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The Political Economy of Cross-Scale Networks in Resource Co-Management

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ABSTRACT. We investigate linkages between stakeholders in resource management that occur at different spatial and institutional levels and identify the winners and losers in such interactions. So-called cross-scale interactions emerge because of the benefits to individual stakeholder groups in undertaking them or the high costs of not undertaking them. Hence there are uneven gains from cross-scale interactions that are themselves an integral part of social-ecological system governance. The political economy framework outlined here suggests that the determinants of the emergence of cross-scale interactions are the exercise of relative power between stakeholders and their costs of accessing and creating linkages. Cross-scale interactions by powerful stakeholders have the potential to undermine trust in resource management arrangements. If government regulators, for example, mobilize information and resources from cross-level interactions to reinforce their authority, this often disempowers other stakeholders such as resource users. Offsetting such impacts, some cross-scale interactions can be empowering for local level user groups in creating social and political capital. These issues are illustrated with observations on resource management in a marine protected area in Tobago in the Caribbean. The case study demonstrates that the structure of the cross-scale interplay, in terms of relative winners and losers, determines its contribution to the resilience of social-ecological systems.

Key Words: *Caribbean; institutions; marine protected areas; natural resource management; power; social-ecological resilience; transaction costs.*

INTRODUCTION

We address here the political economy of the evolution of cross scale linkages. We suggest that cross-scale linkages evolve and are maintained by the organizations and institutions involved in resource management to further their own interests. Rational choice analysis has always suggested that collective action between directly interested parties in any decision, given the power relations between them, does not come about without perceived gain through the bargain. By the same logic, cross-scale interactions come about only because it is in the interest of one or other of the stakeholders involved to develop and to maintain these linkages. Such an account does not, however, explain all social interaction between stakeholders in resource management. Nor can self-interest predict the shape of interactions in every context (Richerson et al.

2002). Yet we argue in this paper that it is important to recognize the winners and losers from cross-scale interactions on the basis of the exercise of power through domination, resistance, and co-operation.

An understanding of cross-scale linkages is important in managing multiple use resources. By linkages we mean direct interactions through networks to provide information or tangible resources related to the management system. Of course almost all possible natural resources systems involve multiple direct users. Even when direct users of resources are small in number or strictly limited, there are inevitably multiple external stakeholders making claims and calls on natural resources at numerous scales. Cross-scale institutional linkages are the norm and even

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universal in natural resource management (Berkes 2002).

Part of this trend towards multiple competing claims stems from processes of integration of localities, societies, and economies in multi-level governance and economic systems. In a globalized world, environmental services and functions are increasingly seen as public goods. They have multiple beneficiaries and claims to them at national and global levels. Many ecosystem services, such as carbon sequestration functions, the maintenance of the world's stock of genetic biological resources, and shared water resources are all portrayed as public goods with a value to global society (Dietz et al. 2003). Inevitably then, markets are created to generate incentives for conserving the atmosphere, water, habitats, or species, for the benefit of stakeholders remote from the resources. Direct resource users are drawn into market exchanges where previously their relationship to resources may have been based on stewardship, self-interest, or other forms of value (O'Neill 2001). Hence the scope for cross-scale linkages has multiplied with the increasing interdependence and global linkages in the world economy.

In effect we question whether integrated and well-linked resource systems (nested within national and international agendas, regimes, networks, and legal systems) are *a priori* more robust or resilient than those with greater autonomy and less linkages. Anderies and colleagues (2004) argue that failure of the links between resources, governance systems, and their associated infrastructures reduce the robustness of a social-ecological system. In this paper, we address in particular the links between elements of the governance of social-ecological systems: these are the links between resource users on the one hand, and regulators and government agencies on the other (Anderies et al. 2004). We argue that part of the persistence and stability of the governance system depends on the distribution of benefits from cross-scale linkages, demonstrated by the ability of the system to command legitimacy and trust among the resource user and the governmental stakeholders. If the structure of cross-scale linkages reduces trust then the robustness of the system is in question. In empirical research, we examine the structure of interplay of cross-scale linkages in the context of a marine protected area in Tobago in the eastern Caribbean. We argue that the benefits from emerging and dynamic linkages are frequently uneven, often reinforcing existing inequalities. But,

at the same time, offsetting linkages facilitate the empowerment of local user groups.

A POLITICAL ECONOMY OF LINKAGES

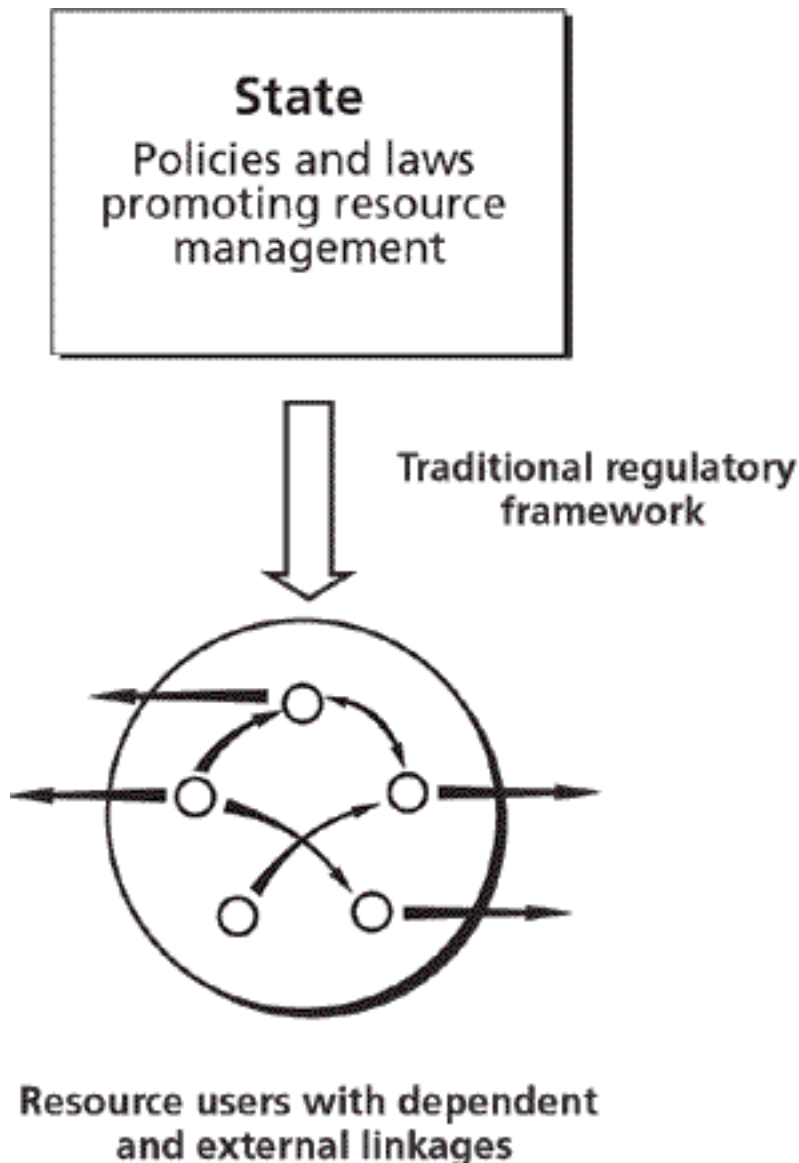
The structure of interplay in resource co-management

