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ANALYSIS

Institutions and environmental governance: A reconceptualization

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ABSTRACT

This article presents the conceptual revisions needed to extend the new institutional approach to environmental governance from its current local and international domains of application to all governance solutions, including national environmental and natural resource use policies and multi-level governance solutions that are increasingly used to address global environmental change. The article suggests that environmental governance is best understood as the establishment, reaffirmation or change of institutions to resolve conflicts over environmental resources. It also explains why the choice of these institutions is a matter of social justice rather than of efficiency. The article suggests a way to understand formal and state-centered governance solutions as forms of collective ownership not unlike common property. The article demonstrates how institutional analysis can gain resolution by looking at the functional and structural tiers, organization of governance functions, and formulation of key institutional rules as key aspects of the design of governance institutions.

1. Introduction

New institutional economics or "new institutionalism" has informed a significant body of research on local common property arrangements and international environmental conventions (Acheson, 2003; Baland and Platteau, 1996; Berge and Stenseth, 1999; Berkes, 1989; Bromley, 1992a; Buck, 1998; Dahlman, 1980; Dolšak and Ostrom, 2003; Hanna et al., 1996; Keohane and Ostrom, 1995; Loehman and Kilgour, 1998; McCay and Acheson, 1987; Ostrom, 1990, 2005; Ostrom et al., 1994; Ostrom et al., 2002; Young, 1994a,b, 1997, 2002). This interdisciplinary research encompassing economics, political science, sociology and anthropology has shed light on the conditions in which voluntary collective action can attain sustainable governance and use of environmental resources and has identified design principles that characterize successful governance solutions.

New institutional research on environmental governance has been phenomenally successful in terms of its volume growth and policy impact. Yet its potential is far from exhausted. Understanding the challenges and solutions of governing large and complex environmental resources such as atmospheric sinks have been identified as key future tasks (Ostrom et al., 1999: 278) and some progress towards understanding their adaptive governance has been made

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(e.g. Dietz et al., 2003). However, much of the literature still examines single-level or uniplanar governance solutions although the governance of global environmental resources is increasingly based on multi-level solutions operating at the local, national, international and intermediate levels simultaneously. This calls for finding ways to accommodate and deal with institutional diversity as part of the solution for adaptive governance (Ostrom et al., 1999: 278; Ostrom, 2005). In particular, there is a need to be able to deal with traditional national policies based on the enforcement power of the state in conjunction with solutions based on voluntary cooperation. Another challenge is to extend analysis from common-pool resources to other kinds of environmental resources. The goal of this article is to present the key conceptual adjustments needed for these analytical extensions.

The greatest obstacle for the further extension of the new institutional approach lies in its mostly implicit definition of "governance". The literature distinguishes between "governance" and "government" by considering the absence of coercive state power as the hallmark of "governance". Yet governance is what governments do. Sometimes – as when resource users govern themselves under customary institutions – environmental governance does not involve the *state*. Yet customary resource users perform the governmental functions of legislation, administration and adjudication and the *government* is involved as the term "self-government" conveys. Rather than a monolithic external actor, the government, and the state, should be understood as arenas and instruments of collective action which are often pertinent in environmental governance. The key implication of the involvement of the state is that it entails a different distribution of power than self-governance solutions. Otherwise, national environmental and natural resource use policies perform similar functions and rely on similar institutional solutions as customary common property arrangements despite being formal, having larger jurisdictions, and relying on the enforcement power of the state.

This article suggests a broader definition of environmental governance as the establishment, reaffirmation or change of institutions to resolve conflicts over environmental resources (Adger et al., 2003; Bromley, 1989, 1991; Young, 1994a,b: 15; see also Knight, 1992). In this definition, *conflict* refers to a conflict of interest, not necessarily to an open conflict, between involved parties. This broader definition is applicable to the governance of all *environmental resources* from conventional renewable and non-renewable natural resources to biodiversity and atmospheric sinks, as well as to environmental safety and the quality of air and water. The definition does not limit the type or scale of environmental governance problems and solutions that can be examined, and it also recognizes social justice as an integral part of environmental decisions as will be discussed below in greater detail.

The expansion of new institutional analysis to new areas of application also requires revisions to the way in which governance institutions are understood. The distinctions between the absence of property or *res nullius*, state property, common property and private property as alternative rights systems for governing the use of natural resources do not accommodate all formal governance solutions that are used in practice. The article suggests that the concept of "state property" should be abandoned and that the concept of "common property" should be expanded to "collective ownership" so as to encompass governance solutions created by national environmental and resource policies and international environmental conventions. At the same time, the article argues that institutional analysis has to go beyond this kind of broad categorizations, suggesting that it can gain resolution by looking at functional and structural tiers, organization of governance functions, and the formulation of key institutional rules, as the core aspects of institutional design of governance solutions.

