From Community-Based Resource Management to Complex Systems: The Scale Issue and Marine Commons

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Abstract

Most research in the area of common property (common-pool) resources in the last 2-3 decades sought the simplicity of community-based resource management cases to develop theory. This was mainly because of the relative ease of observing processes of self-governance in simple cases. However, this creates a problem. Whether the findings of small-scale, community-based commons can be scaled up to generalize about regional and global commons is much debated. Even though some of the principles from community-based studies are likely relevant across scale, new and different principles may also come into play at different levels. Cross-scale institutions (such as institutions of co-management) have something in common: they provide ways to deal with complex adaptive systems. They all pertain to various aspects of complexity, such as self-organization, uncertainty, and resilience, and deal with the challenges of scale. Communities themselves can be seen as complex systems -- embedded in larger complex systems. Thus, community-based resource management needs to deal with cross-scale governance and external drivers of change, as I illustrate with examples of marine commons.

1. Introduction

Sustainable development and resource management "at all levels" (Cash et al., this volume) is a major issue for commons management. The theory of the commons has undergone major transformations over the years, moving from the simplistic "tragedy of the commons" model, to dealing with small-scale, community-based systems as "laboratories" in which to investigate self-organization and self-governance (Ostrom 1990). Proceeding on from this base, commons literature has been dealing with the governance of multiple resources and user-groups, and regional and global commons (Keohane and Ostrom 1995; Dolsak and Ostrom 2003).

There are ongoing debates in many areas of commons research. One of the perhaps more significant debates concerns a scale-related question: can findings from local-level commons be scaled up? That is, can principles generated on the basis of studies of micro-level systems be applied to meso-scale and macro-scale systems? Researchers have been dealing mainly with small-scale, community-based systems, but some of the experimental work on commons, using Prisoner's Dilemma models, have treated nation states as unitary actors in the analysis of global commons (Ostrom et al. 1994), with the implication that the same commons principles may apply across scale. More specifically, a common view is that "some experience from smaller systems transfers directly to global systems" but that "global commons introduce a range of new issues" (Ostrom et al. 1999: 278). In this analysis, a number of factors are considered important, including the size and complexity of the system and the speed at which resources regenerate. In addition to the scaling-up problem, there are at least five other challenges of global commons, concerning such factors as cultural diversity and interlinkages of commons (Ostrom et al. 1999).

Other researchers, coming from a background in regional and global commons, argue that the transferability of small-scale commons experience "is not fundamentally a matter of extreme size and complexity [at the global level]. Rather, the problem arises from differences between individuals and states and from the separation between those who formulate the rules and those who are subject to them" (Young 2002: 153). "Solving the tragedy of the commons at the local level is fundamentally a matter of self-

regulation", but at the global level, "regulation is a two-step process" (Young 2002: 152). Hence, "we should be particularly careful to avoid assuming unreflectively that large-scale and especially global issues are properly treated as CPR problems" (Young 2002: 149).

I approach this debate by suggesting that commons management in many cases should be understood as the management of complex systems, with emphasis on scale, self-organization, and emergent properties such as resilience (Berkes et al. 2003). There is general recognition that common property (common pool) resources are often impacted by forces or drivers at various levels of organization. There is also common agreement on the need to consider multiple levels of management (Ostrom et al. 1999; Young 2002; Adger 2003).

Some of the commons literature, in particular in the area of co-management, explicitly deals with multi-level management. However, theory has not kept pace with the accumulation of a rich set of co-management cases, concerning many resource types, cultures and geographic areas (Jentoft 1989; Pinkerton 1989). Theory development in the area of multi-level management has been weak, but there is in fact a diversity of institutional forms for dealing with cross-scale commons (Berkes 2002).

Co-management is by far the most widely discussed institutional form for dealing with commons management at two or more levels, even though the term is really a catch-all for a number of different kinds of arrangements. Other institutional forms include epistemic communities (Haas 1990), policy networks (Carlsson 2000), boundary organizations (Cash and Moser 2000), polycentric systems (McGinnis 2000) and institutional interplay in which institutions at different levels interact horizontally (across space) and vertically (across levels of organization) (Young 2002).

These concepts have something in common: each provides an approach to deal with complex adaptive systems. They all pertain to scale, and to other aspects of complexity such as self-organization, uncertainty and resilience. If so, one can argue that there is an evolution of thought toward dealing with commons management as complex systems problems. Thus, there is a need to evaluate commons theory to look beyond laboratory-like, community-based approaches and to proceed to an analysis of commons as multi-level systems. I use examples of marine commons to illustrate, as Cash et al. put

it, the phenomenon of resource management "at all levels". Specifically, the objectives are to contribute (1) to an understanding of commons as complex systems, and (2) to the debate on scaling up from local concerns to global challenges.