The overview paper to this special issue explores how cross-scale and cross-level dynamics can take different forms (Cash et al. 2005). From the realm of international agreements through to local level governance of institutions, there are particular patterns of interaction. These interactions between stakeholders are widely observed (Berkes 2002), but they are also widely promoted as solutions to sustainability of community-based management (Brown 2003, Berkes 2004). They are promoted because shared responsibility for management of resources creates positive incentives for sustainable use and overcomes problems of legitimacy from traditional resource management.

In some cases, the imposition of “traditional” resource management (Fig. 1) by government agencies who define social and environmental goals for resource management could be judged as “top down” management. In such cases, a regulatory framework is imposed on resource users, with the “imposers” often impervious to feedback or learning from resource users and civil society. Figure 1 shows linkages between individual agents in the communities. Such local level linkages for resource management are independent of the regulatory framework and indeed networks often develop to substitute for *de iure* regulations or act to circumvent them (Pretty and Ward 2001, Pretty 2004).

One of the main problems identified with the top-down model of interaction between government agencies and resource users in Figure 1 is that these so-called “traditional” resource management practices lead to locked-in patterns of resource use. These patterns are often detrimental to the ability to adapt to surprise and shock: management based solely on the stability of systems creates its own pathologies of risk (Holling and Meffe 1996). Carpenter et al. (2001) propose that rather than seeking adaptation decisions that maximize efficient use of resources at one time scale, a more desirable normative goal should be the enhancement

Fig. 1. A representation of traditional resource management interactions between government and resource users.

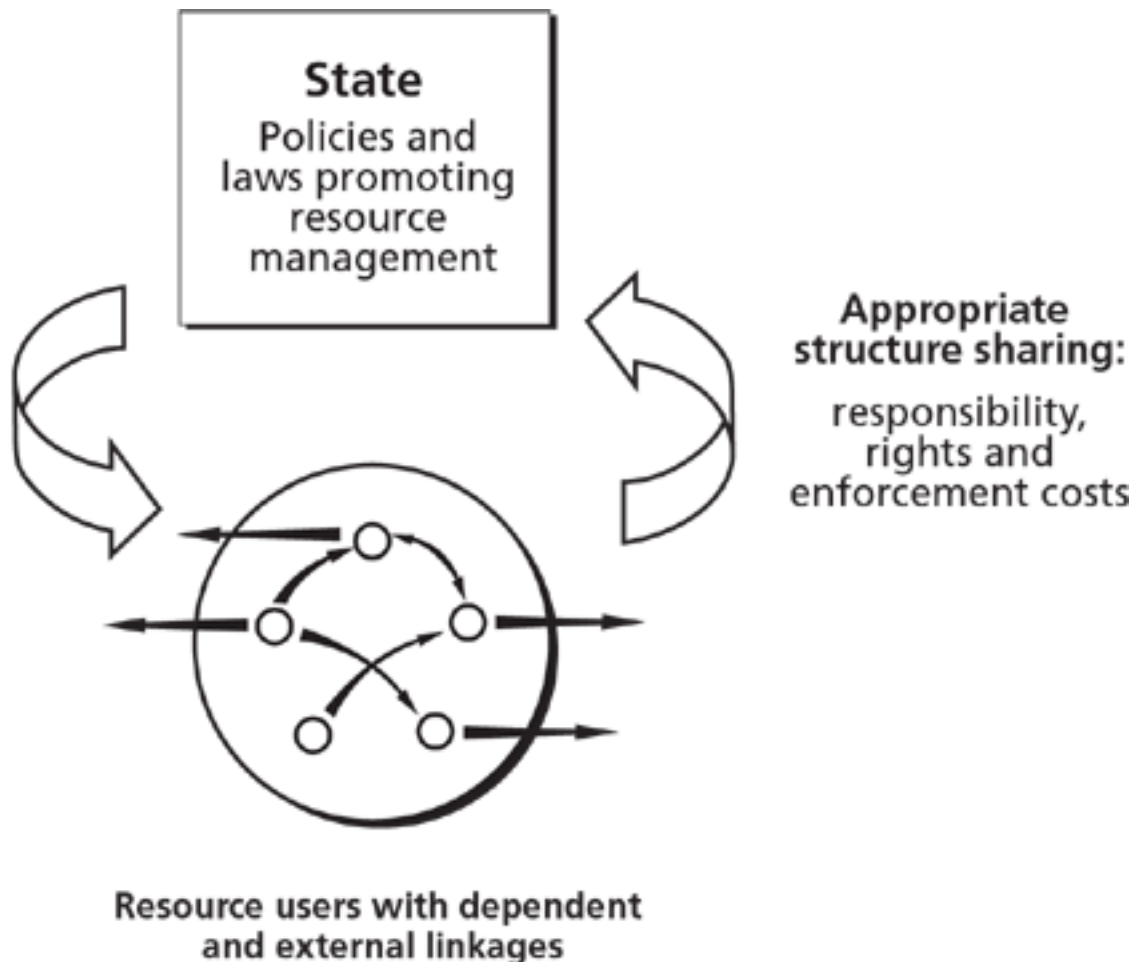


of resilience of social-ecological resource systems to allow for flexibility and perseverance of a system in a state that provides resources and services to users.

