

# Institutional Complexity, Biodiversity and Ecosystem Services

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## Abstract

The value of ecosystem services is increasingly being recognised (Millennium Ecosystem Assessment 2005). Conservation biologists have suggested that ecosystem service based arguments may be potentially useful in developing support for the preservation of species and diverse ecosystems, but their knowledge of the institutional context for the management of such ecosystems is limited (Chan *et al.*, 2007). There is increasing interest in how market-based instruments can be used to capture these values. Thus, within conservation, direct payments approaches have attracted considerable interest, reflecting the economic approach to ecosystem services within this policy sector. But the market is one among many institutions – there is in fact a range of institutional arrangements to realize the value of ecosystem services. Research on the commons that deals with institutional issues that emerge when resources become valuable has much to contribute to understanding of the institutions relevant to the management of ecosystem services. A number of the institutional challenges that emerge with the management of common pool resources (CPRs, e.g. non timber forest products, water, grazing) are relevant to the new resources created by the establishment of markets for ecosystem services (e.g. water supply, carbon sequestration or pollination). This paper analyses the relevance of knowledge about institutions for commons management to the understanding of ecosystem service based approaches to biodiversity conservation.

**Keywords:** *Ecosystem services, biodiversity conservation, institutional design, commons management, collective action.*

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## Introduction

The conservation of biodiversity is now conventionally expressed in terms of the maintenance of natural capital and the supply of ecosystem services (Costanza *et al.*, 1997; Balmford *et al.*, 2002; Turner *et al.*, 2003, Daily 1997, 2000, Daily and Ellison 2002). It is recognised that the flow of services derived from stocks of natural capital are important elements in overall wealth along with physical, financial, human, and social capital. Ecosystem services include provisioning services such as food, water, timber and genetic resources; regulating services such as the regulation of climate, floods and waste treatment; cultural services such as recreation and aesthetic enjoyment; and supporting services such as soil formation, pollination and nutrient cycling (Millennium Ecosystem Assessment, 2005). The potential synergies between the conservation of biodiversity and the delivery of valuable ecosystem services such as downstream water quality and quantity and carbon sequestration have led to an increasing adoption of novel approaches to old debates, adding an additional dimension to pre-existing conservation concerns over species and habitat loss and extinction. In particular, the creation of markets for ecosystem services is seen as offering new opportunities for biodiversity conservation, especially through leveraging additional resources that are available because of growing international concern over issues such as climate change and water scarcity.

This paper argues that while these linkages between biodiversity outcomes and other valuable ecosystem services offer new opportunities in terms of resource mobilisation, they do not, in themselves, guarantee the spontaneous emergence of institutions to ensure the local delivery of conservation. Scholars working on the commons have documented the complexities of local institutions for resource management in a variety of settings; the creation of new markets for conservation does not necessarily solve these institutional challenges. The paper suggests that it is important to distinguish between the *demand for biodiversity conservation*, which is potentially affected by the emergence of new markets for ecosystem services, and the *supply of conservation outcomes*, which is a function of local institutional arrangements at a variety of scales which do not necessarily change in response to the emergence of these new markets. There are similarities between the challenges in managing the delivery of ecosystem services, and the now-familiar challenges in the context of managing local commons. The paper suggests that there is much that can be learned from the existing commons literature as we consider the potential, as well as limitations, of markets for ecosystem services as a new source of incentives for improved biodiversity conservation management.

### **The institutional challenges of managing biodiversity resources**

Through the twentieth century, a series of strategies to conserve biodiversity have become commonplace, centring on the establishment of protected areas and the integration of conservation and development needs of communities (Western *et al.*, 1994; Hulme *et al.*, 2001, Kramer *et al.*, 1997; Adams, 2004). Both of these strategies encounter problems at the local scale that relate directly to the institutional framework within which they are set.

