they attend to the criteria of equity and sustainability. The idea of adaptive development can help take into account the dynamic, non-incremental, synergistic and often surprising nature of climate change hazards that will need to be addressed in the future. Going back to the NE Brazil example above, it would be precisely in the positive synergy between short term risk interventions and long-term development programs that our ability as a society to prepare for both extreme events and long-term incremental change brought about by climate change lie. Adaptive development provides the social infrastructure that bridges individual actions to reduce personal vulnerability into a framework in which such actions contribute to collective capacity to manage risk. In addition, thinking about development through a risk and risk governance lens enables policy makers and scholars to draw upon a vast body of historical and emerging scholarly work that has sought to examine the nature of risks, and how risks can be and have been addressed in the past. Better understanding these responses leads us squarely to the scholarship focusing on hazards, disaster risk and adaptation to climate-related impacts (especially climate variability) (Blaikie, Cannon et al. 1994; Pelling and High 2005).

From a policy point of view, beyond conceptualizing the causal relationship between development and risk, there is a need to understand the dynamics of adaptive action, that is, how the practice of implementing risk management interplays with development policy

negatively and positively. The adaptive nature of this implementation requires monitoring and experimentation that lead to evaluation and learning, aimed especially at increasing understanding of how positive synergies between more traditional development policies (i.e. those which aim to address structural deficits) interact and intersect with new ones designed to address climate-related risk. It also requires that we understand the direct and indirect effects of adaptation policy and make sure that the solutions pursued yield desirable outcomes and do not trade off negatively with sustainability and equity (Ericksen and Brown 2011; Brown 2011).

In general, the concept of adaptive development signals the need to combine both specific responses to climate risks so as to reduce the likelihood that climate impacts will negatively affect development outcomes, as well as more general developmental strategies that in the long run limit the adverse climate impacts on human livelihoods and social welfare. The questions facing development planners and climate policy decision makers are not of the nature of whether to promote development outcomes or enhance the possibility of adaptation to climate impacts. Rather, they are about how to integrate adaptation with development, and how to manage risks in the pursuit of enhanced human welfare and improved livelihoods. Next, we look at specific and generic AC at the household level and discuss their implications for mitigating vulnerability to climate change.

Box 2: Governance and Adaptive Capacity in the Brazilian Water Sector

Brazil's national reform of water management in 1997 brought changes to the water resources sector that have contributed to both better governance, including deeper democratic participation, and improvements in disaster risk response (Engle and Lemos 2010; Johns 2011). Results of the reform in the drought prone Jaguaribe basin in NE state of Ceará reveal how governance factors at the institutional scale contribute to adaptive capacity and how generic improvements in institutional capacity interact with specific risk reduction interventions. However, challenges to inclusion and equality remain that may limit the potential synergies between governance and adaptive capacity (Johns 2011).

In Jaguaribe, state policymakers sought to design a new set of institutions to manage water resources based on emerging models (Integrated Water Resources Management—IWRM), which included participatory user commissions and basin-level committees to deliberate about water allocation (Lemos and De Oliveira 2004). These new institutions have contributed to generic adaptive capacity by giving water users greater access to decision-making and voice. Increased transparency and legitimacy have begun to erode the legacy of clientelistic power arrangements that benefitted elites in the distribution of drought aid by giving preference to irrigation and local elites. The negotiated allocation of water has reduced conflict among users, and increased equality, thereby reflecting the positive relationship between generic governance factors in increasing the efficacy and accountability in specific risk reduction interventions (Johns 2011).

However, there have been limitations in the quality and scope of democratization in which centralized institutions maintain high levels of power, attenuating the decision-making capacity of the new participatory institutions by exercising veto power over democratic decisions that run contrary to the official position. Within user commissions and committees, non-elite and poorer users, such as rural workers and small producers, are still marginalized in part due to their lack of resources, social and political capital (Taddei 2005). Alienation and continued exclusion is also a function of the control of knowledge in the form of technical climate information, which is not equally accessible to all participants (Lemos 2007). Thus, while the reform has improved governance and adaptive capacity, there are still constraints to risk response due to skewed power relationships.