In what follows, the second section redefines environmental governance as the resolution of environmental conflicts. The third section discusses the role of social justice in environmental governance. The fourth section modifies the typology of governance institutions so as to accommodate all governance solutions in it. The fifth section suggests a model for analyzing the institutional design of governance solutions in detail.

2. Governing interdependence and environmental conflicts

Research on the management of natural resources under customary common property institutions and on international environmental governance are the strongest strands of environmental research informed by new institutionalism (Baland and Platteau, 1996; Berge and Stenseth, 1999; Berkes, 1989; Bromley, 1992a; Buck, 1998; Dahlman, 1980; Dolšak and Ostrom, 2003; Hanna et al., 1996; Keohane and Ostrom, 1995; Loehman and Kilgour, 1998; McCay and Acheson, 1987; Ostrom, 1990; Ostrom et al., 1994; Ostrom et al., 2002; Young, 1994a,b, 1997, 2002). Together they constitute what can be called the new institutional approach to environmental governance. However, it is also necessary to examine some earlier new institutional and other related literature in order to clarify the conceptual foundations of the new institutional research on environmental governance.

New institutional economics largely evolved as a critique of mainstream welfare economics, differing from it in two central ways. First, new institutional economics acknowledges that transaction costs exist and influence economic outcomes (Coase, 1937, 1960; Barzel, 1985; Dahlman, 1979). While transaction cost considerations have not played a prominent role in environmental governance research, they do shed light on the implications of institutional designs for governance outcomes (Paavola, 2002a; Paavola and Adger, 2005). Secondly, new institutional analysis of environmental problems is based on the concept of interdependence rather than that of externality (Ostrom, 1990; Knight, 1992; Keohane and Ostrom, 1995). Interdependence exists when a choice or reward of one agent influences those of another. It creates conflicts – such as those over who gets to use particular environmental resources – because interdependent actors cannot usually realize their interests in the subject of conflict simultaneously (see Schmid, 1987; 2002). These conflicts have to be resolved in the sense of defining whose interests are to prevail, and to what degree.

Game theory is the clearest source of interdependence reasoning in the contemporary environmental governance

research but its other roots also merit attention. The best starting point here is the way in which environmental problems are conceptualized in welfare economics and environmental economics. Following Pigou (1920), environmental problems are examined as externalities or physical effects between agents, for which no price is paid and no compensation is received (Mishan, 1971). Partial equilibrium analysis indicates that efficient allocation of resources is not achieved when externalities prevail. Pigou's suggestion was to impose a tax on the generators of negative externalities and to subsidize the generators of positive externalities in order to maximize social welfare.

Economists following the Pigovian approach have typically failed to recognize "externalities" as instances of interdependence. Yet interdependence is obvious in the classic externality examples. Factories belching smoke limit the ways in which laundries can dry their linen, and if the options of laundries are kept open, the options of factories must be limited. Similarly, steam locomotives generate sparks and expose trackside farmers' crops to the risk of fires, but the elimination of these risks by regulating the use of locomotives would limit the freedom of their owners. Hardin's (1968) analysis of the "tragedy of the commons" in the use of rangelands and fisheries highlights interdependence as the source of natural resource use problems. The use of the units of these resources by one agent precludes it by another. This can potentially instigate a race for the appropriation of resource units, which maybe individually rational but which can lead to the over-exploitation of the resource.

Coase (1960) acknowledged that interdependence underlies Pigou's externalities but he did not pursue his analysis to its logical conclusions. He demonstrated that under Pigou's own assumption of costless transactions, the assignment of private property rights to one of the parties is all that is needed: they can reach the efficient allocation of resources without government intervention through private bargaining after the initial endowments are defined in one way or another. This is the essence of the Coase Theorem as it is usually understood. However, Coase (1960) also demonstrated that when transaction costs are introduced, the assignment of rights influences and can determine the allocation of resources. Moreover, he argued that environmental regulations can entail lower transaction costs than private property rights as a way of establishing initial endowments when a large number of actors are involved (Coase, 1960: 17–18). It is noteworthy that Coase did not question the goal of welfare maximization — he just argued that transaction costs should be accounted for in it.

Critics of classical institutional persuasion have pointed at a problem both in the Pigovian reasoning and its new institutional criticisms. They have argued that the Pigovian reasoning on welfare-enhancing policy interventions is illegitimate because it makes a false distinction between allocative and distributive decisions. They suggest that Pigovian taxes and subsidies alter initial endowments, redistribute wealth and income, and result in different equilibria which cannot be compared in Paretian terms (Calabresi, 1991; Dragun and O'Connor, 1993; Vatn and Bromley, 1994). The same applies to Coase's alternative assignments of property rights and the maximization of social welfare subject to transaction costs. From the viewpoint of classical institutional economics, interdependence creates conflicts over who gets to use particular resources which are resolved in one way or another by defining or assigning rights (Schmid, 1987, 2002). This is not an issue of efficiency, but that of distribution.