The paper has five sections following the Introduction, and uses the framework of spatial and temporal scales and domains (social and ecological domains), as suggested by Cash et al. (this volume). First, I review the commons concept, focusing on the core issues of exclusion and subtractability, and the need to expand the analysis beyond the local-level to consider complexity. Second, I identify a selection of scale-related complexities. The next two parts deals with cases, one on community-based examples and the other on international commons. The section on local-scale marine resource management makes the point that even cases of apparent simplicity may have drivers at different spatial and temporal scales. The international marine commons example, focusing on large migratory fish species of the Atlantic, makes the point about the integrated nature of social and ecological domains and the necessity of having to consider both technical/biological factors and social/economic factors in management. Finally, I consider some policy issues and look at scale questions within the broader set of complexity considerations.

2. Cross-Scale Commons: Expanding the Scope of Commons Theory

Common property (common pool) resources share two characteristics: (a) exclusion or the control of access of potential users was difficult, and (b) each user was capable of subtracting from the welfare of all other users (Feeny et al. 1990). These two universal characteristics of commons are referred to as the *exclusion problem* and the *subtractability problem*, respectively. Thus, Ostrom et al. (1999) define *common-pool (or common-property) resources* as whose "in which (i) exclusion of beneficiaries through physical and institutional means is especially costly, and (ii) exploitation by one user reduces resource availability for others."

In theory, and often in practice, a group using a commons can solve the exclusion problem and the subtractability problem. The key is the ability to limit the access of outsiders and to self-regulate its own use. Common property works through incentives.

If members of a group are assured that future harvests would be theirs by right, and not end up being harvested by others, they have the economic incentive to self-regulate.

Exclusion means the ability to exclude people other than the members of a defined group. Evidence suggests that successful exclusion under communal-property is the rule rather than the exception. But stresses of population growth, technology change, and economic transformation may contribute to the breakdown of communal-property mechanisms for exclusion (Berkes 1989). The creation of open access by external forces, such as colonialism and globalization, limits communal property controls for exclusion.

Most national governments consider marine resources as freely open to all citizens and license holders, effectively ignoring *de facto* fishing territories of many maritime communities (e.g., Berkes 1989). This is an example of how national policies may adversely constrain local management (Cash et al., this volume). Exceptions include Japanese coastal fisheries, coastal resources in some Pacific island states, and many marine lagoon systems internationally (Ruddle and Akimichi 1984; Amarasinghe et al. 1997; Johannes 1998; Seixas and Berkes 2003).

Subtractability refers to the ability of social groups to design a variety of mechanisms to regulate resource use among members. In many cases, resource users have been able to avoid Hardin's "tragedy" by devising rules for self-governance, monitoring mechanisms, and sanctions that rely neither on government control nor private property rights (Burger et al. 2001). Much of the common property literature addresses this issue, and the conditions for effective self-governance. Ostrom (1990) lists eight design principles important for the success of community-based institutions. An analysis by Agrawal (2002) expands this list and suggests that there may be as many as forty design principles, or critical enabling conditions, that may be important for the success of commons institutions.

In many cases, community-based management systems are inferred to be successful, not because conservation or sustainability can be shown, but because they have survived for long periods through various crises. Such successful commons institutions have received special attention for theory building precisely because they are long-enduring (Ostrom 1990). Many of them have historical roots, as in Swiss Alpine commons and Japanese village common lands or *iriai,* and Japanese coastal fishery

commons (Ruddle and Akimichi 1984). But is the long-term survival of a community-based management system a good indicator of its sustainability?

Resource management systems tend to go through cycles of crisis and recovery and of institutional renewal. Societies are rarely, if ever, in balance with their resources, and commons institutions are rarely stable for long (Amarasinghe et al. 1997; Seixas and Berkes 2003). Instead of equilibrium, one may expect crises and cycles of change, thus shifting the analytical emphasis from stability to resilience, and to the ability of management systems to build capacity for learning and adapting (Folke et al. 2002).

