

# Creating Incentives for River Basin Management as a Conservation Strategy - A Survey of the Literature and Existing Initiatives

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## Summary

This report provides an overview of existing initiatives to create economic incentives for river basin management as a strategy for protecting biodiversity. It also identifies key issues that need to be considered when evaluating the feasibility of this approach in a particular ecoregion, as part of an overall conservation strategy. Emphasis is on the more direct kinds of incentives, such as contractual arrangements with landholders to implement conservation practices or to maintain land as forest. Institutional arrangements, such as particular forms of property rights, are critical because they determine whether or not those who pay the costs of implementing conservation practices will have access to the benefits. It is characteristic of river basins that costs and benefits are separated between those upstream and downstream - the further they are separated, the greater the uncertainty and the more difficult to link causes and effects, which makes it necessary to use different kinds of incentives at different scales. In smaller catchments, in which there are community ties between upstream and downstream areas, and where stakeholders can directly see the effects of upstream land use practices, understanding these effects may be a sufficient incentive for them to diminish or halt land degradation, provided that there are economically viable alternatives. The situation becomes more complex at larger scales, in which more formal institutional arrangements are required to insure enforcement and compliance, and also to insure a fair distribution of costs and benefits without which there is little incentive to cooperate. An additional limitation at international levels is the lack of authority for enforcing agreements. Incentives at this level depend on the ability to link river basin cooperation to economic and other forms of cooperation upon which nation states rely. Conflicts between the multiple uses of resources and interests found at these different scales also require the negotiation of co-management arrangements.

Overall lessons learned are that economic instruments by themselves are more likely to work in cases in which there are well-established links between management actions and their consequences, and well-defined rights and responsibilities. However, given the uncertainty and complexity inherent in river basin management, such conditions are the exception rather than the rule. The use of economic instruments therefore needs to be combined with processes of stakeholder participation and development of new institutional arrangements that can reduce uncertainty associated with the behavior of other stakeholders and foster the collaboration needed to insure that rules will be enforced, and that those who abide by them will reap future benefits. Such processes also give stakeholders an opportunity for mutual learning about the potential consequences of biodiversity loss, and to reconsider the value they place on it. Institutional analysis is suggested as a way to inform this process and to begin to identify the kinds of social and economic commitments needed to achieve the objectives of biodiversity conservation in particular ecoregions. It is recommended that WWF adopt this approach to conduct assessments of the appropriateness and feasibility of this applying this strategy in selected ecoregions, and also, as part of a broader, adaptive approach to valuation needed to inform decisions related to the conservation of biodiversity.

## Introduction and objectives

Conservation of biodiversity is essential for the maintenance of life on earth, because biodiversity provides greater options or resilience in the face of rapidly changing global

conditions, and plays an important if uncertain role in the overall functioning of ecosystems.<sup>1</sup> Yet it is seldom a factor in decisions regarding the use of natural resources because the direct market benefits that biodiversity sometimes provides are usually not considered sufficient to justify the cost of its protection, and the consequences of its loss do not become apparent until it is too late. Much of this biodiversity is disproportionately concentrated in aquatic systems and adjacent riparian areas and wetlands,<sup>2</sup> which are affected by the cumulative impacts of land use activities throughout the entire upstream catchment area.<sup>3</sup> River basin management thus implies the need for compatibility between conservation objectives and multiple uses of the landscape over broad scales, with increased emphasis on the protection of natural habitats and other components of ecosystem integrity.<sup>4</sup> It is also at this landscape and small catchment scale that we can begin to provide a more comprehensive and detailed characterization of ecosystem processes and to create more realistic scenarios that allow the implications of biodiversity loss in particular places to be anticipated.<sup>5</sup> Such scenarios can be used to assess vulnerability to ecosystem change and enable stakeholders to reconsider the value they place on biodiversity and the commitments they are willing to make to protect it, in light of this new information and based on a greater appreciation of the services ecosystems provide.

Management of river basins and the catchment areas nested within them also provide ecosystem services that have direct market values and which can provide an economic incentive for specific management activities. These services include protection of water supplies, reduction of flooding that can have great damage costs, providing a more even flow of water that is necessary for hydropower facilities, and sustaining freshwater fisheries and recreational values. For example, although protection of biodiversity was not an explicit objective, New York City found it much less costly to provide financial incentives to communities in upper catchment areas for protection of the water supply through land management practices than to construct a filtration plant. Specific kinds of incentives included acquisition of land and conservation easements, creation of an economic development bank to support economic development that is compatible with protection of water quality, funding for infrastructure such as sewage system upgrades, stream corridor protection, and a Watershed Museum for raising public awareness.<sup>6</sup> An initiative taken by the city of Quito, Ecuador, explicitly allocates funds raised through a small increase in water fees to the maintenance of protected areas in the upper catchment for their ecological values.<sup>7</sup> A Chinese initiative to reforest upper basin areas, initiated in the aftermath of the

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<sup>1</sup> Naeem, S., F. S. Chapin III, et al. (1999). Biodiversity and Ecosystem Functioning: Maintaining Natural Life Support Processes. Issues in Ecology 4. Washington, D.C., Ecological Society of America.

<sup>2</sup> Abell, R., E. Dinerstein, et al. (2000). A Workbook for Conducting Biological Assessments and Developing Biodiversity Visions for Ecoregion-Based Conservation. Part II: Freshwater Ecoregions. DRAFT. Washington D.C., World Wildlife Fund, Conservation Science Program.

<sup>3</sup> A catchment, also commonly referred to as a watershed or drainage area, is a topographic area providing runoff to a selected point, usually along a stream. Catchments are of various sizes, and form a nested hierarchy to selected points downstream. Catchments drain to outlet points that lead to other catchments until the flow reaches the ocean or a closed basin. Ibid..

<sup>4</sup> Naiman, R. J. (1992). New Perspectives for Watershed Management. Watershed Management: Balancing Sustainability and Environmental Change. R. J. Naiman. New York, Springer-Verlag.

<sup>5</sup> The landscape level is the appropriate scale for considering this because it is large enough to permit consideration of the context in which places are situated, but still small enough to allow consideration of ecological relationships as they are found in the particular place, rather than relying on generalizations.

<sup>6</sup> Echavarría, M. and L. Lochman (1999). Policy Mechanisms for Watershed Conservation, Case Studies. Arlington, VA, The Nature Conservancy, Latin America and Caribbean Region, Conservation Finance and Policy Program.

<sup>7</sup> Ibid.

disastrous flooding of the Yangtze river in 1998,<sup>8</sup> and which includes a ban on further logging in selected areas, may also protect the habitat of the endangered Giant Panda. This kind of a strategy would also appear to offer great potential in the catchment area that supplies water to the city of Rio do Janeiro in Brazil, which is part of the Atlantic rainforest and which is important habitat to a number of rare and endangered species.<sup>9</sup>

These cases suggest that, when biodiversity protection provides tangible ecosystem services that have market values, the creation of economic incentives for river basin management can also generate a stream of revenue that can be used to protect biodiversity. Given that resource use practices are often driven by economic policies at national and international levels, external sources of funding may remain necessary. However, revenue generated locally within a basin is likely to be more sustainable than reliance on outside sources of funding, because it would give local communities who pay for conservation an incentive to insure that the funds are effectively allocated and that agreements are enforced. Thus it can also contribute to the development of institutional capacity for resource management and biodiversity conservation. A premise of this paper is that generating revenue from internal sources and institutional capacity building provide a foundation for moving from a vision of biodiversity conservation to the development and implementation of a conservation strategy, which is a central concern for WWF ecoregions.

Given the diversity of conditions in different river basins, it is not possible to offer any blueprints for creating such incentives, nor does this report attempt to provide a manual. The objective instead is to identify factors that need to be considered when evaluating the feasibility of creating incentives for managing a particular basin, various methods and approaches that may be appropriate to consider, and sources of further information about them. Based on a selective review of the literature and consultation with WWF staff and external experts,<sup>10</sup> this report identifies existing initiatives to create economic incentives for river basin management, factors that have contributed to their success as a conservation strategy, obstacles to their implementation, emerging issues that are likely to impact on the success of this strategy in the future, and recommendations for follow-up assessment and actions in ecoregions. Emphasis is on the development of direct economic incentives in the context of institutional arrangements needed to support them.

## **Overview of existing initiatives and types of incentives for river basin management**

River basin and catchment management initiatives have proliferated in recent years, not only in the United States, where there are over 1500 of them,<sup>11</sup> but also in many other countries including developed and developing ones. Their purposes range from changing the allocation of water among existing uses (often to include environmental concerns through maintenance of

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<sup>8</sup> Zhang, P., G. Shao, et al. (2000). "China's Forest Policy for the 21st Century." *Science* **288**(23): 2135-2136.

<sup>9</sup> Heal, G. M. (2000). *Nature and the Marketplace: Capturing the Value of Ecosystem Services*. Washington, D.C., Island Press.

<sup>10</sup> Lou Ann Dietz, WWF Latin America Program (Atlantic Rainforest), Curtis Freese (ECSU Consultant); Jaime Cavelier, WWF Latin America Program (Valdivia); Dominick Della Sala and Dale Hile, WWF Klamath-Siskiyou Regional Office; Randy Curtis and Marlou T. Church, TNC; Nels Johnson, WRI; Blake Ratner, Tiger Research (formerly WRI); David Simpson and Pierre Crosson, Resources for the Future.

<sup>11</sup> Lant, C. L. (1999). "Introduction: Human Dimensions of Watershed Management." *Journal of the American Water Resources Association* **35**(3): 483-486.

minimum instream flows), to protection of both quality and quantity of water supplies through reforestation, control of erosion and sedimentation, reduction of flooding, reduction of non point sources of pollutants, and protection of aquatic biota, freshwater fisheries and biodiversity in general. Land use is a critical factor in all of these initiatives, as it affects the demand for water as well as groundwater recharge and the extent of pollutant runoff and erosion.

### ***Economic incentives***<sup>12</sup>

Market-based economic incentives for river basin management fall into two broad categories: direct and indirect. Examples of indirect incentives are those that seek to encourage development activities that rely on biodiversity, such as ecotourism, marketing of non-timber forest products, or biological prospecting, and thus create some incentive to protect them. However, the revenue that can be generated from these activities is small relative to the amount of area that requires protection. For example, the value of any single hectare of endangered habitat for purposes of biodiversity or genetic prospecting is generally small – most of what is paid for samples may reflect the cost of collection and processing as well as taxonomic expertise rather than the value of the material collected.<sup>13</sup> Similarly, only a limited number of areas with high value for biodiversity protection will be able to attract sufficient ecotourism to justify the development of tourism facilities. While such incentives can help to protect biodiversity, they are generally not considered sufficient to protect large areas. As a result, direct incentives are likely to be more effective as a conservation strategy.<sup>14</sup>

This review is concerned instead with direct economic incentives, which appear to have greater potential for promoting conservation because they provide a direct link between services (i.e., maintaining forest cover) and compensation (i.e., payment for those services).<sup>15</sup> Examples of these include:

- *Direct payments or subsidies*, which may include any form of contractual arrangements in which parties agree to implement conservation practices in exchange for some benefit. An example of this is the U.S. Conservation Reserve Program (CRP), which pays farmers to retire sensitive croplands and to implement conservation practices, which include protection of wildlife habitat. Another example is a program in Costa Rica that compensates landholders for hydrological services, carbon fixation, biodiversity protection, and scenic beauty instead of growing crops.<sup>16</sup> In contrast with regulatory measures that often lead to preemptive land clearing as a way to avoid compliance, these payments create a direct financial incentive to

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<sup>12</sup> For convenience, this report refers to economic or market incentives and to institutional arrangements. However, it should be kept in mind that markets are simply a particular kind of institutional arrangement, and that institutional arrangements such as property rights are also a form of economic incentive.

<sup>13</sup> Simpson, R. D., R. A. Sedjo, et al. (1998). The Commercialization of Indigenous Genetic Resources as Conservation and Development Policy. Protection of Global Biodiversity: Converging Strategies. L. D. Guruswamy and J. A. McNeely. Durham and London, Duke University Press.

<sup>14</sup> Ferraro, P. J. (2000). Global Habitat Protection: Limitations of Development Interventions and a Role for Conservation Payments. Department of Agricultural, Resource, and Managerial Economics Working Paper no. 2000-03., Cornell University, Ithaca, NY.

<sup>15</sup> Ibid.