To date, the new institutional research on environmental governance has focused on common-pool resources as a source of interdependence. Common pool resources have two defining physical attributes: rival consumption (subtractability) and the difficulty of exclusion. Many environmental resources are indeed common-pool resources. This includes small-scale natural resources such as forests, pastures and fisheries, which in some places are still governed by customary common property arrangements. However, there are also larger common-pool resources such as bodies of water, air basins, and the global atmosphere, which are used e.g. as waste sinks and which are governed by formal governance solutions.

There are also other sources and types of interdependence which require different kinds of governance solutions. Ordinary private goods with rival consumption and easy excludability make agents interdependent, a situation which has traditionally been governed by establishing private property rights. Private property rights play a role in environmental governance as well. There are also environmental resources such as biodiversity and landscape amenities which are *jointly consumed*: depending on their degree of excludability, they are either toll goods or pure public goods. These resources are available for several actors simultaneously, but their quantity and quality cannot be individually provided. Yet some quantity and quality has to be provided: realizing certain preferences in provision means ignoring other preferences. Moreover, there is no self-evident basis for cost recovery. Marginal cost of adding a user is zero, yet the average cost of provision per user is positive (Schmid, 1987). It is difficult to base cost recovery on preferences because agents have incentives to withhold their willingness to pay (WTP), and their use does not register in the resource physically. Yet some cost recovery scheme has to be adopted: it does not charge the whole WTP from some agents and charges more than the WTP from "unwilling riders".

In addition to their particular rivalry/excludability combination, environmental resources can have other attributes which significantly affect the challenges of, and solutions for, governing them. These other resource attributes include amenability for multiple uses, mobility, stability or fluctuation of yields, and amenability for storage (Schlager et al., 1994: 294–299; Schmid, 1987). Interdependence can also be created and shaped by the attributes of the community of involved and affected actors (see e.g. Ostrom, 2005). Key community attributes include the number of involved agents, heterogeneities of their values, interests and power, as well as the levels and types of social capital they possess (Paavola and Adger, 2005: 356).

In summary, interdependence causes environmental conflicts and a pressure to resolve them by establishing, modifying or reaffirming institutions (Paavola and Adger, 2005). Institutions resolve environmental conflicts by striking a particular balance between conflicting interests by either establishing, reaffirming or redefining entitlements in environmental resources (Adger et al., 2003; Bromley, 1991, 2004). Coase has shown that allocative efficiency will be reached after endowments have been assigned, and that governance

outcomes may vary in the context of positive transaction costs depending on how they are assigned. Therefore, distributive and governance outcomes are the key variables in collective environmental decisions (Calabresi, 1991). As Coase (1960: 43) has argued: "the choice among different social arrangements… must ultimately dissolve into a study of aesthetics and morals."

3. Social justice and environmental governance

The conceptualization of environmental problems as conflicts over environmental resources emphasizes that the choice of governance institutions is a matter of social justice rather than of efficiency. But the choice of governance institutions does not reduce to the narrow question of who are (to be) its economic winners and losers: social justice is broader and more complex than that. Moreover, values and motivations of agents influence what is considered just in particular institutional choices. New institutional research on environmental governance has sometimes acknowledged motivations such as "environmental stewardship" but typically it shares the conventional economic assumption according to which agents seek to improve their personal welfare or utility (but see North, 1990: 17–26). A more nuanced treatment of values and motivations is needed to understand environmental conflicts and their resolution.

One plausible starting point is the acknowledgement of pluralism. It is not uncommon to argue that peoples' values differ, but I am making here a particular argument for the acknowledgement of "radical pluralism" — the co-existence of incommensurable ethical premises of behavior which can be informed by utilitarian, non-utilitarian consequential or deontological ethics (Paavola, 2005). Thus, some may pursue a particular environmental governance solution because of its presumed positive welfare consequences. Others may consider that some of its consequences are inherently good and worth pursuing even if it would require welfare sacrifices, or that the involved rights and duties override all consequentialist reasoning (Paavola, 2002a; Sagoff, 1988; 2004). Those who oppose particular environmental governance solutions also do so on a number of grounds — not only because it is in their narrow economic self-interest. For example, they may consider private property rights inviolable and defend them even if doing so would require welfare sacrifices.

Values influence what resolutions of environmental conflicts are considered just. For example, even the certainty of positive welfare consequences might not justify the adoption of an international emission trading scheme for greenhouse gases to some of its opponents. They could argue that historical responsibility and the right to be free from involuntary exposure to climatic risks should be the primary concerns for climate change policies. For them, reasons should be presented for why, under the prevailing circumstances, would it be better to adopt a trading scheme rather than some other solution to pursue and allocate emission reductions (Bromley, 2004; Bromley and Paavola, 2002). These reasons must explain why social welfare considerations should be considered decisive and why other considerations, such as those regarding the involuntary exposure of people to risks and harms to which they have not contributed, are secondary or can be omitted completely.