3. Scale-Related Complexities

The diversity and widespread prevalence of local-level commons institutions indicate that they have been important for the survival of many societies and still relevant for contemporary resource management (Johannes 1998). However, there are certain limitations of the lessons learned from the study of local-level systems. Research on commons issues over recent decades often sought the simplicity of community-based resource management cases to develop theory. For example, Ostrom (1990: 29) comments that her strategy has been to study small-scale common property situations "because the process of self-organization and self-governance are easier to observe in this type of situation than in many others." This is not to say that such small-scale systems are isolated from the rest of the world and immune to internal and external influences that impact self-governance. There are many such influences.

Here I touch upon four scale-related issues that impact sustainability and resource management: (1) complexity at the level of the community itself, (2) the existence of external drivers of change, (3) the problem of mismatch of resource and institutional boundaries (issue of fit), and (4) the necessity for community-based management to deal with cross-scale issues.

First, the term *community* in community-based resource management is a gloss for a complex phenomenon and may hide a great deal of complexity. Communities are not always simple entities; many show characteristics of complex systems. They may be heterogeneous, with different interests by gender, age, class, socioeconomic group or

ethnic group (Agrawal and Gibson 1999). There often area competing groups within a community and differences may be strong enough that a village may be thought of containing distinct communities, as in caste communities in many parts of India (Berkes et al. 1998). In some cases, a community may be a cohesive group, with shared norms and rules-in-use; in other cases, communities fall short of the expectation of coherent entities representing long-standing sources of authority (Brosius et al. 1998). Hence, it may be more useful to think of communities as multi-dimensional, cross-scale social-political units.

Second, external drivers *[this section is not complete]*

Third, resource boundaries rarely match institutional boundaries (Folke et al. 1997), and scale mismatch is a widespread and fundamental problem. Cash et al. (this volume) identify five kinds: 1) mismatch between scales of human systems and scales of natural systems; 2) the tendency to define issues at one scale; 3) mismatch between scales of knowledge and scales of management; 4) ignoring cross-scale interactions in the human-environment system; and 5) ignoring linked issues or domains. As Brown (2003) puts it, institutions do not "fit" resource or ecosystem boundaries for a number of ecological reasons, including the complexity and dynamics of ecosystems, uncertainty, irreversibility, and disturbance.

Figure 1 shows some commonly considered levels of political and social organization and ecological organization, with marine resource management in mind. The number of levels can be expanded considerably, as done in MEA (2003: 121), which shows eight levels in both the political and the ecological scale. The social-ecological system represents the integration of the social/political and the ecological scales. It emphasizes the view that social and ecological systems are in fact linked, and that the delineation between the two is artificial and arbitrary (Berkes et al. 2003). But such integrated systems of humans-in-nature are more likely to work if there is a fit between the level and boundary of the ecosystem and the institution designed to manage it.

Finally, it appears that most, if not all, cases of natural resource management are cross-scale. Community-based resource management (the lowest level in Figure 1) is characterized by an emphasis at the community or the local level – the community is

where governance begins. But because cross-scale linkages are so pervasive (linkages to the higher levels in Figure 1), attention to the community level alone is never likely to be sufficient to provide for effective management. Combining the essence of community-based management (from the ground up) with the necessity to deal with cross-scale issues invokes the subsidiarity principle. The principle has been adopted, among others, by the Maastricht Treaty that lays out the framework for establishing the European Community: "decisions are [to be] taken as closely as possible to the citizen". It articulates the objective that decisions affecting peoples' lives should be made by the lowest capable social organization (McCay and Jentoft 1996).

In sum, overemphasis on "community-based management" runs the risk of defining issues at one level instead of many (Cash et al., this volume). The scope of inquiry has to be broadened to encompass multiple levels. Communities themselves may be complex and embedded in further complexity due to intervening layers and external drivers and due to the problem of fit between institution and ecosystem boundaries. It is difficult to find a resource management system that does not have some cross-scale linkages and drivers at different scales; this is particularly so in a globalized world. We now turn to a consideration of some marine commons cases to illustrate and expand upon these scale-related issues.

4. Scale Issue in Community-Based Resource Management: Some Cases

The recent theory of the commons is based on are relatively simple, local-level cases, but even these simple cases may have complexities at the community level or cross-scale linkages and drivers. The first example, a coastal resource use case from Cambodia, illustrates community heterogeneity and cross-scale linkages. In some cases, the community-based system itself may have emerged because of the drivers at other levels. The second example, from Kerala, India, provides an illustration of such a system, a simple-looking, single-resource system, small in spatial scale, and involving a relatively small number of homogeneous resource users, but one that has its historical roots in higher-level drivers.