<sup>16</sup> Chomitz, K. M., E. Brenes, et al. (1998). Financing Environmental Services: The Costa Rican Experience. Economic Notes 10. Washington, D.C., The World Bank, Central America Country Management Unit, Latin America and Caribbean Region.

protect forest areas.<sup>17</sup> One cost effective approach for doing this is a two-way sealed bid auction in which landowners bid for government contracts to maintain their land as a protected area or to adopt particular management practices.<sup>18</sup>

- *Acquisition of land or of development rights*, which are then sold separately from the land parcel, or of *conservation easements* that restrict uses of the land. For example, the City of New York is acquiring land and conservation easements in the Catskill and Delaware upper basin areas, so as to prevent land uses that would harm its water supply. The easements are purchased from farmers who have adopted best management practices, and may make future farming of the land conditional upon the use of such practices. Transferable development rights (TDRs) allow those who own land in priority conservation areas to receive compensation for not developing the land by selling the rights to someone wishing to develop in a non-priority area. For these rights to have value and thus to provide an economic incentive for conservation, there must be effective controls on total development as well as clearly specified objectives for resource protection.<sup>19</sup> In the United States, TDRs have been effectively used in the New Jersey Pinelands, and to preserve farmland in Montgomery County Maryland.
- *Taxes or other fees on resource users* that can be used to finance conservation incentives. For example, the municipality of Quito, Ecuador, finances the maintenance of protected areas in its upper catchment with a small increase in the water rates charged, which previously had only reflected the costs of water delivery.<sup>20</sup> In France, river basin management and financial incentives for water purification are financed by charges both for water use and pollution.<sup>21</sup> Environmental taxes are considered particularly appropriate for reducing diffuse sources of pollution and have been effectively used in several European countries for achieving a 40% reduction in the sulphur content of fuels, a phase out of leaded gasoline, and a 35% reduction of Nitrogen monoxide emissions. A water pollution tax was used to increase treatment capacity. Other taxes, for which results are not always distinguishable from those created by other incentives are, taxes on carbon dioxide emissions, waste disposal, toxic waste discharges, fertilizer use, and battery charges.<sup>22</sup> Use of pollution charges has also been effective in reducing water pollution in some developing countries, such as in the Oriente Antioqueno region of Colombia, where they led to a drop in biological oxygen demand by 52% and in total suspended solids by 16%.<sup>23</sup>

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<sup>17</sup> Ferraro, P. J. (2000). Global Habitat Protection: Limitations of Development Interventions and a Role for Conservation Payments. Department of Agricultural, Resource, and Managerial Economics Working Paper no. 2000-03., Cornell University, Ithaca, NY.

<sup>18</sup> Aylward, B., J. Echeverría, et al. (undated). Market and Policy Incentives for Livestock Production and Watershed Protection in Arenal, Costa Rica. CREED Working Paper 25. London, International Institute for Environment and Development.

<sup>19</sup> NRC (1993). Setting Priorities for Land Conservation., National Research Council, National Academy Press.

<sup>20</sup> Troya, R. and R. Curtis (1998). Water: Together We Can Care For It! Case Study of a Watershed Conservation Fund for Quito, Ecuador, The Nature Conservancy.

<sup>21</sup> Echavarría, M. and L. Lochman (1999). Policy Mechanisms for Watershed Conservation, Case Studies. Arlington, VA, The Nature Conservancy, Latin America and Caribbean Region, Conservation Finance and Policy Program.

<sup>22</sup> European Environment Agency (1996). Environmental Taxes: Implementation and Environmental Effectiveness. Copenhagen, European Environment Agency.

<sup>23</sup> World Bank (1999). Greening Industry: New Roles for Communities, Markets, and Governments. Washington, D.C., The World Bank.

- *Removal of subsidies* that create a disincentive to conservation such as for artificial fertilizers, publicly funded construction of logging roads, disaster relief for reconstruction in flood prone areas, and below cost pricing for water and grazing on public lands. Removal of subsidies may be difficult because they often come to be viewed as property rights or entitlements by the beneficiaries.<sup>24</sup> Some have suggested that direct payments could provide a way to redirect subsidies so as to explicitly only compensate environmental services to society. For example, direct payments for ecological services provided by traditional agricultural practices in Central Europe, could replace subsidies that now support production of commodities for which prices fail to cover production costs, which would also be compatible with fair trade and with trade liberalization policies.<sup>25</sup>
- *Marketable permits or trading under a regulatory cap.* This refers to an arrangement in which those polluters who can reduce emissions relatively cheaply, may sell the right to emit the difference between their emissions and the regulatory limit to other polluters, as a way to reduce costs of compliance. For example, pilot programs in the U.S. are intended to allow trading between point sources of pollution such as sewage treatments plants, and non-point sources of pollution such as farms. This is because it may be cheaper to reduce pollution from farms or cease farming altogether than to decrease emissions from the treatment plants. This mechanism has worked well for reducing pollution from single stationary sources that are relatively easy to monitor, such as the reduction of sulphur dioxide from smokestacks that contribute to acid rain, but are expected to be more problematic when applied to multiple non-point sources, which makes it difficult to link causes and effects. Another example is a program in Australia that allows landowners to receive credits for planting trees in upper catchment areas, where increased transpiration reduces the amount of saline water rising to the soil surface. In this case, the credits for planting trees may then be purchased by farmers in the lower catchment areas who benefit by increased water suitable for irrigation.<sup>26</sup>

From a strictly market economic perspective, the key factor that determines whether conservation practices are adopted and maintained is whether or not it is profitable to adopt such practices. In the absence of direct incentives, some factors that affect the profitability of adopting conservation measures are whether the soils are deep enough to remain productive in spite of erosion, the cost of credit needed to invest in conservation measures, and the prices that a farmer can obtain for less erosive perennial crops and products of agroforestry – which may depend on trade policies.<sup>27</sup> Yet by itself, income generated from resource use usually fails to offset the costs of conservation, and, when it does offset the costs, the gains don't necessarily accrue to the resource managers who pay those costs.

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<sup>24</sup> Coggins, G. C. and C. F. Wilkinson (1987). Federal Public Land and Resources Law. Mineola, New York, The Foundation Press, Inc.

<sup>25</sup> Hampicke, U. and D. Roth (2000). "Costs of land use for conservation in Central Europe and future agricultural policy." International Journal of Agricultural Resources, Governance and Ecology 1(1): 95-108.

<sup>26</sup> Perrot-Maître, D. (2000). Market-Based Instruments for Watershed Management: Case Studies around the World. Workshop on Developing Markets for Environmental Services of Forests, Vancouver, British Columbia, Forest Trends.

<sup>27</sup> Barbier, E. B. (1990). "The farm-level economics of soil conservation: the uplands of Java." Land Economics 66(2): 199-211.

A case study in Arenal, Costa Rica<sup>28</sup> showed that, even in the absence of perverse subsidies, neither the market by itself, nor payments offered for by the government for reforestation, provided incentive to reforest steep slopes used for cattle ranching and agriculture in the Rio Chiquito catchment area. Ranching was found to produce higher net present values than reforestation and thus to be more economically efficient. This was because, in addition to generating greater returns for the landholders than could be obtained from incentives offered for reforestation, the increased water yield that resulted from deforestation outweighed the costs of sedimentation, because that yield was of direct benefit to a downstream hydroelectric facility. However, these costs and benefits are not all distributed equally. A subsequent companion study that examined the costs and benefits from the perspective of major stakeholders, and which made distinctions among various kinds of landholders, found that the higher returns per hectare depend in part on location in the catchment, that they accrue primarily to large landholders, and that incentives for conservation may still appear attractive to small landholders. By examining the incentives and disincentives that each group had for implementing particular management measures identified in a stakeholder produced Action Plan, the study also sought to identify conflicts between stakeholder groups, and to suggest more appropriate institutional arrangements.<sup>29</sup>

At least one cost-benefit analysis of implementing protection measures in some of the catchments that supply water to the valley and city of Cochabamba in Bolivia found that the costs of these measures were justified by tangible local benefits.<sup>30</sup> The benefits considered were: expected increased incomes of farmers in the upper catchment that would result from improved farming practices, avoided damages from floods and increased aquifer recharge for high value urban and farming interests downstream. It is suggested that these downstream stakeholders would contribute toward the costs of catchment protection provided that they were sufficiently informed about the benefits. Less tangible benefits, such as conservation of biodiversity and cultural heritage, were not analyzed in this study as they were seen as unlikely to motivate local action.

Although biodiversity is linked to some tangible benefits that have market values, it is not clear that markets alone can provide incentives for protecting the less tangible benefits of biodiversity, for a number of reasons. Among these are the existence value of biodiversity is a public good and is not a tradable commodity, that market values are biased against the long-term because of discounting, and that, because of uncertainty and option values, biodiversity may have a higher value in the future than at present.<sup>31</sup> Although protection of biodiversity will depend primarily on policy solutions, market incentives can still play an important role. In addition, the cost if not the value of protecting biodiversity will still depend on finding ways to pay for it that are

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<sup>28</sup> Aylward, B., J. Echeverría, et al. (undated). Market and Policy Incentives for Livestock Production and Watershed Protection in Arenal, Costa Rica. CREED Working Paper 25. London, International Institute for Environment and Development.

<sup>29</sup> Aylward, B. and A. Fernández González (1998). Institutional Arrangements for Watershed Management: A Case Study of Arenal, Costa Rica. CREED Working Paper No. 21. London, International Institute for Environment and Development.

<sup>30</sup> Richards, M. (1997). "The potential for economic valuation of watershed protection in mountainous areas: a case study from Bolivia." *Mountain Research and Development* 17(1): 19-30.

<sup>31</sup> Heal, G. M. (1998). Markets and Biodiversity. *Protection of Global Biodiversity*. L. D. Guruswamy and J. A. McNeely. Durham and London, Duke University Press.

considered fair and socially acceptable. These costs could be estimated based on the cost of implementing an effective management plan.

Although important, profitability is only one of a number of different kinds of incentives that may motivate conservation, as will be discussed in the remainder of this report. The desire to reduce risk and uncertainty, or insurance value, and to protect ways of life may also be significant as motivating factors. These lead to the development of institutional arrangements, such as different kinds of property rights, which determine the kinds of resource uses permitted, and without which prices would only be hypothetical.

### ***Institutional arrangements***

Regardless of how economically efficient it may be for property owners to adopt conservation practices, the decision to adopt such practices depends on whether or not those who pay their costs will have access to the benefits of their actions. This, in turn, depends on institutional arrangements, particularly on forms of property rights.

Property is not synonymous with a parcel of land but rather, refer to how it may be used, such as whether or not it may be occupied, farmed or developed, whether it may be transferred or sold, and who has access to its resources – all of which may be separable from the land itself.<sup>32</sup> For example, a landowner may or may not own rights to occupy the land, to use the water associated with it for domestic, agricultural or industrial purposes, to sell the water, to cut trees, or to mine the minerals below its surface. Conversely, a community may own rights to some of these uses without owning the right to occupy the parcel of land. Development rights may be purchased by a land trust, or an easement might be negotiated with a government agency to grant public access. Private property is only one of a number of different kinds of arrangements – property may also be publicly owned or held in trust by the government, or be held in common by a community, and may include informal rights based on customary practices and social norms. Failure to control access is often mistakenly referred to as a “common property” situation but in fact is an “open access” situation in which no property rights are in effect. Property rights thus control access to resources, and also provide information about the kinds of incentives that various stakeholders have.<sup>33</sup>

Property rights to water are becoming increasingly critical due to the growing scarcity of and/or conflicting demands over this resource, and also illustrate how property rights shape incentives. For example, rights to water based on historic use or “Prior Appropriation”, which also require that the water be used in ways that are socially beneficial, creates a disincentive for reducing its consumption as this would lead to a reduction of the amount of water a user may claim in the future. Rights to water based on possession of adjacent land, or “riparian rights,” allows

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<sup>32</sup> A formal definition of property, consistent with its use here, is: “sets of ordered relationships among people that define their opportunities, their exposure to the acts of others, their privileges, and their responsibilities (Schmid, 1987, ch. 1; Bromley, 1989). ... It should be emphasized that rights are relationships among individuals with respect to resources rather than the relationship between an individual and a resource.” See: Schmid, A. A. (1995). *The Environment and Property Rights Issues*. The Handbook of Environmental Economics. D. W. Bromley. Oxford UK and Cambridge USA, Blackwell. and Schmid, A. A. (1987). Property, Power, and Public Choice. New York, Praeger.

Bromley, D. W. (1989). Economic Interests and Institutions. Oxford, Basil Blackwell.

