



Climate policy processes, local institutions, and adaptation actions: mechanisms of translation and influence

Arun Agarwal,^{1,*} Nicolas Perrin,^{2,3} Ashwini Chhatre,⁴
Catherine S. Benson¹ and Minna Kononen⁵

This paper reviews and synthesizes the published literature on decentralization of renewable resources and development interventions to identify four key lessons for future adaptation planning at the national level. After presenting an analysis of why studies of decentralization reforms are relevant to adaptation planning, the paper examines priority adaptation projects identified by 47 Least Developed Countries in their National Adaptation Programmes of Action (NAPAs). Our research analyzes the range of institutional instruments and relationships visible in contemporary decentralization reforms. The four major lessons for adaptation planning concern the need for national adaptation planners to: (1) attend systematically to local institutions relevant to adaptation and increase local capacity through transfers of information, financial, and technical resources; (2) empower communities and local governments by increasing local autonomy so as to decentralize adaptation planning and implementation; (3) create mechanisms for information sharing among decision makers across sectors and levels of decision making; and (4) improve accountability of local decision makers to their constituents. © 2012 John Wiley & Sons, Ltd.

How to cite this article:

WIREs Clim Change 2012, 3:565–579. doi: 10.1002/wcc.193

INTRODUCTION

Over the past few years, research on climate change has made clear the lasting impact of ongoing climate shifts and the need for greater attention to adaptation to climate change.¹ Particularly important is attention to the needs of poor, more vulnerable groups of people that are likely to suffer disproportionately from negative climate impacts. Indeed, the need for adaptation has led to a large body of work on historical and future adaptation

strategies.^{2–4} This paper examines how purposive actions to assist effective adaptation by poor, vulnerable populations can build on lessons from past experiences of relevant social and policy interventions. In particular, it investigates how insights from writings on decentralization of renewable resource governance and development can contribute to the design of more effective interventions to support adaptation.

Existing studies of adaptation have substantially advanced the understanding of how people in specific locations have responded to climate risks and also highlighted the enormous gap that remains to be met to address future climate impacts.^{5–8} Other policy-relevant work on adaptation has shown how lessons from ongoing adaptations can be incorporated into the design of adaptation policy interventions.^{9–12} But given the relative paucity of cross-regionally comparative research on the empirics of adaptation (as contrasted to adaptive capacity), useful evidence for better design and implementation of adaptation policy

*Correspondence to: arunagra@umich.edu

¹School of Natural Resources and Environment, University of Michigan, Ann Arbor, MI, USA

²Sustainable Development Department, World Bank, Washington DC, USA

³Europe and Central Asia Department, World Bank, Washington DC, USA

⁴Department of Geography, University of Illinois at Urbana-Champaign, IL, USA

⁵Global Environment Facility, Washington DC, USA

can also be sought in policy and implementation experiences in other domains. The experience of decentralized renewable resource governance interventions is particularly apt for thinking about adaptation for two important reasons.

For one, decentralized renewable resource governance and development interventions are typically place specific: differences in characteristics of locations, populations, and social and political dimensions matter. These differences demand place-specific planning, intervention, implementation, and governance. Differences in social, economic, political, and cultural characteristics, resource endowments, and people's responses mean that blueprint approaches to the governance of renewable resources and development projects may miss the most important opportunities for improvements in outcomes.¹³ Approaches that adapt interventions to territorially specific and relevant requirements have a greater likelihood of being effective. Analogously, sensitivity and vulnerability to climate impacts vary at relatively fine scales, and adaptation possibilities are not the same across places. Adaptation to climate impacts, therefore, is likely to require territorially and scale-specific responses as well.¹⁴

At another level, decentralized renewable resource governance and development interventions are also about creating a better connection between the local variety of institutions and organizations and national level policies and interventions. Effective decentralization not only enables the representation of variety in socio-political, institutional, and asset endowments across locations but also makes it possible to coordinate macro-scale actions and decisions to supply information, resources, or organizational arrangements that a given locality lacks. Similarly, in the context of climate adaptation, there is an urgent need to understand how national policies on adaptation can be structured through an analysis of the relationship between different levels of strategic implementation to enhance effectiveness. Higher-level coordination of territorially specific adaptive responses is essential if adaptation efforts are to be broadly effective because at times past experiences of local adaptations are likely to be inadequate in the face of unprecedented climate change. Thus, locally specific strategies, articulated and coordinated through national policy mechanisms, are of paramount significance in the context of adaptation to climate risks and impacts. The impact of the existing scholarship on adaptation can, therefore, be enhanced through greater attention to the diverse effects of different kinds of linkages across policy and decision-making levels.^{9,15} Research on renewable resource governance and development can usefully inform judgments about effects of different

mechanisms to articulate local adaptation actions and higher-level adaptation policies.

The chief elements of the ensuing argument can be summarized. National-level plans—whether for adaptation, for development, or for renewable resource governance—are managed and implemented through different kinds of local institutions (humanly created formal and informal mechanisms that shape social and individual expectations, interactions, and behavior) and organizations (concrete manifestation of institutions with an identifiable location, personnel, and rule structure).^{16,17} A wealth of experience and knowledge about renewable resource governance and development projects is available to show how local institutions and organizations connect to national objectives and with what effects. These experiences form a fertile source of information for structuring future adaptation interventions and translating them into actions and outcomes. Accordingly, this paper examines the experiences of decentralized renewable resource governance and development to identify useful knowledge for adaptation-related interventions.

The paper begins by taking stock of the most prominent national-level efforts in poor countries to plan for adaptation: the National Adaptation Programmes of Action (NAPAs). The NAPAs were mandated in 2001 through the Marrakesh Accords reached at the Seventh Conference of the Parties (COP7) to the United Nations Framework Convention on Climate Change (UNFCCC). Country governments in the 50 Least Developed Countries (LDCs) worked with United Nations agencies to 'identify priority activities that respond to their urgent and immediate needs with regard to adaptation to climate change' (Ref 18, p. 3). Program documents available from the UNFCCC are the basis of the analysis reported in the next section on the NAPAs.

After analyzing the specific areas in which NAPAs can strengthen local implementation and the articulation of the local and national organizational structures, the paper uses a review of the literature to examine the major lessons of scholarly research on decentralization of renewable resource governance and development. The historical depth of work on decentralized renewable resource governance and development, the substantial number of case-based, comparative, and statistically oriented work on the subject, and the policy orientation of much of this work creates the potential to usefully inform future adaptation efforts. Scholars and decision makers interested in adaptation face similar conceptual and practical challenges as those faced by scholars and decision makers interested in renewable resource

governance and development. There is a useful affinity between their subject matters and policy interests.

METHODS

The conclusions in this paper rely on the analyses of two sets of documents and published literature. The first comprises the NAPA reports produced and submitted to the UNFCCC by 47 of the 50 LDCs (Angola, Equatorial Guinea, and Somalia are the three countries whose NAPA reports were not available as of March 2012). In addition to the NAPA country reports, we also rely on other NAPA-related papers and analyses produced by the UNFCCC Secretariat. The NAPA country reports contain information on the NAPA process that the country followed, the main stakeholders involved in the NAPA process, climate change threats identified for the country, and a prioritized list of adaptation projects selected by country-level stakeholders. As such, these documents are a valuable repository of original information on the process and substance of adaptation planning in LDCs. Nothing comparable to these documents exists for any other group of countries.