The Jaguaribe case illustrates how integration and stakeholder participation contribute to limited gains in adaptive capacity in the case of a severe drought in 2001. The multiple agencies tasked with water management worked together to craft a solution to the water shortage by compensating water-intensive rice producers for foregoing their water allocation and thereby saving perennial fruit orchards. While the coordination enabled by the reform allowed for such a response, there were limitations in using this opportunity for installing bulk water charges in the agricultural sector, mainly due to the limited nature of democratic participation, which stalled a more nuanced and locally-informed implementation of water charges (Johns 2011).

The reform in Jaguaribe has led to increases in generic and specific adaptive capacity over time by allowing water users and small agriculturalists greater access to decision-making through participatory governance, but there are tradeoffs between centralization, knowledge access and participation that complicate the maturity of institutional changes. The reform has complemented wider national anti-poverty measures, such as Zero Hunger and Family Fund (conditional cash transfer schemes), and enhanced the effectiveness and equitable benefits derived from the historical reliance on measures to target specific drought risks. Despite these advances, making further gains in democratic participation is a continuing challenge.

Livelihoods and adaptation

At the household level, the combination of generic and specific AC (or lack thereof) is associated with two kinds of actions: 1) those that enable households to maintain their level of assets even after the climate-related impact (defined as adaptations); and 2) those that allow households to respond to extreme events in the short term, but in ways that may erode their asset-base in the long-term (defined as coping). For example, when a household adapts in anticipation to drought, it might invest in water harvesting or the infrastructure for silage. When the drought hits this household is less exposed and therefore able to 'ride the drought' relatively unscathed. In contrast, a household might otherwise sell some livestock to pay for fodder for the rest of the herd, subsequently losing part of its asset base forcing it to rebuild the herd in less than optimal circumstances. In this case, it copes rather than adapts because it fails to maintain or improve over its original state. In other words, while some extreme event-coping actions such as the sale of livestock or land might allow the household to recover in the short run, they will diminish its asset base in the long run, making the household more vulnerable. Broadly stated, households with enhanced adaptive capacity—and presumably more secure assets and livelihoods -- may be more likely to engage in welfare-enhancing adaptations because they have the stock of capital from which to make these investments. Unlike asset-constrained households, they are less likely to rely on coping strategies that threaten their long-term welfare (Dercon 1998; Siegel and Alwang 1999).

At the household level, livelihood analysis provides a pragmatic approach to assessing capacities. Drawing from Sen's (1981) entitlement theory, sustainable livelihood research (Scoones 1998; Carney, Drinkwater et al. 1999) addresses the relationships among a household's resource base (assets), its entitlements (the institutional context affecting rights and access to resources), and the result of these activities for aggregate household welfare (outcomes, or what we define as responses). Household capacity attributes can be categorized into five classes of livelihood capital: human capital (education, health, attitudes, belief systems); natural capital (soil quality, water endowments); physical capital (equipment, transport); social capital (connectivity in social or political networks); and financial capital (monetary savings, income composition) (Scoones 1998; Ellis 2000).These types of livelihood capital interact to engender coping and adaptation strategies (i.e. responses). Whether the strategies households engage in ultimately enhancing (adaptation)

or maintaining/diminishing their welfare over time (coping), such strategies typically can be classified as those that involve mobility, storage, diversification, communal pooling, and market exchange (Agrawal 2008). Figure 1 below depicts the five types of capital along in relation to adaptive and coping responses.

As mentioned above, to support household adaptation in developing countries, adaptation policy makers must decide whether it is more effective to invest in measures that will reduce vulnerability to a broad range of stressors (climatic and non-climatic), or whether it is best to focus on enhancing capacities to manage specific hazards. In other words, in terms of the livelihood framework, policy-makers must decide which types of livelihood assets and risk management should be strengthened through public investment and support.

At the household level, we theorize that the relationship between specific and generic AC is two-fold. First, the ability of households to benefit from risk management may be predicated on a minimum level of generic capacity. For example, some households may be so vulnerable that they lack the minimum level of resources to benefit from or engage in specific risk management interventions. This may be the case of households lacking basic education and enough financial resources to enroll and benefit from programs such as crop insurance or rural credit. In this case, their AC maybe enhanced by specific educational and social policies such as Oportunidades in Mexico or Zero Hunger in Brazil. It can also be enhanced by their membership in rural labor unions or cooperatives through which they pool risk or share resources (Agrawal 2008). Another example relates to the usability of seasonal climate forecasting (SCF) information. Empirical research has repeatedly uncovered that certain communities of groups in least developed