The system of resource management portrayed in Figure 1 is a stylized representation that is, it appears, at odds with much rhetoric on conservation practice throughout the world. Community-based

management is *de rigueur* and promoted throughout the world through decentralization of control from government agencies to institutions and committees of so-called co-management of resources. There are a number of benefits to the co-management of resources, defined here as shared responsibility between institutions of the state and of local resource users. Co-management can lead to reduced enforcement costs, the sharing of knowledge and

Figure 2. Interactions between government and civil society in co-management arrangements.



Brown et al. 2002.

information on the resource, and systematic learning between all parties. This situation is portrayed in Figure 2, contrasting with 'traditional' resource management depicted in Figure 1, with the two main protagonists being institutions of the state (top) and the community (bottom). Under co-management, the resource users retain their internal linkages and horizontal linkages to other resource

users and markets. With appropriate governance structure for sharing rights and responsibilities for management, there are more direct linkages between agents of government and resource users, while information and learning processes flow between them (Fig. 2).

Co-management of resources is not a panacea for robustness. There are particular areas of resource conservation where participatory management is, in effect, a new received wisdom. Yet the devolution of responsibility often comes without devolution of rights (Adams et al. 2003, Brown 2003). In the developing world in particular, the popularity of community-based management may have arisen because of the reduction of resources and effectiveness of the state and its inability to mobilize resources to provide public infrastructure. But the resources are similarly not available for the new institutions of co-management (Ribot 2002). In such circumstances, cross-scale interactions that develop do so as a substitute rather than as a complement to good governance (Cooke and Kothari 2001).

There have been a number of reviews of experience of co-management (Berkes et al. 2001, Brown et al. 2002) and attempts to explain “best practice” within resource co-management (Berkes 2004). These have focused on the legitimacy of the interactions between resource users and government agencies and on the incorporation of local and scientific knowledge into management. Olsson et al. (2004) and Tompkins et al. (2002) have hypothesized prerequisites for sustained interaction between stakeholders in co-management that include: (1) enabling constitutional order and legislation, (2) the ability for organizations to monitor and adapt their co-management experiments, and (3) the presence of leaders and agents for change.

Design principles for cross-scale interaction are only part of the story. Berkes (2002) argues that virtually all resource management systems have some external linkages and drivers at different scales. He argues that a failure to recognize these linkages is a central reason for some unsuccessful interventions in resource systems and that the persistence of resource degradation may be in part related to ‘cross-scale institutional pathologies’: “it is useful to start with the assumption that a given resource management system is multi-scale and that it should be managed at different scales simultaneously” (Berkes 2002:317).

The linkages between resource stakeholders at different scales are then determined by the structure of the vertical and horizontal interplay between actors; the characteristics of the resource being managed; aspects of agency such as the emergence of leadership and the translation of knowledge at different levels; and the social construction of crisis

to overcome inertia and trigger change (Cash et al. 2005). Some of the determinants of cross-scale interaction are better understood than others. The nature of the resources being managed clearly affects, to some degree, the institutional design. The size of the resources, the physical pressure on exploitation, the cost of enforcement, and the static or fugitive nature of resources all play a part in determining the governance structures of collective resources (Dolšák and Ostrom 2003). These same factors are likely to be important in determining the cross-scale interactions that form part of the institutions of governance, and have been proposed by Anderies et al. (2004) as important design elements for robust social-ecological systems.