Our analysis of identified projects relies on the relatively consistent project descriptions in NAPA country documents. This information includes basic information about the project and the sector of the project, the reasons stakeholders identified the project as being of immediate or urgent priority, and the estimated costs of the project. All information was coded by two research assistants and the consistency of the coding was cross-checked and validated by the first author of the paper.

In addition to the NAPA project reports, we also examined available information about the adaptation projects submitted to the Least Developed Countries Fund (LDCF) by May 2012 for implementation support regarding which some basic information is also available with the UNFCCC.

The second set of writings we reviewed is that for renewable resource governance and development projects. We identified cases of decentralized governance by using keyword searches for studies of grazing, fishing, forest, and irrigation projects. To identify articles and papers we relied on the ISI Web of Science database. Our keyword searches were based on a combination of two sets of terms. The first set concerned the renewable resource type and included the following terms: 'fisher*', 'forest*', 'irrigate*', 'pasture', 'pastoral', 'goat', or 'sheep'. The second set focused on mode of governance and included 'common*', 'common property', 'common govern*', 'local govern*', 'comanage*', and 'decentral*'. Using

this approach, we found 446 case studies of renewable resources. Of these, 63 contained information on local governance mechanisms and the relationship across scales of governance. The information in these studies forms the basis of our conclusions about how the experience of decentralized renewable resource governance and development projects can inform the design of future adaptation efforts.

THE NATIONAL ADAPTATION PROGRAMMES OF ACTION

The NAPAs are the most prominent national-level effort to identify priority areas in which adaptation to climate change is necessary. As such, they are a useful basis for trying to understand how national-level efforts to understand and analyze adaptation needs have worked in practice.

The 2001 Marrakesh Conference of the Parties to the United Nations Framework Convention on Climate Change mandated the creation of NAPAs.¹⁹ NAPAs highlight the highest priority areas for adaptation interventions as seen by important stakeholders in the relevant countries: these include government ministries and departments, nongovernmental organizations (NGOs), and scholars and research institutions engaged with climate change. They showcase the existing international institutional framework through which nation states created adaptation plans. For the most part, the NAPAs are an analysis of likely climate impacts in the relevant country, and a prioritized listing of adaptation needs and projects. For a variety of reasons, few of them examine how to mobilize relevant actors and resources for stated adaptation priorities, how to coordinate adaptation efforts across different agencies and sectors, how to organizationally locate the planning and implementation efforts related to adaptation, or the institutional and organizational arrangements that would be necessary to implement identified adaptation projects. The experience of creating the NAPAs and the information in the NAPA documents nonetheless constitutes an opportunity to understand how national-level adaptation planning processes can serve the interests of the more vulnerable social groups in the poorest countries.

The NAPAs, in identifying priority areas for adaptation interventions, were expected to be guided by a common approach that considered the local nature of adaptation as well as the need for external support in effective local adaptation. At one level, the local nature of adaptation was recognized in the design and process of crafting the NAPAs. The ministries of environment and other agencies that developed the programs did so in

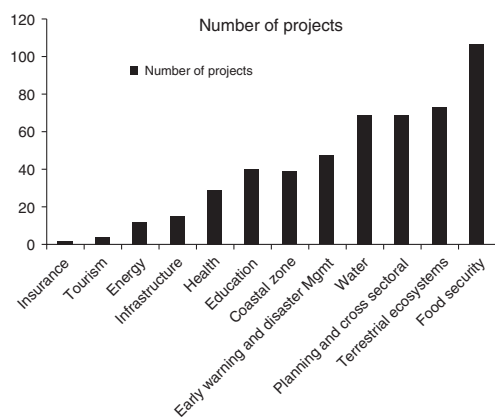


FIGURE 1 | National Adaptation Programmes of Action (NAPA) projects and their sector-wise distribution.

consultation with many local NGOs and institutions. The extent to which such consultation occurred across countries varied greatly in practice. On the basis of these consultations, NAPA planners collectively identified 513 adaptation projects with a total cost of approximately \$1.5 billion.²⁰ In arguing for the need for additional support for adaptation, they also recognized the likelihood that future adaptation challenges could overwhelm the local capacities of poorer groups who might bear a significant proportion of the burden of climate impacts.

Figure 1 indicates that the largest number and proportion of adaptation projects are focused on sectoral issues for improvements in natural resources-related activities such as in agriculture, forestry, water, and in the development of infrastructure—close to 75% of all identified projects. Nearly all projects identified in the NAPAs focus on rural areas. Despite rapid urbanization in much of the developing world, including in the countries that prepared the NAPAs, less than 5% of the projects focus on urban impacts of climate change or on urban adaptation issues. This overwhelming focus on rural adaptation continues to be true for the 60 projects that have been approved for support by the global environment facility (GEF) in the last 3 years (see below).

It is also worth noting that more than 85% of the project descriptions in the NAPA reports find no mention of local organizations or institutions as having a role to play in implementing adaptation. They identify central government agencies as managing adaptation actions despite the acknowledgment in the NAPA guidelines that adaptation will require widespread stakeholder involvement and participation.

A detailed analysis of the projects included in the NAPA reports cannot be carried out because of the limited available information about them. Even for the preliminary analysis and conclusions presented

below, it is worth noting that it is based mainly on documentary rather than interview or participant observation evidence. It ignores, therefore, many of the subtleties of the NAPA process itself or of the social and political concerns that led to the form of the reports. Because of these limitations, our discussion below focuses more on the outcomes of the NAPA process as represented in the country reports than on the political economy of the creation of the NAPA process or reports.

In terms of outcomes, it is important to highlight for the purposes of this paper that most NAPA projects appear to aim to build national governments capacities rather than strengthening the capacity of local actors and institutions to undertake adaptation as also pointed out by an early study of the NAPAs.²¹

That the NAPAs have paid only limited attention to local institutions or to the relationship between local and higher-level institutions is evident in particular for projects that are focused on agriculture, water, forest management, fisheries, small-scale infrastructure, and capacity building at the local level. Such projects provide particularly apposite opportunities for incorporating local institutions and supporting their role in enhancing adaptation. The gap at the local level is regrettable as well because the NAPA process required widespread consultations with NGOs and other civil society actors.

It would thus appear that despite increasing attention to adaptation to climate impacts, national and international adaptation planning is still at an early stage. The NAPAs constitute an important beginning of the long process through which national-level planning for adaptation will begin to be put into place. Effective future adaptation will require strong connections between local institutions and national planning and implementation processes.

Creating and improving such linkages will require that decision makers and implementers identify and strengthen the local institutions that play a key role in adaptation to climate variability and change. It will also be necessary to facilitate stronger connections across the sectors in which adaptation is planned, and between national and local institutions involved in planning and implementation. Indeed, without closer linkages between national and local institutions, national efforts to plan for adaptation are likely not to facilitate adaptation at the local level where it matters most for the lives of poor and vulnerable peoples. Effective adaptation will also require that national plans incorporate local knowledge and histories of adaptation into future efforts.

