

Author: Paul J. Ferraro

Address: Cornell University
Department of Applied Economics and Management
Warren Hall
Ithaca, NY 14853-7801
pjf8@cornell.edu
607-255-2085/607-255-9984 (fax)

Title: Global Habitat Protection: limitations of development interventions and a role for conservation performance payments. *Department of Applied Economics and Management Working Paper no. 2000-03 (Revised)*. Cornell University, Ithaca, NY. (forthcoming in *Conservation Biology* 2001)

Global Habitat Protection: limitations of development interventions and a role for conservation performance payments

Abstract

Conservation biologists, policy makers, and citizens have identified the protection of native ecosystems in low-income nations as a global social objective. Among the more popular initiatives to achieve this objective is the use of development interventions in the peripheral areas of endangered ecosystems. Such interventions *indirectly* provide desirable ecosystem services through two mechanisms: (1) by re-directing labor and capital away from activities that degrade ecosystems (e.g., agricultural intensification); and (2) by encouraging commercial activities that supply ecosystem services as joint products (e.g., ecotourism).

By examining the economics of such interventions and the available empirical evidence, I argue that development interventions are hindered by: (1) the indirect and ambiguous conservation incentives that they generate; (2) the complexity of their implementation; and (3) their lack of conformity with the temporal and spatial dimensions of ecosystem conservation objectives.

In contrast, paying individuals or communities *directly* for conservation performance may be a simpler and more effective approach. In recent years, there has been widespread experimentation with contracting approaches to ecosystem conservation. Conservation contracting can: (1) reduce the set of critical parameters that practitioners must affect in order to achieve conservation goals; (2) permit more precise targeting and more rapid adaptation over time; and (3) strengthen the links between individual well-being, individual actions, and habitat conservation, thus creating a local stake in ecosystem protection. In situations where performance payments are unlikely to

work, indirect development interventions are also unlikely to work. Thus despite the potential barriers to developing a system of conservation contracts in low-income nations, the analysis suggests that performance payments have the potential to improve the way in which ecosystems are conserved in low-income nations.

Introduction¹

Imagine that you live in a house that needs no air conditioning because the trees on your neighbor's property provide shade to cool your home. Recently, however, a new person moved into your neighbor's house. He wants to cut down the trees because he has installed solar panels to reduce his electricity bills. Cutting down the trees will increase the efficiency of the panels, but will require you to install air conditioning and pay much higher electricity bills. Your visiting uncle suggests a plan for ensuring that your neighbor's trees remain standing. He suggests that you create alternative employment and investment opportunities in which your neighbor's returns to labor and capital are so high that he will not want to invest time or money in cutting down his trees.

You may, however, decide that it is easier, and probably cheaper, to simply offer your neighbor an annual payment to leave the trees standing. The payment would have to be large enough to compensate your neighbor for the foregone reductions in his electrical bills, but it would probably be far less than the cost of occupying your neighbor's resources in other activities. Moreover, the probability that the trees will remain standing is higher.

Paying your neighbor to leave his trees standing because they provide a valuable service would strike few people as misguided. In low-income nations, however, citizens and governments interested in habitat and biodiversity conservation have adopted your uncle's less direct and more complex approach. Rather than make explicit payments, they use field-based project and policy interventions to transform local and regional economies in ways that encourage individuals to invest in activities that do not lead to habitat or biodiversity loss. They propose, in effect, to guide the economic development

process toward paths that are compatible with ecosystem protection.

The premise underlying these interventions is sound: if residents near a threatened ecosystem are the principal agents of change, their behavior must change to protect the ecosystem. Even if residents are not the principal agents of change, they are often in the best position to protect the ecosystem and so influencing their behavior is important. Problems arise, however, when one examines the links between ecosystem conservation and the myriad interventions proposed by conservation practitioners (e.g., agroforestry, ecotourism). The next section explores the logical problems associated with using development initiatives to address the loss of *intact ecosystems (habitat)* and the concomitant loss of *biodiversity*. The final two sections introduce a more direct approach that depends on explicit payments tied to conservation results.

The purpose of this paper is to draw attention to and generate discussion about a system of direct payments for achieving ecosystem conservation objectives in low-income nations. Emphasis is placed on the positive aspects of direct payments. Problems associated with systems based on direct payments are not ignored, however, and I hope that this paper can serve as a foundation for examining direct payment systems more thoroughly.

Development Interventions as Means to Achieve Ecosystem Conservation

In this section, I focus on *field-based* interventions, such as technology transfers, that target individuals living near an ecosystem. Broader policy interventions, however, are clearly important in low-income countries. Ecosystem degradation is often stimulated

by road building in remote areas, by direct and indirect subsidies for production activities, and by policies that encourage farmers to clear land in order to avoid taxes or gain property rights. Changes in these policies are thus a necessary condition for ecosystem conservation, but they are unlikely to be sufficient. In the best cases, broad policy changes will reduce pressures on ecosystems by slowing conversion, but they are unlikely to remove all of the individual-level incentives for converting habitat to other uses. Habitat conservation will typically require more precise, field-level incentives.

Below, I identify three principal problems associated with using development interventions to protect ecosystems. First, given the complexity of development interventions and the temporal and spatial scales at which conservation objectives must be achieved, field practitioners are forced to spread their resources over myriad tasks that often have no effect on conservation-related household behavior. Second, when practitioners do manage to have an effect, it is often an undesirable effect from a conservation perspective. Third, even if practitioners generate a desirable effect, they often have difficulty sustaining it because the effect depends on market conditions that change frequently.

Barriers to Change

Experience with development interventions over the last four decades indicates that simply raising standards of living and encouraging economic growth is a major undertaking in many countries (World Bank 1988; Porter et al. 1991). Advocates of development-based conservation interventions propose a much more difficult task. They propose, in effect, to guide or control the development process so that specific behavioral

changes will occur and precise conservation objectives will be achieved. They are attempting not simply to effect change, but to control the precise evolution of the change.

Reviews of development projects have faulted many interventions for being too complex and too diffusely targeted to have any impact on local conditions and behaviors (e.g., Hirschman 1967:22-27; *1966 Korry Report* in Copson et al. 1986; World Bank 1988; Fox 1996). A general lesson has emerged: one must keep the intervention focused and flexible, and composed of a small set of tasks with a medium to high likelihood of success.