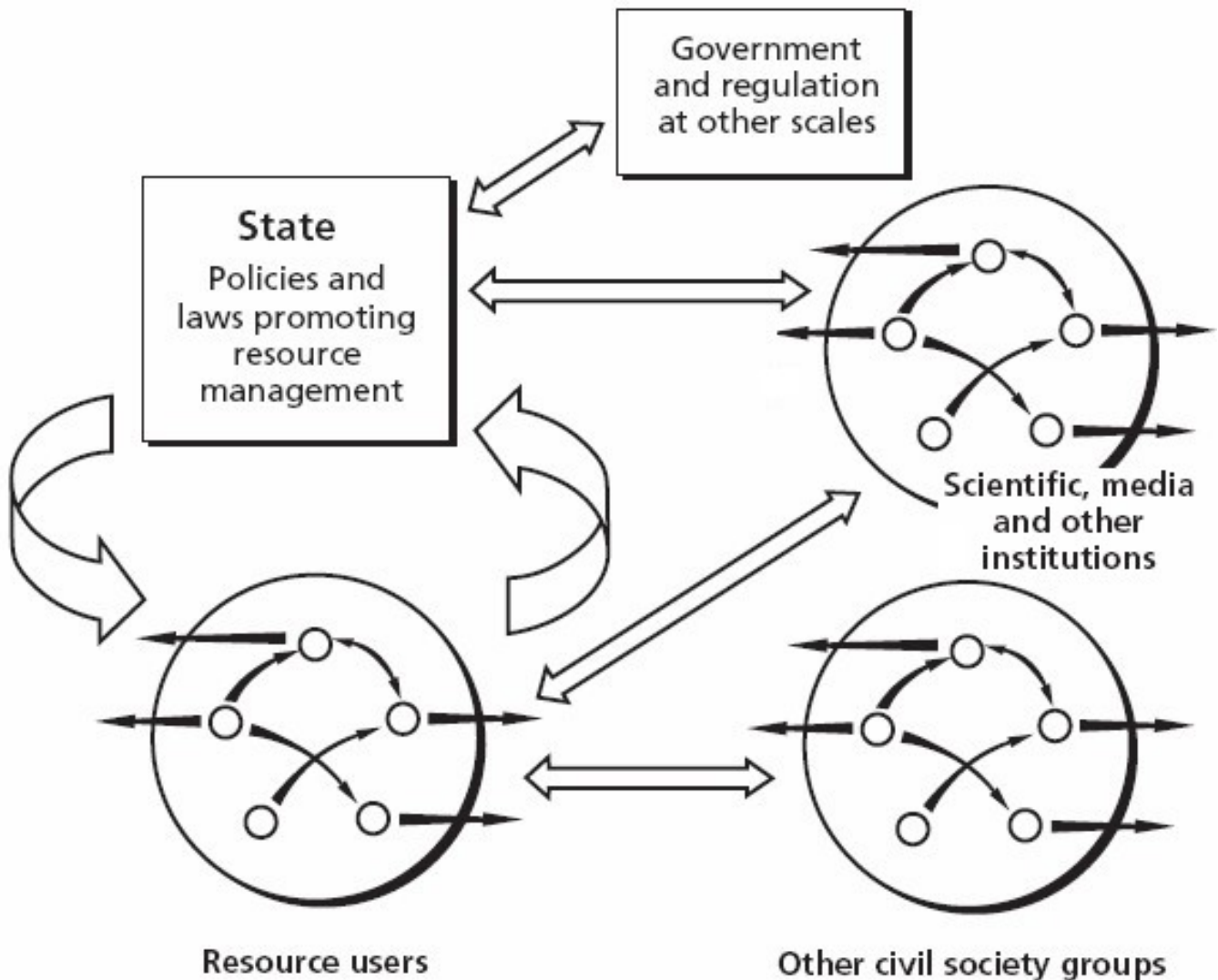
Figure 3 portrays the range of cross-scale interactions that are commonly observed in co-management arrangements in addition to the linkages between state and local community (as portrayed in Figure 2). Local level resource users make common cause with communities in the same situation to learn lessons and spread best practice, as well as to act cooperatively in bargaining with government. These are portrayed as horizontal linkages between resource users, other civil society groups and scientific organizations, media and advocacy organizations both within and external to the locality and jurisdiction of the resources (Fig. 3). Similarly, government agencies involved in resource management frequently have horizontal linkages to cognate departments and organizations. Vertical external linkages portrayed in Figure 3 include those by both communities and agencies to government and regulatory agencies at other levels.

Power relations determine the nature of interaction

The arrows in Figure 3 show the existence of cross-scale interactions. But these cross-scale interactions can take different forms. Young (2002, 2005) classifies the interactions between institutions at different levels (i.e., vertical interplay) as being in the form of dominance, separation, merger, negotiated outcome, or systemic change by both parties. We hypothesize that the form of these interactions is determined by both the power relations inherent within them and the transactions costs associated with them.

First, power and the exercise of power determine how cross-scale interactions occur. The analysis of

Figure 3. Cross scale linkages in resource management.



Co-management institutions instigate linkages to other regulators and users. They also promote vertical linkages to access knowledge, resources, and other forms of legitimacy.

power is widespread and contested within the social sciences. But at its core there is an understanding of power as the application of action, knowledge, and resources to resolve problems and further interests (Lukes 1974, Few 2002). Few (2002) makes a key distinction between, on the one hand, sociological

aspects of power relating to tactical exercises of power through mechanisms of social interaction and, on the other hand, structural implications of power that are manifested through the distribution of resources and influence. Thus power may be exercised through different mechanisms at different

temporal and spatial scales. Peterson (2000) has argued for a simple hierarchy: the exercise of power at local levels is overt and power at higher temporal and spatial scales is always covert or structural (Lukes 1974). This does not seem to be supportable. Clearly different manifestations of power are not scale dependent in time or space because power is in the very fabric of social systems and resides in every perception, judgement, and act, no matter what the context (Foucault 1986, Few 2002). Power is embedded in the ideas and discourses that frame the resource management problem in hand and operates largely independent of scale (Pritchard and Sanderson 2002).

Hence the important elements of power in determining the interactions between actors across scales are how decisions are negotiated, how trade-offs are made to give room for manoeuvre, and how other actors are enrolled on a cause (Arce and Long 1992). Knowledge is a key resource in the exercises of power: it is used by both dominant parties and by those resisting action. Actors across social and temporal scales use these same mechanisms in the exercise of power.

The issues of power within cross-scale interactions are illustrated in the case of political linkages by rubber tappers in Amazonia. Brown and Rosendo (2000) outline the strategies of community-based organizations of small scale rubber tappers in Rondonia in Brazil in promoting their interest through bypassing local governance structures. They show that the rubber tappers successfully recruited the resources of international organizations, including the World Bank in "levelling the playing field" with state and federal government agencies. The linkages they adopted (vertical linkages in Fig. 3) allowed them to deploy both information and resources to renegotiate their sphere of influence in resource management and to secure their livelihoods. But such international alliances are potentially fragile. In this case, they posed political risks for the grassroots organizations in their dealings with government (Conklin and Graham 1995). Government agencies, usually dominant in their relationship with the rubber tappers' organizations, lost trust in the existing institutions of governance, excluded the local resource users, and set up their own cross-scale interactions to re-establish their dominance. Thus cross-scale interactions are always negotiated outcomes of power relations, reaffirming the hierarchies of institutions and actors.