<sup>33</sup> Runge, C. F. (1984). “Strategic Interdependence in Models of Property Rights.” American Journal of Agricultural Economics **66**: 807-13.

reasonable use that does not interfere with reasonable use by others, but may limit the ability to transfer the water and to develop water markets. The ability to develop water markets, inherent in the Prior Appropriations doctrine, could provide incentives for greater efficiency and provide a source of revenue for the development of upper basin areas. However, riparian rights make it possible for local communities to control access and exercise customary rights, which provides an incentive for conservation because it insures access in the future.<sup>34</sup> In an open access situation, the incentive is to consume resources before someone else does, as is found in an expression of what is said to have been the popular attitude toward the harvesting of oysters in the Chesapeake Bay in the late 1800s: "Get it today! Hell with tamar! Leave it till tamar, somebody else'll get it."<sup>35</sup>

Property rights may also change as new kinds of problems arise, often as a result of conflict resolution. For example, development of hydropower at the beginning of the industrial era led to a change in rights to the natural flow of water because it was considered to be of greater value to society. Similarly, as a consequence of the growth of urban areas, rivers became more highly valued for sewage disposal than for supporting commercial fisheries, and land uses became restricted by zoning so as to protect existing values. The Public Trust doctrine, which establishes that certain resources belong to all citizens, and are held in trust by the government on their behalf, resulted from legal conflicts between oystermen and riparian property owners who had sought to exclude them by claiming private rights over adjacent oyster beds to plant oysters.<sup>36</sup> Just as changes in rights are implicit in the development of physical infrastructure such as irrigation systems and dams, ecosystem management also implies the negotiation of new rights and responsibilities in which landowners are obligated to protect the ecosystem, and in which the use of land, water and other natural resources are limited to those uses that do not impair its function.<sup>37</sup> Any initiative to protect downstream water supplies or biodiversity either by providing compensation to upstream landowners for altering land use practices, or by attempting to hold them responsible for damages, in effect involves negotiating new and appropriate forms of property rights, and resolving conflicts with existing practices.

In a textbook approach to economics, the creation of private property rights is offered as a standard solution to environmental degradation, which is seen as the result of a market failure. In theory, if all costs could be accounted for, private property rights could be created and contracts negotiated among gainers and losers so as to maximize everyone's benefit from the resources, assuming that transaction costs are negligible.<sup>38</sup> This would be made possible regardless of who initially holds which rights because either the gains are sufficient for gainers to compensate losers, or the damage to losers is sufficient to warrant them paying the gainers to cease harmful activities. Alternatively, the losers go out of business because the economic activity of the gainers is recognized by the courts as having a higher value to society. In practice,

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<sup>34</sup> Bruns, B. R. and R. S. Meinzen-Dick, Eds. (2000). Negotiating Water Rights. London, Intermediate Technology Publications and the International Food Policy Research Institute.

<sup>35</sup> Wennersten, J. R. (1981). The Oyster Wars of Chesapeake Bay. Centreville, Maryland, Tidewater Publishers. (citing Hunter Davidson, Commander of the Maryland Oyster Navy)

<sup>36</sup> McCay, B. J. (1998). Oyster Wars and the Public Trust: Property, Law, and Ecology in New Jersey History. Tucson, University of Arizona Press.

<sup>37</sup> Sax, J. L. (1993). "Property Rights and the Economy of Nature: Understanding *Lucas v. South Carolina Coastal Council*." Stanford Law Review **45**: 1433-1455.

<sup>38</sup> In the field of economics, this is commonly referred to as "Coase's theorem" – See: Coase, R. H. (1960). "The Problem of Social Cost." Journal of Law and Economics **3**.

however, there are significant transaction costs associated with negotiating such arrangements that are often overlooked, such as the need for a government to enforce property rights and provide a basis for trust that others will follow the rules and abide by agreements that are made.<sup>39</sup> Other costs are inherent in getting all of the interested parties together to negotiate, in monitoring and enforcement, and in the development of institutional arrangements that might reduce such costs in the future.

Experience also suggests that the creation of private property rights only works when there are a limited number of contracting parties with well-defined rights. This is a situation rarely found in environmental cases because they normally involve externalities or damages to third parties such as downstream stakeholders, and to environmental services, all of which are difficult to account for. It is also difficult to limit the benefits of river basin management to those who have contributed toward its cost. In what some have called the "Tragedy of Enclosures," privatization as a solution may also lead to further environmental degradation when it displaces those who use the land for subsistence purposes and traditional resource management regimes, because it leaves them with fewer if any alternatives to more intensive use of ever more marginal land areas.<sup>40</sup> The challenge then is to develop more flexible institutional arrangements that reflect an ongoing negotiation of rights and responsibilities, as new problems arise.

### ***Types of incentives at different scales with a review of case studies***

An inherent feature of river basins is that most of the costs and benefits of implementing conservation practices are spatially separated between upstream and downstream stakeholders, and increasingly, between local and global. Costs and benefits are also separated in time between the present and the future. The further they are separated, both spatially and temporally, the greater the uncertainty and complexity of the problem, and the harder it is to link causes and effects— which is necessary if anyone is to be held responsible for damages. It is also more difficult either to restrict downstream benefits to those who contribute to the cost of protecting the basin, or to hold upstream parties responsible for the consequences of their actions. Because of this, it is also important to distinguish between the kinds of economic incentives and institutional arrangements that are appropriate at different spatial and temporal scales. The following sections present case studies that illustrate the development of different types of incentives and distinguishing features found at different scales.

#### **Small catchment and local scale incentives**

Though river basin management implies the need to coordinate activities over large scales, environmental stewardship is motivated at smaller scales, by threats to specific places and ways of life that people care about and depend on, and that literally provide the common ground that they share with others. Some distinguishing characteristics of place-based partnerships is that they are made up of people with many varied and conflicting interests, but who share values about place<sup>41</sup> and that there is greater accountability associated with face-to-face relationships.

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<sup>39</sup> Lipton, M. (1985). *The Prisoners' Dilemma and Coase's Theorem: A Case for Democracy in Less Developed Countries? Economy and Democracy*. R. C. O. Matthews. New York, St. Martin's Press.

<sup>40</sup> Anderson, A., P. H. May, et al. (1991). *The Subsidy from Nature: Palm Forests, Peasantry and Development on an Amazon Frontier*. New York, Columbia University Press.

<sup>41</sup> Michaels, S. (1999). *Up the Creek with a Paddle: Providing Watershed Management with a Conceptual Context*. College Park, University of Maryland Geography Department Seminar.

Implicit in the focus on catchment areas found in many such partnerships, is recognition of rivers as part of ecosystems, and the interdependency among different uses rather than a concern with any one particular commodity use. When causes of environmental degradation and their effects both occur within the small catchment area that is of common concern and are under the authority of a single jurisdiction, it is more likely that their consequences will be understood, and that community members will have a greater incentive to participate in initiatives to protect it. Although concern with place is not a market-based incentive, it is an economic one in the broader sense, in that it involves the desire to protect a way of life.

At this level, different kinds of initiatives can be found, ranging from formal watershed councils and inter-organizational partnerships that allow stakeholders to more effectively participate in decisions and raise funds for conservation efforts, to informal community based initiatives. Some formal associations date back at least as far as the 1940s in Massachusetts, where citizens began to respond to the degradation of rivers that occurred as a result of industrialization and population growth, by spontaneously developing organizations throughout the state through which to assert their rights to ecologically viable rivers.<sup>42</sup>

Among the better-known place-based initiatives is the Applegate Partnership that formed in the Applegate River watershed in the heart of the Klamath-Siskiyou ecoregion in northern California and southwest Oregon. In the early 1990s, the Partnership came together in response to polarization that had occurred as a result of an oversimplified debate about deforestation. The debate is characterized as a conflict between protecting the endangered spotted owls and providing jobs in the timber industry. While motivated by the desire to find a way to manage resources that was economically viable as well as acceptable from an ecological and aesthetic perspective, it also found ways to address threats to endangered and threatened salmon and steelhead runs within the watershed. Composed of a wide range of local interest groups, the Partnership developed ecosystem management criteria for evaluating timber sales, sponsored ecosystem and community assessments, several community development initiatives, the dissemination of information on different resource management perspectives, and the formation of a Watershed Council which provides a vehicle for raising funds and directing them towards priority restoration efforts.<sup>43</sup> The Applegate River Watershed Council was convened in 1994 to serve as a subcommittee and incorporate local stakeholders to work with state and federal agencies from the Applegate Partnership. The Klamath-Siskiyou Regional Office of WWF-US has provided funding via the Applegate River Watershed Council to remove two irrigation dams that will restore 12 cubic feet per second of instream flows and open 35 river miles of coho and steelhead spawning habitat. The project will transfer thirty-one water rights dating back to the 1850s, from agriculture to instream flow, and replace the dams with water pumps, and flood irrigation practices with sprinkler systems, which are preferable to farmers.<sup>44</sup>

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Michaels, S., R. J. Mason, et al. (1999). "The importance of place in partnerships for regional environmental management." *Environmental Conservation* 26(3): 159-162.

<sup>42</sup> Showers, K. B. (2000). *Connecting with the Grassroots: The Millers River Watershed Council and the Massachusetts Watershed Initiative*. 8th Biennial Conference of the International Association for the Study of Common Property, Indiana University, Bloomington Indiana.

<sup>43</sup> Parker, J. K., V. E. Sturtevant, et al. (1999). *Some Contributions of Social Theory to Ecosystem Management. Ecological Stewardship: A Common Reference for Ecosystem Management*. W. T. Sexton, A. J. Malk, R. C. Szaro and N. C. Johnson. Oxford UK, Elsevier Science. **III**.

<sup>44</sup> Personal communication with Dale Hile, WWF US, Klamath-Siskiyou regional office.

Less formal arrangements are more prevalent in developing countries. Several case studies in small catchment areas illustrate how clear perceptions of causes and effects (usually within the same or neighboring communities), combined with local control over access to resources, may provide sufficient incentives for conservation, regardless of whether there are formal policies in place. Availability of economically viable alternatives to existing practices is also an important factor. For example:

- In the Nizao catchment of the Dominican Republic, when farmers saw and understood that deforestation was reducing the duration of seasonal stream flows, they voluntarily adopted more stringent limits on tree cutting than those required by the government.<sup>45</sup>
- In Dotalugala, Sri Lanka, vigilante action occurred in one community to stop tree cutting in a particular portion of a catchment area. The community also agreed to plant five trees for every one that was cut.<sup>46</sup>
- In Madagascar, following a noted decline in the water cycle, several villages in the vicinity of the Ranomafana National Park sought outside assistance to develop alternatives to slash and burn agriculture. Methods for intensive rice cultivation in the lowlands were introduced that greatly improved yields and reduced incentives for cultivating the upland areas. Also introduced were off season crops and agroforestry methods in the uplands, which led farmers to understand the connection between maintenance of forest cover in the uplands and the supply of irrigation water in the lowlands. As an additional incentive for conservation, the community received half of the revenue from the park for development initiatives.<sup>47</sup>
- In a village in the Greater Afram Plains of Ghana, following the initiation of community based land use planning and management, local residents banned farming in six areas in which stream sources had been identified and developed plans for reforesting them.<sup>48</sup>
- In the Comuna of Loma Alta, a farming community in Western Ecuador, questions raised by researchers conducting an institutional analysis provided insights to the community concerning the role of the forest in providing water and led them to place greater value on it, which ultimately led to the establishment of a community-run forest reserve.<sup>49</sup>

Even within small areas, however, there can be significant uncertainty regarding links between causes and effects that may aggravate existing conflicts and competition for resources between different ethnic communities. Policies and agreements that are reached may reflect the typically disproportionate representation of lowlanders in decision-making processes and the economic marginalization of uplanders. For example,<sup>50</sup> in the Chom Thong district in Thailand, an association formed by lowland communities blamed the forest clearing and shifting cultivation

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<sup>45</sup> Uphoff, N. and J. Langholz (1998). "Incentives for avoiding the Tragedy of the Commons." Environmental Conservation 25(3): 251-261.

<sup>46</sup> Ibid.

<sup>47</sup> Ibid.

<sup>48</sup> Ibid.

<sup>49</sup> Becker, D. C. (2000). IFRI: A Springboard to Tropical Forest Conservation and co-Management in Western Ecuador. 8th Biennial Conference of the International Association for the Study of Common Property, Indiana University, Bloomington, Indiana.

<sup>50</sup> Ratner, B. D. (2000). Watershed Governance: Livelihood and Resource Competition in the Mountains of Mainland Southeast Asia. Washington, D.C., World Resources Institute.

carried out by an upland community for flash floods and a severe drought that dried up ten waterways, although climate changes may have been a contributing factor. Another perception of lowland communities was that the uplanders' greater access to the water supply was unfair to them. In this case, rather than seeking incentives for changing land use practices, the association requested authorities to relocate the uplanders to the lowlands. Subsequent draft legislation presented a compromise that would instead make the uplanders resource use rights conditional upon compliance with certain restrictions.

## **Larger basin and international level incentives**

At larger scales, ranging from larger catchment areas to international river basins, water sources are more distantly removed from the urban and other downstream areas that may depend on them. Because of this, and because impacts of land use are of a gradual and incremental nature, the value of protecting upper catchment areas are not as fully appreciated by downstream stakeholders, leaving such activities more vulnerable to budget cuts. For example, in 1995, the city of Tegucigalpa Honduras cut the budget of its catchment management unit by 50% and began to phase it out following government austerity measures required by the International Monetary Fund.<sup>51</sup> A portion of the city's water supply is provided by the La Tigra national park. In larger basins, effects of land use practices on hydrology may also be minimal because they may be offset by time lags between tributaries and variation in rainfall over different parts of the basin.<sup>52</sup> Even when these effects are significant, it is not a given that the economic implications will be negative, as was seen in the discussion of Lake Arenal in Costa Rica, and as was found in a review of the empirical literature regarding effects of land-use change on hydrology and links to economic welfare.<sup>53</sup> However, even when the value of upper catchment areas is significant and is appreciated, the distance between upstream and downstream makes it harder to insure that actions taken will be effective and that agreements will be kept. Stakeholders in upper catchment areas are also generally at an economic disadvantage, more dependent on natural resources, and may have little control over land uses, which may be influenced by even more distant external factors such as commodity prices. These disparities between upper and lower basin areas have also led to conflicts that have made collaboration difficult.