Adaptation efforts will also need to be integrated better with ongoing development and

natural resource management plans than has hitherto been the case. Such plans are already working through many different kinds of local institutions in different parts of the world. Ignoring the lessons of existing development and resource governance policies, especially as such lessons are pertinent to adaptation interventions, will be to reinvent the wheel. As the reality of climate change is recognized more widely, the need to integrate adaptation into development and conservation projects will become more urgent—coordination among these diverse functions of local institutions and the mechanisms through which such coordination can be achieved will also therefore become more important. To protect the interests of the poorest and most vulnerable populations, the role of local institutions in adaptation is undeniable—this important role is one major reason the linkages of local institutions and the effects of different kinds of linkages needs to be considered more fully and frontally.

In this context it is also worth mentioning that in some contrast to the early stages of the NAPA planning process, more recent evidence indicates that community and local level processes are beginning to find at least a minimal representation in the implementation of NAPA projects. By May 2012, the LDCF had endorsed 60 NAPA projects submitted by 44 different countries.²² Although much detailed information for these projects is again not available, nearly 25% of these projects seem to have incorporated some role for communities and local organizations. GEF commitment for these projects exceeds \$260 Million and the total investment in these projects is on the order of \$1.2 Billion, constituting perhaps the most critical systematic commitment to adaptation in the LDCs. It is worth noting that in contrast to the estimated average cost of a project included in the NAPA report (on the order of \$3.0 Million), the costs of projects funded by the LDCF is closer to \$20.0 Million!

As the implementation of these projects proceeds, lessons from existing experiences of decentralized renewable resource governance and development become all the more important to review and assess.

DECENTRALIZED GOVERNANCE OF NATURAL RESOURCES AND DEVELOPMENT: INSTITUTIONS AND INFLUENCES

Recent efforts to decentralize the governance of renewable resources and development have been going on at least since the mid-1980s.²³ Beginning in this period, decentralization attracted widespread attention as a policy choice and as a solution to the

problems confronting state-led centralized attempts to conserve the environment. There is certainly debate over the scope, extent, and depth of the reforms that have occurred since the late-1980s. Positions in this debate range from those for whom nothing much has changed^{24,25} to those who see the world of governance to have undergone a major transformation.^{26–29} Much of the debate's heat may be explained by differences in the regional and territorial focus of the reforms that are studied and the resources and policies that are the focus of attention. It is also true that governments in many countries have demonstrated at least some commitment to decentralized management. This commitment to decentralization covers most natural resources that play an important role in the day-to-day subsistence of many poor people: forests, coastal and inshore fisheries, rangelands, and irrigation water among them.

Nonetheless, there is great diversity in the nature of decentralization reforms across locations. There are variations in the extent of decentralization of resource governance and development interventions. The local actors that gain decision-making powers differ. The actions domains in which they can make decisions are dissimilar from one case to another. Also, certainly, the reasons for decentralization reforms are often distinctive, depending on context.

But all decentralization reforms have at least one common goal. This goal is to create mechanisms that establish formal linkages between central governments and localities. Such linkages typically generate new types of relationships between central agencies and existing local institutions. These new relationships may result either from the creation of new organizational structures or through a revision of relationships with existing institutional partners. For example, the Joint Forest Management Program in India, an attempt to decentralize the governance of forests in partnership with local communities, has often selected existing local forest management committees and recognized them formally as partners. This occurred, for example, in the provinces of West Bengal and Orissa. But in other provinces such as Madhya Pradesh and Rajasthan, decision makers in the forest department more often created entirely new organizational structures at the local level with whom they entered into partnerships to reallocate decision-making authority for forest use and management at the local level.

A review of decentralization reforms is instructive particularly because the decentralized governance of renewable resources and development projects has

led to highly variable outcomes—some intended, others unintended. These reforms have sometimes reinforced existing inequalities and social heterogeneities and at other times undermined them. In some cases, they have strengthened local autonomy, and at other times led to stronger integration of local units of governance into national plans. The formal relationships and local–central partnerships sometimes successfully extend the capacity of governments to manage resources sustainably and equitably. In other situations, they are ineffective in achieving both sustainability and equity objectives, and they may even undermine local institutions. The variations in the outcomes of different decentralization reforms provide a rich tableau of experiences to be analyzed in relation to adaptation policies. In reviewing the outcomes of decentralization reforms it is particularly important to understand the mechanisms through which local actions and collective outcomes are connected to central policies and institutions.

Our review suggests that governments in different countries have sought to influence outcomes of decentralized governance of fisheries, forests, irrigation, and pastures using a slew of mechanisms. Their efforts and the representation of these have led to widely ranging outcomes. We discuss below four thematically relevant conclusions for climate adaptation policies that emerge from our review:

1. *Diversity of local actors and decision makers:* Decentralization reforms transfer decision-making authority to, and rely upon, a number of different kinds of decision makers at different levels of decision making to implement reforms.
2. *Diversity in mechanisms of local-central articulation:* There is also a large variety of institutional, informational, and financial mechanisms through which to create durable relationships between local and higher-level organizational structures—these have different implications for local institutional capacity.
3. *Institutional relationships and local autonomy:* Decentralization initiatives sometimes reduce local autonomy and at other times enhance it—the specific political effect is usually driven by institutional relationships encoded in decentralization policies; and finally.
4. *Institutional relationships and equity:* The nature of accountability relationships, information sharing, and levels of access to institutions have a key role to play in shaping whether decentralization relationships will lead to more or less equitable outcomes.

Diversity of Local Actors and Decision Makers

Local governance of natural resource management is characterized by the involvement of a great number of actors whose interests differ. Differences in the interests of local actors are on the one hand a function of the level at which decentralized decision making occurs: village or community, district, provincial, or regional. On the other hand, the identity of the local actors, the property rights they hold, and the domain of their functioning—private, civic, and public—also obviously shape their interests. At the local level, decentralization may lead to greater decision-making responsibilities on the part of community councils, local governments, NGOs, cooperatives, resource-user committees in different sectors, and in some cases, even private market-based organizations. At higher levels, decentralization reforms tend to confer greater powers and responsibilities for decision making typically for public rather than civic or private agencies and actors—whether these are elected bodies or line agencies of central ministries and departments.

The diversity of local decision makers who gain authority to make decisions as a result of decentralization is instructive for adaptation processes because it indicates that there is no single best solution to enhance local capacities to undertake adaptation. An examination of the interests, relative strengths, legitimacy, and property rights of decision makers in different domains also indicates that the goals of decentralization reforms often shape choices about appropriate partnerships at the local level and at the same time influence the degree of local flexibility in decision making, findings important when designing partnerships to address climate change adaptation.