The negative implications of cross-scale linkages on the less powerful can, however, be offset by other types of linkage. Some forms of both vertical and horizontal interaction promote and facilitate so-called "political capital" (Birner and Wittmer 2003). Community interactions in co-management and in vertical interplay with other institutions have been shown in particular circumstances to side benefits of politicizing and empowering the local level institutions. Hence the vertical interplay, depending on its structure, can change the nature of the bargain and power relations between stakeholders. Birner and Wittmer (2003) argue that the high level of political mobilization of the rural population of Thailand who were involved in community forestry practices was so significant that it helped to strengthen the nation's democratic institutions at crucial periods over the past decades [see Sneddon (2003), however, on the contested definitions of political power in this context]. Birner and Wittmer (2003) show that social capital built through shared resource management can give impetus to political action through a number of mechanisms.

Social interaction in resource management provide platforms for political participation, foster political ideas, as well as more fundamental issues of building skills for public debate and knowledge of political processes. These potential gains from vertical interplay for the less powerful stakeholder groups are a counterpoint to the coercive dominance of some forms of linkage. The institutions of co-management, in effect, exhibit cross-scale linkages that can potentially subvert assumed power hierarchies from top to bottom in institutional scale.

The second element in the political economy of how cross-scale interactions occur is the cost of knowledge. The cost of obtaining knowledge is a key element itself in the calculus of power. In institutional economics, these costs are known as transaction costs and are made of up the costs associated with searching for information, searching for partners in collective action, drawing up and enforcing contracts, and building up networks and social capital. In neo-classical economics, transactions costs relate primarily to the costs of exchange and search within markets. Hence, neo-classical economics portrays such costs as a drag on efficiency. But there are broader transaction costs in social interactions around environmental and resource management. The desired outcomes of environmental management

such as the maintenance of ecosystem services and resilience are more often public rather than private goods (Eggerston 1995, Krutilla 1999). Hence transaction costs for resource management involve negotiations over shared values, objectives and consensus around sustainability, and involve social interaction (as depicted in Fig. 3) well beyond simple market exchange.

Some transaction costs are related to interactions between regulators and resource users. In cases where these linkages involve contracts and exchanges, transaction costs can be significant and can limit the positive outcomes. Falconer (2000), for example, shows that farmers failed to adopt voluntary conservation practices in the UK even where they were being paid to do so because of the perceived high transaction costs in setting up the contracts with government agencies. Policy mechanisms to avoid this mismatch in transactions costs include reducing the costs to farmers associated with voluntary schemes through farmers negotiating collectively, or through governments incurring the transaction costs themselves and further compensating farmers for their time in negotiations and providing information (Falconer 2000).

It is well understood, therefore, how transaction costs limit action and constrain the exercise of power (both domination and resistance). Costs associated with initial search and building up of networks (the links portrayed in Fig. 3) are fixed costs and act as an initial barrier to such interactions. Learning to engage policy makers through scientific and technical language or understanding the objectives of disparate organizations are, in effect, transaction costs of cross-scale negotiations and linkage. They become sunk costs when the interactions are established and hence many cross-scale linkages are effectively institutionalized. Trust is vital to the continued existence of many linkages and trust is "costly": it builds up through repeated interactions and institutionalization of the links.

When the costs of setting up and maintaining cross-scale linkages are high, information and knowledge become highly asymmetric within the governance system. The powerful have the important information because they can afford to invest in obtaining it. Conflicts associated with these asymmetries can cause conflict and can eventually undermine the governance structures (for differing

views see Baland and Platteau 1999, Agrawal 2001, Adams et al. 2003). Hence we argue that particular horizontal and vertical linkages may simply promote the individual institutions without promoting the flexibility or trust of the overall management structure or its adaptability.

It is not sufficient, of course, simply to observe that many governance systems exhibit inequality in resources and hence the powerful usually get their way. The reasons why inequality is important have been examined carefully by Boyce (1994), Baland and Platteau (1999), and others. Boyce (1994) demonstrates theoretically that in resource allocation decisions, the unequal power relationships inherent in unequal distributions of wealth lead to undesirable outcomes. If it is, in general, the powerful who gain most from environmentally damaging activities, then the bargained solution between these winners and the less well-off losers (sufferers of the impacts of the environmentally damaging activity) will be skewed towards the benefits of the powerful. This occurs for a number of reasons including the additional transactions costs of the bargaining on the less well-off group.

If wealth and resources of the stakeholders are correlated with their power and status at individual and collective levels, then inequality in itself leads to less co-operative linkages and less desirable outcomes for the linkages that actually emerge. Power in decision-making is, of course, related to more than simply wealth or resources: it is circumscribed by cultural and other determinants of governance (Scott 1998, Ribot and Peluso 2003). This explains why the powerful tend to get their way, whatever the source of power.

The range of potential interactions outlined by Young (2004), including coercive dominance and systemic change, highlights that the incentives and potentially the benefits from the interactions are uneven. Dominance of an institution at one level clearly leads to winners and losers. Institutions at all levels, however, from resource users to international organizations, utilize cross-scale linkages to further their own interests and agendas within their management systems whether they are dominant or are simply resisting change. On the positive side, where there are material conflicts over the distribution and allocation of resources, cross-scale linkages provide a platform for their resolution.

In summary then, we have argued in this section that cross-scale linkages are ubiquitous to resource management institutions within social-ecological systems. We have shown that the power relations between the institutions effectively determine the emergence and persistence of the cross-scale interactions, whatever form they take. And these power relations are universal: they are related to the application of knowledge and resources to further particular interests and pervade all forms of social interaction. They have an economic dimension; the costs of setting up and maintaining linkages are important. When power is unevenly distributed, more powerful actors can tilt the playing field such that information and knowledge are further skewed in their favor. The implications of this political economy approach to linkages are now illustrated with reference to a resource management system around a protected area in the Caribbean to demonstrate the nature of winners and losers from interplay.