Sufficient reasons for environmental decisions relate to both distributive and procedural justice. Decisions on governance institutions resolve whose interests in environmental resources are realized and what the incidence of beneficial and adverse consequences of decisions will be. These decisions can be informed by conventional rules of distributive justice such as Aristotle's just deserts, Bentham's greatest happiness for the greatest numbers, Rawls' maximin, or equality of resources, outcomes or opportunity (Young, 1994a,b). These rules are often applied as if the distribution of some overarching good such as "utility" or "welfare" could resolve all dilemmas of distributive justice. This would require the commensuration of goods and bads and would allow compensating one bad with another kind of good. For example, adequate compensation could be considered to fully resolve justice dilemmas related to unequal incidence of environmental degradation and hazards.

However, it is not at all obvious that this line of reasoning should be accepted. For example, Walzer's (1983) notion of complex equality requires the absence of domination by one group of people across "spheres of justice". This suggests that for example vital interests in health and safety could be considered distinct from those related to income, and to occupy their own sphere. Therefore, the questions of income inequality and environmental justice would need to be resolved separately but not necessarily independently: groups disadvantaged in income terms should not be disadvantaged in other spheres of justice. In the light of this theory, justice would demand the protection of vital interests in health and safety to avoid repeating the injustice of income distribution.

The existence of several spheres of justice does not reduce the degree of pluralism in any of the spheres, however. It would still be difficult to agree on the rules of justice in each of them. This means that the legitimacy of environmental decisions must rest in part on procedural justice (Paavola, 2005). Procedural justice assures those whose interests are not endorsed by a particular environmental decision that their interests can count in other decisions. It also enables affected parties to express their consent or dissent, and to maintain their dignity (Schlosberg, 1999: 12–13, 90; Soyinka, 2004). The core concerns of procedural justice include (Lind and Tyler, 1988; Fraser, 2001; Schlosberg, 1999; Shrader-Frechette, 2002):

1) Which parties and whose interests are recognized, and how?
2) Which parties can participate, and how?
3) What is the effective distribution of power?

These questions are related to but do not reduce to each other. *Recognition* is the foundation of procedural justice (see Fraser, 2001) but it can take many forms which do not necessarily involve participation. For example, President Clinton's Executive Order 12898 required federal agencies to identify and address the consequences of their programs, policies and actions to minority and low-income populations (see Paavola, 2005). These kinds of rules can make the consideration of a group's interests an integral part of planning and decision-making processes. *Participation* can again take

many forms from simply informing or hearing affected parties to giving them effective rights to contest decisions and actions (Fitzmaurice, 2003: 339). The solutions for recognition and participation, together with political–economic factors of distributive nature, generate a particular *distribution of power*. The relative power of involved parties determines to which extent they can make their interests to count.

Distributive and procedural justice are linked in practice despite being separate fields of scholarship. Distributive outcomes influence but do not determine recognition, participation and power in different spheres of action. This is because institutions constitute actors such as consumers, citizens, organizations and firms in particular ways and structure their interactions in different contexts partly independently of distributive factors. Arguments for maintaining a distinction between markets and politics recognize this: constitutive institutions of the two realms generate different power structures, which helps to diffuse power in the society. Recognition, participation and distribution of power in turn influence plans and decisions, including their distributive implications. This is the rationale of participatory reforms — participation which does not influence outcomes is meaningless.

Legitimate environmental decisions thus have to reflect both distributive and procedural justice concerns. This is especially so when people have broader concerns than their narrowly construed economic welfare. In the context of pluralism, distributive justice matters in a broad sense of whose interests and values will be realized by the establishment, change or affirmation of environmental governance institutions. Often multiple goals co-exist, which may entail different governance solutions for the pursuit of different goals. Yet the dilemmas of distributive justice will remain difficult to resolve. Procedural justice plays a role in justifying decisions to those whose interests and values are sacrificed to realize some other interests and values. It can also facilitate learning and transformation of values and motivations of involved actors. Therefore, governance solutions do more than specify entitlements as envisioned by Coase (1960): they also provide for participation and avail conflict resolution to involved actors (Ostrom, 1990). But before moving on to the details of governance solutions, there is a need to revisit the categorization of governance solutions in order to make space for formal and state-centered solutions.

4. Towards an inclusive view of governance solutions

Environmental governance should be understood broadly so as to include all institutional solutions for resolving conflicts over environmental resources. This would eliminate the distinction between “governance” and “government” in environmental matters and invite us to explain why solutions not involving the state are used to respond to some environmental conflicts, and why solutions based on the central role of the state prevail in others.