More formal institutional arrangements are thus required to insure that all interests are represented, to develop economic incentives that are regarded as fair, and to assure that the rights and responsibilities of increasingly distant communities are recognized and enforced. The types of institutional arrangements established might be critical to the effectiveness of incentive programs because stakeholders are unlikely to collaborate unless they feel that the distribution of costs and benefits is fair, and the actions taken are regarded as effective. For example, in Brazil, which adopted a nationwide river basin management policy, domestic water users are reported to be willing to pay more for water when the revenue from water fees is invested in the basin where

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<sup>51</sup> Lee, M. D. (2000). "Watershed Protection Challenges in Rapidly Urbanizing Regions: The Case of Tegucigalpa Honduras." *Water International* 25(2): 214-221.

<sup>52</sup> Kiersch, B. (2000). Land use impacts on water resources: a literature review. Land-Water Linkages in Rural Watersheds Electronic Workshop, Discussion Paper No. 1. Rome, FAO.

<sup>53</sup> Aylward, B. (2000). *Economic Analysis of Land-use Change in a Watershed Context (Circulation Draft)*. Presented at a UNESCO Symposium/Workshop on Forest-Water-People in the Humid Tropics, Kuala Lumpur, Malaysia.

the funds are generated, and when users are able to participate in decisions as to how the revenue is spent.<sup>54</sup>

The remainder of this section presents examples of various types of these larger scale initiatives and illustrates the diversity of arrangements found in different settings. First are those in which urban areas or downstream agricultural users provide compensation to those in the upper catchment areas for implementing conservation measures, examples of which are New York City, Quito Ecuador, and the Cauca Valley in Colombia. Several initiatives to provide direct incentives for river basin management have also been taken at national scales, which include a system of transfer payments for river basin management in Colombia, the Costa Rican Forestry Environmental Services Program (FESP), the U.S. Conservation Reserve Program (CRP), the Chinese reforestation initiative, and the South Africa Working for Water program. International river basin initiatives include that of the Mekong River Basin Commission, and the conflicts regarding the development of a waterway in the upper Parana basin. Together, these cases illustrate different types of market incentives, and the role of institutional arrangements. The kinds of incentives found in smaller catchment areas remain important and need to be embedded in larger scale initiatives for the latter to be effective.

### **The New York City Agreement**

The City of New York is investing up to \$1.5 billion over a 10 year period in several measures to protect its upstream water supply, in the hope that it can avoid the expense of constructing a filtration plant, estimated at \$9-11 billion including operating costs over a 10 year period. This is financed through a 9% increase in charges to water users, which would have to be at least double that amount if the filtration plant is required to be constructed. The funds are being used to implement an agreement between New York City, the U.S. Environmental Protection Agency, and a Coalition of Watershed Towns. The catchments from which New York derives its water (Croton, Catskill and Delaware) cover an area of approximately 1,969 km<sup>2</sup> approximately 125 miles north of the city. 90% of the water supply is obtained from the Catskills and Delaware catchments, which contain a population of approximately 77,000.<sup>55</sup> The main elements of the agreement are:

- A land acquisition component, in which the city will invest \$250-300 million in the Catskill/Delaware catchments, and \$17.5 million in the Croton catchment, for purchases of land or of conservation easements near reservoirs wetlands and watercourses.
- Revision of regulations giving the City greater authority in reviewing and approving potentially harmful projects, and in setting standards and other requirements pertaining to wastewater treatment plants, septic systems, and storm water control.

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<sup>54</sup> Porto, M., R. L. Porto, et al. (1999). "A Participatory Approach to Watershed Management: The Brazilian System." *Journal of the American Water Resources Association* 35(3): 675-684.

<sup>55</sup> Echavarría, M. and L. Lochman (1999). *Policy Mechanisms for Watershed Conservation, Case Studies*. Arlington, VA, The Nature Conservancy, Latin America and Caribbean Region, Conservation Finance and Policy Program. Perrot-Maitre, D. (2000). *Market-Based Instruments for Watershed Management: Case Studies around the World*. Workshop on Developing Markets for Environmental Services of Forests, Vancouver, British Columbia, Forest Trends. See also: New York Department of Environmental Protection: <http://www.ci.nyc.ny.us/html/dep/>; Catskill Corporation: [http://www.cwconline.org/about/ab\\_hist.htm](http://www.cwconline.org/about/ab_hist.htm); and the Agricultural Council: <http://www.nyc.org/>

- A Protection and Partnership program that provides \$310 million in funding that is administered locally by the Catskill Corporation, to develop and upgrade infrastructure which includes sewage systems, water treatment plants, storm water management facilities, and also for stream corridor protection. It also establishes a \$60 million “Catskill Fund for the Future” as an economic development bank to support development that is consistent with protection of the catchment, Funding is also provided for a Watershed Museum in the Catskills for environmental education.
- An additional \$472 million is being allocated to upgrade city-owned infrastructure, which includes sewage treatment facilities and dams.
- An Agricultural Program provides \$40 million to support implementation of best management practices in farms and forests, for purchasing of conservation easements from farms for which “whole farm” management plans have been developed to reduce agricultural non-point sources of pollution. Through an agreement with the US Department of Agriculture, additional funding provided through the Conservation Reserve Enhancement Program for retiring sensitive land areas, will also be allocated consistent with priorities for catchment protection. This is a program (described in a previous section) in which farmers may bid on contracts to retire environmentally sensitive lands.

Equally as important as the funding provided is the process by which this agreement was reached and is being carried out. It was preceded by a history of conflict between New York City and the upper catchment communities over the past 100 years, in which much land was lost and many communities were displaced for development of the 19 reservoirs that now exist. Upper catchment residents resented the legislative authority that had been granted to New York City, which had enabled it to acquire lands upstate, and to construct this water supply infrastructure. Farmers also feared that additional regulations would put them out of business. However, regulation remains an important ingredient. Facing prospects of much higher costs for water filtration that may be required by the U.S. Environmental Protection Agency if the initiative is not effective, the City had a greater incentive to provide benefits to communities in the upper catchment area in exchange for their collaboration. Similarly, although seeking to rely as much as possible on incentives, enforcement of the new regulations in the upper catchment areas is also an important aspect of the initiative.

This time the upper catchment communities were explicitly included in the negotiation of the agreement, in which a consensus-building approach was used. In addition to offering economic benefits, the agreement also established a regional partnership council to enable all of the parties to participate in decision-making. Among the provisions of the agreement is that the City will not acquire land from unwilling sellers through condemnation and will instead consult with the upper catchment towns and villages, which may exclude certain parcels from outright acquisition. However, the City may still purchase conservation easements. Although voluntary, the agricultural component of the agreement has achieved a relatively high rate of participation by allowing it to be led by farmers. Those who participated in a pilot phase of “whole farm planning” marketed it to other farmers and, as of August 1998, 315 of the 350 farms in the region had agreed to participate. It is governed by an Agricultural Council, which has also made an effort to link farmers with New York City markets, and is looking into certification for farm and forest goods produced using best management practices.

### **Quito Ecuador, Conservation Fund**

In Quito, Ecuador, 1% of the revenue from hydropower generation and water use fees goes into a fund that is designated to be used for protection of the Cayambe-Coca and Antisana reserves, which are important sources of the Quito water supply. Ecosystem protection is an explicit objective of this fund. The Cayambe-Coca Reserve is also a source area for 11 major rivers and includes several lakes and wetlands. Land use activities of the approximately 27,000 inhabitants of the two areas threaten the reserves and also affect the quality of the water and generation of electricity used by Quito. Initially proposed by The Nature Conservancy and the Fundacion Antisana, a local NGO, to provide adequate support for protection of the reserves, the fund was launched with support of the mayor of Quito, and is managed by an asset management company. A panel of 4-6 people make decisions about how the funds are allocated, which are generally channeled to landowners and others with stewardship capacity for changing land use practices. Initially, the fee amounts were calculated based on the cost of patrolling the reserves, but the next step planned is to determine the actual costs of water protection, which will also provide the basis for raising public awareness about the links between water and biodiversity conservation. There are also plans to solicit contributions to the fund from other sources, and to expand the program to cover the remainder of the Condor Biosphere reserve that includes two additional national parks.

### **Colombia, Water User Associations**

In Colombia's Cauca river basin, farmers affected by seasonal water scarcity formed 12 water user associations, which finance catchment management projects. Local user fees were added to water access fees already collected by the existing Cauca Valley Autonomous Regional Corporation, a public entity established to allocate water among various uses and protect the upper basin area. These additional fees made it possible to establish a separate fund for special projects, which was kept separate from administrative costs. Voluntary fees vary depending on the particular association and the willingness of their members to pay for protection of the catchment area, which may reflect the perceived opportunity cost of the declining water supply. Fees range from \$1.50 to \$2.00 per liter per second in addition to the existing fee of \$.50 for the water access permit, and are paid quarterly. Projects funded included reforestation, erosion control, land acquisition, identification and protection of springs and threatened streams, and economic development in upland communities. The success of this initiative is in part attributed to the profitability of agriculture in this basin. It also led to the formation of a Colombian Federation of Water Users to facilitate establishment of such associations throughout the country. Although no cost-benefit analysis has been done of the projects supported by these user associations, they are generally regarded as a promising vehicle for local participation in conservation efforts, and as reinforcing the national trend in Colombia towards regional management.<sup>56</sup>

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<sup>56</sup> Echavarría, M. and L. Lochman (1999). Policy Mechanisms for Watershed Conservation, Case Studies. Arlington, VA, The Nature Conservancy, Latin America and Caribbean Region, Conservation Finance and Policy Program. Johnson, N. and D. Perrot-Maître (2000). Market-Based Instruments and Watershed Management: Overview. Workshop on Developing Market for Environmental Services of Forests, Vancouver, British Columbia, Forest Trends, Washington D.C. Perrot-Maître, D. (2000). Market-Based Instruments for Watershed Management: Case Studies around the World. Workshop on Developing Markets for Environmental Services of Forests, Vancouver, British Columbia, Forest Trends.

## **Colombia, Transfer Payments for Environmental Services**

Also in Colombia, at the national level, water users pay for environmental services through a national system of transfer payments. Motivated by the need to insure a steady flow of water for hydroelectricity, drinking water, and water purification, hydroelectric power companies above a certain capacity (10,000 kw) must transfer 3% of gross electricity sales to the Regional Autonomous Corporations, which have been delegated the authority for catchment management. An additional 3% is transferred to municipalities in which basins and reservoirs are located, of which 1% is allocated to basin protection. Towns are also required to allocate 1% of their budgets toward the purchase of land to protect their water supply. Because of the advantage this gives to regions receiving transfers from the electricity sector, 20% of this income is pooled into a general fund that is distributed to the poorer regional corporations.<sup>57</sup>

## **Costa Rican Forestry Environmental Services Program (FESP)**

The Costa Rican National Forestry Fund (FONAFIFO) was explicitly established to compensate landowners for providing environmental services, which were defined to include: mitigation of greenhouse gases, protection of water supplies, and protection of biodiversity, ecosystems, ways of life and natural scenic beauty. It is primarily financed through a 5% sales tax on fossil fuel, but there are plans to increase revenue through fees for catchment protection services and from the sale of carbon sequestration services to foreign partners. Landowners may receive payments for reforestation, natural forest management, or forest preservation.<sup>58</sup> In one catchment area, additional compensation provided by a hydroelectric company (\$18 per hectare) is added to that provided by FONAFIFO (\$30 per hectare). The total amount is not based on the value of the hydrological service, but is considered approximately equivalent to the opportunity cost of foregone land development (e.g., revenue that might have been derived from cattle ranching). One study that sought to estimate the monetary benefits of water resources in Costa Rica concluded that water prices should be increased by 120% to reflect the economic and ecological value.<sup>59</sup>

Among the transaction costs is a requirement that landowners prepare a management plan, which has a lower per hectare cost for larger tracts and therefore makes the program less accessible to small holders. Another transaction cost is the need to file civil lawsuits for breach of contract in the event of noncompliance, because no explicit penalties are provided for in the contracts themselves. Conservation easements have been used as an alternative because an immediate injunction can be secured if the terms are violated. One way of reducing transaction costs has been through the creation of intermediary organizations such as FUNDECOR, which enrolls small holders, handles paperwork, serves as supervising forester, develops management plans, monitors performance, and provides technical assistance. It is also experimenting with advance

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<sup>57</sup> Ibid.