Development-based conservation interventions, however, often exhibit the exact opposite characteristics. For example, the annual work plans for five integrated conservation and development projects in Madagascar listed on average forty key activities, not including administrative tasks (CI 1995; PPNR 1995; VITA et al. 1995; WWF 1995; CI et al. 1996). Moreover, many of the tasks listed (e.g., intensify agriculture, develop community institutions) were likely to involve many sub-tasks in order to be successful.

Given the immediacy of conservation objectives and donor demands, practitioners must also achieve results quickly. Development interventions, however, rarely produce significant transformations of economies and individual behavior in the short run. New technologies, markets, and attitudes take many years to develop and slowly work their way through societies.²

In order to reconcile the short-term immediacy of habitat conservation objectives with the slow pace of social change, conservation practitioners resort to two approaches, often in combination. The first approach is to regulate by force in the short run, while

waiting for changes in resource use incentives to materialize. Successful development interventions, however, depend on trust and cooperation between residents and outside technicians. Trust is difficult to engender in the presence of repressive force. The second approach involves spending large amounts of money and resources to introduce new technologies, infrastructure, and attitudes quickly. The history of development interventions in low-income nations, however, speaks for itself: attempts to introduce multiple technological, institutional, and attitudinal changes simultaneously typically fail (World Bank 1988; Porter et al. 1991).

The fundamental tension between the time horizons of conservation and development objectives is further exacerbated by differences between the appropriate spatial scales at which conservation objectives and development interventions are realized. Ecosystems are often very large and encompass many biological and cultural zones. Thus the effort to conserve them must be accomplished at a landscape scale. Development initiatives, however, are context specific and often best begun on a small-scale (Bunch 1982) or with a narrowly defined focus (World Bank 1988). When practitioners quickly introduce new technologies, markets, and attitudes at large scales they spread their resources thinly over a large territory, thereby diluting or misdirecting their impact.

Barriers to Desirable Change

Even if conservation practitioners are able to effect changes in a local economy, their interventions may not alter the incentives that prompt rural residents to degrade habitat. Rather than serving as substitutes for ecosystem-degrading activities, the new

technologies and employment opportunities introduced by conservation practitioners are often complements (Ferraro et al. 1997). In other words, residents adopt the new technologies or employment opportunities (e.g., animal husbandry) *and* continue to engage in activities that threaten ecosystems (e.g., hunting).

Moreover, the new technologies or employment opportunities can exacerbate habitat loss. For example, contrary to the dominant hypothesis of many conservation and development projects, agricultural intensification will *not* necessarily take pressure off of native ecosystems. In fact, some studies suggest the opposite: decreases in input prices (Ozorio de Almeida & Campari 1995; Lewandrowski 1997) and increases in productivity (Wiersum 1986; Barraclough & Ghimire 1995; Kaimowitz & Angelsen 1998:51; Foster et al. 1999; Angelsen 1999) in low-income nations are associated with increases in the area of land under agriculture. Two recent reviews have found that the relationship between intensification and ecosystem protection in low-income nations was indeterminate (Kaimowitz & Angelsen 1998; Lee et al. 2000).

Successful agricultural development interventions raise household incomes. More income permits farmers to purchase more labor and capital with which to further expand their activities. The needs of most people are not finite, particularly those of poor farmers. If farmers can be better off by expanding new or old technologies into intact ecosystems, they will do so. An increase in the returns to agriculture can therefore be equivalent to an increase in the opportunity costs of conservation. In such cases, conflicts between local residents and conservation practitioners will grow with increases in agricultural productivity.

Successful agricultural development interventions in rural areas typically also require improvements in transportation and market infrastructure. A review of deforestation analyses (Kaimowitz & Angelsen 1998), however, found that many studies link deforestation to proximity and quality of transport routes and markets. Better infrastructure can make pro-conservation activities more profitable, but it can also make other activities more profitable as well.

The introduction of better infrastructure and new livelihood opportunities also tends to encourage immigration into a region. Thus, even if one could implement a labor-absorbing development strategy to promote habitat conservation, the pool of labor may simply expand and render the strategy ineffective. Unless current residents have a direct incentive and the ability to protect the ecosystem from conversion, the entire “agricultural sector” near the ecosystem will expand. This phenomenon has been noted in case studies and general equilibrium analyses (e.g., Jones 1989; Elahl & Khushalani 1990; Coxhead & Jayasuriya 1994; Ferraro et al. 1997; Oates 1999).

A paradox seems to exist. Stagnation in the agricultural sector can put pressure on forests as farmers extensify their production and the landless migrate to the forest margins. On the other hand, agricultural profitability threatens forests by increasing incentives to clear land for cultivation. The paradox is resolved by recognizing that, at the most fundamental level, the profitability of agriculture, no matter how marginal, drives habitat conversion. Therefore, only the profitability of conservation can arrest it.

To increase the profitability of protecting ecosystems, practitioners have turned to another popular approach: market-based initiatives, such as selective timber logging or nontimber forest product extraction, that raise the local value of intact ecosystems and

thereby maintain ecosystem services as joint products. Experience to date with such initiatives, however, indicates that success is likely only under limited conditions (Campbell et al. 1999; Salafsky et al. 1999). The task of turning remote rural residents into eco-entrepreneurs is complex, and most projects yield too few benefits, for too few people, to compete with activities that lead to habitat conversion (Browder 1992; Richards 1993; Lawrence et al. 1995; Smith 1996). Attempts to increase the benefits from ecosystem use often lead to the degradation or simplification of the ecosystem (Freese 1997). Even low intensity, subsistence (Redford 1992) or commercial (Howard et al. 1996; Peres 1999) activities can lead to the same outcome. Moreover, the scientific data required to determine appropriate extraction levels may be expensive to gather (Freese 1997). Other authors have also noted problems related to the sustainability of extractive initiatives (Tewari & Campbell 1996; Barrett & Arcese 1998) and the inefficiencies of subsidies that are often required to make eco-activities profitable (Simpson & Sedjo 1996).

Despite the theoretical appeal of interventions oriented toward increasing the local value of intact ecosystems, the practical implementations to date have many shortcomings: they often fail to match the benefits generated by ecosystem conversion, they can lead to undesirable ecosystem simplification, and they require significant resources to implement, monitor, and sustain.