In the case of protected areas, there are significant tensions between conservation managers and the needs, rights and expectations of local people. Protected areas can impose direct costs on neighbours, from crop raiding wild animals (especially larger herbivores such as elephants or buffalo, or primates), and attacks from predators like big cats (Emerton, 2001; Woodroffe *et al.*, 2005). The displacement of people from parks imposes a significant impact on livelihoods (e.g. Brechin *et al.*, 2003; Chatty and Colchester, 2002; Colchester, 2002; Paudel, 2006). The benefits of protected areas primarily reflect global values (Balmford and Whitten, 2003). Locally and regionally, people benefit through ecosystem services (e.g. constancy of water supply from forest cover). Local people can also receive a share of revenues from tourist fees and from related economic activities, which can include direct employment, land leasing or licensing arrangements, community equity or profit-share schemes, or independent locally-owned commercial activities (such as selling curios, food or cultural performances to tourists). Benefits from development investment targeted on 'support zones' around protected areas can be a significant source of economic benefits to park neighbours (e.g. Archabald, and Naughton-Treves, 2001). However, many actors in addition to local people make calls on such benefits, including local and national government agencies and departments (Adams and Infield, 2003). Access to benefits from conservation (such as social investment or development funds, or profit-sharing from tourist enterprise) is usually subject to rules of eligibility (e.g. formalized membership of a selected community in immediate proximity to the park border) and compliance with a range of regulations. In such arrangements, there is ample room for elite capture of revenues. For instance, Paudel (2006) analyses the distributional inequities of conservation programmes in Nepal, even those intended to benefit local people.

In the case of efforts of integrate conservation and development, experience has shown that diverse projects that tried to address many different aspects of household economies are complex to organise, and vulnerable to over-optimistic planning and limited knowledge of planners (Stocking and Perkin 1992). The micro-politics of such projects are complex, the nature and performance of institutions are critical, and outcomes are often perverse (Brosius *et al.*, 2005). Community-based natural resource management (CBNRM), tried extensively in southern Africa in the 1980s and 1990s in programmes such as such as ADMADE in Zambia and CAMPFIRE in Zimbabwe, focused on allowing local authorities (and through them local people) to benefit from the profits of the private professional safari hunting industry (Fabricius *et al.*, 2004). These CBNRM programmes were based on a series of assumptions about the capacity and working of local institutions. First, it was assumed that communities would be more efficient managers of natural resources in their areas of jurisdiction than other agencies. Second, it was assumed that community management would lead to improved incomes for communities, therefore both making a significant contribution to poverty reduction and providing economic incentives for conservation. Third, it was assumed that community management would reduce human-animal conflict, leading to better tolerance of wildlife and better outcomes for biodiversity. Fourth, there was widespread belief that community management of natural resources would be more efficient than state management, thereby improving efficiency and reducing the costs of management (Hutton *et al.*, 2005). In practice, CBNRM in southern Africa suffered because it did not allow sufficient community control over natural resources, not because communities are inherently unable to manage those resources (Murombedzi, 2001). Decentralization

alone does not create the conditions required for significant community control over natural resources (Ribot and Larson, 2004). In this case, decentralization of control from central to local government did not give sufficient incentive for communities to internalize the costs of resources management (Murphree, 2001; Jones, 2001).

## **Ecosystem Services and Biodiversity Conservation**

In recent policy debates, a new paradigm is emerging in conservation, drawing on arguments based on the value of ecosystem services. The economic valuation of species and ecosystems is now a recognised dimension of conservation science (Costanza *et al* 1997; Daily 1997, 2000; Daily and Ellison 2002; Balmford *et al*, 2002), and received widespread attention in the report of the Millennium Ecosystem Assessment (MEA, 2005). The relevance of ecosystem services to arguments for the preservation of species and diverse ecosystems has been widely noted (Armsworth *et al.*, 2007; Egoh *et al.*, 2007), although understanding of the trade-offs between ecosystem services, biodiversity and human wellbeing remains limited (Chan *et al.*, 2007).

One feature of the growth of neoliberal approaches to environmental management has been increasing interest in market-based instruments to capture ecosystem values (Table 1). The Millennium Ecosystem Assessment defines a series of categories of ecosystem services (provisioning services; regulating services; cultural services; supporting services; see Table 1). Some of these are already subject to market exchange, e.g. provisioning services such as non-timber forest products or grazing or browse resources. Other services are normally not exchanged through the market (regulating, cultural and supporting services). Here, new forms of valuation and new economic products offer the opportunity to create a market for these services that might ensure their sustained availability, for example tradeable pollution permits or 'reduced emissions from deforestation and degradation of natural habitats' (REDD) schemes. The idea of direct payments for biodiversity represents the creation of a market and payment mechanism for paying a particular kind of cultural service (based on existence value) (Ferraro and Kiss 2002).