The Cambodia case (Marschke and Nong 2003; Marschke and Berkes, in press)

•Two major groups in Koh Sralao village
•Long-term residents who prefer a healthy mangrove ecosystem that supports a variety of resources
•Immigrants who are pursuing commodity production
•The mangrove is used by several villages in the region
•There are two levels of government
•Several government agencies have jurisdiction over the mangrove ecosystem

[this section is not complete]

Turning to the India case, the *padu* is a lagoon and estuarine resource management system, mainly for shrimp fisheries, found in Sri Lanka and the southern Indian states of Kerala and Tamil Nadu. *Padu* systems are characterized by the use rotational fishing spots allocated by lottery; they are species- and gear-specific, with rules to define fishing sites and rights holders, often according to social groups or caste groups. Some *padu* systems in Sri Lanka go back to at least to the 18th century and possibly to the 15th (Amarasinghe et al. 1997).

We investigated three community-based fisher associations (*sanghams*) in the Cochin estuary of Kerala, south India, that use the *padu* system. The community associations administered the rotational allocation of shrimp fishing spots and operated under a set of well defined rules serving livelihood, access equity and conflict resolution needs among their members. However, as a commons institution, the *padu* system of the Cochin estuary only dates back from the late 1970s (Lobe and Berkes 2004). Tracing their origins showed that they arose out of two events that took place in the 1970s.

The first was the globalization of shrimp markets in the 1970s. Shrimp became "pink gold", as many small-scale fishers in south India abandoned other resources in pursuit of shrimp (Kurien 1992). The second factor was the centralization of fisheries management in Kerala. In 1967, the Kerala Fisheries Department started to institute a new licensing arrangement, replacing an older system of land and fishing site holdings called *pattayam*. Beginning in 1974, state legislation required licenses for all fishers, but the state lacked the means to enforce the new law. As shrimp fishing was lucrative and

attracted new entrants, the resource effectively became open-access, forcing the fishers to self-organize to consolidate what they considered to be their rights in a large and crowded estuary and lagoon system (Lobe and Berkes 2004).

Each *padu* association in the Cochin estuary dealt with the exclusion issue by limiting the access of non-members, and the subtractability issue through rules that provide for equity, social responsibility and conflict management among its members. However, the Kerala State government neither recognizes the three associations nor does it license the fishers (it does license some of the other groups). Lack of state recognition and mechanisms for cross-scale coordination have limited the ability of these local-level associations to contribute to management at the regional (estuary and lagoon) level. Indeed, they continue fishing only because of a 1978 court order establishing them "as fishers by profession" and ongoing State-level political action by their *dheevara* caste organization (Lobe and Berkes 2004).

The *padu* case illustrates how external drivers related to economic development (international markets for shrimp) and resource management policies (state-level reorganization of fishing rights) impact community-based institutions. The *padu* systems of the Cochin area have their origins in ancient South Asian traditions of coastal resource use, but they are in fact the products of relatively recent economic and political transformations. Their existence is fragile because of lack of state-level policies and lack of government recognition. Whereas the Sri Lanka case shows legally recognized cross-scale governance from the local to the national (Amarasinghe et al. 1997), the Kerala case has no cross-scale governance, no intermediate-level institutions, and no arrangements between the community and the government.

Figure 2 sketches the differences between these two lagoon management cases that use variations of the same *padu* system. In Negombo lagoon, Sri Lanka, the fishers are well organized at the community level through four Rural Fisheries Societies (RFSs). They are subject to the rules made by each of the RFSs at the local level, coordinated across the four RFSs at the regional level. The national government has legally devolved management authority to the RFSs through the *Negombo (Kattudel) Fishing Regulations* (Amarasinghe et al. 1997). By contrast, no effective cross-scale linkages exist in the Cochin estuary and lagoon, Kerala, even though the fishers are well organized at the

community level and even though there is legislation from 1995 that devolves resource management to municipal-level organizations.

5. Cross-Scale Issues in International Commons: An Atlantic Fishery Case

Migratory marine resources create particularly difficult problems for community-based fisheries management and pose a multitude of scale mismatch problems. A given stock may be used by coastal and offshore fisheries, by small and large-scale operations, and in some cases by more than one national jurisdiction. The additional problem is that the movement of the stocks makes it very difficult to deal with problems of exclusion and subtractability. The management of migratory marine resources creates fundamentally different kinds of problems, as compared to the management of stationary resources and community-based users who tend to develop shared values and mutually agreed rules, and who can monitor one another's behavior and impose sanctions.