Barriers to Sustaining Desirable Change

Even if practitioners overcome the problems outlined above, an important obstacle remains: how to maintain the created system of incentives for habitat protection.

Development-based conservation approaches appear to assume implicitly that one can intervene in an area, transform the local or regional economy, exit, and then watch as the transformed system rolls along in perpetuity. Societies, their economies, and their environments, however, are never static. Prices change, roads degrade, new pests develop, and new information arrives. Development-based initiatives will therefore inevitably require repeated interventions over time. In the long run, such approaches are likely to be extremely expensive, even if they are successful in the short run.

A Role for Conservation Performance Payments

Development interventions will not make ecosystem protection optimal for rural residents in many areas of the world. As argued above, the links that development interventions create between individual well-being and habitat conservation are often vague and indirect, or simply nonexistent. Thus conservation practitioners find that creating an appropriate set of incentives and maintaining these incentives over time is difficult.

Despite the difficulties in using development interventions to promote habitat protection, conservation practitioners should not abandon attempts to change field-level incentives. As Laarman (1995:53) argues, the challenge is to test and ultimately implement interventions superior to our current efforts, not to discard the principles of intervention. Given the discussion above, ideal interventions should have the following characteristics:

- 1) they are relatively simple, in the sense that they allow practitioners to focus their energy on a few activities with high probabilities of success;
- 2) they achieve conservation objectives in the short-term and the long-term;
- 3) they achieve conservation objectives at the scale of ecosystems;
- 4) they provide clear, direct incentives for residents to actively protect habitat;
- 5) they deter entry/immigration; and
- 6) they reduce the social and political conflicts over resource allocation that often endanger ecosystem survival.

To design an intervention possessing these six characteristics, practitioners may consider an *International Habitat Reserve Program (IHRP)*. An IHRP is a system of institutional arrangements that facilitates *conservation contracting* between international or national actors and individuals or groups that supply ecosystem services. The contracts specify that the outside agents will make periodic performance payments to local actors if a targeted ecosystem remains intact or if target levels of wildlife are found in the ecosystem.

The notion of compensating people for their role in maintaining resources that have a global value is not new (Barbier & Rauscher 1995; Swanson 1995; Simpson & Sedjo 1996). Direct compensation schemes for individuals living near threatened ecosystems are rare, however, because there are serious obstacles to designing an effective scheme (Simpson & Sedjo 1996; Ferraro & Kramer 1997). Practitioners must deal with strategic behavior by recipients, the complexity of institutional design, conflicts over property rights, and potentially high costs of implementation. Practitioners can,

however, learn from existing initiatives that pay individuals or groups for conservation performance.

The best known conservation payment initiatives are the agricultural land diversion programs of high-income nations. In Europe, fourteen nations spent an estimated \$11 billion (1993-97) to divert well over 20 million hectares into long-term set-aside and forestry contracts (OECD 1997). In the United States, the Conservation Reserve Program (CRP) spends about \$1.5 billion annually to contract for 12 - 15 million hectares, an area twice the size of all national and state wildlife refuges in the lower 48 states (Clark and Downes 1999).³

These conservation contracting programs account for only a few percent of agricultural support budgets, but they are among the fastest growing payments to farmers in high-income nations (OECD:14). Their dramatic growth is partly due to their popularity among various stakeholders (OECD:20) and the opportunities they afford for flexible targeting and adjustment to local conditions (OECD:48). Moreover, payments for enhancing the supply of environmental goods and services are likely to be one of the few government transfers to rural farmers that global trade organizations, like the WTO, will countenance (Potter & Ervin 1999).

Nongovernmental organizations (NGOs) have also developed innovative direct payment approaches. The Delta Waterfowl Foundation, for example, has an “adopt-a-pothole” program that pays prairie farmers who protect nesting areas for ducks (Delta Waterfowl Foundation 2000). The Defenders of Wildlife have a program that rewards landowners for occupied wolf dens on their property (Defenders of Wildlife 2000).

Although rare outside of high-income countries, direct payment systems can also be found in the tropics. In the last four years, Costa Ricans have created institutional mechanisms through which local, national, and international beneficiaries of ecosystem services compensate those who protect ecosystems (Castro et al. 1998; Calvo & Navarrete 1999). Costa Rica's 1996 Forestry Law (no. 7575) explicitly recognizes four ecosystem services: carbon fixation and sequestration, hydrological services, biodiversity protection, and scenic beauty. The law gives landowners the opportunity to be compensated for the provision of these services.

Costa Rican practitioners have identified sources of financing and have developed rules for allocating available funds. Funds are allocated through the National Forestry Financial Fund (FONAFIFO), which works directly with landowners and indirectly through third-party intermediaries (e.g., NGOs). FONAFIFO raises money from international donors and national sources, such as a fuel tax and payments made by hydroelectric plants. FONAFIFO then distributes the money through contractual arrangements with private individuals and groups.

FONAFIFO establishes contracts for three land use categories: reforestation, sustainable forest management, and forest preservation. The forest preservation category is the most common contract. Each category is associated with a fixed annual payment per hectare. Regional conservation agents and third-party NGOs identify potential participants based on regional conservation priorities. They often target land buffers around protected areas. Landowners who are awarded contracts receive annual payments if they comply with the contract.

Costa Rica's Environmental Services Payment program is new, but appears to be having some success. On a June 1999 trip, I observed excess demand for conservation contracts among landowners and support for the program from many sectors. However, serious issues remain, including minimizing transaction costs, designing and targeting contracts, and developing appropriate institutional rules and roles.

In large part, the design of a direct payment initiative depends on field conditions and conservation objectives. In one region, targeted lands may already be in private hands. In another region, the lands may be publicly owned, but a fraction of the total land will be ceded to local residents, as individuals or as groups. For some ecosystems, a payment for preventing deforestation may be sufficient. In others, bonuses may be paid if periodic surveys indicate the presence of target levels of wildlife. In areas where wildlife are agricultural pests or injurious to humans, compensation payments for damage may also be required (e.g., predator compensation funds of Defenders of Wildlife and the World Wildlife Fund).