Debates on property regimes offer the best starting point for the argument that all governance solutions can be understood as forms of ownership. For two decades after Hardin's (1968) damning analysis of the commons, the nationalization or privatization of natural resources seemed the only alternatives for resource tenure. In the 1980s, scholars working on common property arrangements made counter-arguments to Hardin's analysis which, together with the accumulating empirical evidence, legitimated common property as a viable form of resource tenure (Bromley and Cernea, 1989; Ostrom, 1990; Runge, 1986; Wade, 1987, 1988). The established view became that four property rights regimes exist for governing the use of natural resources: open access or *res nullius*, common property, state property and private property (Bromley and Cernea, 1989; Bromley, 1992b; Hanna et al., 1996). At this juncture, *res nullius* and ineffective state property regimes became the culprits for resource degradation and depletion.

Many common environmental governance solutions such as national environmental and natural resource policies do not fit conveniently to this typology of property regimes. Moreover, “state property” does not have a clear meaning. On one hand, the state holds private property rights to some environmental resources and can alienate them at its will. On the other hand, the state manages certain environmental resources on behalf of its people, as if holding them in public trust, without legitimate authority to alienate them (Sax, 1970; Rose, 2003). This is an example of collective ownership not unlike common property. Thus the concept of “state property” should be abandoned. On the other hand, the concept of “common property” should be understood more broadly so as to encompass all forms of collective ownership, including governance regimes constituted by national environmental and natural resource policies and international environmental conventions.

Thus a typology of governance regimes should distinguish between *res nullius*, collective ownership and private ownership. Private ownership vests comprehensive decision-making authority in the owner, who can alienate the owned resources on the market (see Cole, 2002). Forms of collective ownership do not usually constitute a right to alienate the resource at all and lesser rights constituted by them are often inalienable collective or individual rights. However, the distinction between private and collective ownership is often fairly blurred. Collective entities such as firms face the same collective action problems as private owners as communities and various organizations face as collective owners. Rights created by collective ownership can be held individually and are sometimes transferable. For example, usufruct rights to agricultural land can often be bequeathed across generations. Some rights constituted by collective ownership, such as the water rights under the Spanish *Huerta* arrangements described by Ostrom (1990: 69–82) or the land rights among the Waluguru in Tanzania (Young and Fosbrooke, 1960), can also be transferable within the community.

Many environmental and natural resource policies can be understood as forms of collective ownership. For example, water and air pollution control regulations determine to what extent polluters can use air basins and watercourses for depositing wastes. At the same time, they define the right of other users to be free from greater pollutant concentrations. These entitlements resemble usufruct rights of common property arrangements in that both are attenuated and non-transferable. Environmental taxes and charges constitute collective ownership where administrative prices are used to

allocate environmental resources. Trading systems, such as the one established in the United States to govern SO_2 emissions under the Clean Air Act, constitute a form of collective ownership (Rose, 2002; Tietenberg, 2002) which is not fundamentally different (apart from obvious differences in scale and formality) from trading irrigation water within common property arrangements (Ostrom, 1990).

But all environmental policies are not constitutive of collective ownership: private ownership also plays an important role. For example, many new informational and voluntary policy instruments such as eco-labeling schemes and certified environmental management systems (Dietz and Stern, 2002; OECD, 2003) constitute good environmental performance as an intangible private property. In the same vein, policies requiring insurance coverage for oil spills and other environmental hazards confirm these risks as private property and create a market for pricing and exchanging them.

The revised typology of property regimes still fails to capture the complexity of contemporary environmental governance solutions. One reason for this is that property rights are usually understood as bundles of rights held by the owner(s) vis-à-vis other agents. This viewpoint is appropriate for understanding how institutions structure human behavior, but it does not characterize the institutional solutions themselves that govern the use of particular environmental resources. Many environmental resources such as bodies of water facilitate multiple uses, and a variety of agents can hold entitlements to different aspects of the same resource simultaneously (Fig. 1). For example, in India complex systems of land rights have distinguished the rights of farmers to cultivate land from the rights of pastoralists to grazing after the growing season (Chakravarty-Kaul, 1998). In many parts of Africa, ownership of land is distinct from the ownership of trees: land belongs to clans but fruit and other trees planted and tended by individuals belong to them (e.g. Young and Fosbrooke, 1960).

Many contemporary environmental governance solutions also create complex systems of rights. In market economies, the use of land is partly governed by private ownership and markets. In Fig. 1, this is represented by the regime C. However, forest policies define aspects of forested land as a distinct resource and establish a layer of institutional rules which qualify the authority of private land owner over it. In Fig. 1, this is represented by regime B. Game and wildlife policies establish another layer of institutions (A) that define game and wildlife a distinct resource and establish rules for its governance. Still further layers of institutions exist for the governance of sub-soil minerals, ground water, historical heritage, landscape amenities and biodiversity. Water resources, the coastal zone, air basins and atmospheric sinks are similarly governed by a conglomerate of governance institutions. One reason for the complexity of these governance solutions is the sheer size, multiple uses, and the complexity of the resources in question. Complexity of governance solutions may also enhance their robustness and resilience, particularly in fragile contexts (see e.g. Anderies et al., 2004; Walker et al., 2002).

