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Social Capital, Collective Action, and Adaptation to Climate Change

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Abstract: Future changes in climate pose significant challenges for society, not the least of which is how best to adapt to observed and potential future impacts of these changes to which the world is already committed. Adaptation is a dynamic social process: the ability of societies to adapt is determined, in part, by the ability to act collectively. This article reviews emerging perspectives on collective action and social capital and argues that insights from these areas inform the nature of adaptive capacity and normative prescriptions of policies of adaptation. Specifically, social capital is increasingly understood within economics to have public and private elements, both of which are based on trust, reputation, and reciprocal action. The public-good aspects of particular forms of social capital are pertinent elements of adaptive capacity in interacting with natural capital and in relation to the performance of institutions that cope with the risks of changes in climate. Case studies are presented of present-day collective action for coping with extremes in weather in coastal areas in Southeast Asia and of community-based coastal management in the Caribbean. These cases demonstrate the importance of social capital framing both the public and private institutions of resource management that build resilience in the face of the risks of changes in climate. These cases illustrate, by analogy, the nature of adaptation processes and collective action in adapting to future changes in climate.

Key words: social capital, vulnerability, adaptation, resilience, global climate change, coastal management, economic development.

The effects of observed and future changes in climate are spatially and socially differentiated. The impacts of future changes will be felt particularly by resource-dependent communities through a multitude of primary and secondary effects cascading through natural and social systems. Given that the world is increasingly faced with risks of climate change that are at the boundaries of human experience,[1] there is an urgent

[1] The evidence for significant warming in this century on a scale unprecedented in the era of modern human history (in the range of 1.4°C to 5.8°C by 2100) was summarized by the Intergovernmental Panel on Climate Change (2001). Novel and largely unknown risks include those associated with the expansion of the range of pathogens, diseases, and pests affecting

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need to learn from past and present adaptation strategies to understand both the processes by which adaptation takes place and the limitations of the various agents of change—states, markets, and civil society—in these processes. Societies have inherent capacities to adapt to climate change. In this article, I argue that these capacities are bound up in their ability to act collectively.

Decisions on adaptation are made by individuals, groups within society, organizations, and governments on behalf of society. But all decisions privilege one set of interests over another and create winners and losers. Thus, the effectiveness of strategies for adapting to climate change depend on the social acceptability of options for adaptation, the institutional constraints on adaptation, and the place of adaptation in the wider landscape of economic development and social evolution. The effectiveness of adaptation also depends on the compounding factors of economic globalization and other trends (see O'Brien and Leichenko 2000).

It is clear that individuals and societies have adapted to climate change over the course of human history and will continue to do so—climate is part of the wider environmental landscapes of human habitation (e.g., de Menocal 2001). Thus, individuals and societies have been at risk of climatic hazards and other factors, and this vulnerability can act as a driver for adaptive resource management. There are various scales and actors involved in adaptation. Some types of adaptation are undertaken by individuals in response to threats to the climate, often triggered by individual extreme events. Others are undertaken by governments on behalf of society, sometimes in anticipation of change but, again, often in response to individual events. Key vulnerable groups are often excluded from making decisions on the public management of climate-related risks. Poor households are, for example, forced to live in hazardous areas on the margins of urban settlements, which puts them at risk of flooding, and are frequently ignored when the infrastructure is designed to alleviate such vulnerabilities. The space occupied by socially marginalized groups itself becomes invisible (cf. Scott 1998). The vulnerability of marginalized groups and their exclusion from decision making has been documented throughout the world, from Japan to the United States and the Caribbean, for instance (Uitto 1998; Cutter, Mitchell, and Scott 2000; Pelling 1999, 2002).

Therefore, adaptation processes involve the interdependence of agents through their relationships with each other, with the institutions in which they reside, and with the resource base on which they depend. The nature of these relationships has been central to human ecology and geography, microeconomics, and the anthropological and political sciences. Each discipline has theorized relations of trust, the nature of exchange relations, and the cultural significance of and institutional constraints on the use of the natural environment. But the different emphasis of each discipline has led to a piecemeal view of the importance of connectedness and networks and the role of institutions. Proponents of some economic and political science models have argued that institutions are merely an outcome of individual exchange and of the state's provision of frameworks to provide stability for these exchanges. Advocates of structural approaches have contended that institutions are embedded in the antecedent decisions and cultures of the societies in which they emerge. They have explained such phenomena as economic performance, the resilience and stability of societies, and cultural attitudes toward the environment in different ways (e.g., Bray 1986; North 1990; Wilbanks 1994; Adger et al. 2003).

In resolving some of these dilemmas, the concept of social capital appears to have

human and nonhuman populations and with a significant change in sea level caused by the collapse of the West Antarctic Ice Sheet (see, e.g., Harvell et al. 2002; Vaughan and Spouge 2002; Schneider 2001). Increasingly, adaptation is understood as a process that is precipitated by the need to cope with extremes within such changes (see Kelly and Adger 2000; Jones 2001).