Formal versus Informal Institutions

Creating new civil society or public organizations to allocate resources can help sidestep existing unequal political relationships in a given context and thereby help improve equity in resource allocation through local organizations. But such a solution may occur only at the expense of the effectiveness of the local organization. Contrasting strengths of different kinds of civil society institutions around irrigation in Yemen illustrate the trade-off between equity and effectiveness.³⁰

Spate and masque irrigation are the two main forms of irrigation in Yemeni highlands.^a The basic water allocation principle is that landowners located upstream in a valley (*wadi*) irrigate their lands before those located downstream. *Sheikhs*, decision makers located within tribal structures of social interactions, are typically responsible for managing the allocation

of water. They are well connected to other local institutions and decision makers, but less integrated with higher-level or central institutional arrangements and decision makers. A number of recent irrigation projects opted to establish new water users' associations and groups. Two different World Bank-assisted projects, for example, sought to improve spate irrigation and soil and groundwater conservation by bypassing the sheikhs and other decision makers in tribal water management institutions in favor of new water management structures.^b

This strategy has advantages and disadvantages that recall the issues of fit (the interaction between institutional characteristics and ecosystem properties), interplay (intended or unintended relationships among institutions), and scale (the differences or similarities between institutions to respond to local to higher-level environmental challenges).¹⁵ Traditional institutions are generally better connected to local populations, work to represent local interests and concerns, and mediate between external interventions and local communities, suggesting their strong fit with local realities. But traditional decision-making structures are weak at interplay: they have only limited ability to change existing rules for allocating water or mobilizing large-scale support. They are also not as relevant in helping maintain irrigation structures in areas close to formal administrative centers. Finally, traditional institutions are less effective in addressing large-scale action that requires coordination and resources beyond the spatial scale of the functioning of local institutions. These could be tasks requiring supra-local coordination include repairing large-scale damages or undertaking preventive measures to reduce problems resulting from flooding and droughts. These points illustrate problems of interplay and scale in the functioning of traditional institutions.

In contrast, new water users' associations and groups such as those established by the World Bank-assisted project in Yemen seek local involvement on a more equitable basis instead of favoring landowners in upper catchments of valleys and rivers. They also enjoy formal recognition and the capacity to change rules formally. Finally, they have better information about water availability in making decisions about water allocation. However, these advantages regarding scale and fit are offset by problems of interplay because of their limited connections to communities and households. Nor do new institutions enjoy the same legitimacy as do tribal leaders and institutional structures.

More generally, the example indicates the advantages and disadvantages of reliance on formal versus informal institutions in efforts to implement

development, conservation, or adaptation strategies. Externally introduced institutions and organizations are often structured so that their activities can promote greater equity in distribution of benefits, especially when NGOs and international donors are involved in the implementation. But these institutions take time to find acceptance and in the meanwhile may not find sufficient traction in the communities where they are located. In contrast, when externally introduced programs for sustainable development rely on prevailing institutions, they may help consolidate existing patterns of inequality.

Deconcentration versus Devolution

Similar trade-offs between effectiveness, representativeness, and democratic functioning mark the decision to decentralize powers to elected local governments versus local administrative bodies. The common distinction that is often drawn in the large literature on decentralization between devolution and deconcentration (or political/democratic vs administrative decentralization) typically turns on whether the local actors empowered through reforms are elected governments or administrative branches of central ministries and departments. However, the real question in the effective decentralization of decision-making powers may be not so much whether it is elected or administrative bodies that partner with central bodies but whether decentralization reforms allow newly empowered local actors to exercise these new powers.

Two examples illustrate this variation. An early effort to decentralize forest governance in India occurred in Kumaon in 1931 when local residents resisted the efforts of the colonial government to convert the region's forests into state-owned resources. As a result of local protests, the central government agreed to permit the formation of elected forest councils in each village in the region. More than 3000 such councils exist today, and each has the authority to manage small plots of forests close to their village.³¹ They have effectively limited deforestation in the region, and also met many of the demands of local users for different subsistence products from forests.³²

The decentralization reforms in the forest sector in much of East and West Africa stand in contrast to the success of India's reforms (Ref 33, p. 17–25). Referring to decentralization of resource governance as 'fettered reforms', Ribot outlines how the extent of local decision-making powers is greatly limited in many countries. In Mali and Uganda, for example, elected local governments have the rights to make decisions related to forests, but they lack any significant forests over which to make decisions. In Senegal, although local governments are elected, they

are still upwardly accountable to higher-level forest authorities, meaning that local level authority remains restricted.³⁴

Sectoral administrative bodies—for example, local units of the forest department—on the other hand have substantial decision-making powers in all the above countries (India, Mali, Senegal, and Uganda) regarding forests. They are empowered to make decisions about where, what, how much, and how to harvest, and whether to allocate any benefits to local populations. In addition, they are also often responsible for monitoring whether forests are being used in accordance with existing laws and have the capacity to impose sanctions on users that break laws.

In some countries, governments and international donors have relied upon help from local or international NGOs to make decentralization more effective.^{35–37} NGOs often provide substantial managerial inputs into decentralization efforts, promote participation, and gain local support.³⁸ They enjoy legitimacy and local support, but even the best functioning NGOs remain unaccountable to local populations on whose behalf they act.³⁹ Consequently, one limitation of transferring significant authority and responsibilities to NGOs is that it can be difficult to identify legitimate and effective NGOs from those that are conduits for cash transfers.

As part of the formal administrative apparatus, administrative bodies have greater decision-making powers than elected local governments or NGOs—but they suffer in comparison with respect to their ability to elicit participation, and in the extent to which they are accountable to local populations. Chiefs and informal power brokers at the local level are often well connected to local populations, but may not be interested in pursuing more equitable resource allocation. Elected local governments enjoy greater legitimacy and where elections are fair and competitive they may also be more accountable to their constituents. But without broad participation, effective decision-making powers, and capacity to implement reforms, they will turn out to be ineffective.

The above discussion on the advantages of NGOs versus administrative bodies versus local governments has two key implications for selecting the actors involved in designing and implementing climate change adaptation programs and policies. We suggest that to overcome the gaps in capacity, legitimacy, and accountability, partnerships with local actors have to be chosen with attention to the specific advantages they confer, particularly in terms of greater local acceptance and legitimacy. Thus, building multi-actor partnerships may be a key to address adaptation needs at the local level. Adaptation policies aiming

to create effective partnerships will thus need to work with a variety of local actors, and use the strengths of different actors to promote specific goals related to design and implementation of adaptation projects, participation of and accountability to local users, and monitoring and sanctioning related to implementation. Such coordination is costly; in the longer run, it is also more effective.

Diversity in Mechanisms of Local–Central Articulation

Studies of decentralized resource governance and development also document many different ways in which central policies articulate with and integrate existing and new local institutions into decentralization policies and legal frameworks. The discussion of the diversity of local actors suggested that policy makers cannot draw upon blueprint approaches to decentralization reforms to support effective adaptation. All the goals of decentralization—whether it is improving local capacity, promoting efficient implementation, enhancing the legitimacy of new or traditional institutions, integrating local institutions better in administrative processes, increasing the accountability of decision makers to their constituents, or enabling participation and local support for new projects—depend on specific institutional and resource transfer mechanisms. Table 1, based on a survey of 63 cases of decentralized resource governance related to forests, irrigation, rangelands, and fisheries, highlights the diversity of articulation mechanisms used by central governments to link local actors with central decision makers.⁴⁰

As Table 1 illustrates, central governments use a variety of mechanisms to connect local decision-making bodies with formal mechanisms of rule. These include technical, monetary, and other resource transfers, rules to integrate traditional or new institutions into legal frameworks, creation of incentive systems, shifts in accountability relations, changes in information flows to affect monitoring and reporting, and accounting and audit mechanisms.