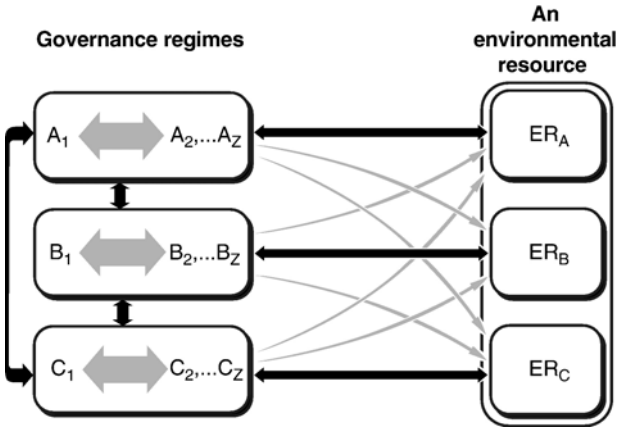

Fig. 1 – Governance regimes and environmental resources.

This kaleidoscopic picture of governance solutions and resource rights may not appeal to those who promote exclusive and non-attenuated private ownership of environmental resources. Their argument has been that private property rights maximize the value of resources and ensure that they are allocated to their most highly valued uses (Posner, 1992: 33–34). However, property rights and governance systems are costly to establish and maintain and thus the value of a resource sets limits to how costly its governance solutions can be (Bromley, 1989: 15–18; see also Dahlman, 1980). This line of reasoning suggests that some resources remain ungoverned because they generate too low benefits or entail too high governance costs. When resources offer greater benefits or entail lower governance costs, they may support a common property regime. When benefits increase or governance costs decrease still further, resources can support private property rights.

But private property rights are not necessarily the pinnacle in the evolution of governance institutions: the theory merely suggests that it becomes affordable to define rights in a greater detail when a resource becomes more valuable. Private property rights vest the private owner with the authority to refine and alienate rights to dimensions of the resource. But this is only one way to specify resource rights in greater detail, one not particularly attractive when transaction costs are high and prevent the emergence of markets for rights to dimensions of the resource. An alternative is to form new layers of collective ownership which specify new usufruct or regulatory rights to dimensions of the resource. Complex governance systems involving overlapping institutions can thus have a solid economic explanation: they can reflect the high value of environmental resources and help to realize a broad range of diffuse benefit streams (see Balmford et al., 2002; Turner et al., 2003).

To conclude, despite clarifying important conceptual issues, the distinctions between *res nullius*, collective property and private property are not sufficiently detailed to help make concrete claims about the institutional design of governance solutions. A new analytical model of the institutional design of governance solutions is needed for this purpose.

5. Institutional design of governance solutions

The key argument of this section is that the institutional design of governance solutions can be understood to have three core aspects: 1) functional and structural tiers; 2) governance functions

and their organization, and 3) formulation of key institutional rules. The configuration of these aspects of institutional design for a governance solution has significant implications for governance outcomes such as the range, magnitude and distribution of benefit streams, as well as for the distribution of costs of provision.

5.1. *Functional and structural tiers of institutions*

Governance institutions have three functional tiers. For example, Kiser and Ostrom (1980: 208–215) and Ciriacy-Wantrup (1971: 44–46) discuss the "three worlds of action" and the "three-level hierarchy of decision-systems". The functional tiers are governed by corresponding rules. At the "operational level", individuals make choices within the constraints of "operational" rules which define their choice sets. A decision to catch fish within the constraints set forth by regulations regarding approved gear or catch is an example. At the "collective choice" level, authorized actors make collective choices such as what constitutes acceptable gear or catch. These decisions are based on "institutional" rules. Finally, decisions regarding the authority of collective actors and the procedures they are supposed to follow form the "constitutional" level of action. Accordingly, these decisions are governed by "constitutional rules".

Operational, institutional and constitutional levels refer to institutional *functions* rather than to the vertical *structure* of governance solutions. Some governance solutions such as customary common property arrangements exhibit all three functional levels while being frequently based on single-level or *uniplanar* institutions. However, today many governance solutions have both the three functional levels and a multi-level structure. For example, the U.S. Clean Water Act directly establishes many rules of water use, but it also provides for the establishment of state-administered permit programs under which permit conditions are set for individual polluters. Constitutional, institutional and operational levels exist both at the federal and state levels of governing water quality.