purchase across the range of social sciences. At its core, social capital describes relations of trust, reciprocity, and exchange; the evolution of common rules; and the role of networks. It gives a role to civil society and collective action for both instrumental and democratic reasons and seeks to explain differential spatial patterns of societal interaction. With the promise of and claims to integration, no wonder social capital is so seductive (see, e.g., Pretty and Ward 2001; Mohan and Mohan 2002; Sobel 2002; Bebbington and Perreault 1999; Durlauf 2002). But like the term *sustainable development*, the term *social capital* is interpreted across the social science disciplines, and investigated empirically, using different models and data. Economics has been skeptical about the efficacy of the concept: Arrow (2000) argued that social capital is, indeed, a misnomer and does not share the fundamental characteristics of other forms of capital. I contend that social capital has explanatory power specifically in the area of collective action for environmental management. From the civil society's response to the impacts of Hurricane Andrew to the networks of reciprocity and exchange in pastoralist economies, it has long been recognized that social capital is central to the lived experience of coping with risk (Zeigler, Brunn, and Johnson 1996; Cantor and Rayner 1994; Platteau 1994, 2000). But the concept of social capital also promises to explain how the civil society interacts with the institutions of market and state in a systematic manner, one that is relevant to the nature of the climate-related risks outlined earlier.

This article first discusses the major features and debates in the literatures on social capital and on adaptive management to environmental risks. Analyses of social capital are diverse and range from research on community and associations to economic analyses of well-being and the role of trust in economic transactions. The article presents pertinent lessons from geographic and other research on how social capital can facilitate security and resilience, particularly in the context of resource-dependent livelihoods, by reference to its interactions with natural capital. A framework is developed that classifies social capital as bonding or networking and highlights the relationship of these aspects of social capital as oppositional or synergistic to the state. The next section presents examples of how social capital is central to adaptive capacity, using insights from previous studies of coping with extremes in climate or managing vulnerable resources.

Social Capital and Collective Action

Controversies and Positions

Collective action is at the heart of many decisions on the management of natural resources. In agriculture, forestry, and other resource-dependent livelihoods, resources frequently exist under multiple property-rights regimes. There are many different users, and there is limited information about the impacts of environmental change on sustainability. Diverse social sciences, from anthropology to psychology, have explored how societies choose to allocate scarce resources in the face of limited information and uncertain futures. The underlying theories are distinct and are often in conflict about the methods, scope, and framing of questions—that is, Whose decisions? and What decisions? Thus, the processes of and outcomes of decision making, from the efficiency, equity, and legitimacy perspectives, have all been contested (Adger et al. 2003). Common to all theories of social interaction, however, is the recognition that collective action requires networks and flows of information between individuals and groups to oil the wheels of decision making. These sets of networks are usefully described as an asset of an individual or a society and are increasingly termed social capital.

At its core, social capital theory provides an explanation for how individuals use their relationships to other actors in societies for their own and for the collective good. This collective good, or welfare, has both material elements and wider spiritual and

social dimensions. Hence, social capital captures the nature of social relations and uses it to explain outcomes in society. The greatest criticisms of the writings on social capital are that they conflate cause and effect, particularly when they are used to explain economic performance, educational attainment, or patterns of regional economic growth (Harriss and de Renzio 1997; Paldam 2000; Arrow 2000; Sobel 2002; Durlauf 2002). Further critiques have stemmed from the apparent capture of noninstrumental or "social" aspects of life into a "capital" framework, which some economists have viewed as imperialism (see Fine 1999; Ruttan 2001).

Thus, the bringing together of all elements of social life into an economic framework under social capital is both a strength and a weakness. But social capital spans the domains of many social sciences. Since it is created through interactions between individuals, "it would seem reasonable to argue that the quality of these relationships is shaped by, and itself shapes the character of and the contexts in which they live"; hence, by reference to its grounded location in place and time, it is argued, social capital is a geographic concept (Mohan and Mohan 2002, 193; see also Bebbington and Perreault 1999). Geographic applications have shown the power of the concept of social capital in determining both the political spaces of voluntarism and association and have investigated geographic determinants of the formation of social capital in a civil society (Mohan and Mohan 2002). But geographic analyses have also emphasized the importance of the scale and location of social relationships and have explored how social capital is directly linked to rights to access and development in resource-dependent societies (Pretty and Ward 2001; Bebbington 1999; Bebbington and Perreault 1999; Brown and Rosendo 2000; Berkes 2002).

Following from these contestations across disciplines, I argue that the contested nature of social capital is due, in part, to what Dasgupta (2003) identified as the conflation of institutions with different forms of social capital. Some elements of social capital are quasi-private and hence can be traded, invested in, and inherited. This type of social capital is familiar to economists as being closely related to human capital (Glaeser, Laibson, and Sacredote 2002). This quasi-private social capital is an attribute of an individual but one that cannot be evaluated without knowledge of the society in which the individual operates (Sobel 2002). But "public" social capital resides collectively in the networks of individuals and communities. These sets of collectively held networks shape different institutional forms. Dasgupta (2003) argued that multiple equilibria or institutional forms are derived from the networks and trust generated through collective social capital. A major point of dispute is whether the presence of public or private social capital actually explains social outcomes, such as regional economic performance, the performance of democratic systems, or other social phenomena.

Although many economists and geographers have agreed that empirical studies are weak on explanation (Durlauf 2002; Sobel 2002; Castle 2002), I argue that these insights offer the greatest explanatory power in explaining the evolution of the collective management of environmental resources. And this area is of the greatest relevance to managing the risks of climate change. Social capital is an integral part of theories of adaptive management in the context of environmental risks. The concept allows for a consideration of social practices and collective action in relation to both other forms of capital, particularly natural capital, and the performance of institutions in coping with the variability and uncertainty that are inherent in interactions with the natural world. I consider each issue in turn.