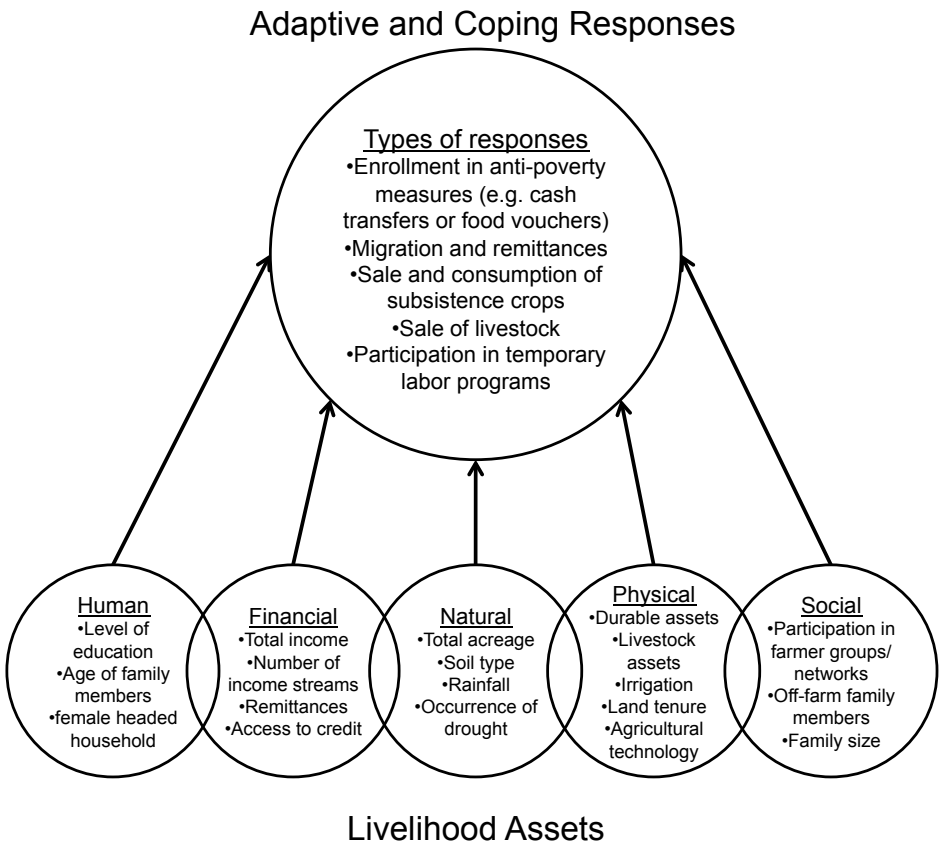

Figure 1: Relationship between Capitals, Adaptive & Coping Responses

countries are severely limited in their ability to benefit from SFC because of their lack of minimum capacity to respond to the projections. In this case, even if farmers had access to SFC, their lack of financial capital constrains their ability either to change crops (to shorter or longer grains, for example) or engage in other forms of adaptation (Finan and Nelson 2001; Ingram, Roncoli et al. 2002; Lemos, Finan et al. 2002). Here, if households had the socioeconomic preconditions to change their crops or participate in seed distribution programs, there would be the possibility of a synergistic relationship between generic and specific AC as climate information could be effectively employed to mitigate climate variability risk.

In contrast, reliance on cash transfers may erode households' long-term capacities through the issue of "lock-in", that is, when welfare programs create relationships and dependencies between state and society that are difficult to uproot and may create rigidity rather than flexibility to respond to multiple stressors. Saldaña-Zorilla (2008), for example, found that despite the decline in public investment and support for the rural sector, there was a persistent expectation among farmers in Mexico that the government should be responsible for disaster risk mitigation, contributing to enhanced vulnerability and passivity. Eakin and Bojorquez-Tapia (2008) found that larger-scale private sector farmers in northern Mexico who had historically benefited from preferential access to land, financial services and commercialization support were more sensitive and ultimately more vulnerable to climatic shocks than their relatively resource-poor *ejidal* (a form of collective tenure) neighbors. As public support for farmers of almost all types declined in the 1990s in Mexico, and the government no longer guaranteed insurance or provided financial support, the larger-scale and more privileged farm class found it lacked the crop and livelihood diversity to cope effectively with extreme events. The *ejidatarios*, having never relied on public support as a means of coping with shocks, were far more autonomous and self-reliant in terms of risk management, although also less commercially engaged and productive than their counterparts. In other cases in Mexico, larger-scale commercial producers moved quickly to secure public support following agricultural market liberalization in Mexico in the early 1990s. Their actions, designed to ensure that federal and state policy are closely aligned with their sectoral interests, resulted in a dangerous degree of complacency and neglect of risk such that famers require unprecedented federal support after their crops failed to frost in February 2011 (see Eakin, Bausch et al. 2011 in review).