Multi-level governance solutions may emerge because an upper level of governance is established to coordinate between lower-level solutions, or because lower levels of governance are established to implement higher-level strategies. There are instances where federations and over-arching institutions have been created through bottom-up processes to coordinate the functioning of local governance solutions (Ostrom, 1990; Sengupta, 2004). The opposite, top–down process creates many formal multi-level governance solutions. Many federal environmental and natural resource policies provide for or mandate the establishment of state programs in the United States. Many European Union's directives also require both national legislation and local solutions (Paavola, 2004b). The United Nations Framework Convention for Climate Change (UNFCCC) similarly requires national actions, programs or solutions for the purposes of planning, coordination and implementation (Paavola, 2005).

The bottom up and top down processes often generate nested institutional structures where the governance solutions with a smaller jurisdiction are nested within larger-jurisdiction solutions. But this is not all that there is to multi-level governance solutions. As will be explained in greater detail in the next sub-section, all governance solutions perform certain generic governance functions such as exclusion and provisioning. Multi-level governance solutions may emerge to realise economies of scale or scope in the implementation of these governance functions (Le Quesne, 2005). That is, governance functions may be implemented at different levels of governance and the different levels of governance may be functionally complementary, instead of just being nested. But this is not to say that multi-level governance solutions are tightly focused on their goals. There are always "degrees of freedom" between the levels of governance in multi-level solutions, because at each level the surrounding institutional framework partly determines what the effective rules are.

5.2. *Governance functions*

When discussing common property arrangements, Schlager and Ostrom (1992) distinguish between "ownership functions" and "management functions" (see also McCay, 1996). I suggest that a more detailed and analytically highly useful typology of governance functions can be distilled from the lists of common features of successful governance solutions presented for example by Ostrom (1990: 88–102) and Agrawal (2002). On the basis of these lists, generic environmental governance functions include:

1) exclusion of unauthorized users;
2) regulation of authorized resource uses and distribution of their benefits;
3) provisioning and the recovery of its costs;
4) monitoring;
5) enforcement;
6) conflict resolution;
7) collective choice.

Different governance solutions organize these governance functions differently. In a small, customary common property regime, resource users are often members of a community such as a village or a fishermen's association which makes, enforces and adjudicates the rules of resource use. The community performs all governmental functions without separation of powers and the resource users can participate directly in environmental decision-making affecting them. Resource users may themselves perform some governance functions such as monitoring of compliance with the rules of exclusion and authorized resource use. Alternatively, posts of "officials" can be created for the purpose.

Formal national policies entail deeper division of labor between governmental organizations and multi-level solutions may organize different functions at different levels. General-purpose legislatures make some of the collective choices at the local, state or federal levels while delegating others to be made in specialized agencies which may involve interested and affected parties directly and/or through representation. Specialized agencies also frequently monitor and enforce rules while conflict resolution can be split between these agencies and general-purpose courts. Most contemporary environmental policies also require the resource users to practice self-monitoring and reporting. International environmental conventions are

"constitutions" for special-purpose jurisdictions which have their own decision-making, monitoring and implementation bodies and designated conflict resolution processes. It is important to appreciate that the complexity of formal governance solutions, and the associated division of labor and decision-making authority, are not obstacles for effective governance of environmental resources: they create a system of checks and balances which disperses power, creates transparency and accountability, and fosters democracy in environmental matters (see e.g. Hukkinen, 1999: 147–166).

Governance solutions thus perform broadly similar functions but organize them in different ways which have their particular transaction cost implications. The nature and scale of the governance problem, the institutional design of governance solutions, and its transaction cost implications influence the choice and performance of governance solutions (Paavola and Adger, 2005). For example, community-based solutions can work when the scale of the governance problem is limited and homogeneity and social capital reduce transaction costs and foster collective action among the involved actors. Co-management solutions may work when extra-local funding or transfers are involved but implementation depends on local knowledge and collective action. State-based solutions require state capacity, social capital and rule of law to be effective. When governance functions such as collective choice or provisioning are best organized at different spatial levels, multi-level solutions emerge.

5.3. *Institutional rules*

Institutional analysis should also examine central institutional rules of the above discussed generic governance functions, because their formulation has implications for transaction costs and distributive, procedural and governance outcomes. I will discuss below those rules that provide for the exclusion of unauthorized users from the resource, create entitlements to and regulate authorized resource use, provide for monitoring of resource use and structure participation and decision-making in environmental governance.

Rules of exclusion influence (together with the attributes of the resource in question) how effectively unauthorized users can be excluded. For example, early state water pollution control programs in the United States often prohibited "the creation of public nuisances" or "harmful pollution of water" (Paavola, 2004a). The purpose of these rules was to exclude certain uses and users from watercourses. However, it was difficult to monitor compliance with and to enforce these kinds of rules — it required expensive litigation to find out whether a public nuisance had been created. Frequently this kind of exclusion rules resulted in lax (if any) enforcement. In contrast, contemporary water and air pollution policies typically contain a blanket prohibition of *unlicensed* discharges which provides a better basis for the exclusion of unauthorized users and for the regulation authorized use.