A CASE STUDY OF GAINERS AND LOSERS FROM INTERPLAY

The foregoing discussion suggests that not all interplay is equal in terms of its influence on action. The implications of cross-scale linkages in reality can best be deduced from cases of where such interactions occur. The issues raised are examined in this case with respect to co-management arrangements of a marine protected area in Tobago in the eastern Caribbean. The decline of coral reef, water quality, and fisheries resources over recent decades spurred the government of Trinidad and Tobago in the 1990s to initiate a marine protected area called the Buccoo Reef Marine Park. Efforts to share responsibility and promote co-management were initiated and partially supported through action research in the late 1990s. The research reported here attempted to identify conflicts and trade-offs between users of the Park and to seek consensus on ways forward in co-management. Both government and local user groups engaged in outreach activities making linkages to both the research and management processes and to other institutions at various levels (as portrayed in Fig. 3). The research, carried out over four years, involved investigation of the techniques for identifying trade-offs and building consensus for co-management of the Park (Brown et al. 2001, 2002). The observations in this paper are an analysis of the linkages and process of management through the lens of power and its

impacts outlined in the sections above.

Identification of power relations between resource users and the identification of cross-scale linkages that were a part of the governance system required intensive interdisciplinary research. The research process undertaken by us from 1997 to 2001 became integral to evolving management of the Park. Hence the researchers and actors from the government agencies involved became identifiable stakeholders in the outcome of the management. The research used participatory methods including focus groups, ranking exercises, and consensus workshops. The initial interactions between stakeholders were based on trust built up over two years. Thus the observations on power relations and cross-scale linkages below are derived both from formally elicited perceptions of stakeholders themselves and from observations of the researchers acting as part of the management process.

One of the identified constraints to co-management in Trinidad and Tobago is that various levels of government involved in management of coastal resources are often conflicting in their aims and in their attitudes to co-management and sharing responsibility. Thus we further investigated prerequisites for sustainable and successful co-management at the scales involved in managing the marine park within its multiple jurisdictions. Each set of stakeholders recognized the constraints on information and the tactics by which other groups either facilitated or blocked their attempts to build networks and cross-scale linkages. Across the stakeholder groups we documented perceptions of how these power relations played out. Table 1 demonstrates, for example, that at both operational and structural levels, stakeholders perceived problems both in developing cross-scale linkages (e.g., inadequate staff and resources, low levels of innovation) and in accessing information on how these linkages could be developed. These perceptions in Table 1 reflect the underlying power of actors at different levels.

In addition, the demand by most of the stakeholders for cross-scale linkages to aid their co-management of resources are subject to external constraints and influences. While Trinidad and Tobago law outlines the rules governing national parks and protected areas within the country, for example, the legal framework is increasingly steered and constrained by international guidelines and initiatives on protecting biodiversity and various other

Table 1. Perceptions of constraints to cross-scale linkages for participatory resource management among regulators and resource users in Tobago, 1999-2001.

Organizational areas	Perceived problems
Operational	Inadequate staff trained in integrated and inclusive approaches. Inadequate full-time outreach staff. Few successful examples of integrated and inclusive approaches. Over-use of external consultants.
Structural	Information hoarding. Inadequate public access to information. Project-driven approaches impose project cycle and time-tabling. Government workers slow to adapt methods used by external groups and communities.

Tompkins et al. 2002.

international agreements and aid donors. Indeed in Trinidad and Tobago participatory consultation for the establishment of new protected areas has come about mainly through pressure from external sources, such as the World Bank and multi-lateral donor agencies. These external stakeholders are in fact a major driver of environmental legislation within the country.

There are a large number of cross-scale linkages within the system of co-management of the local resource of Buccoo Reef Marine Park, some of which are summarized in Table 2. Table 2 also demonstrates the level which these linkages cross and attempts to show how the linkages between the scales do not benefit all stakeholders equally. The linkages include regular links to implement the organizations of co-management between the regulators and the resource users (Linkage 1 in Table 2); links from newly empowered user groups to other best practices in the Caribbean (3) and to the facilitators of the participatory processes (2); and important links to sources of scientific information that validated lay knowledge (4) of processes of degradation and renewal within the reef system. The co-management efforts, although fragile, spurred the formation of local user groups of the Park. These groups engaged in dialogues with other reef user groups in the Caribbean region (Geoghegan et al. 1999). Although such civil society links ostensibly represent horizontal

linkages at the operational level, these linkages enabled access to resources and information beyond the direct interaction.

The sections above highlight the role of knowledge and information in the exercise of power. The research project itself represents a major source of linkage for both civil society groups and government agencies (examples 1, 2, and 4 in Table 2). Access to information became a key aspect of the power relations between stakeholders. For example, the blame for existing degradation of reef flats had for more than 20 years been attributed the reef tour operators who take tourists to the reef. This was the highest profile and most visibly obvious reef degradation problem. Despite their previous marginalization, the reef tour operators group became involved in the co-management process. Previous scientific information collated as part of the research process showed that the long-term health of the reef was more dependent on reducing pollution loadings from coastal development than on changes in tourism practices that had very localized impacts (Pastorok and Bilyard 1985, Rajkumar and Persad 1994, Kumarsingh et al. 1998). In this case, the cross-scale linkage empowered a previously disparate local users of the resource to engage in the co-management process and altered the blame culture of the discourse.

In the framework above the role of underlying

Table 2. Differential benefits of cross-scale linkages in Buccoo Reef Marine Park.

Linkages	Example	Level of linkages	Who benefits?
1. Forum for participatory management	Buccoo Reef Advisory Group formed between local resource users and consults with Marine Park authorities; implements voluntary wardens and educational activities.	Resource users with government regulators.	Regulators and user groups equally.
2. Vertical linkages to enable participatory management	Resource stakeholders use consensus building workshops to activate change and access NGOs* and local media.	Both government agencies and resource users linked with 'external' researchers and media.	User groups.
3. Links to similar users elsewhere	Buccoo Reef resource users make links to other co-management groups in St. Lucia and throughout the Caribbean.	Horizontal linkages between resource users in different countries.	User groups.
4. Links to scientific information	Review of scientific evidence on causes of coral reef decline validated the local perceptions of change and knowledge and attributed change to a range of land-based causes including sewage treatment and land use change.	Both government agencies and resource users linked with 'external' researchers and scientific information	Specific user groups. Regulators.
5. Access and influence over external regulatory frameworks	Marine Park management influenced the direction of national (Trinidad and Tobago) legislation through government channels and linkages, excluding other consultation.	Government stakeholders make vertical linkages within government structures	Regulators.