<sup>58</sup> Chomitz, K. M., E. Brenes, et al. (1998). *Financing Environmental Services: The Costa Rican Experience*. Economic Notes 10. Washington, D.C., The World Bank, Central America Country Management Unit, Latin America and Caribbean Region.

<sup>59</sup> Perrot-Maître, D. (2000). *Market-Based Instruments for Watershed Management: Case Studies around the World*. Workshop on Developing Markets for Environmental Services of Forests, Vancouver, British Columbia, Forest Trends.

purchases of wood for which landholders receive an annual flow of financing.<sup>60</sup> To date, applications by landholders to participate in FONAFIFO have exceeded the fund's capacity to provide support.

### **U.S. Conservation Reserve Program (CRP)**

The U.S. Conservation Reserve Program pays farmers to retire sensitive croplands and implement conservation practices. Up to 36.4 million acres may be enrolled in the program at any one time, at a total cost to the government of \$1.8 billion per year, and an average payment to farmers of \$50 per acre, which is determined through a bidding system. Although initiated to control soil erosion in response to the dust bowl of the 1930s, additional selection criteria were adopted in 1994 and 1997 that include protection of wildlife habitat, protection of water quality, location in a conservation priority area, restoration of wetlands, and potential for reducing erosion. At present, the program supports 2 million acres in wildlife habitat, 2.5 million acres in tree plantations, 32.3 million acres maintained as grassland, and 8,500 miles of filter strips planted along streams.<sup>61</sup>

### **Chinese Natural Forest Conservation Program**

In response to catastrophic floods on the Yangtze River in 1998, as well as concern over soil erosion, loss of biodiversity, and forest and landscape degradation, China began to invest a significant amount of funds in incentives for protecting upper basin areas.<sup>62</sup> A Natural Forest Conservation Program was implemented in 18 upper basin provinces and autonomous regions. Levels of government investment have been \$500 million in 1998, \$750 million in 1999, and \$875 million in 2000. At the same time, timber harvests dropped from 32 million m<sup>3</sup> in 1997 to 23 million m<sup>3</sup> in 1999.

Instruments used to achieve the program objectives include technical training and education of provincial leaders and forestry officials, land management planning, and mandatory conversion of marginal farmlands to forest lands. An incentive provided for the latter are the costs of land conversion and free food in the amount that would have been obtained from the land had it not been converted. Some forest dwellers have been resettled, and are provided compensation if they do so voluntarily. Another incentive is through contracts with local people who agree to protect the forest while maintaining rights to gather non-timber products, such as the case of so-called extractive reserves in Brazil.

### **South Africa, Working for Water Program**

This program is designed to remove alien invasive plant species that threaten biodiversity and reduce water supplies because they consume significantly more water than native plants. The program is also designed to promote economic development by providing training and employment in the most impoverished social sectors. Funding sources include general taxes,

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<sup>60</sup> Chomitz, K. M., E. Brenes, et al. (1998). Financing Environmental Services: The Costa Rican Experience. Economic Notes 10. Washington, D.C., The World Bank, Central America Country Management Unit, Latin America and Caribbean Region.

<sup>61</sup> Farm Service Agency Online: The Conservation Reserve Program; <http://www.fsa.usda.gov/dafp/cepd/12logocv.htm>

<sup>62</sup> Zhang, P., G. Shao, et al. (2000). "China's Forest Policy for the 21st Century." *Science* 288(23): 2135-2136.

municipalities that benefit both from increased water supplies and jobs, international donors and landowners. At present, most of the funds are derived from general taxes and international donors. The program seeks to increase the share provided by private landowners and municipalities.<sup>63</sup>

### **Mekong River Basin Commission**

A case study conducted by WRI illustrates the various levels of conflict in the Mekong River Basin.<sup>64</sup> Located in the upper part of the basin, China is not a participant in the Mekong River Commission, although it has a disproportionate influence on the whole basin, and where it intends to build a series of dams sufficient to provide 17% of China's electricity needs. Plans for development of dams, which require steady flows of water, are in conflict with the lower part of the basin, where annual flooding of the Mekong is part of a cycle that sustains wetland habitat for over 500 endemic species of fish – upon which a majority of the population depends for its livelihood. At this local level, downstream, subsistence fishermen are in conflict with commercial fishermen, who have better defined property rights because they generate government revenue. Subsistence fishermen, in turn, have an incentive to convert floodplain forest to agriculture and to fish illegally because they are formally excluded from the best fishing areas.<sup>65</sup> There are also conflicts between the neighboring countries of Vietnam and Thailand over water allocation because of increased amounts of water needed by Thailand to support development plans. In Laos, unrestricted logging is displacing residents of proposed reservoir areas. Resolving these multi-layered conflicts will require more effective institutional arrangements than the Mekong River Basin Commission, which lacks the authority to enforce agreements or mediate disputes, or even to convene all of the relevant international actors, or to ensure the representation of those potentially most affected by proposed developments. The WRI report suggests that incentives for river basin cooperation might be developed by making international economic cooperation conditional on integrated river basin management.

### **Upper Parana River Basin**

A similar story can be told about the Upper Parana river basin in Latin America, in which there are conflicts between plans to develop a waterway (hidrovia), and to protect biodiversity in the world's largest freshwater wetland (the Pantanal). Plans to develop the hidrovia are driven by geopolitical interests of the southern cone countries of Latin America in increasing trade, which would also lead to an increase in exploitation of natural resources in the upper basin. It is perhaps of greatest interest to Bolivia, a land locked upper basin country that has fewer options for transporting goods. Of greatest concern is the potential reduction of yearly flooding in the Pantanal that could occur if the hydrological regime is altered, and the loss of its capacity to store large amounts of water that are released very slowly. The yearly floods bring nutrients that support large populations of fish, and which are extremely vulnerable to small changes in water

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<sup>63</sup> Anonomous (Draft). Working for Water Programme of South Africa, Case Study Summary. [The Implementation Handbook for Managing Ecosystem Services](#). N. Johnson. Washington, D.C., World Resources Institute.

<sup>64</sup> Ratner, B. D. (2000). [Watershed Governance: Livelihood and Resource Competition in the Mountains of Mainland Southeast Asia](#). Washington, D.C., World Resources Institute.

<sup>65</sup> Degen, P., N. van Acker, et al. (2000). [Taken for Granted: Conflicts over Cambodia's Freshwater Fish Resources](#). 8th Biennial Conference of the International Association for the Study of Common Property, Indiana University, Bloomington Indiana.

levels. The fish in turn support diverse populations of birds and other animals, including giant otters and caiman. Given the large size of the entire basin, it is difficult to link changes in the upper basin to those in the lower part. However, there is concern that loss of the storage function of the Pantanal could lead to increased flooding in the mid-basin area because the previously delayed flood peaks in the upper Parana might then coincide with those of the upper Paraguay river of which it is a tributary.<sup>66</sup>

Here also, the concerns of local stakeholders, many of whose livelihoods are tied to the flooding cycles, are not reflected in decision-making processes. In addition to the direct impacts of developing the Hidrovia, their concerns extend to the cumulative impacts of regional development that would be supported by the Hidrovia, which includes expansion of commercial agriculture, mining and processing of iron and manganese ore, and logging. Environmental and economic assessments of the potential costs and benefits of the Hidrovia are narrowly focused on the monetary costs and benefits of the project itself and they fail to consider the complex ecological ramifications of reduced water levels as well as conservation plans developed for the Upper Parana basin.<sup>67</sup>

## **Learning from mistakes**

### **Some costs of inappropriate institutional arrangements in the Missouri and Mississippi river basins**

In the Mississippi river basin, flood control structures have paradoxically led to an increase in flood damages. Monetary damages in the 1993 flood alone, which brought about the failure of approximately 1000 levees, were estimated at US\$16 billion. It has also been estimated that the 1993 flood could have been contained in 13 million acres of wetlands or approximately half of the wetland acreage drained since 1780, and that most of the water-holding capacity of the soils has been lost.<sup>68</sup> A historical analysis of its major tributary, the Missouri river, suggests that there are also large if not always quantifiable costs of not including stakeholders in the initial planning phases of development plans. Development of that basin was based on the 1944 Pick-Sloan plan, which consisted of extensive flood control and navigation improvement projects that included 6 main stem and 22 tributary dams, 41 hydroelectric plants, 95 reservoirs, several river levees, and extensive dredging for navigation. The agreement was intended to provide a plan for comprehensive development of the basin that would benefit all parties, but which primarily benefited the lower basin states at the expense of the upper basin states. At present, the combined gross product of the lower basin states is three times larger than that of the upper basin states, half of which is from Colorado. In the upper basin states, the poverty rate is above the national average, while that of the lower basin states is below it. Indian tribes, who legally hold senior water rights in the basin, and who paid the highest price through loss of land to flooding for

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<sup>66</sup> Ponce, V. M. (1995). Hydrologic and Environmental Impact of the Paraná-Paraguay Waterway on the Pantanal of Mato Grosso, Brazil: A Reference Study., San Diego State University.

<sup>67</sup> Dunne, T., J. Melack, et al. (1997). The Hidrovia Paraguay-Paraná Navigation Project: Report of an Independent Review., Environmental Defense Fund (EDF) and Fundação Centro Brasileiro de Referência a Apoio Cultural (CEBRAC). Kawakami de Resende, E. and S. Tognetti (Forthcoming). Ecological and Economic Context of the Proposed Paraguay-Paraná Hidrovia and Implications for Decisionmaking. Implementing Sustainable Development: Integrated Assessment and Participatory Decision-Making Processes. H. Abaza and A. Baranzini, UNEP.

<sup>68</sup> Hey, D. L. and N. S. Philippi (1995). "Flood Reduction through Wetland Restoration: the Upper Mississippi River Basin as a Case History." Restoration Ecology 3(1): 4-17.

reservoirs and displacement of their populations, were excluded from the planning process, and also from negotiation of subsequent water allocation compacts among the states. These inequities led to extensive basin-wide litigation, loss of trust, and destruction of long-term relationships among between state governments. Among the lawsuits was one brought by upper basin states during a drought in 1990, to prevent the discharge of greater volumes of water from the Oahe reservoir than were flowing into it, so as to protect several species of game fish. A subsequent suit alleged that the Army Corps of Engineers gave higher priority to downstream uses than to recreation, fish and wildlife uses upstream. This case illustrates conflicts between valuing the river as an ecosystem, and valuing it purely in terms of the commodities it provides, which fractures the river into kilowatt hours of electricity, acre-feet of water, agricultural outputs, and barge tonnage.<sup>69</sup>

### **Inadequacy of relying only on market-based approaches: Water privatization in Chile**

The inadequacy of relying only on private property and market-based approaches for resolving conflicts among multiple uses of a river basin is illustrated by the experience with water privatization in Chile. Conflicts often occurred between the consumptive use rights of downstream irrigators, and the non-consumptive use rights of upstream hydroelectric facilities, because of their need to store water when it is most needed by irrigators. In a case study on the Bio Bio River, where the construction of the Pangué Dam was also seen as a threat to unique ecosystems and to local indigenous communities, environmentalists and indigenous groups joined irrigators in opposition to the dam. However, they were excluded from a subsequent agreement reached between the hydroelectric company and the irrigators because they did not own any water rights. The compromise agreement that was reached favored the electricity sector, in that its use of water resources had a higher market value than use of the water for irrigation. Under these criteria, concerns with protection of biodiversity are predictably dismissed. Subsequent attempts to include stakeholders who held no formal water rights met with resistance from those who did hold water rights. Another observation was that the irrigators had less incentive to negotiate because it would have entailed high transaction costs. Meanwhile, the more powerful hydroelectric interests had little incentive to negotiate because their rights were usually given greater priority than the regulatory authority of state agencies, given their economic power.<sup>70</sup>

### **Obstacles and special considerations in larger scale management initiatives**

In larger scale management initiatives, beyond those that are local and place-based, tensions and value conflicts often arise between local and regional or national objectives, unless they are embedded within them. For example, a case study conducted in the uplands of the Nam Ngum in Laos<sup>71</sup> found that those displaced by the construction of dams for hydroelectric power, which are associated with national policy objectives, frequently compete for land and natural resources

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<sup>69</sup> Thorson, J. E. (1994). *River of Promise, River of Peril: The Politics of Managing the Missouri River*. Lawrence, Kansas, University Press of Kansas.

<sup>70</sup> Bauer, C. J. (1998). "Slippery Property Rights: Multiple Water Uses and the Neoliberal Model in Chile, 1981-1995." *Natural Resources Journal* **38**: 109-155.