Despite the details that must be addressed, conservation performance payments offer clear advantages over the use of less direct development interventions.

Simplicity and Appropriate Scales

With direct payments, practitioners can focus their scarce resources on two key tasks: the design of appropriate institutions and payment schemes. With a smaller set of parameters to influence, practitioners are more likely to achieve their conservation objectives. Furthermore, they can be confident that if a contract is struck, the conservation effect will be positive.

With regard to spatial scale, performance payments are amenable to a landscape approach. For large areas that include different agro-economic zones, the complexity of using development-based interventions to promote habitat conservation is substantial. Practitioners must tailor supporting institutions, infrastructure and appropriate technologies to each zone. Using a contract approach, practitioners need only focus on variations in institutional arrangements across zones. Because performance payments can be targeted more precisely than development interventions, practitioners can also be more confident that their interventions will have an effect on the areas targeted for conservation (e.g., corridors) rather than elsewhere. An OECD study of land diversion programs (OECD 1997:48) noted that in the EU, “[i]mplementation is based on national and regional plans and offers opportunities for flexible targeting and adjustment to local conditions.”

Performance payments are also amenable to the short time horizon under which conservation objectives must be met. As soon as the money and the institutions are ready, payments can be made, thus quickly establishing the link between conservation and resident well-being. Practitioners can sustain this link with appropriate financial and institutional design (e.g., endowments). If conditions change dramatically, practitioners can adapt and re-orient by adjusting payment levels, target areas, or institutions.

Clear Conservation Incentives

With payments that are conditional on conservation results, the connection between conservation expenditures and objectives is unambiguous to both recipients and donors. Recipients face a clear choice: protect a parcel of land and receive payments or

clear the parcel and forgo the payments. Donors may find conceptualizing and observing the effects of their expenditures easier than with development-based interventions. Funds may therefore be more forthcoming (Simpson & Sedjo 1996).

The explicit connection between payments and conservation objectives also sends a clear signal to residents that ecologically valuable land is economically valuable. In contrast, current conservation efforts often send a signal to residents that they should preemptively clear land lest it be regulated or expropriated. In the Costa Rican payment program, some observers believe that farmers without contracts are forgoing clearing forest in the hope that they may secure a contract in the future (F. Tattenbach, FUNDECOR, per. comm. 1999).

By virtue of the direct link between payments and conservation objectives, performance payments create incentives for local residents to have an *active* stake in protecting ecosystems. In contrast, many indirect development-based approaches (e.g., agricultural intensification) encourage *passive* conservation by local residents. Residents do not make a deliberate choice to protect an ecosystem; the targeted ecosystem is simply not used in productive activities and thus is not degraded. Without active local involvement in conservation, however, many ecosystems will remain open-access resources under continuous threat of conversion.

An increasing amount of evidence indicates that private and common lands are often managed better than government lands for ecological services (Laarman 1995:12). This outcome is especially likely when local institutions can coordinate monitoring and enforcement efforts. Of course an important problem with private control of ecosystems is the divergence between private and social values. With performance payments,

however, private agents capture social values attributed to the ecosystem and thus private and social objectives can coincide.

While providing clear benefits to residents, performance payments provide fewer incentives for immigration than more diffuse development interventions do. Newcomers cannot capture a share of the benefits by simply arriving in a region; they must hold a conservation contract. Contracts also eliminate the open access character of many ecosystems by effectively allocating the land to a use by local residents (i.e., conservation). There are anecdotal examples of indigenous people gaining property rights over formerly public lands after which immigration was curtailed (Mbanefo and de Boerr 1993; Laarman 1995:38).

Rights and Responsibilities

In the context of performance payments, residents are cast as providers of valuable services. Their role is changed from adversary to collaborator. This change not only helps to avoid the ethical dilemma of denying poor or indigenous people the ability to earn a livelihood, but it also improves conservation enforcement by creating “citizen guards” who have an active interest in protecting ecosystems. Casting residents as collaborators can also render conservation education more effective. Residents are not told what they are doing wrong, but rather what they are doing right.

At the national and international level, conservation contracts encourage the beneficiaries of ecosystem conservation to pay for those benefits. In particular, the participation of wealthy nations in the conservation of ecosystems in low-income nations has long been recognized as a critical component of global biodiversity protection

(Article 20(2) of the Convention on Biological Diversity 1992; World Bank 1992). A controversial aspect of development-based conservation approaches, however, is that much of the financial transfers leave a local area through physical capital purchases and salaries of myriad ex-patriate and host-country experts. Direct payment initiatives ensure that more of the transfers stay in a region.

Host-country governments are also less likely to perceive performance payments as weakening national sovereignty. Industrialized nations are not pressuring low-income nations to set aside lands for protection, but rather they are engaging in a contractual agreement much like any contract for the supply of a service.

Principal Issues in Conservation Contract Design

Although conservation contracts have advantages over less direct development interventions, they are neither easy to implement nor a one-size-fits-all intervention. Practitioners must overcome obstacles inherent in institutional design, property rights, financing, and strategic behavior by potential beneficiaries. The same obstacles, however, often play a central role in the implementation of development-based interventions. Conservation contracting has the advantage of allowing practitioners to focus their energies on overcoming these obstacles.

Institutional Design and Human Capital Investments

In order to design a payment program, practitioners must identify the institutions that will implement the program. Who will raise the money? Who will distribute the

money? What institutions will guarantee the rights to benefits distributed by the system? Will coordination among rural residents be required, and if so, how will this be accomplished? How will the legal system be made accessible to rural residents? How will statutory laws and institutions be meshed with traditional ones?

An OECD study of agricultural land diversion programs (OECD 1997:48) noted that while the EU programs are successful by many criteria they “also [require] major technical and administrative expertise on the part of regional and local authorities. The lack of organisational capacity and experience could limit the potential of the programme, especially in countries that have never operated similar schemes before.” Practitioners in low-income nations can learn from direct payment initiatives in the industrialized world and Costa Rica, but the institutional requirements of a direct payment scheme may be insurmountable in many areas.