In contrast to self-managed community resource use systems that operate mainly with social sanctions (Ostrom 1990; Wilson et al. 1994), fisheries that are carried out over a region that has many communities and user-groups may require different management practices. Such regional level management may include, for example, harvest quotas that are coordinated and enforced by government, as local solutions alone would not likely be effective (McCay and Jentoft 1996). In the case of migratory stocks that range over large ocean areas, the situation is likely more complicated. Such resources pose cooperation and enforcement problems that cannot be solved at the local or regional levels. Efforts to protect such resources, as with global commons in general, have usually depended on bilateral or multilateral international agreements that require voluntary cooperation among governments.

I illustrate these issues with a case study of tuna and tuna-like fishes of the Atlantic region, managed by the International Commission for the Conservation of Atlantic Tuna (ICCAT). The first example concerns the scientific complexities and uncertainties in the management of Atlantic bluefin tuna (*Thunnus thynnus*). The second example is about the management of a suite of oceanic large pelagic species which migrate through the Caribbean region and are fished by the small island states and fishing

communities of the region. The case illustrates the social and political complexities of international commons management.

Consider the example of Atlantic bluefin tuna. Until recent years, ICCAT recognized two stocks (or management units), one in the west and one in the east Atlantic, consistent with larval surveys indicating two major breeding grounds, the Gulf of Mexico and the Mediterranean Sea. There has been a sharp decline in the abundance of the western Atlantic bluefin since the 1970s. In 1982, ICCAT began setting an annual catch limit to try to conserve the stock, but it took nearly another decade before the tuna biomass stabilized (Magnusson et al. 2001). In the meantime, using new and more sophisticated tagging techniques, it was found that the two stocks were not discrete as previously thought. Western-tagged bluefin tuna were found to make transatlantic migrations, causing a mixing of stocks in the two feeding grounds (Block et al. 2001), complicating management measures based on the assumption of two discrete populations.

The tuna example illustrates some of the complexities in the management of an international common resource. The ICCAT, as a multilateral agency, can set quotas and protect the resource -- but only with the full agreement of the participating nations. These nations, in turn, have to force these international rules on their fishing industry. Where local perceptions of resource availability and sustainability are at odds with the international view, the stage is set for potential conflicts. Uncertainties in migration and other biological characteristics of the tuna create further management problems, pitting nation against nation. Because it is an offshore resource, monitoring is difficult. Further, economic stakes are high; bluefin tuna is a very high-priced commodity for *sushi* and *shashimi* and has a globalized market.

The tuna case is significant in illustrating some characteristic management directions used for international marine resources. The community level or even the national level does not match the geographical scale of a migratory tuna. To solve the scale mismatch problem, an international agreement becomes necessary. Once the international management agency is set up, it relies on progressively more sophisticated technical research, such as new ways of investigating migration patterns, and may become increasingly more distant from the realities of fishing communities.

Quotas are set and adjusted, according to the status of the resource and the scientific information available in the judgment of technical personnel. Science of management rarely provides a once-and-for-all answer. Instead of providing clarity, new research may suggest additional complexities to which cross-scale management must then adjust. Nevertheless, all these efforts may not be sufficient for conservation in the face of multiple jurisdictions, possible non-compliance, and remaining scientific uncertainty.

Bluefin tuna is not the only species managed by ICCAT. Some 30 species of tunas and tuna-like species of the Atlantic Ocean and adjacent seas, including the Caribbean, come under the international coordination role of ICCAT. A number of species, deemed to be overfished, have been coming under new conservation measures by ICCAT, specifically under annual total allowable catch (TAC) limits. In addition to the bluefin tuna, TAC controls apply to several other tuna and billfish stocks, including swordfish (*Xiphias gladius*). These stocks are fished by a number of countries, including distant water fleets. The major players include the United States, Brazil and the European Union, all of which are ICCAT members. The Caribbean Community (CARICOM) is an observer on ICCAT and represents the small island nation states of the region.

The ICCAT allocates the TAC in catch quotas based solely on historical harvests. This puts CARICOM countries at a disadvantage because their fleets have been small-scale and have only recently expanded into the long-line fishery for large pelagic species (Chakalall et al. 1998). Internationally accepted catch allocation criteria include other considerations as well, including socio-economic criteria such as the interests of small-scale costal fisheries and the needs of coastal communities (Singh-Renton et al. 2003).