Advice is the most common information mechanism. In the forest sector, in particular, the reviewed studies described how technical forest officers provide advice, support, and training on silvicultural practices and technical aspects of forest management.^{41–47} Provision of reports on annual performance is another information mechanism that governments use to create better links with lower level actors, particularly in the fisheries sector.

Human resource development and capacity-building mechanisms often promote interactions

TABLE 1 | Mechanisms to Connect Local Institutions with Higher-Level Decision Makers and Policies

Mechanisms to Articulate Local and Central Institutions	Effects of Mechanisms
<i>Information mechanisms</i>	-Improve transparency
-Advice	-Improve coordination
-Audits	-Provide local institutions and actors better knowledge for making decisions
-Mechanisms for reporting corruption	-Increase accountability of decision makers
-Activity reports	
-Management plans	
<i>Human resource and capacity building mechanisms</i>	-Increase ability to make decisions and carry out plans
-Appointment of officials	-Improve quality of planning and implementation at local level
-Performance monitoring	
-Training	-Promote interactions among local institutions
-Education	
-Exchange programs	
<i>Institutional change mechanisms</i>	-Create accountability relations between decision makers at local level and their superiors as well as lower level constituents
-Creation of new rules	
-Authority to monitor, sanction, adjudicate	
Elections	-Protect/improve resources and local governance strategies
	-Reduce free riding
<i>Financial mechanisms</i>	-Increase local autonomy
-Accounting reports	-Change dependency relationships
-Funds transfers	
-Taxing authority	

among local level institutions and multiple levels of institutions. For example, when a higher level of government appoints officials to local institutions, as De la Torre-Castro⁴⁸ shows for fisheries officers in Zanzibar, the appointed official comes to serve as a link between formal administrative bodies and village level management. This type of mechanism can also improve local level planning as described by Lin⁴⁹ for Myanmar.

Human resource mechanisms such as performance monitoring also show how central governments may grant authority to local level actors in some domains but retain power and oversight authority for other decisions. Nayak and Berkes⁵⁰ describe how forest department officials serve as members of forest management committees and the forest department retains the power to decide which species are planted under Joint Forest Management schemes in India. Similarly, Raik and Decker⁵¹ note that mayors in Madagascar must recognize community forest associations before they are allowed to operate and these associations are then subject to evaluations after

3 years to ensure that the communities meet outlined responsibilities. Nunan⁵² notes similar oversight of Beach Management Unit (BMU) committees in Uganda, where its rules are approved by local government, and performance is monitored annually.

Institutional change mechanisms also illustrate how central government may use certain requirements to regain power. Saunders et al.⁵³ describe how the Tanzanian government revoked community rights to manage forests on the grounds that the community was not meeting its responsibilities. In the cases described by Saunders et al. erstwhile community forests once again were then placed under the control of central government authorities.

Financial mechanisms are common across all sectors. They mechanisms include revenue sharing, higher levels officials approving funding requests from those at lower levels, or financial support. In some cases, lower levels of governments may also be granted the authority to collect taxes, as Tan-Mullins⁵⁴ illustrates in Thailand: the subdistrict has jurisdiction over fishing in the first 3 nm (1 nm = 5.55 km) of inshore water, while the district has the jurisdiction and tax collection authority for the next 6 nm. Three different ministries have district offices involved in fisheries. He concludes that the involvement of officials from multiple levels of the government results in duplication of responsibilities and may also cause confusion for local level officials.

Financial mechanisms may also be used as incentives, such as when the National Irrigation Administration allows local irrigation authorities to retain revenue that they collect from farmers.⁵⁵ Maikhuri et al.⁵⁶ also identified revenue sharing and tax collection responsibilities in their examination of pasture resources, where forest officials share percentages of revenue from auctioning dead trees with community forest councils, district development boards, and the local revenue board.

Institutional Relationships and Local Autonomy

In an important paper on participation and decentralization, Blair⁵⁷ refers to the ideal of public accountability in decentralized democracies: Administrators should be accountable to elected officials who in turn should be accountable to the public through elections. This ideal holds only debatably even in western, long-standing democracies where the relationships between administrators and elected representatives as also those between the voting public and elected politicians are beset with agency problems and information asymmetries. In the

context of local level electoral and appointed officials, the degree of local autonomy and accountability is highly variable across the world. In the context of climate change adaptation this degree of autonomy is important because without sufficient autonomy, effective climate change adaptation will remain a top-down activity, undertaken without sufficient information about local risks and capacities relevant to climate change.

Questions of agency relationships and the direction of power flows are particularly important in the case of decentralized center–local relationships. Because decentralization of natural resource governance has fared poorly in many countries, a large number of scholars view decentralization as a means for modern states to create formal linkages that extend projects of regulation and control over local populations and institutions. Samakande et al.⁵⁸ talking about irrigation in Zimbabwe, state that smallholder irrigation is a ‘political tool to control the poor masses’ (2004: p.1075). Hoffman⁵⁹ illustrates how the Nigerian federal government extended its reach into localities through the creation of local governments. Meinzen-Dick and Raju⁶⁰ suggest that Indian decentralization does not result in autonomous government by local resource users in the same way as in self-governing systems. Instead, state involvement often constrains the institutional autonomy of user groups.

Decentralization reforms constrain local autonomy and capacity particularly when they are accompanied by upward forms of accountability. New forms of reporting outcomes and methods of monitoring are two ways to create such upward accountability. For example, the Government of Uganda devolved activities and powers, including development and enforcement of bylaws, collection of information, and participation in the licensing process to Beach Management Units that came to be legally recognized by the 2003 Fish (Beach Management) Rules. Despite such increases in responsibilities, local autonomy declined: the local government is expected to approve Beach Management Unit rules and the central government monitors the annual performance of BMUs. Maikhuri et al.⁵⁶ further illustrate the ways in which decentralization reforms may include reporting requirements that ensure upward accountability and transfers of funds from localities to the center. Village forest councils are required to submit proposals to received monetary payments for dead trees, and revenues from forest timber products are collected through centrally controlled auctions, ensuring that even locally generated revenue accrues to both district and central government levels.

State interventions often ignore traditionally coordinated and regulated resource access, as both Thebaud and Batterbury⁶¹ and Singh et al.⁶² document for pastures. Thebaud and Batterbury,⁶¹ following Scott,⁶³ write that state ‘modernization projects’ weaken traditional mechanisms of governance. In Niger, pastoralists historically dug their own water sources, which allowed for local negotiation of pasture areas and limited the number of animals that could graze within the area. The state introduction of modern infrastructure, such as permanent cement wells and deep tube wells, undermined traditional systems of governance and a system of open access emerged. Similarly, Singh et al.⁶² showed how an external intervention of placing watering ponds in traditional rainy season pasture lands ignored local, traditional knowledge, and reduced the effectiveness of local institutional systems. In a review of South African development community (SADC) countries, Swatuck⁶⁴ demonstrates a similar process in which state government actions led to a decline in existing cooperation and conflict resolution mechanisms in the irrigation sector. Furthermore, powerful social actors at the local level dominated the new institutions, resulting in the replication of previous power relations.