* NGOs = non-governmental organizations

inequality in access to information is highlighted as a key element determining the nature of linkages. In the Tobago case, regulatory stakeholders retained a gatekeeper role to higher-level regulatory change throughout the negotiation and renegotiation of co-management responsibilities. The fisheries and planning authorities had exclusive knowledge and some influence over developments in legislation and planning policy that were the remit of Trinidad and Tobago national policy agencies. The local stakeholders remained effectively outside of such processes. Hence cross-level linkages by these powerful agents began to undermine trust in shared management arrangements. The regulator always appeared, in the perceptions of resource users, to have a 'trump card' of access to central government and higher level rule making bodies.

There are many examples, in the case of Buccoo Reef Marine Park, of cross-scale linkages between resource users and external agents and between different levels of regulatory institutions. Table 2

also highlights examples of differential access to scientific information. Such linkages build the knowledge base and promote the interests of individual stakeholders. How do these observations tie with the suggestions in the previous section on the role of power in cross-scale linkages? It appears that once engaged in a process of co-management and rapidly evolving institutional structures, opportunities for cross-scale interactions and alliances abound. Government agencies tend to have more resources to engage in such linkages and hence to benefit from them. Thus the initial distribution of linkages may indeed skew the power relations between groups. They also have the potential to undermine trust between stakeholder groups. But the offsetting trend, that of empowerment of previously disengaged stakeholder groups, is also apparent in this case. Thus the political economy of cross-scale linkages requires systematic empirical evaluation, recognizing the role of power in all its manifestations within processes of negotiation.

CONCLUSIONS

In this analysis we have examined the structure of interplay as a major shaping force in cross-scale interactions. The cross-scale nature of resource management systems is under-researched. Many, if not all systems, are inherently cross-scale and their success in promoting sustained engagement and resilient and shared management are determined by factors at a range of levels from constitutional and organizational to those at the level of resource users. The example above, of the linkages that helped to shape a co-management arrangement for marine park management in Tobago, demonstrates that there are many of the types of linkages identified by Young (2005) and Cash et al. (2005) that exist simultaneously and evolve over time.

The theoretical analysis in the sections above suggests that the structure of interplay in cross-scale linkages is intertwined with the political economy of those linkages. There are winners and losers in cross-scale dynamics, though interactions, the linkages are by no means a zero-sum game. In addition, some linkages emerge that radically alter the playing field while others reinforce existing inequalities between powerful and less powerful players. These observations all attest to the role of power in determining the structure of multi-scale human environment systems. While the analysis by Young (2005) outlines possible types of interaction, we suggest here that dominance is the most frequently observed type of linkages. But the micro-politics of cross-scale interactions show that stakeholders employ diverse tactics including building links that bypass existing structures. The lens of political economy gives important insights into why these cross-scale linkages emerge.

As linkages between different parts of systems across scales and levels emerge, it is important, in terms of prescriptive design principles, to ensure that empowerment of cross-scale institutions is matched with the resources that enable aspirations for sustainable management to be fulfilled (Anderies et al. 2004). The persistence and stability of governance systems depends on the distribution of benefits from cross-scale linkages, for example, through the mechanism of trust. The key is to identify those linkages that promote the obvious potential for enhanced management and avoid those that have the potential to undermine trust between stakeholder groups.

Responses to this article can be read online at:
<http://www.ecologyandsociety.org/vol10/iss2/art9/responses/>

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LITERATURE CITED

- Adams, W. M., D. Brockington, J. Dyson, and B. Vira.** 2003. Managing tragedies: understanding conflict over common pool resources. *Science* **302**:1915-1916.
- Agrawal, A.** 2001. Common property institutions and sustainable governance of resources. *World Development* **29**:1649-1672.
- Anderies, J. M., M. A. Janssen, and E. Ostrom.** 2004. A framework to analyze the robustness of social-ecological systems from an institutional perspective. *Ecology and Society* **9**(1):18. [online] URL: <http://www.ecologyandsociety.org/vol9/iss1/art18/>.
- Arce, A., and N. Long.** 1992. The dynamics of knowledge: interfaces between bureaucrats and peasants. Pages 211-246 in N. Long and A. Long, editors. *Battlefields of Knowledge: The Interlocking of Theory and Practice in Social Research and Development*. Routledge, London, UK.