**Table 1 Ecosystem Services and Payment Mechanisms**

<b>Kind of service</b>	<b>Example of Service</b>	<b>Payment Mechanism</b>
Provisioning services	food, water, timber and genetic resources	Market
Regulating services	regulation of climate, floods and waste treatment;	REDD, upstream/downstream payments
Cultural services	recreation and aesthetic enjoyment;	Direct Payments to conserve biodiversity
Supporting services	soil formation, pollination and nutrient cycling	

Source: Millennium Ecosystem Assessment, 2005.

To conservationists, there are two key attraction of an approach that places monetary values on ecosystem services. First, placing valuing species and ecosystem attributes that were either previously not priced or were undervalued in

monetary terms in theory allows economic appraisal mechanisms such as cost-benefit analysis to take proper account of the full biodiversity values inherent in undeveloped ecosystems. This allows biodiversity to be included in project and programme appraisals for the first time, rather than being treated as an externality.

Second, payment for ecosystem service (PES) programmes that create financial products and payment mechanisms bring a new and potentially large revenue stream into conservation (Swingland, 2002). Under the proposals for Reducing Emissions from Deforestation and Degradation (REDD) in the Kyoto Protocol, countries are to establish a baseline level of deforestation, and any measures to reduce this will be rewarded with emission reduction credits that can be sold on the international market. While forest conservation has long been recognised as an important priority, the REDD mechanism creates a new market, recognising that forest conservation has positive synergies with the mitigation of climate change. In effect, this creates an additional demand for forest conservation, adding to already existing arguments relating to species and habitat loss, the provision of valuable timber and non-timber forest products, livelihoods for poor people, and local ecosystem services. Thus if the international market in carbon created by the Kyoto Protocol (debated at the UNFCCC COP 13 in Bali in 2007) funds 'avoided deforestation', substantial flows of revenue could be generated that could meet under-funding problems and improve the efficiency of forest protected areas (Niesten *et al.*, 2002, Pagiola *et al.*, 2002).

Such payments also create new conservation actors in the form of the clientele for ecosystem services, recruiting parties interested primarily in the service rather than the biodiversity that is attached to it (e.g. in downstream water flows rather than the diversity of swamp ecosystems upstream, or carbon sequestration rather than the biota of rainforest blocks) Thus, for example, payment for carbon sequestration in Indonesia's swamp forests could persuade forest companies to halt timber extraction in favour of this new source of revenue (Pearce 2007). Payments for watershed services have been used to alter the behaviour of upstream land managers in areas as diverse as New York's Catskills watershed and a number of regions in central America (Landell-Mills and Porras 2002), leading to beneficial impacts on biodiversity and delivering desired improvements in water quality and quantity.

### **Institutional Politics and Ecosystem Service Payments**

While payments for ecosystem services offer new sources of funds and broaden the range of actors interested in the protection of habitats, they do not of themselves solve the institutional problems of other approaches to conservation on the ground. One attraction of the PES approach is that it promises to bypass the complex institutional frameworks that lead to the degradation of common pool resources (CPRs) such as forests, water or rangelands, and which are recognised to restrict the effectiveness of community-level conservation schemes (e.g. Hulme and Murphree, 2001). However, as Ferraro and Kiss (2002) note while discussing direct payments for biodiversity, there is every reason to expect that these new economic products will lie within institutional arrangements that are potentially as complex (and whose effects on outcomes is potentially as perverse) as any other resource. Awareness of this appears to be limited among conservation planners. Research on the institutional politics of CPRs, and particularly the institutional issues that

emerge when either the value of common pool resources rises, or new resources are recognised, has much to contribute to understanding of the institutions relevant to the management of ecosystem services. While the creation of a market opportunity may allow the buyer of the service to pay the seller of the service for the service provided, this does not guarantee that there will be suitable institutions in place to ensure the continued supply of the service.