Two cases from Indonesia’s fisheries sector provide an example of how government decentralization policies can both undermine and support local institutions.^{65,66} The 1979 Village Administration Law eroded traditional institutions and management norms⁶⁶ as did the New Order’s Basic Provisions of Local Level Government Law.⁶⁵ However, the 1999 Local Autonomy Law encouraged traditional fishing community based decentralization policies.⁶⁴ Indonesia’s laws now seek to support and revitalize traditional management authorities^c and recognize local authorities and institutions, allowing for their adoption in local governance.⁶⁶ Thornburn⁶⁷ also notes that customary institutions in Indonesia survived colonial government, national structures, and regional trade networks; despite all the different waves of external actors, Kei people in the case study area have maintained their livelihoods and social structures.

Successful examples exist in which decentralization leads to greater local capacity, cooperation between local and central decision makers, and improved local effectiveness. A certification program in the Philippines fisheries sector illustrates how new mechanisms can promote effectiveness. The Government of the Philippines addressed a lack of capacity, collaboration, and integration, limited financial sustainability, and weak law enforcement through a local

government certification program.⁶⁸ It promoted local participation in coastal management and devolved responsibilities to local governments through the 1991 Local Government Code and the 1998 Fisheries Code, partially in response to donor and NGO support for Integrated Coastal Management. These new policies created new institutional roles for both national and local governments, resulting in an uncertain period of transition, where jurisdictional and legal responsibilities were often unclear. To address these uncertainties the Government of the Philippines developed a coastal resource management certification system to promote incentive strategies for local governments. Over 100 local governments have now implemented this certification system. Benchmarks for the first level of certification include baseline assessment conducted, annual budget allocated, organizations for coastal resource management formed and active, multiyear coastal resource management and shoreline plan developed and adopted, and at least two best practices implemented. Provinces initially review certification and then it is reviewed by the Department of Environment and Natural Resources and a multi-sector agency body. Certification is considered a seal of approval for local governments and a motivating factor in improving coastal resources management.⁶⁸

This review of examples of decentralization reforms and the evolving relationship of local decision makers with central actors suggests that even when decentralization is undertaken, there are many pressures to keep local autonomy at low levels. But effective local adaptation requires flexibility and autonomy in decision making at the local level because without such flexibility it is difficult for local governments and other decision makers to take advantage of available information and capacities. For effective adaptation, therefore, central governments need to realize and recognize existing local capacities as also to promote the use of existing information among local decision makers.

Institutional Relationships and Local Equity

Accountability relationships are key in shaping the balance of power between the center and the locality, and in allowing sufficient autonomy at the local level to ensure the development of plans that are responsive to local needs. They are also central to equity-related outcomes of decentralization reforms. When local elite and decision makers are not locally accountable, the likelihood of elite takeover of resources and unequal allocation of available resources increases substantially.

Sarch's⁶⁹ case study of Nigerian fisheries shows how traditional institutions may perpetuate elite

capture of power and result in inequitable outcomes. For example, while British colonial authorities did not erode traditional systems everywhere, feudal tax systems were legitimized and maintained to strengthen the ability of colonial rulers to collect taxes. Mosse⁷⁰ illustrates a similar situation for irrigation in India, explaining how traditional water systems were based around privileged access; consequently, recent attempts to base water user associations on traditional institutions replicate inequalities in access. Araral⁵⁵ also documents how donors and governments support systems based on patronage produced highly unequal outcomes 'when they uncritically accept(ed) the primacy of irrigation bureaucracies, strengthened their capacities, and augmented these structures by promoting farmer participation at tertiary canals' (2005: p. 132).

Another important case in point is how financial transfers occur and are handled locally. Fiscal decentralization or local authority to collect and manage revenues can contribute to effective decentralization. At the same time, some case studies illustrate how local political elites may capture financial resources. Rap⁷¹ illustrates the appropriation of funding following financial transfers to local water users' association in Mexico. Politically influential individuals used the water users' association as a political platform for political campaigns, including using water users' association funds to finance campaigns. Although the goals of water users' association included efficient, effective, and optimal output of service delivery, the appropriation of association resources resulted in a lack of funding for basic water association activities and undermined the association's accountability and legitimacy.⁷¹

In contrast to the example from Mexico which suggests that local level financial management resulted in less efficient and less equitable management of local natural resources, case studies on irrigation from the Philippines illustrate how central governments can successfully promote local level management through incentive schemes. The Philippines National Irrigation Administration (NIA) transferred authority to local level groups following a financial crisis. The NIA awarded grants for larger repair work to local irrigation groups according to Fujiie et al.⁷² allowing it to transform its role from one of a construction agency to one more focused on management.⁵⁵ The NIA also implemented a new financial incentive system to ensure greater compliance in collection fees, allowing irrigation associations to retain higher percentages of irrigation fees if they collected greater fees. The associations that participated in this incentive scheme were three times as active as associations that did not

receive similar assistance. In contrast to the example in Mexico, this Philippines case study provides strong support that government can positively affect local associations through specific interventions and policies.

CONCLUSION

Our paper is motivated by a concern to understand how institutional arrangements can be structured so as to improve the efficacy of interventions that seek to support and enable more effective adaptation by poorer and marginal groups. Our examination of the suite of mechanisms and the range of outcomes related to the decentralized governance of resources and development suggests a number of lessons in this regard. Two central points concern the need to promote the capacity of local institutions and improve the relationships between local and national-level adaptation planning processes.

More specifically, the analysis leads toward four key areas in which local adaptation institutions and national adaptation policies can be articulated better for more effective adaptation:

- Increase local capacity through appropriate transfers of information, financial, and technical resources so that there is greater ability at the local level to plan for adaptation and to use local and indigenous knowledge of historical adaptations to build toward future adaptive strategies. This will also mean strengthening local capacities for planning, budgeting, implementation, and monitoring, and where feasible the ability to raise resources locally. Capacity building also requires coordination across a variety of local actors and decision makers since no single blueprint solution for partnering with a specific type of actor can address the multiple needs for effective local adaptation.
- Empower communities and local governments by increasing local autonomy so as to decentralize adaptation planning and implementation effectively. This recommendation has implications for the design of monitoring and information sharing mechanisms, resource transfers, and the nature of accountability relationships. At least for horizontal accountability, institutional mechanisms to make local administrative bodies accountable to

elected local governments will be more effective in improving participation and making decision making responsive to local needs.

- Develop mechanisms for sharing information among local decision makers in different sectors, between general purpose local governments and local and higher-level governance arrangements, and across decision making arrangements. Without such information sharing, coordination across different decision makers will prove difficult, and there will also be greater opportunities for corruption.
- Improve accountability of local decision makers to their constituents. Accountability relations are central to the balance of power between decision makers and those on whose behalf they make decisions. When decision makers are not accountable downwardly to citizens and users of services, the chances of elite capture and abuse of power also increase.

The examination of existing efforts to decentralize renewable resource governance and development provides concrete information about the many different ways in which specific information, institutional, technical, and reporting mechanisms can be used to link national and local adaptation processes. Adaptation to climate change may be new. But the articulation between local and national adaptation processes can still be improved substantially by attending to the ways in which natural resource managers have sought to make national resource policies locally responsive and effective.