We have been following the community-based fishery in Gouyave on the small island state of Grenada, a CARICOM member (Grant and Berkes, unpublished). Gouyave has one of the larger long-line fisheries in the region and a tradition of fishing large pelagic species by handline. The main species in the community harvest are yellowfin tuna (*Thunnus albacares*) for the export market, Atlantic sailfish, locally called "ocean gar" (*Istiophorus albicans*) for the local market, and a variety of small tunas, marlins and swordfish.

From the point of view of the fishing community in Gouyave, their fishery is too small to make a difference but vulnerable to powerful international players. They have grudgingly accepted to stay out of the swordfish fishery, mainly by setting their long-lines to avoid the species. Community opinion is still brewing with respect to possible TAC limits on marlins. However, in the case of possible TAC limits on sailfish or "ocean gar", they draw the line since this species is locally important for both food and income.

As Singh-Renton et al. (2003) have argued, the ICCAT needs to be persuaded that top-down enforcement is unlikely to be effective for small-scale fisheries, requiring a focus on community-based management instead. What are the prospects for such community-based, cross-scale management? **Figure 3** maps out the linkages in four levels of management in the case study. CARICOM Fisheries communicate effectively with the member countries, including Grenada, and pass on information from ICCAT regarding management measures. Grenada Fisheries Division, in turn, informs the fishing industry. Fishing communities such as Gouyave are organized internally but a lack consistent voice through well established associations, creating a weak link between the national and the community levels. While top-down information flow is effective for the most part, bottom-up flow is generally poor.

6. Discussion and Policy Issues *[this section is not complete]*

Commons thinking has been evolving to deal with resources as complex systems problems. The literature has been turning to the examination of scale, self-organization, uncertainty and resilience, all of which are concepts of complex adaptive systems (Gunderson and Holling 2002). Commons research evolved through the critique of the "tragedy of the commons" model used "to paint a disempowering, pessimistic vision of the human prospect," and to rationalize central government control or privatization of all commons (Ostrom et al. 1999). Commons research over the last 20-30 years has documented in considerable detail the self-organization and self-regulation capability of communities of resource users to solve the exclusion and subtractability problems of the commons.

However, research also showed that community-based resource management is vulnerable to external drivers. In particular, community-based resource management is insufficient and incapable of dealing with problems such as migratory marine resources. Hence, it is important for commons theory to look beyond local-level, community-based resource management. We need to elaborate a commons theory that provides insights into the solution of regional and global as well as local commons problems. In this sense, community-based management can be considered as a shorthand for governance that starts from the ground up but deals with cross-scale relations.

Building theory for commons and community-based management requires an understanding of commons as complex systems, with attention to scale, self-organization, uncertainty, resilience and other characteristics of complex adaptive systems. As the examples in this paper indicate, cross-scale issues in commons management are pervasive. The marine commons cases considered here illustrate the full range of scale problems in social-ecological systems, as classified by Cash et al. (this volume):

1) mismatch between scales of human systems and scales of natural systems;
2) the tendency to define issues at one scale;
3) mismatch between scales of knowledge and scales of management;
4) ignoring cross-scale interactions in the human-environment system; and

ignoring linked issues or domains (indirectly scale-related, since many issues display scale-dependency).

Complex systems theory for cross-scale linkages

- 'More is different' (Anderson, Science 1972)
- Reality is hierarchical
- Each level is independent, to some degree, of the levels above and below
- Each level requires new concepts and principles.

Scaling up from local concerns to global challenges?

- Some of the commons principles seem to apply at all levels, e.g., exclusion & subtractability

- The global level requires new concepts and principles, different from the community level
- But then, each level requires new principles

From CBRM to complex systems

- Communities are complex systems
- Embedded in larger complex systems
- Hence CBRM systems need to deal with cross-scale governance
- And CBRM systems need to deal with external drivers of change, such as markets, central government policies, international economic policies ("globalization") and donor policies

Some policy considerations:

1. Creating political space for self-governance for CBRM systems and improving capability for self-organization and institution-building

[more]

2. Improving institutional learning and building adaptive capacity to deal with change and to cope with shocks and stresses of change

One of the major lessons is the emphasis on the ability of a society or management system to build capacity for learning and adapting -- the resilience approach (Gunderson and Holling 2002). Conventional ways with bilateral and multilateral international agreements, based on biological and economic controls, seems to be limited in building such capacity. As seen with the marine resources cases, alternative approaches such as scale-matching, adaptive management and stakeholder participation in decision-making are starting to come into use – approaches that may help build capacity for learning and adapting.

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