<sup>71</sup> Ratner, B. D. (2000). *Watershed Governance: Livelihood and Resource Competition in the Mountains of Mainland Southeast Asia*. Washington, D.C., World Resources Institute.

with established upland residents and may be resettled in fallow areas that are part of shifting cultivation systems. National policies that allow continued logging are also in conflict with local land use needs. Although the government formally recognizes customary land uses, these and other policies suggest a lack of understanding of the diversity of local conditions and land uses. Researchers have identified at least 16 different types of customary land uses.

Important considerations at larger scales are the equitable distribution of costs and benefits, and how to broaden the participation of upland residents by addressing their interests. Also important at this level is the process of developing institutions for allocating and enforcing water rights, so as to link downstream demand with protection upstream, providing appropriate information and making it accessible.<sup>72</sup> As will be further discussed in the section on adaptive management, institutional development is a complex process that needs to be carried out with an adaptive and participatory approach.

A distinguishing characteristic of initiatives to protect river basins that cross international boundaries is the lack of a central governing authority, and the difficulty of insuring that all of the relevant stakeholders are represented in decision processes. At this level, incentives are driven by geopolitical interests associated with international trade, and the development of transportation infrastructure and exploitation of resources needed to increase it. Typical are conflicts among the economic interests of the different states in addition to those within states, between externally driven national interests and local needs, and the distribution of costs and benefits between national stakeholders.

## **Lessons learned**

### ***Implications of uncertainty***

Given the separation of costs and benefits of river basin management between upstream and downstream stakeholders over a broad range of scales, high uncertainty is a defining characteristic. On the other hand, market-based incentives tend to work best when uncertainty is low, i.e., when there are single and controllable sources of environmental degradation, when there are well-established links between management actions and their consequences, and when stakeholders have well-defined rights and responsibilities. Such conditions allow for some degree of predictability regarding monetary values, upon which market incentives are based. However, the development of new rules to change incentives is a messy process that may add to uncertainty because it involves diverse actors at multiple scales, and because of the many different ways that stakeholders may be affected. Thus it cannot be viewed merely as an analytical task. Incentives, broadly defined, consist not only of financial rewards and penalties, but any positive or negative changes in outcome that stakeholders perceive to be the result of particular actions over which they have some control.<sup>73</sup> For example, the incentive to cooperate to avoid resource degradation depends on whether a particular stakeholder believes that others will cooperate. The use of market instruments to create incentives therefore needs to be part of a process of developing new institutional arrangements, in which all affected stakeholders are adequately represented, and which can reduce uncertainty by fostering the collaboration needed to insure that rules are enforced, and that those who abide by them reap the future benefits.

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<sup>72</sup> Ibid.

<sup>73</sup> Ostrom, E., L. Schroeder, et al. (1993). Institutional Incentives and Sustainable Development. Infrastructure Policies in Perspective. Boulder, Westview Press.

Some challenges inherent in this broader approach that will be discussed in the following sections include the need for an adaptive approach to management in which policies are viewed as experiments, inclusion of stakeholders from upper basin areas in participatory processes, and equity of institutional arrangements upon which incentives are based. Adaptive management also implies the need for a broader approach to valuation that provides stakeholders with an opportunity to learn about the role of biodiversity in maintaining ecosystem processes, to reconsider their values in light of new information, and for negotiation and conflict resolution when these values are in conflict.

### ***The role of stakeholder participation***

Participation in decision-making is ultimately an institutional problem of giving a voice to multiple perspectives,<sup>74</sup> and of considering conflicts among multiple criteria where no optimum solution exists.<sup>75</sup> Although it can be expensive and time consuming, participatory processes may result in lower costs overall because they allow for a better understanding of the resource context and can lead to the design of more effective and efficient resource management programs,<sup>76</sup> and also permit anticipation of conflicts and consequences that will need to be addressed.

Conversely, failure to use a participatory process may result in much higher costs in later stages, as was seen in the case study of the Missouri and Mississippi river basins. Nevertheless, involving those most affected in decisions regarding large-scale economic development, which are driven by factors such as “national interests,” represents an institutional challenge even in the most developed countries with established traditions of representative democracy (i.e., Europe and North America).

A challenge inherent in river basin management is the participation of upland residents in decision-processes from which they have often been marginalized, because of cultural, linguistic, educational and geographical barriers. Given the diversity of conditions in upper basins, participation of upland stakeholders is “key to the identification of opportunities [to create incentives] consistent with existing land-use patterns, available resources, and potential market linkages.”<sup>77</sup> To the extent that upper basin management initiatives and development projects are based only on the consideration of downstream consequences or are driven by national priorities that fail to benefit upland residents, they are unlikely to cooperate.

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<sup>74</sup> Wynne, B. (1997). Methodology and Institutions -- Value as seen from the risk field. Valuing Nature? Economics, Ethics and Environment. J. Foster. London and New York, Routledge.

<sup>75</sup> O'Connor, M., S. Faucheux, et al. (1996). Emergent Complexity and Procedural Rationality: Post-Normal Science for Sustainability. Getting Down to Earth: Practical Applications of Ecological Economics. R. Costanza, O. Segura and J. Martinez-Alier. Washington D.C., Island Press.

<sup>76</sup> Hanna, S. (1995). Efficiencies of User Participation in Natural Resource Management. Property Rights and the Environment. S. Hanna and M. Munasinghe. Washington, DC, Beijer International Institute of Ecological Economics and The World Bank: 59-68.

<sup>77</sup> McCauley, D. S. (1986). Watershed Management in Indonesia: The Case of Java's Densely Populated Upper Watersheds. Watershed Resources Management: An Integrated Framework With Studies from Asia and the Pacific. K. W. Easter, J. A. Dixon and M. M. Hufschmidt. Boulder CO, Westview Press.

## ***The importance of equity***

Different kinds of economic incentives and institutional arrangements all reflect different ways of distributing costs and benefits among stakeholders, for achieving particular objectives. The most fundamental incentive for stakeholders to cooperate in any kind of incentive scheme is that this distribution be perceived as fair. Conversely, inequity may be regarded as a fundamental incentive for environmental degradation because it allows some to reap the benefits while others pay the costs, which can easily occur in river basins because they are spatially separated between upstream and downstream.<sup>78</sup> Whether or not a particular arrangement is fair can only be determined in the context in which it is to be applied, and requires the perspectives of stakeholders.

The case studies show that incentives that work and seem fair in one context may not be in another. For example, in the Cauca Valley case study in Colombia, irrigation farmers were able to pay for management of upstream catchment areas through voluntary increases in their water fees because their agricultural products had a relatively high value. In other cases, it has been suggested that small increases in water fees could easily bankrupt farmers given the low prices for agricultural products in global markets, and given that water is such a large part of their total operating costs.<sup>79</sup> In another example, funding of the protection of upper basin areas by downstream urban areas, so as to protect their water supply, appears fair when those upper basin areas are economically disadvantaged because this begins to address historical urban and rural economic disparities. However, fairness would be questionable if the urban area were upstream from agricultural and fishing interests. In addition, although the case of Quito Ecuador demonstrates that this approach can be feasible even in a developing country, this may not always be the case, given that, in a number of developing countries, even primary sewage treatment is lacking and municipalities often find it problematic to collect fees sufficient just to cover the existing water delivery costs. The case of Tegucigalpa in Honduras shows that funding for catchment management is likely to rank low in the face of austerity measures.<sup>80</sup> Direct payments for environmental services particularly raise issues of who should pay and how much, and the extent to which providing these services should simply be regarded as an obligation inherent in the responsibility not to harm others.

Equity is essential to the goal of sustainable development because the use of economic instruments in isolation can place a disproportionate and unfair share of the burden on people with the least influence on decision making, such as those outside of jurisdictional borders, and also the most vulnerable and least advantaged members of society, who may make the problem worse because they have fewer choices. For example, in seeking parties with whom to negotiate contracts for reforestation of upper catchments, it may be more efficient to negotiate with a few large landholders than with numerous smallholders who may have less security of tenure, who may also have significant language and educational barriers to collaboration, and who may respond to incentives in more diverse ways. On the other hand, smallholders with few options may then have increasing incentives to use ever more marginal land areas with more damaging

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<sup>78</sup> Segura, O. and J. Boyce (1994). Investing in natural and human capital in developing countries. *Investing in Natural Capital*. A.-M. Jansson, C. Folke, M. Hammer and R. Costanza. Washington, DC, ISEE/Island Press.

<sup>79</sup> Porto, M., R. L. Porto, et al. (1999). "A Participatory Approach to Watershed Management: The Brazilian System." *Journal of the American Water Resources Association* 35(3): 675-684.

<sup>80</sup> Lee, M. D. (2000). "Watershed Protection Challenges in Rapidly Urbanizing Regions: The Case of Tegucigalpa Honduras." *Water International* 25(2): 214-221.

land use practices. Distribution of risks and uncertainty among different stakeholder groups then becomes a key consideration for evaluating incentives, because environmental problems often result from shifting costs to those outside or marginal to the decision-process, and need to be viewed as problems of social and political conflict as much as biophysical ones. Lastly, openness and transparency of the decision process is what allows stakeholders to judge whether a process is efficient, effective, and fair.

### ***Requirements for scaling up***

Implementing economic incentives at larger scales will require that the interests of local stakeholders be adequately represented in decision processes at all levels, including those of international river basin commissions. This requires attention to the process of identifying the diversity of stakeholder interests, because biases in selection or exclusion of stakeholders can also lead to the sabotage of initiatives taken.<sup>81</sup> While it is tempting to rely on existing institutions and to assume that these represent existing interests, it is important to keep in mind that they have usually developed to solve very different kinds of problems, often in an earlier era, and are often resistant to change because they serve powerful and entrenched interests. For example, the Prior Appropriations doctrine, that gives water users in the western U.S. a vested property right to as much water as they are able to divert and put to beneficial use, has, for this reason, been called one of the “Lords of Yesterday.”<sup>82</sup> River basin management, on the other hand, presents new kinds of problems that are beyond the capacity of existing institutions. Therefore it is important that the origin of existing institutions be understood and that they be critically examined in light of the problem that is being addressed.

At the largest scales, issues of river basin management are difficult to separate from the broader issues of governance as well as national and international policies. It is important to keep in mind that present centralized, command-and-control systems of resource management and bureaucratic forms of governance came into being along with the industrial revolution, because of the social and economic conflict generated by massive resource extraction and infrastructure development, and the need to justify controversial decisions.<sup>83</sup> Adaptive ecosystem approaches to management cannot truly occur without changes of the same magnitude. While this degree of institutional change may be beyond the scope of a project to develop incentives for river basin management, it should be kept in mind as an ultimate objective of efforts to implement ecoregion conservation. The nested quality of river basins and their management—in which larger systems are built progressively on smaller ones—provides a useful template for conceiving, planning and implementing conservation strategies in ecoregions.

Another consideration in scaling up is that, when it is beyond the ability of local users to control access to resources, co-management arrangements become necessary. This refers to a cooperative approach that becomes necessary because no single level of government or non-governmental entity has the capacity that is required. However, co-management is often undermined by the reluctance to share power or to resolve conflicting interests between these

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<sup>81</sup> Ravnborg, H. M. and M. d. P. Guerrero (1999). “Collective Action in Watershed Management--Experiences from the Andean Hillside.” *Agriculture and Human Values* 16(3): 257-66.

<sup>82</sup> Wilkinson, C. F. (1992). *Crossing the Next Meridian: Land, Water, and the Future of the West*. Washington, D.C., Island Press. National Research Council (1996). *Upstream: Salmon and Society in the Pacific Northwest*. Washington, DC, National Academy Press.

<sup>83</sup> Hays, S. P. (1959). *Conservation and the Gospel of Efficiency. The Progressive Conservation Movement, 1890-1920*. Cambridge, Harvard University Press.

entities. For example, policies of national governments are often biased against resource dependent communities, and fail to assure them of future access to resources or security of livelihoods, while local jurisdictions may fail to consider the downstream implications of their actions. The development of a management plan can provide a platform for negotiating co-management arrangements among stakeholders, and provide a basis for monitoring.