NOTES

^aUnder spate irrigation, elementary stone or earthen bunds together with diversion canals are used to divert flood waters from riverbeds or valleys (*wadis*) into fields. Runoff can also be harvested from small surfaces and diverted by gravity directly onto fields using ditches (*masques*).

^bThe specific projects are the Groundwater and Soil Conservation Project (number P074413, for US\$ 40 Million, 2004–2011 and the Irrigation Improvement project (number P062714 for US\$ 21.3 million, 2001–2008).

^cThese include *alek pasie*, *malimau pasie*, *maliamu kapa*, *panglima laut*, and *sasi*.

REFERENCES

1. O'Neill BC, Oppenheimer M. Dangerous climate impacts and the Kyoto Protocol. *Science* 2002, 296:1971–1972.
2. Adger WN, Agrawala S, Mirza MMQ, Conde C, O'Brien K, Pulhin J, Pulwarty R, Smit B, Takahashi K. Assessment of adaptation practices, options, constraints and capacity. In: Parry ML, Canziani OF, Palutikof JP, van der Linden PJ, Hanson CE, eds. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge University Press; 2007, 717–743.
3. Conway D, Schipper ELF. Adaptation to climate change in Africa: challenges and opportunities identified in Africa. *Glob Environ Change* 2011, 21:227–237.
4. Libecap GD, Strickel RH, eds. *The Economics of Climate Change: Adaptations Past and Present*. Chicago: University of Chicago Press; 2011.
5. Adger WN. Social vulnerability to climate change and extremes in coastal Vietnam. *World Dev* 1999, 27:249–269.
6. Batterbury S, Forsyth T. Fighting back: human adaptations in marginal environments. *Environment* 1999, 41:7–30.
7. Berkes F, Jolly D. Adapting to climate change: Social-Ecological resilience in a Canadian western Arctic community. *Conserv Ecol* 2001, 5:18. Available at: <http://www.consecol.org/vol5/iss2/art18>. (Accessed July 15, 2012).
8. Reid P, Vogel C. Living and responding to multiple stressors in South Africa—Glimpses from KwaZulu-Natal. *Glob Environ Change* 2006, 16:195–206.
9. Eakin H, Lemos M. Institutions and change: the challenge of building adaptive capacity in Latin America. *Glob Environ Change* 2010, 20:1–3.
10. Larsen RK, Swartling ÅG, Powell N, May B, Plummer R, Simonsson L, Osbeck M. A framework for facilitating dialogue between policy planners and local climate change adaptation professionals: cases from Sweden, Canada and Indonesia. *Environ Sci Policy* 2012, 23:12–23.
11. Sietz D, Boschütz M, Klein RJT. Mainstreaming climate adaptation into development assistance: Rationale, institutional barriers, and opportunities in Mozambique. *Environ Sci Policy* 2011, 14:493–502.
12. Stringer LC, Dyer JC, Reed MS, Dougill AJ, Twyman C, Mkwambisi D. Adaptations to climate change, drought, and desertification: local insights to enhance policy in southern Africa. *Environ Sci Policy* 2009, 12:748–765.
13. Ostrom E. A diagnostic approach for going beyond panaceas. *Proc Natl Acad Sci* 2007, 104:15181–15187.
14. Boyd E, Lemos M. The politics of adaptation across scales: the implications of additionality to policy choice and development. In: Boykoff MT, ed. *The Politics of Climate Change: A Survey*. London: Routledge; 2010, 96–110.
15. Young O. *The Institutional Dimensions of Environmental Change: Fit, Interplay, Scale*. Cambridge, MA: MIT Press; 2002.
16. Ostrom E. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge: Cambridge University Press; 1990.
17. Uphoff N, Buck L. Strengthening rural local institutional capacities for sustainable livelihoods and equitable development, Social Development Department of the World Bank. Mimeo. 2006.
18. UNFCCC. *Report on the Least Developed Countries Expert Group Stocktaking Meeting on the Progress Made by Parties in the Preparation and Implementation of National Adaptation Programmes of Action*, FCCC/SBI/2007/32. Bonn: UNFCCC; 2007.
19. UNFCCC. The Marrakesh Accords & The Marrakesh Declaration, Advance Text. 2001. Available at: http://www.unfccc.int/cop7/documents/accords_draft.pdf. (Accessed July 22, 2012).
20. UNFCCC. *National Adaptation Programmes of Action: Index of NAPA Projects by Country*. Bonn: UNFCCC; 2012.
21. Osman-Elasha B, Downing T. *Lessons Learned in Preparing National Adaptation Programmes of Action in Eastern and Southern Africa. Policy Analysis Report*. Oxford: European Capacity Building Initiative; 2007.
22. UNFCCC. Status of NAPA implementation under the LDCF: As of May 2012. 2012. Available at: http://unfccc.int/cooperation_support/least_developed_countries_portal/_ldcf_napa_projects/items/5632.php. (Accessed July 2012).
23. Agrawal A, Ribot JC. Accountability in decentralization: a framework with South Asian and West African cases. *J Dev Areas* 1999, 33:473–502.
24. Ribot J. Decentralisation, participation, and accountability in Sahelian forestry: legal instruments of political-administrative control. *Africa* 1999, 69:23–65.
25. Wunsch JS. Decentralization, local governance and 'recentralization' in Africa. *Public Adm Dev* 2001, 21:277–288.
26. Bardhan P. Decentralization of governance and development. *J Econ Perspect* 2002, 16:185–205.
27. Campbell T. *The Quiet Revolution: Decentralization and the Rise of Political Participation in Latin American Cities*. Pittsburgh: University of Pittsburgh Press; 2003.
28. Noel E. Power, politics and place: Who holds the reins of environmental regulation? *Ecol Law Q* 1999, 25:559–563.