First, social capital is a necessary element of economic transactions and collective action on scarce environmental resources. But Dasgupta (2003) argued that most definitions and analyses of social capital have conflated its private and public dimensions. Private dimensions of social capital reside with individuals and are already incorporated within economic models. Indeed, economics can provide a theoretical basis

for analyzing this type of social capital if it is assumed to be a private good. In this formulation, repeated social interaction has direct welfare value in overcoming the incentives for free riding and in building trust (Glaeser, Laibson, and Sacredote 2002). The collective or community dimensions of social capital, however, relate to networks that are public goods. This type of social capital enhances the overall economic performance, rather than that of specific agents. It is an empirical question whether, in a given set of circumstances, social capital is bound up with institutions or is an asset that can be created and passed on by individuals. The private and public aspects of social capital have been studied in many empirical analyses (e.g., Narayan and Pritchett 1999; Fafchamps and Minten 2002) of resource-dependent societies. Many of these studies have pointed to collective and quasi-private elements of social capital coexisting in parallel. Networks of trust and reciprocity can, in fact, be created by individual leaders in their own interests and are not held exclusively by communities.

Second, social capital is an important determinant of human well-being, along with the traditional factors of production and natural capital. Natural capital is the set of unpriced environmental goods and services on which both economic processes and the basis of human and nonhuman life depend (Ekins 2000; Daily 1997). Social capital, even if it does not share the same characteristics as other forms of capital, plays an important role in obtaining and providing access to natural capital for individuals and societies. For example, the collective traditional management of fisheries, forests, and rangelands under informal institutions provide rules, knowledge, and obligations that are mediated through social capital. If individuals' traditional ecological knowledge of the environment is human capital (Berkes, Colding, and Folke 2000), then traditional management of the environment is a manifestation of social capital. Bebbington (1999) and others have argued that social capital brings with it an inherent capability to gain access to resources and hence to enhance the security of livelihoods and well-being. In this sense, social capital, in enhancing security and reducing risk directly or through interactions with the state, market, and other parts of the civil society, is likely to be a key element in any strategy for adapting to climatic hazards. Given the potential interaction with other forms of capital and its various manifestations in the private and public sphere, the following section disaggregates social capital into important components to illuminate the possibilities of adaptation.

Social Capital, the State, and Policy

Social Capital as Bonds, Networks, and Synergies between the State and Civil Society

As I alluded to earlier, social capital is made up of "the norms and networks that enable people to act collectively" (Woolcock and Narayan 2000, 226). However, it does not exist in a political vacuum, and its existence alters the power relationships between civil society and the state (Bebbington and Perreault 1999). The key issues are, therefore, whether social capital exists only outside the state and whether social capital is a cause or simply a symptom of a progressive (and perhaps flexible and adaptive) society. Each controversy is important for understanding the adaptive capacity for climate change. The importance of the state in facilitating social capital relates to the importance of strategic environmental planning for climate change. If a government can provide a physical or regulatory infrastructure to minimize the potential impacts of floods or droughts, for example, will this infrastructure ever be sufficient for adaptation if its use does not resonate with social norms?

Although the idea that social interaction oils the wheels of collective action is intuitively appealing, it has been articulated in different ways by different disciplines (see, e.g., Dasgupta and Serageldin 2000; Putnam 2000; Coleman 2000). As I mentioned earlier, the role of social capital in the

management of natural resources and in the collective handling of environmental risks is most pertinent in the area of climate change. Social capital is a necessary "glue" for adaptive capacity, particularly in dealing with unforeseen and periodic hazardous events (see also Burton, Kates, and White 1993), but the prevalence of different types of social capital is important at different times to different social groups.

In Figure 1, social capital is shown as the arrows between individuals in a social group—the arrows represent the sharing of knowledge, the sharing of financial risk, the sharing of market information, or claims for reciprocity in times of crisis. Ties within a defined socioeconomic group, as shown in the left panel, have come to be known as *bonding social capital* and may be based on family kinship and locality. By contrast, the right panel in Figure 1 demonstrates *networking social capital,* which is made up of economic and other ties that are external to the group.

While bonding social capital is based on friendship and kinship, networking social capital is based on the weaker bonds of trust and reciprocity. Hence, networking social capital tends to rely not on the rules of enforcement and sanction of informal collective action, but on legal and formal institutions. An analysis of social capital in these forms thus moves beyond a consideration of social relations as deviations from the rational allocation of resources (implied in neoclassical economics). This notion, that social relations always constitute an economic constraint, has long been questioned by theories and observations of beneficial patron-client relations in agrarian societies (Scott 1976; Platteau 1994). Social capital relations that are generated and maintained for noneconomic purposes are often a necessary component of coping with extremes in weather and other hazards and their impacts (Adger 1999; Ribot 1996; Pelling 1998).