- Baland, J. M., and J. P. Platteau.** 1999. The ambiguous impact of inequality on local resource management. *World Development* 27:773-788.
- Berkes, F.** 2002. Cross-scale institutional linkages for commons management: perspectives from the bottom up. Pages 293-321 in E. Ostrom, T. Dietz, N. Dolšak, P.C. Stern, S. Stonich, and E.U. Weber, editors. *The Drama of the Commons*. National Academy, Washington, D.C., USA.
- Berkes, F.** 2004. Rethinking community-based conservation. *Conservation Biology* 18:621-630.
- Berkes, F., R. Mahon, P. McConney, R. C. Pollnac, and R. S. Pomeroy.** 2001. *Managing Small-Scale Fisheries: Alternative Directions and Methods*. International Development Research Centre, Ottawa, Ontario, CA.
- Birner, R., and H. Wittmer.** 2003. Using social capital to create political capital: how do local communities gain political influence? A theoretical approach and empirical evidence from Thailand. Pages 3-34 in N. Dolšak and E. Ostrom, editors. *The Commons in the New Millennium: challenges and Adaptations*. MIT, Cambridge, UK.
- Boyce, J. K.** 1994. Inequality as a cause of environmental degradation. *Ecological Economics* 11:169-178.
- Brown, K.** 2003. Three challenges for a real people-centred conservation. *Global Ecology and Biogeography* 12:89-92.
- Brown, K., W. N. Adger, E. Tompkins, P. Bacon, D. Shim, and K. Young.** 2001. Trade-off analysis for marine protected area management. *Ecological Economics* 37:417-434.
- Brown, K., and S. Rosendo.** 2000. Environmentalists, rubber tappers and empowerment: the political and economic dimensions of extractive reserves. *Development and Change* 31:201-227.
- Brown, K., E. L. Tompkins, and W. N. Adger.** 2002. *Making Waves: Integrating Coastal Conservation and Development*. Earthscan, London, UK.
- Cash, D. W., W. N. Adger, F. Berkes, P. Garden, L. Lebel, P. Olsson, L. Pritchard, and O. Young.** 2005. Cross-scale dynamics in human-environment systems. *Ecology and Society*. In press.
- Conklin, B. A., and L. R. Graham.** 1995. The shifting middle ground: Amazonian Indians and ecopolitics. *American Anthropologist* 97:695-710.
- Cooke, B., and U. Kothari.** 2001. *Participation: The New Tyranny?* Zed Books, London, UK.
- Dietz, T., E. Ostrom, and P. C. Stern.** 2003. The struggle to govern the commons. *Science* 302:1907-1912.
- Dolšak, N., and E. Ostrom.** 2003. The challenge of the commons. Pages 3-34 in N. Dolšak and E. Ostrom, editors. *The Commons in the New Millennium*. MIT, Cambridge, UK.
- Eggerston, T. A.** 1995. *Economic Behavior and Institutions*. Cambridge University Press, Cambridge, UK.
- Falconer, K.** 2000. Farm-level constraints on agri-environmental scheme participation: a transactional perspective. *Journal of Rural Studies* 16:379-394.
- Few, R.** 2002. Researching actor power: analyzing mechanisms of interaction in negotiations over space. *Area* 34:29-38.
- Foucault, M.** 1986. Disciplinary power and subjection. Pages 229-242 in S. Lukes, editor. *Power*. Blackwell, Oxford, UK.
- Geoghegan, T., Y. Renard, N. Brown, and V. Krishnarayan.** 1999. *Evaluation of Caribbean Experiences in Participatory Planning and Management of Marine and Coastal Resources*. Technical Report 259, Caribbean Natural Resources Institute, Vieux Fort, Saint Lucia.
- Krutilla, K.** 1999. Environmental policy and transactions costs. Pages 249-262 in J.C.J.M. van den Bergh, editor. *Handbook of Environmental and Resource Economics*. Elgar, Cheltenham, UK.
- Kumarsingh, K., R. Laydoo, J. K. Chen, and A. M. Siung-Chang.** 1998. Historic records of phosphorus levels in the reef building coral *Montastrea annularis* from Tobago, West Indies. *Marine Pollution Bulletin* 36:1012-1018.
- Lukes, S.** 1974. *Power: A Radical View*. Macmillan, London, UK.

- Olsson, P., C. Folke, and F. Berkes.** 2004. Adaptive co-management for building resilience in social-ecological systems. *Environmental Management* **34**: 75-90.
- O'Neill, J.** 2001. Property, care, and environment. *Environment and Planning C: Government and Policy* **19**:695-711.
- Pastorok, R. A., and G. R. Bilyard.** 1985. Effects of sewage pollution on coral-reef communities. *Marine Ecology Progress Series* **21**:175-189.
- Peterson, G.** 2000. Political ecology and ecological resilience: an integration of human and ecological dynamics. *Ecological Economics* **35**:323-336.
- Pretty, J., and D. Smith.** 2004. Social capital in biodiversity conservation and management. *Conservation Biology* **18**:631-638.
- Pretty, J., and H. Ward.** 2001. Social capital and the environment. *World Development* **29**:209-227.
- Pritchard, L., Jr., and S. E. Sanderson.** 2002. The dynamics of political discourse in seeking sustainability. Pages 147-169 in L. Gunderson, and C.S. Holling, editors. *Panarchy: Understanding Transformations in Human and Natural Systems*. Island, Washington, D.C., USA.
- Rajkumar, W., and D. Persad.** 1994. Heavy metals and petroleum hydrocarbons in nearshore areas of Tobago, West Indies. *Marine Pollution Bulletin* **28**:701-703.
- Ribot, J. C.** 2002. *Democratic Decentralization of Natural Resources: Institutionalizing popular participation*. World Resources Institute, Washington, D.C., USA.
- Ribot, J. C., and N. L. Peluso.** 2003. A theory of access. *Rural Sociology* **68**:153-181.
- Richerson, P. J., R. Boyd, and B. Paciotti.** 2002. An evolutionary theory of commons management. Pages 403-442 in E. Ostrom, T. Dietz, N. Dolšak, P.C. Stern, S. Stonich, and E.U. Weber, editors. *The Drama of the Commons*. National Academy , Washington, D.C., USA.
- Scott, J. C.** 1998. *Seeing Like a State: How Certain Schemes to Improve the Human Condition have Failed*. Yale University Press, New Haven, Connecticut, USA.
- Sneddon, C.** 2003. Reconfiguring scale and power: the Khong-Chi-Mun project in northeast Thailand. *Environment and Planning A* **35**:2229-2250.
- Tomascik, T., and F. Sander.** 1985. Effects of eutrophication on reef-building corals 1. Growth rate of the reef-building coral *Montastrea annularis*. *Marine Biology* **87**:143-155.
- Tompkins, E., W. N. Adger, and K. Brown.** 2002. Institutional networks for inclusive coastal zone management in Trinidad and Tobago. *Environment and Planning A* **34**:1095-1111.
- Young, O. R.** 2002. *The Institutional Dimensions of Environmental Change: Fit, Interplay, and Scale*. MIT, Cambridge, UK.
- Young, O. R.** 2005. Vertical interplay among scale-dependent resource regimes. *Ecology and Society*. In press.