29. Rosenau JN. The future of politics. *Futures* (special issue) 1999, 31:1005–1016.
30. Agrawal A, Perrin N. *Mobilizing Rural Institutions. SDV Internal Report*. Washington DC: The World Bank. 2009.
31. Agrawal A. *Environmentality: Technologies of Government and the Making of Subjects*. Durham, NC: Duke University Press; 2005.
32. Somanathan E, Prabhakar R, Mehta BS. Decentralization for cost-effective conservation. *Proc Natl Acad Sci U S A* 2009, 106:4143–4147.
33. Ribot J. *African Decentralization: Local Actors, Powers, and Accountability*. Democracy, Governance, and Human Rights Paper No. 8, Geneva: United Nations Research Institute for Social Development; 2002.
34. Ribot JC, Agrawal A, Larson AM. Recentralizing while decentralizing: how national governments reappropriate forest resources. *World Dev* 2006, 34:1864–1886.
35. Bratton M. Non-governmental organizations in Africa: Can they influence public policy? *Dev Change* 1990, 21:87–118.
36. Korten DC. 1987. Third generation NGO strategies: a key to people-centered development. *World Dev* 15 (suppl 1):145–159.
37. Uphoff N. Grassroots organizations and NGOs in rural development: opportunities with diminishing states and expanding markets. *World Dev* 1993, 21:607–622.
38. Utting P, ed. *Forest Policy and Politics in the Philippines: The Dynamics of Participatory Conservation*. Quezon City, Philippines: UNRISD and Ateneo de Manila University Press; 1999.
39. Edwards M. *NGO Rights and Responsibilities: A New Deal for Global Governance*. London: The Foreign Policy Center.; 2000.
40. Benson C, Agrawal A. More power, less autonomy? Decentralized natural resource governance in the twenty-first century, Keynote lecture delivered at the IASC regional meeting, Arizona State University, October 2, 2010.
41. Thang N, Rossler P, Schaltenbrand H, Sieber P. Safeguarding multifunctional forest ecosystems in Vietnam: Introducing village-level community forest management. *Mt Res Dev* 2007, 27:196–201.
42. Andersson K, Gibson C. Decentralized governance and environmental change: Local institutional moderation of deforestation in Bolivia. *J Pol Analysis Mgmt* 2007, 26:99–123.
43. Acharya K. Private, collective, and centralized institutional arrangements for managing forest “Commons” in Nepal. *Mt Res Dev* 2005, 25:269–277.
44. Devkota SR. Is strong sustainability operational? An example from Nepal. *Sustainable Dev* 2005, 13:297–310.
45. Agrawal A, Ostrom E. Collective action, property rights, and decentralization in resource use in India and Nepal. *Pol Soc* 2001, 29:485–514.
46. Wily L. Moving forward in African community forestry: trading power, not use rights. *Soc Nat Resour* 1997, 12:49–61.
47. Agrawal A, Yadama G. How do local institutions mediate market and population pressures on resources? Forest Panchayats in Kumaon, India. *Dev Change* 1997, 28:437–466.
48. De la Torre-Castro M. Beyond regulations in fisheries management: The dilemmas of the “beach recorders” Bwana dikos in Zanzibar, Tanzania. *Ecol Soc* 2006, 11: [online]. (Accessed September 29, 2012).
49. Lin H. Community forestry initiatives in Myanmar: an analysis from a social perspective. *Int Forestry Rev* 2005, 6:79–88.
50. Nayak PK, Berkes F. Politics of co-optation: Community Forest Management Versus Joint Forest Management in Orissa, India. *Environ Manage* 2008, 41:707–718.
51. Raik DB, Decker DJ. A multisector framework for assessing community-based forest management: lessons from Madagascar. *Ecol Soc* 2007, 12: [online]. (Accessed September 29, 2012).
52. Nunan F. Empowerment and institutions: managing fisheries in Uganda. *World Dev* 2006, 34:1316–1332.
53. Saunders F, Mohammed SM, Jiddawi N, Sjoling S. An examination of governance arrangements at Kisakasaka mangrove reserve in Zanzibar. *Environ Manage* 2008, 41:663–675.
54. Tan-Mullins M. The state and its agencies in coastal resources management: the political ecology of fisheries management in Pattani, southern Thailand. *Singap J Trop Geogr* 2007, 28:348–361.
55. Araral E. Bureaucratic incentives, path dependence, and foreign aid: an empirical institutional analysis of irrigation in the Philippines. *Policy Sci* 2005, 38:131–157.
56. Maikhuri RK, Nautiyal S, Rao KS, Chandrasekhar K, Gavali R, Saxena KG. Analysis and resolution of protected area - people conflicts in Nanda Devi Biosphere Reserve, India. *Environ Conserv* 2000, 27:43–53.
57. Blair H. Participation and accountability at the periphery: democratic local governance in six countries. *World Dev* 2000, 28:21–39.
58. Samakande I, Senzanje A, Manzungu E. Sustainable water management in smallholder irrigation schemes: understanding the impact of field water management on maize productivity on two irrigation schemes in Zimbabwe. *Phy Chem Earth* 2004, 29: 1075–1081.
59. Hoffmann I. Access to land and water in the Zamfara Reserve. A case study for the management of common property resources in pastoral areas of West Africa. *Hum Ecol* 2004, 32:77–105.

60. Meinzen-Dick R, Raju KV, Gulati A. What affects organization and collective action for managing resources? Evidence from canal irrigation systems in India. *World Dev* 2002, 30:649–666.
61. Thebaud B, Batterbury S. Sahel pastoralists: opportunism, struggle, conflict and negotiation. a case study from eastern Niger. *Glob Environ Change-Hum Policy Dimens* 2001, 11:69–78.
62. Singh VK, Suresh A, Gupta DC, Jakhmola RC. Common property resources rural livelihood and small ruminants in India: a review. *Indian J Anim Sci* 2005, 75:1027–1036.
63. Scott JC. *Seeing Like a State*. New Haven, CT: Yale University Press; 1999.
64. Swatuk LA. Political challenges to implementing IWRM in Southern Africa. *Phys Chem Earth* 2005, 30:872–880.
65. Satria A, Matsuda Y. Decentralization of fisheries management in Indonesia. *Mar Policy* 2004, 28:437–450.
66. Siry HY. Decentralized coastal zone management in Malaysia and Indonesia: a comparative perspective. *Coast Manage* 2006, 34:267–285.
67. Thorburn CC. The house that poison built: Customary marine property rights and the live food fish trade in the Kei Islands, Southeast Maluku. *Dev Change* 2001, 32:151–180.
68. White A, Deguit E, Jatulan W, Eisma-Osorio L. Integrated coastal management in Philippine local governance: evolution and benefits. *Coast Manage* 2006, 34:287–302.
69. Sarch MT. Fishing and farming at Lake Chad: institutions for access to natural resources. *J Environ Manage* 2001, 62:185–199.
70. Mosse D. Collective action, common property, and social capital in South India: an anthropological commentary. *Econ Dev Cult Change* 2006, 54:695–724.
71. Rap E. Cultural performance, resource flows and passion in politics: A Situational analysis of an election rally in western Mexico. *J Lat Am Stud* 2007, 39:595–625.
72. Fujii M, Hayami Y, Kikuchi M. The conditions of collective action for local commons management: the case of irrigation in the Philippines. *Agric Econ* 2005, 33:179–189.

FURTHER READING

- Agrawal A. *Climate adaptation, Local Institutions, and Sustainable Livelihoods*, SDV, Washington DC: The World Bank; 2008.
- Farrington J, Bebbington A. *Reluctant Partners: Non-Governmental Organizations, the State, and Sustainable Agricultural Development*. New York: Routledge; 1993.
- Gibson CC, Ostrom E, Ahn TK. The concept of scale and the human dimensions of global change: a survey. *Ecol Econ* 2000, 32:217–239.
- National Research Council (NRC). *Radiative Forcing of Climate Change: Expanding the Concept and Addressing Uncertainties*, Committee on Radiative Forcing Effects on Climate Change, Climate Research Committee, Board on Atmospheric Sciences and Climate, Division on Earth and Life Studies. Washington, DC: The National Academies Press; 2005, 208.
- Solomon S, Plattner G, Knutti R, Friedlingstein P. Irreversible climate change due to carbon dioxide emissions, 2009. Available at: www.pnas.org/cgi/doi/10.1073/pnas.0812721106. (Accessed September 29, 2012).