### ***Adaptive management***

River basin management requires adaptive approaches to new and unanticipated kinds of problems because these often exceed the response capacity of existing institutions. Among these are the unintended consequences of existing policies and incentives, which are often not perceived until a disaster strikes. For example, the role that land-use practices in upper basin areas played in aggravating disaster damages associated with Hurricane Mitch in Honduras is leading USAID and other funding agencies to reevaluate their criteria for allocating funds for post-hurricane reconstruction.<sup>84</sup> Similarly, catastrophic flooding of the Yangtze River in China in 1998 led to the Chinese government's initiative to reforest upper watersheds and to large reductions in timber harvests.<sup>85</sup>

Although not widely perceived as a disaster because its consequences are not immediately obvious, biodiversity loss has already been characterized by scientists as comparable in magnitude to the catastrophic extinctions of the past. Given the irreversibility and magnitude of its already existing and potential consequences, the challenge is to develop a more proactive approach to conservation, which requires greater public awareness of biodiversity's critical importance—especially in developing countries, which contain most of the world's biodiversity. While there will always be surprises, the challenge is to institute a process of mutual learning, through which stakeholders can anticipate and learn about unintended consequences before disasters occur, and to build the institutional capacity needed to respond to them when they do occur. This implies the need for a broader approach to valuation (discussed in the following section), to provide the information needed to inform social learning processes and to develop new options, which leads to a proactive stance. In contrast, disaster research suggests that emphasis on technical data collection regarding type, severity and location of hazards, without considering the conditions that increase or reduce vulnerability, may actually increase hazards, because governments may consider themselves to be better prepared merely through such accumulation of data.<sup>86</sup>

### ***An adaptive approach to valuation***

Economic valuation is a key source of information for justifying decisions, which can be used to identify existing incentives and also allow resource users to consider the costs and benefits of changing existing land use practices.<sup>87</sup> How it is done then depends on what kinds of criteria are

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<sup>84</sup> USAID (1999). Watershed management for hurricane reconstruction and natural disaster vulnerability reduction. USAID Contribution to the Discussion of Ecological and Social Vulnerability Consultative Group for the Reconstruction and Transformation of Central America, Stockholm Sweden May 25, 1999.

<sup>85</sup> Zhang, P., G. Shao, et al. (2000). "China's Forest Policy for the 21st Century." *Science* **288**(23): 2135-2136.

<sup>86</sup> White, G. F. (1996). "Geography and Other Disciplines." *Geography Bulletin* **38**(1): 5-6.

<sup>87</sup> Aylward, B., J. Echeverría, et al. (undated). Market and Policy Incentives for Livestock Production and Watershed Protection in Arenal, Costa Rica. CREED Working Paper 25. London, International Institute for Environment and Development.

used to justify a decision in a particular context. For example, in a case study of a decision by a watershed council (Comité de Bassin) of whether to protect wetlands that provide flood protection benefits to the city of Paris,<sup>88</sup> the purpose of valuation was to show that more money could be saved over time than the amount to be invested. In other words, it was to justify a budget decision to invest in wetlands protection, which was not the central mission of the organization. In this case, the decision was primarily justified based on technical criteria, in that the wetland was viewed in technical terms, for its contribution to flood reduction, which was the main concern of stakeholders. Market and civic criteria follow in priority because it was presented in monetary terms, and in a public and political context. Rough estimates were sufficient, based on scientific and technical information regarding the wetland, and on options that had been actually discussed. The values of the stakeholders were assumed to be inherent in the mission of the organization. Therefore, it was not necessary to ask their preferences and to use monetary units as equivalents of aggregate welfare, as is often done in environmental valuation studies. Although the decision concerned protection of a wetland, environmental or biodiversity concerns did not provide any justification for the decision.

The above study cites a particular classification of justification criteria which, in addition to technical, market and civic orders found in this valuation of a wetland, also include justifications based on notoriety or fame, domestic-traditional which refers to concerns with heritage and communal identity, and inspiration, which refers to transcendent and religious values.<sup>89</sup> Other classifications are possible. An important point here is that relevant options are assessed through a logic of classification based on social norms, rather than one of calculation.<sup>90</sup> Giving value to biodiversity concerns then requires that these be given higher priority than market concerns, rather than allowing conservation priorities to be determined by markets.

In another example, the purpose of a cost benefit analysis that was done to evaluate the hidrovía or waterway that was proposed for the Parana-Paraguay river system, was to determine actual return on the investment to justify international financing of the project. Critics of the project challenged the assumptions made in the analysis and found errors that called into question whether the actual returns would justify the cost under the criteria used in the study itself.<sup>91</sup> However, the major objection was that it only considered benefits that would result from savings in transportation costs considering the costs of construction, maintenance and equipment. In other words, justification for the project was based on market criteria. As discussed in a previous section, of concern to many stakeholders were the cumulative impacts of massive development that would be induced by the construction of the hidrovía, its impacts on the Pantanal – an area of great diversity of species and also of landscapes, and threats to ways of life that were also viewed as natural and cultural heritage.<sup>92</sup> Civic criteria were another basis for the objection,

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<sup>88</sup> Laurans, Y. (2001). "Economic evaluation of the environment in the context of justification conflicts: development of concepts and methods through examples of water management in France." *International Journal of Environment and Pollution* 15(1): 94-115.

<sup>89</sup> These criteria were developed by Boltanski and Thévenot. See: Boltanski, L. and L. Thévenot (1991). *De la justification. Les économies de la grandeur*. Paris, Gallimard.

<sup>90</sup> Dietz, T. and P. C. Stern (1995). "Toward a theory of choice: socially embedded preference construction." *The Journal of Socio-Economics* 24(2): 261-279.

<sup>91</sup> Bucher, E. H. and P. C. Huszar (1995). "Critical Environmental Costs of the Paraguay-Paraná waterway project in South America." *Ecological Economics* 15(1): 3-9.

<sup>92</sup> Kawakami de Resende, E. and S. Tognetti (Forthcoming). Ecological and Economic Context of the Proposed Paraguay-Paraná Hidrovía and Implications for Decisionmaking. *Implementing Sustainable Development: Integrated Assessment and Participatory Decision-Making Processes*. H. Abaza and A. Baranzini, UNEP. Dunne, T.,

because these concerns had not been addressed in an inclusive public process. Within the public arena, stakeholders relied heavily on technical sources of justification for stopping the project, citing the water storage functions of the Pantanal, the loss of which could have extensive downstream ramifications, though environmental criteria were implicit. Also cited in support of opposition were the opinions of respected and well-known scientists. Market criteria were not excluded. An underlying objective of the stakeholders was regional economic development that would be consistent with protection of biodiversity.

In a broader, adaptive or institutional approach to valuation, the objective is to establish a process that provides stakeholders with an opportunity to reconsider their values and priorities in light of new information.<sup>93</sup> This implies the need for using different kinds of criteria and information for decision-making than when problems are defined in narrow technical terms, because decisions are embedded in complex problems of high stakes and high uncertainty, such as conservation of biodiversity, in which there are multiple decision-makers and conflicting interests. Information needed to inform such a process should then include identification of existing incentives and disincentives for protecting biodiversity in a river basin context, what options that are available, and conflicts between the interests of different stakeholders, as well as sources of uncertainty and perceptions regarding the equity of existing and proposed institutional arrangements. Much of this information is provided by stakeholders themselves who, through a process of learning and deliberating, and by establishing trust needed to cooperate with one another, may also generate new options. Valuation is thus reframed as a process of negotiation and conflict resolution rather than of finding a single optimum and efficient solution, as it is in just such situations of conflict and risk, when ways of life are threatened, that value statements emerge and are expressed.<sup>94</sup>

Conventional approaches to valuation remain useful for determining market values under existing institutional arrangements. However, it needs to be kept in mind that creating new incentives constitutes a change in these arrangements, and that values and property rights are not static, but have always changed in response to new kinds of problems as a result of learning, negotiation and conflict resolution among stakeholders regarding their rights and responsibilities, and the distribution of costs and benefits. In short, changing incentives in a river basin context ultimately involves changing values and institutional arrangements associated with property, and vice versa.

The need for broader approaches to valuation is an issue raised in a number of the initiatives that have been discussed. For example, in the National Landcare Program in Australia, one researcher calls attention to the lack of a formal assessment upon which to base decisions for the allocation of resources among regions and among projects within them, and suggests the need for “issue-based economic valuation data across whole catchments” and for a benefit-cost analysis that is extended to better represent stakeholder values.<sup>95</sup> The proposed development of the Hidrovia in

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J. Melack, et al. (1997). The Hidrovía Paraguay-Paraná Navigation Project: Report of an Independent Review., Environmental Defense Fund (EDF) and Fundação Centro Brasileiro de Referência a Apoio Cultural (CEBRAC).

<sup>93</sup> O'Connor, M. (2000). “Pathways for environmental evaluation: a walk in the (Hanging) Gardens of Babylon.” *Ecological Economics* 34(2): 175-194. Wynne, B. (1997). Methodology and Institutions -- Value as seen from the risk field. *Valuing Nature? Economics, Ethics and Environment*. J. Foster. London and New York, Routledge.

<sup>94</sup> O'Connor, M. (2000). “Pathways for environmental evaluation: a walk in the (Hanging) Gardens of Babylon.” *Ecological Economics* 34(2): 175-194.

<sup>95</sup> Curtis, A. and M. Lockwood (2000). “Landcare and catchment management in Australia: Lessons for state-sponsored community participation.” *Society and Natural Resources* 13(1): 61-73.

Brazil also generated considerable controversy over how the costs and benefits were calculated, and how these could be more adequately accounted for.<sup>96</sup> The Nature Conservancy (TNC), which has a number of initiatives underway to create funds for catchment protection, is also beginning to place emphasis on valuation and is exploring a number of ways to do this.<sup>97</sup> In the general framework TNC is using, information needed is whatever is required to convince people that they will benefit from taking action, which may include information about hydrology, water use, and economic considerations such as cost of damage avoidance, cost of prevention, cost to replace the service, value of a change in productivity, and contingent values.

There are several ways of approaching this broader approach to valuation, which cannot all be elaborated here but mostly involving a combination of methods, such as institutional analysis with multi-criteria decision analysis. Institutional analysis is useful as a way to inquire into the specific context of a situation. Multi-criteria decision analysis can be used to anticipate conflicts, and also as a framework for organizing information obtained in an institutional analysis and presenting it back to stakeholders. This is an approach that has successfully been used to structure public information campaigns regarding water issues, in a case study conducted in Troina, Sicily.<sup>98</sup>

The Institutional Analysis and Development (IAD) framework<sup>99</sup> seems particularly useful because it is specifically designed to inquire into the context of decisions and rules established to control access to common pool resources. By examining resource management policies at the implementation phase, it provides information about unintended consequences of past decisions; existing incentives related to the use of particular resources; perceptions of stakeholders regarding equity and efficiency of these arrangements; and how these arrangements might be improved. It consists of gathering both biophysical and socioeconomic information, based on various kinds of surveys and interviews with selected stakeholders, to determine the environmental conditions, and the appropriateness of existing institutional arrangements for conservation purposes. Key questions regarding the latter pertain to development objectives and alternatives from the various stakeholders perspectives, factors perceived as contributing to resource decline, existing rules actually in use that determine access to resources, whether these rules are seen as beneficial and fair, the perceived consequences of violating them, whether they

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<sup>96</sup> Bucher, E. H. and P. C. Huszar (1995). "Critical Environmental Costs of the Paraguay-Paraná waterway project in South America." *Ecological Economics* **15**(1): 3-9.

Bucher, E. H. and P. C. Huszar (1996). "Project evaluation and economic development: on using benefit-cost analysis to evaluate Hidrovia." *Ecological Economics* **19**(3): 201-203.

Kawakami de Resende, E. and S. Tognetti (Forthcoming). Ecological and Economic Context of the Proposed Paraguay-Paraná Hidrovia and Implications for Decisionmaking. *Implementing Sustainable Development: Integrated Assessment and Participatory Decision-Making Processes*. H. Abaza and A. Baranzini, UNEP.

<sup>97</sup> The Nature Conservancy brochure on "Water Valuation Methodology for Conservation." Contact: Marlou Tomkinson Church, <mchurch@tnc.org>

<sup>98</sup> Funtowicz, S., S. Lo Cascio, et al. (1999). *The Troina Perceived Water Issue: a Multicriteria Evaluation Process. Environmental Evaluation*. M. O'Connor. Cheltenham, UK/Northampton, MA USA, Edward Elgar Publishing. **1**. De

Marchi, B., S. Funtowicz, et al. (2000). "Combining Participative and Institutional Approaches with Multicriteria Evaluation. An Empirical Study for Water Issues in Troina, Sicily." *Ecological Economics* **34**(2).

<sup>99</sup> Ostrom, E. (1990). *Governing the Commons. The Evolution of Institutions for Collective Action*. Cambridge, Cambridge University Press.