But this does not mean that more networks, greater reciprocal relations and commitments, and generally "more" social

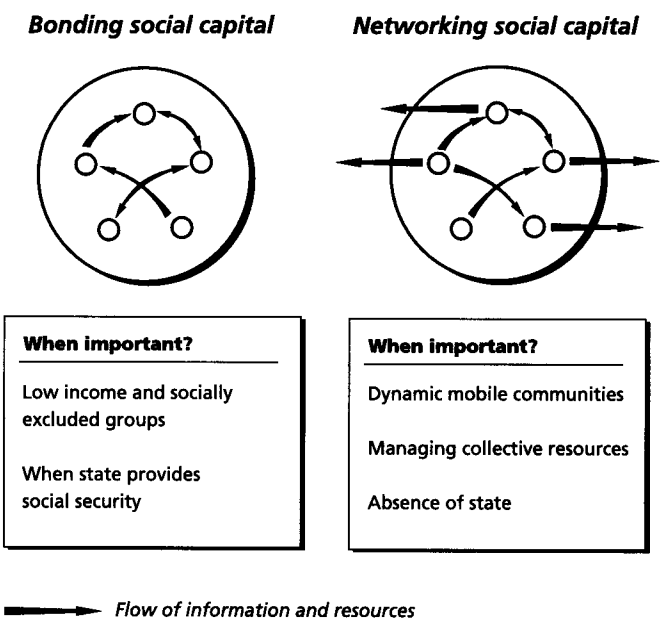

Figure 1. Circumstances in which bonding and networking social capital are important for adaptive capacity.

capital are always beneficial for all individuals or all situations. It is the different combinations of bonding and networking social capital that allow communities to confront poverty and vulnerability, resolve disputes, and take advantage of new opportunities (Woolcock and Narayan 2000). Not all social networks are harmonious with good governance and the operation of society, however. As Woolcock (1998) and Portes (1998) pointed out, criminal gangs and other groups have strong social capital, but their objectives subvert the social capital of others in society and ultimately constitute "social disorganisation" (Arrow 2000).

The discussion so far has been on the social capital of nonstate actors. But this view, it is argued, fails to account for the role of higher-level formal institutions in promoting and facilitating social capital. Another issue in the area of social capital is, therefore, the interaction of individuals and groups with the organizations of the state. Those who hold the institutional view of social capital have argued that "the very capacity of social groups to act in their collective interest depends on the quality of the formal institutions under which they reside" (Woolcock and Narayan 2000, 234; see also Evans 1996; Ostrom 1996).

Potential interactions between networks and the state are shown in Figures 2 and 3, building on the ideas of Woolcock and Narayan (2000). For both figures, the extreme cases of bonding social capital with low levels of networking social capital (left) and high networking social capital (right) are represented. On the left, individual social capital is constituted as "private" bonding ties. On the right, greater networking social capital is in place. These figures depict four extreme cases:

A "well-functioning" state with low levels of networking social capital (Figure 2). In this case the state can provide the necessary underpinning and social security for marginalized groups, although some social groups are inevitably excluded from all formal social

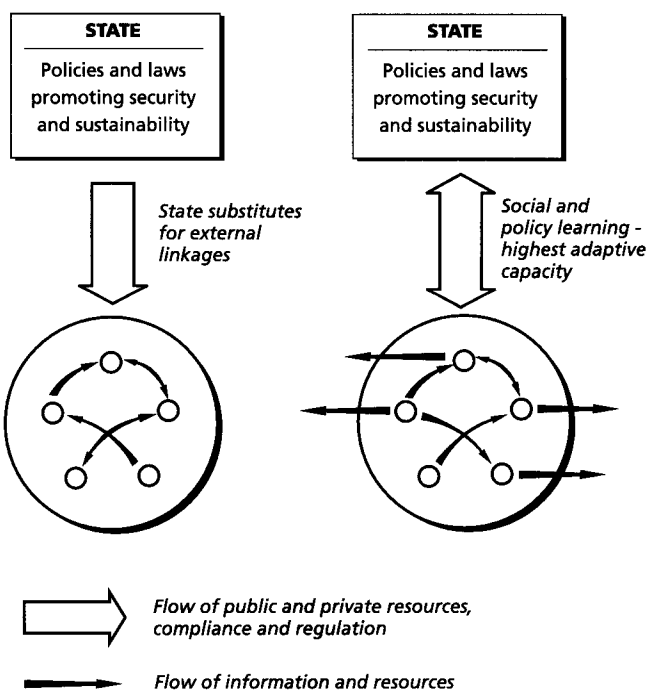

Figure 2. Vertical linkages between state and society with a "well-functioning" state.

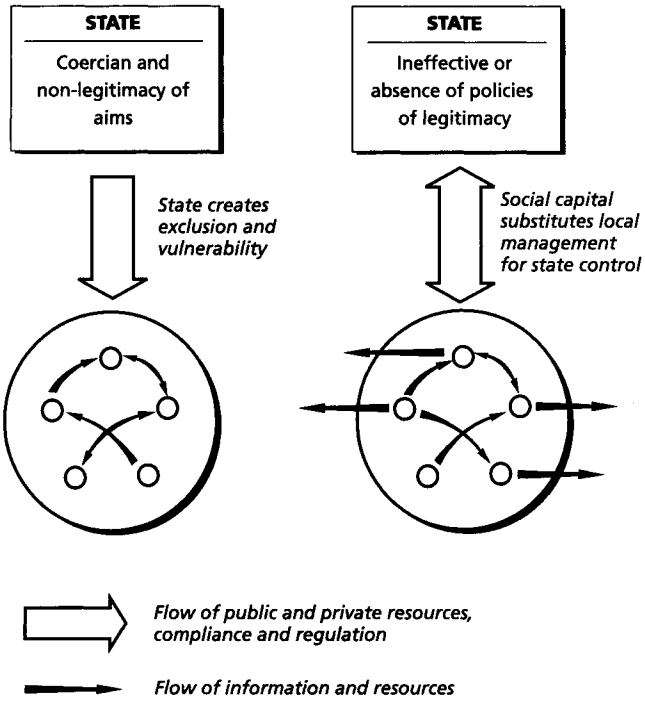

Figure 3. Vertical linkages between state and society with a dysfunctional or absent state.

security. Many societies characterize state welfare systems as crowding out individual community insurance and collective behavior. In the environmental sphere, states regulate and invest in environmental protection on behalf of civil society; for example, they provide backstop insurance for weather-related risks to property.