### **Free-riding and Transaction Costs**

Free-riding, a familiar problem in collective action problems, is highly relevant to PES schemes. Thus, take the example of a PES scheme where downstream water users pay upstream farmers to manage their land in ways that ensures a permanent supply of clean water. Where there are multiple farmers with lands in the catchment, there are potential risks of opportunistic behaviour and free-riding, as with any collective action situation. Here, clean water can only be guaranteed to the buyer if *all* farmers switch to organic methods; the presence of chemical fertiliser on any field has the potential to undermine water quality. If there are costs associated with the transition to organic cultivation, the individual farmer has an incentive to free ride, hoping that her individual impact on overall water quality will be small enough to escape detection. If all farmers act in this way, the switch to organic farming will not take place, despite the potential collective gains to both the sellers and the buyers of this ecosystem service. The transaction costs inherent in the coordination of diverse actors is likely to be a considerable constraint on the success to which the newly-created market actually yields effective habitat protection. Such markets are not magic solutions. Perverse outcomes, in terms of negative environmental externalities or transaction failures, are quite likely (Niesten *et al.*, 2002).

While in theory it might seem relatively straightforward for the farmers across a catchment to coordinate their actions to overcome this potential collective action problem, in practice it is often not so straightforward. The contrast is with a situation where *individual* actors respond to the creation of a market for a previously unrecognised ecosystem service (such as a firm that captures HFCs through thermal oxidation techniques for the sale of Certified Carbon Reduction Units under the Clean Development Mechanism), where there may be no collective action problem. However, in many developing country contexts, where conservation interest is focused on PES as a strategy to protect biodiverse habitats, the supply of these services depends on the coordination of multiple actors. Creation of a market for the service does not necessarily guarantee that appropriate institutional structures will emerge.

There is an obvious parallel with a new manufactured product that comes to market. The demand conditions determine the willingness of buyers to purchase the product, but these do not directly affect the manufacturers' production process. They do provide manufacturers with incentives to create products that meet this demand, knowing that there is a market, but do not actually affect choice of techniques. Similarly, in the case of ecosystem services, what payment mechanisms and markets create is an opportunity to sell a service, but in order to do so, the suppliers of that service have to get together to ensure that what is of value can actually be produced. The institutions that are required to produce the service will not

automatically emerge. Just as in the case of institutions for the management of the commons, these have to be created.

The broader point is that the creation of new markets for ecosystem services generates the potential for such services to be supplied, but does not address the lack of the institutions necessary to provide the service. The creation of the new market does not automatically create the conditions under which those services can be produced. So, for example, the creation of an additional market for forest conservation in the form of REDD payments has no necessary impact on the conditions of supply. Countries that have struggled to implement forest conservation policies in the face of weak governance (e.g. Smith *et al.*, 2001) are not necessarily going to be in a position to improve governance structures and monitoring mechanisms simply because there is a new demand for the services provided by avoided deforestation. The existence of large-scale private actors does not necessarily solve these problems (Pearce 2007).

While the REDD mechanism might in theory affect rates of forest conversion by altering the relative economic returns between forest conversion for agriculture and carbon payments under avoided deforestation, it will only do so if the money that is available under the mechanism actually finds its way to the individual actors responsible for forest loss. Where forest conversion is the result of the multiple decisions of numerous actors (e.g. forest settlement smallholders), the institutional challenges of ensuring that payments reach those critical individuals are considerable. The parallel with attempts to 'devolve' benefits from community-based natural resource management in wildlife (e.g. in Zimbabwe, Murombedzi, 2001) are not encouraging. While the sources of revenues are different (big game hunters offering to pay large sums for trophy hunting as opposed to companies seeking to offset their carbon emissions), their net effect is very similar in that they create a potential revenue stream which alters incentive structures for resource managers. Community wildlife management experience suggests that creating a revenue stream is no more than a first step. Once such revenues are available, real impact occurs only when suitable structures are established to ensure that these flows of benefits result in desired behavioural change, and that the opportunity costs of foregone uses are fully compensated. This is not easy to organise; the devil lies in the institutional detail.