Entitlement rules are key rules in governance solutions, because their formulation has significant implications for environmental outcomes and the distribution of benefits of resource use. For example, riparian law – which establishes common rights of riparians to the use of water in a watercourse abutted by their land – underwent several changes in the 19th century United States (Paavola, 2002b; Rose, 1994). Early in the 19th century, the doctrine of natural flow entitled riparians to undiminished quantity and quality of water. Industrialization put pressure on the use of water resources in the following decades. The adoption of the rule of reasonable use in the late 1820s made it possible for water users to change the quantity or quality of water somewhat without legal liability for damages. In the mid-19th century, the rule of reasonable use was transformed into a balancing test, which confirmed the more valuable water use as the reasonable one and extinguished less valuable rights without compensation. This was a part of what Morton Horwitz (1977) has called the capital subsidy to the nascent industry in the 19th century United States.

Monitoring rules determine what is being monitored and by whom. For example, in the 19th century United States, common law of water rights required water users to monitor each others' water use and to actively seek the protection of their own interests when they were harmed. This was first relatively straightforward as most discharges contained solids that caused obvious damages such as the clogging of waterwheels of downstream mills (see Paavola, 2002b). Water pollution that endangered public health was not as obvious to the naked eye, which brought about water quality monitoring by government agencies. Today monitoring of compliance with the U.S. federal water pollution control legislation consists of a complex mix of state and federal inspections and water quality monitoring as well as self-monitoring and reporting by the polluters (e.g. Magat et al., 1986).

Decision-making rules determine whose interests are recognized and who can participate in environmental decisions, and what are the rules and procedures that have to be observed when making decisions. These rules largely determine the procedural justice implications of governance solutions. Decision rules influence distributive outcomes as well. For example, the governance of water quality under the common law in the 19th century United States was organized so that decisions were made in the courts as a result of private litigation (see Paavola, 2002b). This granted participation in decision-making according to the ability and willingness of plaintiffs and defendants to pay for litigation. This was the primary reason for the gradual relaxation of rules of water use discussed above. Decision rules have important implications for the contemporary environmental governance solutions as well. For example, the implementation, effectiveness and legitimacy of the European Union's Habitats Directive suffered when stakeholder groups angered by the lack of opportunity to participate and to voice their concerns over the designation of habitat preservation sites staged protests across the member states (Paavola, 2004b).

To conclude, the formulation of key institutional rules has implications for transaction costs and distributive and procedural justice and influences the performance and legitimacy of governance solutions. Judgments regarding the implications of institutional rules require simultaneous consideration of the governance problem and its context because they fundamentally shape the governance challenges (Adger et al., 2003): institutional designs are just one variable which can affect the governance outcomes. In practice, institutional analysis has to analyze and compare the implications of

alternative rule formulations and institutional designs that could be or could have been applied to the governance problem at hand.

6. Conclusions

This article has outlined the conceptual revisions needed to extend the new institutional approach from its current local and international domains of application to all environmental governance solutions. The article suggests that environmental governance is best understood as the establishment, affirmation, or change of institutions to resolve environmental conflicts. The article also suggests that the choice of governance solutions is a matter of social justice rather than of economic efficiency. The acknowledgement of pluralism broadens distributive concerns in environmental decisions to issues such as the distribution of ecological and health impacts. These concerns are unlikely to replace traditional distributive considerations but they should not be ignored either: they have to be addressed either within integrated governance solutions or the legitimacy of multiple solutions has to be admitted. Pluralism also gives an important role for recognition, fair participation and legitimate distribution of power as the underpinnings of legitimacy. Legitimacy is important for its own sake and because it underlies voluntary compliance and thus effectiveness of governance solutions.

The article suggests that the extension of the new institutional approach also requires a revised conception of governance institutions. The established typology of four property regimes must be replaced by a scheme which identifies private ownership, collective ownership and *res nullius* as the main types of governance solutions. This typology can accommodate formal governance solutions such as national environmental and natural resource policies as particular forms of collective ownership. These and many other governance solutions did not fit conveniently to the earlier typology. The article also suggests that the observation that many environmental resources are governed by overlapping governance regimes is consistent with theories suggesting that entitlements will become more detailed when the value of resources increases.

While the revised typology of governance solutions improves the conceptual clarity in the analysis of governance institutions, it is too crude to be useful in institutional analysis. The article proposes a model of the design of environmental governance institutions which draws attention to their functional and structural tiers, organization of governance functions, and the formulation of key institutional rules as the central aspects of the institutional design of governance solutions. This analytical lens increases the resolution of institutional analysis, helps to determine social justice implications of environmental governance solutions, and helps to bring transaction cost reasoning to bear on institutional analysis.

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