Practitioners must also design institutions that can ensure participating rural residents receive their rightful benefits. Institutions must thwart attempts by powerful individuals to divert payments or to use the distribution of benefits as a tool to enhance their power. Experiences in low-income nations and Eastern Europe suggest that preventing such outcomes is no easy task. In so far as conservation contracting adds enforcement eyes to the system, however, direct payment initiatives may reduce the corruption currently observed in government-controlled natural resource management. Practitioners can also learn from recent attempts to use NGO advocates and transparent institutions to share with rural residents the revenues from tourism (Peters 1998) and wildlife culling (Muir & Bojö 1994).

Conservation contracting requires periodic payments and monitoring over time.

Thus the use of performance payments implies long-lived institutions and financial support. An advantage of development-based interventions is that they seem to require only short-term investments to achieve long-term results. But as a recent World Bank analysis (Wells et al. 1999: 26) noted, conservation initiatives “based on simplistic ideas of making limited short-term investments in local development and then hoping this will somehow translate into sustainable resource use and less pressure on parks need to be abandoned.”

Thus despite its imposing institutional needs, a system of direct payments has many of the same institutional requirements as development-based interventions. Both require institutions that can monitor ecosystem health, resolve conflict, coordinate individual and institutional behavior, and allocate and enforce rights and responsibilities over time (Brown & Wycoff-Baird 1992; Wells et al. 1999). Unlike more complex development interventions, however, direct payment initiatives allow practitioners to focus their resources on designing and maintaining the requisite institutions. A narrower focus will not guarantee a better outcome, but past studies of field interventions have suggested it can help substantially (World Bank 1988; Porter et al. 1991).

Property Rights

Closely related to institutional design is the specification of property rights over the contracted areas. Given differences in conservation objectives and in biophysical, cultural, and socio-economic characteristics across regions, there is no single correct way to specify property rights. In some areas, individuals may have, or be given, full, alienable property rights. In other areas, their rights may be more circumscribed. In one

situation, rights may be allocated to individuals, while in another case, rights will be allocated to groups.

The key task in any conservation initiative is to ensure that those who invest in conservation have clear, enforceable rights to the benefits from their efforts. History demonstrates, however, that allocating (or re-allocating) property rights can be an expensive and conflict-ridden process (e.g., Sobhan 1993). Moreover, without strong institutions to enforce rights (see previous section), conservation contracting will contribute little to ecosystem protection. In rural areas of low-income nations, legal institutions are weak at best, and thus the costs of establishing and enforcing property rights may be prohibitive.

Another difficult task for practitioners is the identification of the individuals to whom property rights will be allocated. Rights must be allocated to those who can control the use of the resource. The choice of who will, and who will not, receive the rights to payments, and therefore the rights to exclude others from the resource, is open to political manipulation and can produce conflict. Allocating property rights may be one of the most serious challenges to conservation contracting.⁴ Of course, allocating rights and brokering the interests of different stakeholders have also been identified as critical components of development-based conservation projects (Brown & Wycoff-Baird 1992).

In some countries, the rule of law, both traditional and formal, is weak or nonexistent. In such cases, conservation contracting may be impossible. In the same circumstances, however, traditional development interventions or public ownership of ecosystems are also unlikely to lead to desirable conservation outcomes.

Strategic Behavior and Displacement of Threat

Practitioners must anticipate strategic behavior by people who will attempt to extract maximum benefits from the program. For example, the promise of payments could encourage people to feign interest in converting lands that would not have been converted in the absence of payments. Residents holding contracts may also convert or harvest from substitute ecosystems that would not have been exploited in the absence of contracts. Other potential strategic behaviors include seeking short-term conservation contracts simply to overcome credit constraints and generate cash for making ecosystem-degrading investments. The potential for such behaviors, however, also exists in development-based conservation initiatives.

Residents may also try to exert market power to force conservationists to pay unusually high rents. Practitioners can mitigate the negative consequences of market power through appropriate institutional design (e.g., U.S. CRP competitive bidding system). Politically powerful citizens may be able to influence the allocation of contracts such that funds are not allocated to areas of high conservation value, but rather high political value. Such an outcome, however, is also widespread in the allocation of development investments. A transparent parcel ranking equation based on objective criteria may help to prevent such an outcome in direct payment initiatives.

Strategic behavior may also be found in the period prior to project implementation. If there is widespread publicity about conservation payments, wealthier and more knowledgeable individuals may engage in land speculation, in the hopes of securing a large portion of the payments. Practitioners may also see an influx of immigrants hoping to be considered “residents” when property rights are allocated or

immigrants who simply do not understand that they need to hold a contract to benefit from the program.

Payment Costs

The notion of paying for people to protect habitat may strike some as an expensive proposition. Many of the regions in which conservation practitioners work, however, are at the margins of the economy where land uses are not very profitable. Analyses of land use around protected areas indicate that residents would accept payments from \$28 - \$190 per year per hectare to forgo the benefits of ecosystem conversion (Ferraro 1994; Shyamsundar & Kramer 1996; Smith & Mourato 1998). In Costa Rica, annual payments of \$35 per hectare generate excess demand for conservation contracts (Calvo & Navarrete 1999).

Practitioners may also find that they do not need to make payments for an entire targeted ecosystem to achieve their objectives. They need only include “just enough” of the ecosystem to make it unlikely, given current economic conditions, infrastructure and enforcement levels, that anyone would convert the remaining area to other uses. Thus, in a well-designed system, not only will residents protect contracted lands near their communities, but they will also protect the remaining ecosystem beyond their lands. The area that constitutes “just enough” may change over time, but with performance payments, practitioners can adjust rights and payments to maintain the required incentives.

The maintenance of biodiversity and other ecological services may also be compatible with some uses (e.g., tourism, extraction of forest products). In these cases,

payments would have to compensate residents for a subset of the foregone development options, but not all of them. Unlike indirect investments in eco-enterprise development, however, performance payments achieve conservation objectives regardless of whether or not markets support commercial use of the ecosystem.

The absolute value of performance payments should be evaluated in light of how much money is now being spent on conservation initiatives. Some habitat conservation initiatives have spent up to \$1 million per year in very small areas. Very few, however, have been able to dramatically change local incentives for habitat protection (see for e.g., Wells et al. 1992; Ferraro et al. 1997; Hackel 1999; Wells et al. 1999; Oates 1999). Considering the likely costs of using development interventions to create *and maintain* incentives for habitat protection, performance payments may be very cost-effective over the long run.