A "well-functioning" state with high levels of networking social capital (Figure 2). The idealized situation is a synergy between the state and civil society (Evans 1996) that promotes social and policy learning. Open processes of democratic participation and environmental governance can promote both self-regulation and the sustainable use of environmental resources (Agrawal 2001).

A dysfunctional or absent state with low levels of networking social capital (Figure 3). Coercive states often deliberately exclude or undermine social capital. When a state is driven by ideology, subjected to colonialism, or provoked by other circumstances to be at odds with the civil society, conflict ensues, and the most marginal sections of the society are made vulnerable. In these circumstances, civil strife and displacement of the population can occur, sometimes triggering famine even in the absence of a drop in the production of food or an environmental catastrophe. This situation explains some of the major famines of the twentieth century (Sen 1981).

A dysfunctional or absent state with high levels of networking social capital (Figure 3). In the absence of an effective state, networking social capital is forced to substitute for some or many of the roles provided by governments. But the outcomes are often far from desirable. The most widely discussed example of such a situation is the collapse of many aspects of government at the breakup of the Soviet Union. In this case, a new network economy was identified (Grabher and Stark 1998) in which criminal and corruption networks dominate aspects of this economic system to the detriment of virtually the entire population.

Implications for Environmental Risks and Adaptation to Climate Change

Each of the four circumstances outlined in the framework and illustrated in Figures 2 and 3 is observed today. The nature of the relationship between social capital and the state has profound implications for environmental and other governance issues. The implications of these situations and types of social capital and the state interactions are hypothesized in Table 1. This table outlines the pertinent features (following Woolcock and Narayan 2000) of the horizontal bonding and networking aspects of social capital, the institutional limitations on the formation of social capital, and the potential for synergy between the state and civil society. It also outlines the implications for adaptive capacity to climate change.

First, the networks view assumes that social capital is a phenomenon beyond the reaches of the state—social capital often substitutes for the state's involvement in the provision of public goods and is synonymous with what we normally refer to as a civil society. This perspective on social capital has widespread currency in diverse social science disciplines and has been used in the analyses of comparative performance economic systems. Second, institutional approaches to social capital emphasize structure, rather than agency. These insights are also used in comparative analyses of national economic performance, but only as macrovariables (e.g., Knack and Keefer 1997). The macrovariables, such as political freedom, bureaucratic performance, and participation in political processes, are readily measurable at the national level and are more easily quantifiable than are civil-society phenomena. Third, the synergistic approaches to social capital recognize the limitations of both but are focused less on measuring the presence, absence, or density of social capital than on measuring the processes by which the state

Table 1

Types of Social Capital, Links to the State, and Implications for Adaptive Capacity in the Context of Climate Change

Aspects of Social Capital	Features Applied to Well-Being and Welfare	Implications for Adaptive Capacity
Bonding and networking social capital	Stresses horizontal linkages and the role of nonstate actors. The density of social capital leads to measurable outcomes of material well-being.	The social capital of individuals and groups is important for geographic and social manifestations of vulnerability and coping with risks.
State limitations on the formation of social capital	The civil society operates to the degree that institutions of the state facilitate it.	The role of the state remains important for planned adaptation and sustainable development. Governance is vital in managing global environmental risks and in promoting sustainable technologies.
Synergy between social capital and the state	Argues that state-society links and density are key. Addresses the complementarity and potential substitution of state and nonstate and the normative issues of promoting environment for social learning.	State-society linkages are important both for wider sustainable development and for the comanagement of resources. States can facilitate sustainable and resilient resource management and enhance adaptive capacity.

and civil society interact through their embeddedness and complementarity (Evans 1996).

Social capital, although not specifically designed for the purpose, can also play an important role in coping with environmental stresses and can be encouraged through appropriate interventions. For example, social capital, together with the institutions within which it resides, contributes to risk management in agriculture, forestry, and fisheries (Pretty and Ward 2001). Networks of reciprocity, for example, are important for coping with the impacts of extremes in weather and other catastrophic environmental events. But although important for coping, social capital does not necessarily facilitate pro-active adaptation and the enhancement of well-being (Dasgupta 2003) and can curtail innovation and adaptation.

Social learning and adaptation include such collective activities as discourse, imitation, and conflict resolution. As I highlighted earlier, collective action is not necessarily for everyone's benefit (Portes 1998). Social hierarchies and inequalities in resources and entitlements are rarely overturned in the course of adaptation, and external changes, such as extremes in climate and other natural hazards, tend to reinforce these inequalities (Adger, Kelly, and Ninh 2001). As individuals and groups interact synergistically with the state, so the institutions of the state also evolve in a process of policy learning. Adaptation in the political sphere involves periodic shocks to ideologies and paradigms of policy intervention such that these external shocks are conduits of social learning and adaptation.