Ostrom, E., R. Gardner, et al. (1994). *Rules, games, and common-pool resources*. Ann Arbor, University of Michigan Press.

are enforced, the kinds of sanctions imposed, and conflicts with more formal, externally imposed rules.<sup>100</sup>

Equally important is a comparison of how institutional settings in which valuation is conducted influences the values elicited from stakeholders. For example, different responses and different kinds of information are obtained when respondents are given the opportunity to learn, deliberate and also contribute to how questions are framed, as occurs in a “Citizen Jury”,<sup>101</sup> than when they are expected to reactively respond to questions framed by researchers, as occurs in a contingent valuation survey. The evaluator is thus just as much a part of the process as those requesting the valuation and other stakeholders. One of the roles of the evaluator is to draw on information generated in different disciplines, by different logics, and at different scales, and to present it in an intelligible form that can be understood by all stakeholders, and that can be validated by experts. Another requirement is that the valuation be based on convincing assumptions about attitudes of the relevant actors.<sup>102</sup>

### ***Linking biodiversity and river basin management***

In recent years, the concept of biodiversity has expanded to include the maintenance of ecosystem functions, which is sustained by the full complement of species, populations, and genetic information influencing that ecosystem, as well as by landscape processes such as the flow of water. At large scales, biodiversity conservation acts as a buffer against long-term and large-scale change. In other words, it has insurance value because it provides options under changing environmental conditions, and increases ecosystem resilience, which refers to the capacity for self-organization in the face of stress from external sources.<sup>103</sup> To the extent that

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<sup>100</sup> Different groups of researchers have tailored this approach for use in evaluating the management of forests and fisheries, so as to provide the basis for comparative analysis among different sites. A handbook for rapid appraisal of fisheries management systems developed by Pido et al (1996) provides a set of more specific guidelines that could easily be tailored for use in examining management approaches. More specifically, it identifies 33 relevant variables in six categories, the kinds of questions that need to be answered, and sources of data and methods that might be used to answer them. These categories are: 1) biological, physical and technical; 2) market (supply and demand); 3) characteristics of fishers, stakeholders and community; 4) fisher/community institutional and organizational arrangements; 5) external institutional and organizational arrangements, and 6) other exogenous factors. A key step is to present the report to the community for validation – a step in which it is more important to identify differences in perspective than to forge a consensus. This particular approach was able to be carried out in a three to six week period by a team of 6-8 researchers. Pido, M. D., R. S. Pomeroy, et al. (1996). A Handbook for Rapid Appraisal of Fisheries Management Systems. Manila, Philippines, International Center for Living Aquatic Resources Management.

Pido, M. D., R. S. Pomeroy, et al. (1997). “A Rapid Appraisal Approach to Evaluation of Community-Level Fisheries Management Systems” Framework and Field Application at Selected Coastal Fishing Villages in the Philippines and Indonesia.” Coastal Management **25**: 183-204.

<sup>101</sup> A Citizen Jury is just one of several processes that have been used in participatory processes that give stakeholders an opportunity for deliberation, and is structured much like a courtroom jury, in which experts provide testimony. Although its decisions are not legally binding, it has been found useful for allowing a small group of diverse stakeholders to examine a problem in some depth, from different perspectives, and may influence a decision process. For more information on participatory processes see: Renn, O., T. Webler, et al., Eds. (1995). Fairness and Competence in Citizen Participation. Dordrecht, Boston, London, Kluwer Academic Publishers.

<sup>102</sup> Laurans, Y. (2001). “Economic evaluation of the environment in the context of justification conflicts: development of concepts and methods through examples of water management in France.” International Journal of Environment and Pollution **15**(1): 94-115.

<sup>103</sup> Perrings, C., K. G. Mäler, et al., Eds. (1995). Biodiversity loss. Economic and ecological issues., Cambridge University Press.

biodiversity is perceived only as an issue of genetic loss, the consequences will be regarded as global, and there may be little incentive for conservation at local levels. However, to the extent that biodiversity is necessary for ecosystem functioning, it may have greater consequences for places and thus more value for local communities, who will have greater incentive to protect it.<sup>104</sup>

As the preceding cases illustrate, most river basin management efforts have been motivated by human utilitarian needs such as flood protection and clean water, in which the protection of biodiversity is largely incidental. Even where there is an explicit purpose of protecting biodiversity, there appears to be little public awareness of the issue. The explicit objective of river basin management to protect biodiversity has only been piloted in a few areas but has the potential to conserve large areas because of the nested quality of river systems. These experiments have not been evaluated to determine whether they are effective for protecting biodiversity, and whether the economic incentives and institutional arrangements are adequate. Linking management to biodiversity conservation is an opportunity for WWF to raise awareness among the public and policy makers within priority ecoregions, because it is in this context that biodiversity conservation takes tangible form as a direct service provider for people.

## Conclusion

This report has reviewed different kinds of incentives for managing river basins that may also help to protect biodiversity. These range from informal, community-based initiatives, to more formal combinations of market-based, regulatory and policy incentives required at larger scales, when threats are beyond the control of affected communities. There are no recipes for determining which incentives are the best or most appropriate in any given situation or can most effectively accomplish the objective of protecting biodiversity, because this depends heavily on site-specific circumstances, and on what is considered fair given those circumstances. A lesson that has been learned from the study of treaties negotiated to resolve international water conflicts is that, while there has been a great deal of effort to define universal principles for equitable allocation, negotiations generally end up with a focus on defining reasonable and equitable use based on needs, and on the uniqueness of the particular basin, which requires historical and geographical information, both biophysical and cultural. However, uses and needs have rarely if ever been explicitly defined to include environmental criteria such as instream flow that would promote conservation of biodiversity.<sup>105</sup> The case studies examined in this report demonstrated that different kinds of economic incentives and other institutional arrangements represent different objectives and different ways of distributing costs and benefits among stakeholders. What is considered fair in one location may not be in another because of different circumstances.

Direct payments for environmental services particularly raise issues of who should pay and how much, and the extent to which providing environmental services is an obligation inherent in the responsibility not to harm others. Unlike other kinds of public goods such as law and order, defense and public health services, environmental services are privately rather than publicly produced, as a result of numerous decisions about land use and resource consumption, by

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<sup>104</sup> Ibid., Eds.

<sup>105</sup> Wolf, A. T. (1999). "Criteria for Equitable Allocations: The Heart of International Water Conflict." Natural Resources Forum 23(1): 3-30.

individual holders of various forms of property rights.<sup>106</sup> These services are more appropriately considered common pool resources because, in addition to the difficulty of excluding freeloaders, decisions about their consumption all have public consequences in that they increase or reduce what is available to others.<sup>107</sup> Property rights are not static and absolute, but have always been contingent upon the affects they have on others, and thus have always changed in response to new kinds of problems and unforeseen consequences of past decisions, as well as new social objectives. Protection of biodiversity is a relatively new social objective, developed in response to problems of environmental degradation, and reflects recognition of consequences that had not been previously considered as relevant factors for justifying policy decisions. Thus it implies a more fluid concept of rights and responsibilities associated with property, which would increase the capacity to respond to environmental variability, consistent with adaptive approaches to ecosystem management.

The potential for market incentives to protect biodiversity will depend on the extent to which protection of biodiversity overlaps with the provision of services that have a market value. For example, while protection of forest cover or wetland areas can often help to reduce flooding as well as protect biodiversity, the incentive to do it, *for flood reduction purposes*, will depend on the extent to which potential damage costs can be avoided, which will depend on whether there are large urban areas downstream that would incur those damages and that may also provide a source of revenue.<sup>108</sup> Another obstacle is the difficulty of linking forest cover to actual flood reduction, particularly in larger basins, where there may be multiple causes associated with any given effect or vice versa. In one case that was reviewed, the water stored in forests was more highly valued for filling reservoirs, particularly when ranching activities for which the forest is cleared have high economic returns.<sup>109</sup>

In general, pollution charges and resource use fees have been found to be effective in reducing pollution from diffuse sources and for generating funds for management of upper basin areas, and seem to be more acceptable to stakeholders when the proceeds are allocated to the basin in which they are generated and when they are able to participate in allocation decisions.<sup>110</sup> An analysis of the advantages and disadvantages of different kinds of tradable environmental allowances,<sup>111</sup> suggests that, in general, they work best for pollution problems at larger scales, to control single more controllable sources of pollution, but are more problematic for dealing with complex relationships among multiple resources. Although they can be designed to accommodate resource variability and other concerns such as economic losses to communities

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<sup>106</sup> Heal, G. M. (2000). Nature and the Marketplace: Capturing the Value of Ecosystem Services. Washington, D.C., Island Press.

<sup>107</sup> Ostrom, E., R. Gardner, et al. (1994). Rules, games, and common-pool resources. Ann Arbor, University of Michigan Press.

<sup>108</sup> Laurans, Y. (2001). "Economic evaluation of the environment in the context of justification conflicts: development of concepts and methods through examples of water management in France." International Journal of Environment and Pollution **15**(1): 94-115.

<sup>109</sup> Aylward, B., J. Echeverría, et al. (undated). Market and Policy Incentives for Livestock Production and Watershed Protection in Arenal, Costa Rica. CREED Working Paper 25. London, International Institute for Environment and Development.

<sup>110</sup> Porto, M., R. L. Porto, et al. (1999). "A Participatory Approach to Watershed Management: The Brazilian System." Journal of the American Water Resources Association **35**(3): 675-684.

<sup>111</sup> Rose, C. (2000). Common Property, Regulatory Property, and Environmental Protection: Comparing Common Pool Resources to Tradable Environmental Allowances. 8th Biennial Conference of the International Association for the Study of Common Property, Indiana University, Bloomington Indiana.

when rights are sold to outsiders, added qualifications and conditions may reduce the pool of buyers and sellers, and the value of the rights. Also, reducing a cap after rights have been allocated for specific amounts may leave public officials vulnerable to charges of “taking” property, and potentially liable for compensating rights holders. A distinct advantage of market-based incentives is that they may also make it possible to reach agreement on at least the minimum amount of biodiversity that should be conserved because this can be treated as a problem of numbers rather than a moral one that can, in principle, be resolved given sufficient information.<sup>112</sup>

However, the greatest values of biodiversity appear to be those which cannot be known in advance, for aspects that have no direct links to market values, and that may be infinite. For example, the amount of biodiversity needed to maintain ecosystem resilience under changing conditions depends on unforeseeable consequences of past practices combined with natural environmental variability and disturbances. Similarly, the consequences of losing ecosystem resilience and of changes in the entire ecosystem are impossible to predict. These are not values that can be objectively determined. Like property rights, values are not absolute. Rather, they arise from transactions and depend on the amount of information that stakeholders have, and on what negotiating parties can agree to. They may also change as problems and conditions change, as learning occurs, and as a result of negotiation and conflict resolution among stakeholders. Decisions to protect biodiversity are then policy decisions rather than strictly economic ones that should address not only how much to conserve, but also questions of how it should be paid for, and by whom.

Informal community-based incentives are likely to remain important for biodiversity conservation, because, in spite of global cumulative losses, the consequences of this loss are experienced at local levels. Among their advantages is that they can work even with a complex combination of rights and responsibilities because of the greater understanding that can be achieved in agreements or contracts that are negotiated in a face-to-face setting, rather than in bundles of rights that must be standardized for purposes of trade among strangers. Greater accountability and monitoring of resource use is also possible at the community level and rights are easier to adjust in response to variability of the resource.<sup>113</sup> However, like market-based incentives, community-based ones are also not sufficient because root causes of biodiversity loss are often beyond the control of particular communities. As is demonstrated by the phenomenon of international wildlife trade, local management regimes may also be more vulnerable to outside commercial pressures to exploit particular resources. This weakens the most basic incentive for conservation, which is the ability of a community to reap the benefits of it and to assure they will have access to the conserved resource in the future.

The inadequacy of community-based initiatives for addressing distant upstream threats or for controlling land uses upstream, combined with the inadequacy of large-scale, centralized, national level approaches, suggests the need to develop collaborative or co-management regimes. Because of conflicting interests found between upstream and downstream stakeholders, as well as between levels of governance, there is no recipe for this either. In fact, co-management

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<sup>112</sup> Heal, G. M. (2000). Nature and the Marketplace: Capturing the Value of Ecosystem Services. Washington, D.C., Island Press.

<sup>113</sup> Rose, C. (2000). Common Property, Regulatory Property, and Environmental Protection: Comparing Common Pool Resources to Tradable Environmental Allowances. 8th Biennial Conference of the International Association for the Study of Common Property, Indiana University, Bloomington Indiana.

attempts often fail because of reluctance to share power, as well as the existence of conflicting incentive structures. For example, upstream land uses may be driven by national level incentives to cut timber for export markets rather than by local needs. However, the process of negotiating co-management agreements can provide a platform for mutual learning among stakeholders, and for conflict resolution about just what it is that they are being asked to collaborate in, which may eventually lead to new incentive structures and management regimes. It may also open up opportunities for giving biodiversity conservation a higher priority in that, it is in situations of conflict and crisis, when ways of life are threatened, that stakeholders become aware of a broader range of factors that are of relevance for their well-being, and have an opportunity to reconsider the values they place on them.<sup>114</sup>

Although there may be no recipes for creating incentives for river basin management, and the process may be a messy one, there are many things that can be done to promote them. The conduct of an institutional analysis, based on biophysical as well as socioeconomic information, provides a way to inquire into the specific context found in a particular basin, better understand the constraints faced by stakeholders, and assess what approaches might be feasible. It can also be used to inform stakeholders, which would give them an opportunity to explicitly consider the level of priority to give to biodiversity conservation as an objective of river basin management, and to contribute to the process of generating new options.

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<sup>114</sup> O'Connor, M. (2000). "Pathways for environmental evaluation: a walk in the (Hanging) Gardens of Babylon." *Ecological Economics* 34(2): 175-194.

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