With a budget equivalent to the U.S. Conservation Reserve Program in 1996 (\$1.8 billion), practitioners could make annual payments on up to 60 million hectares. With appropriately targeted payments across the landscape, the actual number of hectares effectively protected could easily be triple or quadruple this amount. To put this area into perspective, consider that in 1996, 309 million hectares were in IUCN protected area classes I-IV in the Middle East,⁵ South and Southeast Asia, Central and South America, and Africa (Green & Paine 1997:13). Of the 25 hotspot ecosystems identified by conservationists as global priorities, 212 million hectares remain (Mittermeier et al. 1999).

In the case of Madagascar, donors have proposed spending \$180 million over five years for biodiversity and ecosystem conservation (World Bank 1996). This same

amount of money could be used to make annual payments at \$35/hectare on over one million hectares of land. The forests in Malagasy parks and reserves cover just over one million hectares (Hannah et al. 1998). Properly targeted, the money could also be used to make payments in other ecosystems and lands outside parks.

The performance payments to rural residents would not, of course, be the only costs. Practitioners and payment recipients will incur transaction costs in their efforts to design and administer institutions. For example, the administrative costs for Canada's PCP land diversion program were estimated to be about one-quarter of the payment costs (OECD 1997:27). Although transaction costs in conservation contracting may be significant, many of the same costs are also incurred in development-based interventions. For example, practitioners must monitor ecosystem health and rule compliance in both interventions.

Benefits and Risks Associated with the Use of Cash Payments

When successful, development-oriented conservation initiatives can provide local economic benefits as well conservation results.⁶ Performance payments, however, also provide local benefits. In comparing the two approaches, a recent economic analysis (Ferraro and Simpson 2000) suggests that direct payments are more cost-effective conservation measures than indirect development interventions. Thus local agents could be made better off under appropriately designed payment schemes. Moreover, performance payments benefit poor farmers by improving cash flows and providing a fungible store of wealth. For risk-averse farmers, non-stochastic payments also help to diversify the household portfolio and reduce exposure to risk. In the U.S. CRP, risk

reduction was an important incentive for enrollment (Gustafson 1994:37).

Cash payments, however, can exacerbate residents' exposure to risk by making residents more dependent on markets for meeting their consumption needs. In rural areas, markets are often imperfect, and residents may not be able to transform cash into the resources they need or may be able to do so only at higher prices than anticipated. The same potential problem, however, is prevalent in commercial development interventions. In contrast to development-based interventions, however, direct payment initiatives do not require households to make significant labor investments and thus permit households to continue production on previously cleared lands or to work off-farm. Conservation payments can thus be viewed as a complement rather than a substitute to current income.

Financial transfers that are conditional upon stopping or limiting what may have been traditional activities can also lead to a variety of social problems (e.g., the Obijwa of Canada). These problems, which are also prevalent in development-based approaches, become more likely the more an activity is associated with the identity of individuals and opportunities to engage in the activity outside of contracted lands shrink. Moreover, outside observers may view conservation contracts as payments for simply doing nothing ("welfare stigma"), rather than as provision fees to local residents for ensuring the supply of valuable public services.

Conclusion

The problem of habitat and biodiversity loss is complex. A complex problem,

however, does not always require a complex solution. Conservation practitioners may identify a hundred factors that affect ecosystem use in an area, but they need not design a hundred-pronged intervention to achieve their objectives.

While most of the tropical world continues to experiment with indirect, hydro-headed development interventions to promote ecosystem conservation, some nations are experimenting with more direct contracting approaches that use performance payments to achieve conservation results. Conservation contracting initiatives deserve the attention of practitioners and scholars. Although a contracting approach is neither a magic bullet nor an appropriate intervention for every site, it offers advantages to conservation practitioners in low-income countries:

- it can reduce the complexity of implementation in diverse local conditions;
- it can achieve conservation objectives at the scale of ecosystems, in both the short run and the long run;
- it can permit precise program targeting and rapid adaptation over time;
- it can strengthen the links between individual well-being, individual actions, and habitat conservation, and thus create a local stake in ecosystem protection;
- it can change the role of local residents from adversary to collaborator; and
- it can encourage beneficiaries of ecosystem services to pay for the services.

An International Habitat Reserve Program that facilitates conservation contracting can be an important component of a four-part global conservation strategy: 1) change policies that encourage inefficient habitat conversion; 2) generate livelihood opportunities in regions *far* from threatened ecosystems in order to reduce immigration and encourage emigration away from threatened ecosystems; 3) increase the perceived benefits that local, regional, national, and international citizens receive from natural

ecosystems; and 4) design institutions to ensure that those who are in the best position to supply valuable ecological services benefit from their efforts.

To implement a conservation contracting initiative in low-income nations, practitioners face substantial obstacles in matters of institutional design, property rights allocation, and strategic behavior by potential beneficiaries. The implementation of less direct, development-oriented interventions, however, faces similar obstacles. Although there is no guarantee that a direct payment initiative will succeed, the contrasts between direct and indirect approaches to conservation suggest that performance contracts may be one of the most effective and efficient mechanisms for protecting habitats in low-income nations. Scholars and practitioners would do well to begin experimenting with contracting initiatives in the field.

References

- Angelsen, A. 1999. Agricultural Expansion and Deforestation: modeling the impact of population, market forces and property rights. *Journal of Development Economics* 58:185-218.
- Barbier, E. B. & M. Rauscher. 1995. Policies to Control Tropical Deforestation: trade intervention versus transfers. Pages 260-282 in C. Perrings, K.-G. Mäler and C. Folke, editors. *Biodiversity Loss: economic and ecological issues*. Cambridge University Press, Cambridge.
- Barraclough, S. L. and K. B. Ghimire. 1995. *Forests and Livelihoods: the social dynamics of deforestation in developing countries*. St. Martins Press, New York.
- Barrett, C. B. and P. Arcese. 1998. *Wildlife Harvest in Integrated Conservation and*