These perspectives on the interaction between the state and social capital are not mutually exclusive and all have, I argue, useful perspectives on adaptive capacity in the area of climate change. Networking social capital is clearly important at the local level for understanding social differentiation in vulnerability. Bonding social capital within families and households can be an important asset for coping with the impacts of extremes in weather and catastrophic events. Networked social ties to external agents are also important both for coping and for evolutionary adaptation. In the case of the small island microstates, for example, international migration assists in both coping when extreme weather events occur and in furthering the stability and resilience of island populations. Such migratory strategies have been used throughout human history in the Pacific Islands to promote resilience, even though they have been portrayed negatively in terms of promoting dependency (see Barnett 2001; Connell and Conway 2000). Institutions of the civil society and related practices, such as seasonal migration, can play an important role in coping with the impacts of the variability of and changes in climate and can be encouraged through appropriate interventions (see, e.g., Little et al. 2001; Roncoli, Ingram, and Kirshen 2001).

But there are some public goods that can only easily be provided by the state. These goods include major infrastructural investment in flood defense, the management of water resources, and spatial planning that become necessary when the impacts of climate change are significant and risky for large populations. The synergistic approaches to social capital suggest that the implementation of investment and planned adaptation to climate change is best brought about by the comanagement of resources. Thus, stakeholders from the civil society buy into a shared vision of risk and adaptation in the long run and sustainable resource management in the immediate term.

Social Capital and Adaptation to Climate Risks

The foregoing sections have argued that the social dynamics of adaptive capacity are defined by the ability to act collectively. Resource-dependent communities have historically acted collectively to manage weather-dependent, fluctuating, and seasonal resources, such as fish, livestock, and water resources, on which their livelihoods depend. At the same time, governments intervene to manage and regulate

resources. When the vertical linkages between the civil society and the state, portrayed in Figures 2 and 3, are strengthened, novel institutional arrangements like comanagement emerge. Such synergistic social capital promotes the adaptive capacity of societies to cope with climate change.

In the case of coping with weather-related hazards, social networks play a primary role in adaptation and recovery. When governmental intervention to plan for and forewarn communities in disaster planning, or to assist in recovery is largely absent, social capital, in effect, takes over as a substitute for help from the state. The rolling back of the state in times of crisis or "adjustment" often means that this substitution of social capital is a necessity, rather than a choice. The two cases presented in the following sections illustrate contrasting situations, levels of social capital, and adaptative outcomes with regard to present-day weather-related risks and resource management. The first is a case of the formation of social capital and state–civil society synergies in coastal resource management in Trinidad and Tobago. The second demonstrates the emergence of networking social capital to substitute for the state's provision of hazard management in Vietnam following decentralization and retrenchment in the 1990s (derived from Adger 1999, 2000a; Adger, Kelly, and Ninh 2001).

What elements of social capital were measured in these studies? In the study of the management of coastal resources in Trinidad and Tobago, the relevant public social capital was bound up in the establishment of new institutions for resource management. Since the previous sections have argued that social capital can result in different institutional forms (i.e., they are not synonymous), this study examined the presence and evolution of institutions as an outcome of changing social relations and trust between the state and civil society. In the case of the management of climate risks in Vietnam, the social capital has both private elements and community elements. The private elements are observed through the emergence of credit and exchange networks, while the public elements are bound up in individuals' perceptions of trust that they will have resources to call on in times of crisis. Both case studies demonstrate major challenges to the evolution of new institutions (as outcomes of social capital) to provide social resilience in the face of climatic risks.

Synergy Between Social Capital and Comanagement of Protected Marine Areas in Tobago

Marine resources are central to the livelihoods of a significant and growing proportion of the world's populations who live in coastal regions and are frequently governed through state agency and regulation, overlaid with informal local institutions. The management of fisheries and other resources by governmental agencies is often based on zoning and the exclusion of local users. These regulations may be aimed at sustaining resources for users or privileging important economic sectors, such as tourism. Comanagement arrangements between governmental agencies and local stakeholders are in vogue because they are perceived as reducing conflict between users (Singleton 1998). In effect, the comanagement of coastal resources offers institutional arenas whereby synergism between the state and social groups can occur and can promote sustainable utilization (Pomerory and Berkes 1997; McCay and Jentoft 1996; Berkes 2002). There are incidental benefits to such synergistic relationships: networks of resource users can assist in adaptation and coping strategies for extreme events and shocks.

These hypotheses have been tested in the case of action research in Trinidad and Tobago that examined how synergistic social capital emerged and the institutional constraints and opportunities for such social capital to promote adaptive capacity (derived from Brown et al. 2001; Brown, Tompkins, and Adger 2002; Tompkins, Adger, and Brown 2002).

In Tobago, positive learning relationships between the government and local stakeholders in the management of a protected

marine area (Buccoo Reef Marine Park) have been facilitated by governmental initiatives, conflict resolution, and a new institutional design. A new management plan for the marine park coalesced the interests of diverse user groups in the late 1990s. As trust developed among the parties, social capital within the civil society emerged, and the state regulatory authorities considered comanagement arrangements. By informing all stakeholders about the implications of using resources and the acceptability of changing practices, directly resolving conflicts among users of the resource and building trust between the stakeholders, it was possible for the stakeholders themselves to have an input into the management of the protected marine area.