Equally, there may be free riding problems at the other end of the market, amongst the buyers of the ecosystem service. If the buyer of an ecosystem service is a single entity, such as a water supply company interested in upstream water yield, it can relatively easily compare the relative costs of installing a filtration unit with the costs of compensating upstream farmers for a switch in their farming practices. If it makes good economic sense, the company's managers are well placed to start to organise the payments necessary to secure the service. However, if the buyers are diffuse, such as the residents of a large city with interests in upstream water supply, there are significant transaction costs associated with aggregating their individual demands for improved water quality into an effective offer that can be put to the service provider. An intermediary is required in order to consolidate this demand, and this is the role that is often played by government bodies, who act on behalf of their citizens in such quasi-public good situations.

## **Institutional issues in the management of ecosystem services: drawing on the commons literature**

What the previous section has highlighted is that the presence of multiple buyers and multiple sellers in the market for ecosystem services is likely to result in familiar problems associated with aggregating the actions of these often-diffuse actors, and coordinating their behaviour in order to achieve collectively beneficial outcomes. For scholars of the commons, this much is well known. However, it is interesting to note that this fairly straightforward observation appears to have been somewhat neglected because of the optimistic hype surrounding payments for ecosystem services. There appears to be an assumption that the creation of a new market will automatically result in a ready supply of the desired ecosystem services, and that there will be appropriate institutional arrangements to ensure its availability over time. These institutional challenges arise in at least five contexts, each of which are familiar to those who work on the political ecology of the commons, and are summarised here:

(i) First, existing institutions may be relevant to resources underpinning an ecosystem service, but in ways that prevent its value being realized. Thus private ownership of forest land or timber extraction rights allows private benefits from timber extraction but may prevent realization of public benefits of water supply. If the benefits to the right holder exceed the benefits they can derive from delivering wider ecosystem services, a PES scheme will not lead to conservation of forest.

(ii) Second, ecosystem services are novel, and often not obvious without complex scientific appraisal. Thus debates about carbon dynamics of forests are intellectually challenging, and it is not clear that simple 'rules of thumb' that seek to create a simple market will yield reliable results. Nor is it clear that revenue flows from such an ecosystem service will be understood by actors on the ground and accepted so that free riding is avoided. A related problem is that ecosystem services are often difficult to delimit in space (e.g. flood mitigation) and may be episodic in time (e.g. due to market changes or climate change). It may not be obvious to all parties that such resources exist, or what determines their availability. Such resources are hard to identify, bound and manage.

(iii) Third, the values attached to flows of ecosystem services are also subject to change, as markets change. Therefore, despite the costs and political capital necessary to establish a PES system, there is no guarantee that this will endure. Such systems need to be flexible. Creating such flexibility is itself a huge challenge.

(iv) Fourth, there is a distributional politics to access to and benefits from ecosystem services. The interests and capacity to manage ecosystem services and CPRs will vary between actors. Wealth, power, gender etc. are as relevant to ecosystem services as to CPRs.

(v) Fifth, the creation of institutions and organisations to manage PES is a complex and potentially politically contested process. The development of novel strategies for paying for ecosystem services reflects that of the creation or modernization of institutions for managing CPRs (e.g. water rights and water management associations). Such transformations often create tension between traditional and



modern institutions (e.g. state-linked rational resource management organizations based on nominally democratic 'committee' structures, and existing institutions rooted more closely to culture, power and belief in wider local society (such as traditional leaders, chiefs, spiritual leaders)).

Each of these problems is well rehearsed in the commons literature, and there is a considerable wealth of both empirical and theoretical literature exploring these design and implementation issues in some detail. This paper will not attempt to exhaustively review this literature, but simply points to the need to recognise the parallels between the existing body of scholarship on the commons, and the emergent interest in the provision of ecosystem services in response to newly-created market opportunities.

## **Conclusions**

The creation of markets for ecosystem services does not, in itself, offer any solutions to the ever-present problems of collective action associated with aggregating the interests of diffuse agents involved in both the production and consumption of these services. Clearly, the transaction costs of negotiating and monitoring market-based solutions need to be compared with the perceived efficiency gains from implementing such solutions for the delivery of ecosystem services (Vira, 2002). The fact that a market *can* be established is insufficient to ensure that appropriate supply-side arrangements exist for the delivery of ecosystem services, or that buyers can be meaningfully aggregated to create sufficient demand. Institutional considerations are critical to on-going policy debates about the importance of ecosystem service markets as a new strategy for the conservation of biodiversity; considerations that are all-too familiar to those who have worked on the commons for these past many decades.

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