- Development Projects: linking harvest to household demand, agricultural production, and environmental shocks in the Serengeti. *Land Economics* 74:449-465.
- Barry, P.J. 1997. Rates of Return to Public Investment in Agricultural Research and Education. *CHOICES* (Fourth Quarter):14.
- Browder, J. O. 1992. The Limits of Extractivism. *Bioscience* 42:174-182.
- Brown, M. and B. Wyckoff-Baird. 1992. Designing Integrated Conservation and Development Projects. Biodiversity Support Program, Washington, D.C.
- Calvo, A., and G. Navarrete. 1999. El desarrollo del sistema de pago de servicios ambientales en Costa Rica. FONAFIFO and UNDP, San Jose, Costa Rica.
- Campbell, B., N. Byron, P. Hobane, E. Madzudzo, F. Matose, and L. Wily. 1999. Moving to Local Control of Woodland Resources – Can CAMPFIRE Go Beyond the Mega-fauna? *Society and Natural Resources* 12:501-509.
- Castro, R., L. Gamez, N. Olson, and F. Tattenbach. 1998. The Costa Rican Experience with Market Instruments to Mitigate Climate Change and Conserve Biodiversity. FUNDECOR, MINAE, and the World Bank, San Jose, Costa Rica.
- Clark, D. and D. Downes. 1999. What Price Biodiversity? Economic incentives and biodiversity conservation in the United States. Center for International Environmental Law, Washington, D.C.
- Conservation International (CI). 1995. Projet de Conservation et de Développement de la Reserve Naturelle Intégrale No. 3 de Zahamena. Plan Annuel de Travail 1995. Antananarivo, Madagascar.
- Conservation International (CI), ANGAP, DEF, and KfW. 1996. Projet de Conservation et de Développement Intégré Complexe des Aires Protégées d'Ankarafantsika.

- Programme de Travail Phase I, 1996-1997 (April 1996). Antananarivo, Madagascar.
- Copson, R.W., T.W. Galdi, and L.Q. Nowels. 1986. U.S. Aid to Africa: the record, the rationales, and the challenge. Congressional Research Service, Washington, D.C.
- Coxhead, I. A. and S. Jayasuriya. 1994. Technical Change in Agriculture and Land Degradation in Developing Countries: a general equilibrium analysis. *Land Economics* 70:20-37.
- Elahl, A. and B. Khushalani. 1990. Technical Issues of Irrigation Development in Sub-Saharan Africa. Pages 69-82 in S.M. Barghouti and G. Le Moigne, editors. *Irrigation in Sub-Saharan Africa: the development of public and private systems*. World Bank Washington, D.C.
- Ferraro, P. J. 1994. Natural resource use in the southeastern rain forests of Madagascar and the local impacts of establishing the Ranomafana National Park. Masters Thesis. Duke University, Durham, North Carolina.
- Ferraro, P. J. and R. A. Kramer. 1997. Compensation and Economic Incentives: reducing pressures on protected areas. Pages 187-211 in R. A. Kramer, C. van Schaik and J. Johnson, editors. *Last Stand: protected areas and the defense of tropical biodiversity*. Oxford University Press, New York.
- Ferraro, P.J. and R.D. Simpson. 2000. The Cost-Effectiveness of Conservation Payments. *Resources for the Future Discussion Paper 00-31*. Resources for the Future, Washington, D.C.
- Ferraro, P. J., and R. Tshombe, R. Mwinyihali, J.A. Hart. 1997. *Projets Intégrés de Conservation et de Développement: un cadre pour promouvoir la conservation et la gestion des ressources naturelles*. Working Paper no. 6. Wildlife Conservation Society,

Bronx, New York

- Foster, A. D., J. Behrman, and M. Rosenzweig. 1999. Population Growth, Technical Change, and Forest Degradation. Working Paper. Department of Economics, Brown University, Providence, Rhode Island.
- Fox, J.W. 1996. The Venture Capital Mirage: assessing USAID experience with equity investment. USAID Program and Operations Assessment Report no. 17. USAID, Washington, D.C.
- Freese, C.H. 1997. The 'Use It or Lose It' Debate: issues of a conservation paradox. Pages 1-48 in C.H. Freese, editor. Harvesting Wild Species: implications for biodiversity conservation. The Johns Hopkins University Press, Baltimore.
- Green, M.J.B., and J. Paine. 1997. State of the World's Protected Areas at the End of the Twentieth Century. Paper presented at IUCN World Commission on Protected Areas Symposium on Protected Areas in the 21st Century: From Islands to Networks Albany, Australia, 24-29th November 1997. World Conservation Monitoring Centre, Cambridge.
- Gustafson, C. 1994. Rural Economies. Pages 35-38 in When Conservation Reserve Program contracts expire : the policy options : conference proceedings, February 10-11, 1994 / sponsored by Soil and Water Conservation Society with the support of the Agricultural Research Service, Economic Research Service, Extension Service, Fish and Wildlife Service, Forest Service, Soil Conservation Service, and the U.S. Environmental Protection Agency, Arlington, VA. The Society, Ankeny, Iowa.
- Hackel, J.D. 1999. Community Conservation and the Future of Africa's Wildlife. Conservation Biology 13: 726-734.

- Hannah, L., B. Rakotosamimanana, J. Ganzhorn, R.A. Mittermeier, S. Olivieri, L. Iyer, S. Rajaobelina, J. Hough, F. Andriamialisoa, I. Bowles, and G. Tilken. 1998. Participatory planning, scientific priorities, and landscape conservation in Madagascar. *Environmental Conservation* 25: 30-36.
- Hirschman, A.O. 1967. *Development Projects Observed*. The Brookings Institution, Washington, D.C.
- Howard, A.F., R.E. Rice, and R.E. Gullison. 1996. Simulated Financial Returns and Selected Environmental Impacts from Four Alternative Silvicultural Prescriptions Applied in the Neotropics: a case study of the Chimanes Forest, Bolivia. *Forest Ecology and Management* 89:43-57.
- Jones, J. R. 1989. Human Settlement of Tropical Colonization in Central America. Pages 43-85 in D. A. Schumann and W. L. Partridge, editors. *The Human Ecology of Tropical Land Settlement in Latin America*. Westview, Boulder, Colorado.
- Kaimowitz, D. and A. Angelsen. 1998. *Economic Models of Tropical Deforestation: a review*. Center for International Forestry Research, Bogor, Indonesia.
- Laarman, J. 1995. *Government Policies Affecting Forests in Latin America: An Agenda for Discussion*. Environment Division, Social Sectors and Sustainable Development Department, Inter-American Development Bank, Washington, D.C.
- Lawrence, D.C., M. Leighton, and D.R. Peart. 1995. Availability and Extraction of Forest Products in Managed and Primary Forest around a Dayak Village in West Kalimantan, Indonesia. *Conservation Biology* 9:76-88.
- Lee, D.R., P.J. Ferraro, and C.B. Barrett. 2000. Agricultural Intensification, Economic Development and the Environment: an introduction.” In D.R. Lee and C.B. Barrett,