The civil society stakeholders (village councils, dive operators, government regulators, local tourism interests, and others) formed a Buccoo Reef Action Group in 1999. Through negotiation with the government, this group began to discuss the possibilities of comanagement arrangements, such as voluntary wardens, lobbying for improvements in the disposal of sewage, and other regulatory tasks. Tompkins, Adger, and Brown (2002) described this formation of social capital. They distinguished between institutions at the community, formal-organizational, and national-regulatory levels and characterized the means by which institutions adapt to and learn about new issues in terms of networks of dependence and exchange. The evolving networks of the Buccoo Reef residents and activists involved both local place-based contacts that were used to resolve conflicts over fishing and other resources and more distant external networks to nongovernmental organizations and other advocacy groups throughout the Caribbean. This case suggests that networking social capital can be facilitated in a synergistic manner by the state, with many of the networks and contacts being with individuals and institutions outside the local resource-management scale.

But a key question, in the context of this article, is whether the networking social capital, built up in this case through synergy with state agencies, enhances adaptive capacity in the context of climate change. From the example in Tobago, it appears that inclusionary and integrated coastal management contributes to adaptive capacity in two ways. First the networking social capital can act as a resource in coping with extremes in weather. Although Trinidad and Tobago only rarely experience hurricane landfall, many of the individuals who are responsible for disaster planning are the same ones who now work more closely to promote the management of the protected marine area. Thus, the existence of the networks themselves promotes adaptive capacity.

Second, the legitimate and proactive institutions promote the sustainable management of resources, which in effect, maintains the resilience of the social-ecological systems on which the population of Tobago depends and ultimately enhances adaptive capacity. For coral reef ecosystems, for example, it is clear that high sea-surface temperatures, such as those experienced in El Niño years and that may become more frequent over time with climate change, pose a threat to these ecosystems' continued widespread existence in tropical coastal waters (Reaser, Pomerance, and Thomas 2000). Sea-surface temperatures reached the highest on record during the major El Niño–La Niña event of 1998 (Reaser, Pomerance, and Thomas 2000). In the same year, coral reefs around the world suffered the most severe bleaching on record. Although coral and species composition can quickly recover from bleaching (Brown, Dunne, Goodson, and Douglas 2000), evidence suggests that corals that have been weakened by other stressors may be more susceptible to bleaching events and hence less able to recover. By resolving conflict and creating the environment for sustainable use, networking social capital and comanagement institutions enhance the capacity to adapt to the impacts of changes in climate as manifested in periodic extremes in sea-surface temperatures and gradual changes in sea level.

Networking Social Capital as a Substitute for Government

Like social and ecological resilience, social capital is often observable only when there is some perturbation to the social or ecological system (cf. Carpenter, Walker, Anderies, and Abel 2001). The changing ability of the state to provide security is one such perturbation.

The retrenchment of the state has been the most starkly evident in the postsocialist countries, where many functions that were previously provided by the state collapsed during the 1990s (see Grabher and Stark 1998). In the mid-1990s, the local-level hazard planning and coastal defense system in Vietnam was suddenly confronted with decentralization and the breakup of agricultural cooperatives. The resulting institutional response proved to be an example of social capital substituting for the state.

Sea dikes that were constructed for coastal defense in coastal northern Vietnam are the principal investment in the physical infrastructure to ameliorate the threat of climatic hazards associated with typhoons and coastal storms, and until the mid-1990s, they were the major responsibility of the coastal communes and districts. Agricultural cooperatives during the collectivization period were responsible for managing these defenses. Each adult allocated ten days of labor each year to repairing and maintaining the sea-dike system. Since the decollectivization of agriculture, this role of the agricultural cooperatives has largely been made redundant, and the sea defenses in many areas were not maintained for a number of years, exacerbating vulnerability to present-day extremes in climate.

Qualitative data collected in households in coastal areas in 1996 and 1997 examined the trust and reciprocity in coping with the impacts of typhoons and new networks for the collective maintenance of coastal defenses (detailed in Adger 2000a). Decentralized communes engaged in obfuscation and nondecision making to divert the remaining resources from coastal defense toward their higher priorities of aquaculture development. The decentralization process, far from increasing local accountability, further exacerbated the social vulnerability to coastal storms.

The findings of a household survey showed that social capital emerged in the wake of economic liberalization in the 1990s for both instrumental reasons (in credit systems) and for cultural purposes (in reestablishing church and other activities). Networks and social capital resulted in new credit and insurance schemes. In the collectivized period before Vietnam's 1992 Constitution, formal credit was permissible only through agricultural cooperatives run by the state. The role of credit in recovery from stress and the disruption of livelihoods was perceived by householders to be particularly important when external assistance was not available for the immediate injection of resources. These findings mirror earlier observations of the use of kinship and community networks to cope with economic crises and reform (Luong 1992). In the localities surveyed, street associations—informal associations of neighbors within hamlets who have traditionally maintained religious buildings and funeral and marriage ceremonies—reemerged. Associations, along with reciprocal feasting and the exchange of gifts, have become revitalized in northern Vietnam; it has long been recognized that these processes promote security in times of crisis. Sikor (2001) pointed out, however, that these networks have significant implications for social exclusion and differentiation within localities in Vietnam.