Moreover, cash transfer programs may "crowd out" other initiatives (such as private investments) that may enhance AC. For example, Murtinho (2011) found that in some rural Andean communities, autonomous adaptations to address problems of water scarcity were effectively "crowded out" by unsolicited public sector interventions. Rather than enhancing capacities to collectively manage current and future risk, the heavy-handed support of government was diminishing the probability that the community would take action. Figure 2 below shows a conceptual model of some of the relationships between generic and specific AC.

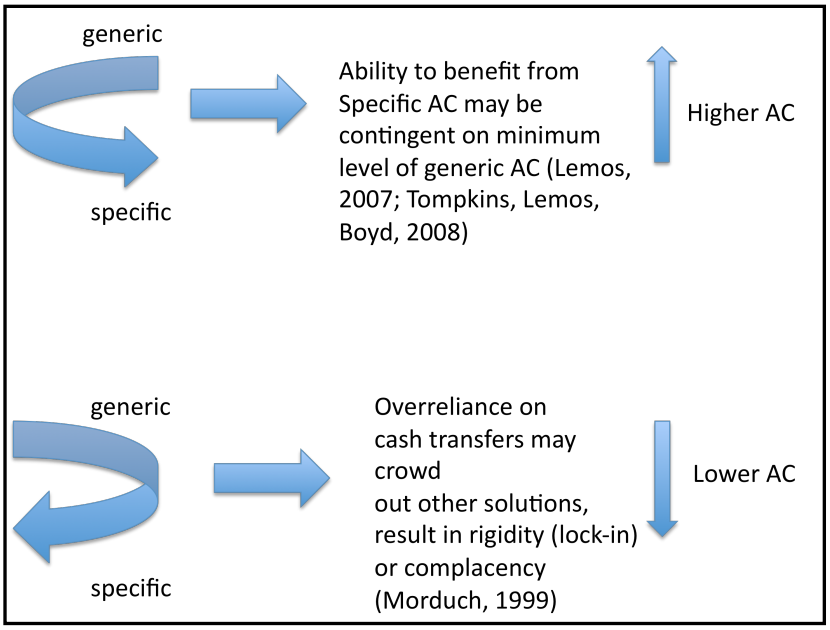

Figure 2: Positive and negative feedbacks between generic and specific AC

Conclusions

This paper focuses on the relevance of adaptive capacity in the context of the increasing certainty that climate change impacts will affect human populations and different social groups substantially and differentially. The paper does so by arguing for greater attention to increasing climate risks in the design of development policies. The argument builds on two conceptual distinctions. The first is between specific and general adaptive capacity where specific adaptive capacity refers to the ability of agents and systems to address the risks specific to a particular climate threat and generic adaptive capacity references household endowments and system characteristics that enable more flexible responses to a diverse range of climate threats and other stressors. Bolstering both generic and specific adaptive capacities, with careful attention to minimizing the potential tensions between these two types of adaptive capacity, can help vulnerable groups maintain their ability to address risks in the long run at the same time as they respond effectively to short term climate impacts.

An analogous distinction that the paper advances concerns the idea of adaptive development, which focuses on development in increasingly risky contexts compared to earlier variants of development that focused on growth, equity, and/or sustainability. The paper highlights how future development policies and interventions are likely to require greater attention to risk reduction to secure the objective of greater welfare because more frequent, intense, and widespread climate threats may otherwise undermine development gains.

The paper also highlights the fact that specific and generic adaptive capacity are not always positively related, just as development interventions and growth focused development outcomes can sometimes reduce the ability to cope with risks. Using a number of case examples, the paper identifies how to enhance the potentially synergistic relationship between

specific and generic adaptive capacity or between risk reduction and growth, equity, and sustainability.

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