In this instance, informal collective decision making for coastal defense and new bonding and networking social capital both substituted for the loss of state planning. The adaptive strategies of many areas of the world that are faced with climatic risks have been based on local-level social networks and evolving indigenous management practices. The research from Vietnam suggests that these strategies could become more prevalent and necessary for marginalized communities. Governments increasingly do not have the resources or frameworks to provide security to marginalized groups in

the face of unknown environmental and other risks (see also Berkes and Jolly 2001; Little et al. 2001; Roncoli, Ingram, and Kirshen 2001). Hence, sustaining the preconditions for the emergence and promotion of social capital remains an important element in overall resilience.

Conclusions

This article has proposed that social capital has both public and quasi-private elements that can be further characterized in their role in bonding and networking. Furthermore, horizontal linkages in social capital are predicated on the legal and institutional structures that facilitate community association and networking. Thus, there are potential conflicts and synergies between the state and civil society in generating and maintaining social capital. In the context of climate change, many potential risks necessarily involve intervention and planning by the state, yet adaptation strategies are equally dependent on the ability of individuals and communities to act collectively in the face of risks. This interdependence between social capital and the state is particularly the case for resource-dependent communities in the developing world that already require dense social capital to manage resources effectively.

The case studies demonstrate positive elements in the formation of social capital—communities find strategies to manage risks through strategic and local networks and interactions. But the two cases also demonstrate diverse manifestations of the forms of social capital in different circumstances. In Tobago, positive networks sprang up in conjunction with the government, while in Vietnam, adaptation strategies were facilitated by social capital that emerged in the absence of governmental support or frameworks. The decentralization of the government and the liberalization of product and factor markets in Vietnam in the 1990s allowed and, to some extent, tolerated the emergence of new networks and forms of social capital. But both cases highlight the synergistic nature of social capital—governmental structures and institutions are vital to the promotion of social capital. At the least, governments have to be tolerant of the emergence of social capital in alternative networks to provide social security and resilience.

The examples presented are, of course, cases of coping with present-day vulnerability to variability in weather, rather than cases of strategies for adapting to changes in climate per se. Nevertheless, I argue that they provide useful analogues and insights into the use of social capital and collective action to adapt to the risks posed by climate change. I highlight three lessons from this rich agenda on collective action, social capital, and adaptation. First, the nature of adaptive capacity is such that it has culture and place-specific characteristics that can be identified only through culture and place-specific research. In addition, policy interventions for planned adaptation at the national and other levels of policy making may not be sensitive to these nuances. Hence, adaptive capacity will be differentially affected by such policies. But this does not mean that the lessons learned from research on social capital cannot be generalized.

Therefore, the second lesson is that to generalize, one needs to learn from theoretical insights into institutions. In particular, there are the institutional prerequisites for the evolution and persistence of collective action and its relative importance compared to state intervention. From the cases presented here, it is clear that the nature of weather-related risk, the institutional context (whether hierarchical, rigid governmental, or more fluid and synergistic governance structures), the homogeneity of the decision-making group, and the distribution of the benefits of management and other factors are all important in collective action for adaptation. Greater insights can be gleaned on how collective action is central to adaptive capacity at various scales by case-specific research.

The third lesson is that institutional theories of social capital provide a means to generalize the macrolevel determinants of

adaptive capacity. But the measurement and observation of social capital remain problematic. Bonding and networking social capital are not easily quantifiable phenomena. In many studies, their presence or absence is approached through the number and extent of contacts, memberships, and other proxies. At the macrolevel, there are more easily quantifiable proxies, but these proxies are more loosely correlated with the social capital phenomenon in question. In terms of adaptation to climate change, many activities that enhance social resilience (e.g., spreading risk over time) are not obviously climate related.

Assessing vulnerability, options for adaptation, and the contribution that social capital makes to adaptive capacity to climate change are, therefore, contested policy and research areas. Assessments of the future impacts of climate change often use the modeling of alternative future scenarios to quantify the effects, risks, or people at risk from particular impacts (Arnell et al. 2002). From this review, I argue that many aspects of adaptive capacity reside in the networks and social capital of the groups that are likely to be affected. This capacity to adapt suggests that some groups within society may be less at risk than modelling studies have portrayed because of their latent ability to cope in times of stress. It will always be difficult to test this proposition because future changes in climate are likely to be outside the range of institutional memory or lived experience.

Although insights from social capital and collective action can inform the processes of adaptation, societies that are dependent on climate-sensitive resources are themselves heterogeneous and will have variable experience and success in coping with stress that is brought about by changes in climate. So when they are faced with significant changes in climate regimes and extremes in weather in the future, different societies will clearly adopt radically different strategies. Their ability to make a sustainable transition will, I argue, be determined, in part, by their networks and social capital. Different types of networks will settle on different types of strategies for adaptation, depending on their adaptation space. As is becoming clear with coevolving social and ecological systems in general (Folke et al. 2002; Adger 2000b), social and institutional diversity itself promotes resilience.

Building trust and cooperation between actors in the state and civil society over adaptation has double benefits. First, from an instrumentalist perspective, synergistic social capital and inclusive decision-making institutions promote the sustainability and legitimacy of any adaptation strategy. Second, adaptation processes that are built from the bottom up and are based on social capital can alter the perceptions of climate change from a global to a local problem. When actors perceive adaptation to and the risk of climate change as being within their powers to alter, they will be more likely to make the connection to the causes of climate change, thereby enhancing their mitigative, as well as adaptive, capacity.

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