- editors. Tradeoffs or Synergies? Agricultural Intensification, Economic Development and the Environment in Developing Countries. CAB International, Wallingford, UK. (Forthcoming)
- Lewandrowski, J., J. Tobey, and Z. Cook. 1997. The interface between agricultural assistance and the environment: chemical fertilizer consumption and area expansion. *Land Economics* 73:404-427.
- Mbanefo, S. and H. de Boerr (1993). CAMPFIRE in Zimbabwe. Pages 81-88 in E. Kemf and E. Hillary, editors. *Indigenous peoples and protected areas: the law of mother Earth*. Earthscan, London, UK.
- Mittermeier, R.A., N. Myers, and C. G. Mittermeier, eds. 1999. *Hotspots : earth's biologically richest and most endangered terrestrial ecoregions*. CEMEX; Conservation International, Mexico City.
- Muir, K. and J. Bojö. 1994. *Economic Policy, Wildlife and Land Use in Zimbabwe*. Environment Department, World Bank, Washington, D.C.
- Oates, J. F. 1999. *Myth and Reality in the Rain Forest: how conservation strategies are failing in West Africa*. University of California Press, Berkeley, California.
- OECD. 1997. *The environmental effects of agricultural land diversion schemes*. OECD, Paris.
- Ozorio de Almeida, A. L. and J. S. Campari. 1995. *Sustainable Settlement in the Brazilian Amazon*. Oxford University Press, Oxford.
- Peres, C. 1999. Tropical Forest Disturbance and Dynamics in Southeastern Asia. *Trends in Ecology and Evolution* 14:217-219.
- Peters, J. W. 1998. *Sharing National Park Entrance Fees: forging new partnerships in*

- Madagascar. *Society and Natural Resources* 11:517-530.
- Porter, D., B. Allen, and G. Thompson. 1991. *Development in practice: paved with good intentions*. Routledge, London.
- Potter, C. and D.E. Ervin. 1999. Freedom to Farm: agricultural policy liberalisation in the US and the EU. Pages 53-70 in M.R. Redclift, J.N. Lekakis, and G.P. Zanias, editors. *Agriculture and World Trade Liberalisation: socio-environmental perspectives on the common agricultural policy*. CAB International, Oxon, UK.
- Projet Parc National Ranomafana (PPNR). 1995. *Plan Annuel de Travail du Projet Parc National Ranomafana 1995 (Janvier)*. Antananarivo, Madagascar.
- Redford, K. 1992. The Empty Forest. *Bioscience* 42:412-22.
- Richards, M. 1993. The Potential of Non-Timber Forest Products in Sustainable Natural Forest Management in Amazonia. *Commonwealth Forestry Review* 72:21-27.
- Salafsky, N., B. Cordes, J. Parks, and C. Hochman. 1999. *Evaluating Linkages Between Business, the Environment, and Local Communities: final analytical results from the Biodiversity Conservation Network*. Biodiversity Support Program, Washington, D.C.
- Shyamsundar, P. and R.A. Kramer. 1996. Tropical Forest Protection: An Empirical Analysis of the Costs Borne by Local People. *Journal of Environmental Economics and Management* 31: 129-144.
- Simpson, R. D. and R.A. Sedjo. 1996. Paying for the Conservation of Endangered Ecosystems: a comparison of direct and indirect approaches. *Environment and Development Economics* 1:241-257.
- Smith, N. J. H. 1996. Effects of Land-Use Systems on the Use and Conservation of Biodiversity. Pages 52-79 in J.P. Srivastava, N. J. H. Smith and D. A. Forno, editors.

- Biodiversity and Agricultural Intensification: partners for development and conservation. World Bank, Washington, D.C.
- Smith, J., S. Mourato, et al. 1998. Willingness to Pay for Environmental Services among Slash-and-Burn Farmers in the Peruvian Amazon: implications for deforestation and global environmental markets. Selected paper presented at American Agricultural Economics Association Annual Meeting, August 2-5, 1998, Salt Lake City, Utah.
- Sobhan, R. 1993. Agrarian Reform and Social Transformation: preconditions for development. Zed Books, London, UK.
- Swanson, T. 1995. The International Regulation of Biodiversity Decline: optimal policy and evolutionary product. Pages 225-259 in C. Perrings, K.-G. Mäler and C. Folke, editors. Biodiversity Loss: economic and ecological issues. Cambridge University Press, Cambridge.
- Tewari, D.D. and J.Y. Campbell. 1996. Increased Development of Non-timber Forest Products in India: some issues and concerns. *Unasylva* 187:26-33.
- VITA, SAF/FJKM, TFMT, and Clark University. 1995. Projet de Conservation et de Développement Intégrés des Aires Protégées d'Andasibe-Mantadia. Plan Annuel de Travail 1995 (Fevrier). Antananarivo, Madagascar.
- Wells, M., and K. Brandon, with Lee Hannah. 1992. People and parks: Linking protected area management with local communities. World Bank, World Wildlife Fund, and U.S. Agency for International Development, Washington, D.C.
- Wells, M., S. Guggenheim, A. Khan, W. Wardojo, and P. Jepson World Bank. 1999. Investing in Biodiversity: a review of Indonesia's Integrated Conservation and

Development Projects. Directions in Development Series. World Bank (Indonesia and Pacific Islands Country Department), Washington, D.C.

Wiersum, K. F. 1986. The Effect of Intensification of Shifting Cultivation in Africa on Stabilizing Land-use and Forest Conservation. *Netherlands Journal of Agricultural Science* 34:485-488.

World Bank, Public Information Center. 1996. Madagascar-Second Environment Program Support (Project ID MGGE40596). World Bank, Washington, D.C.

World Bank, Operations Evaluation Department. 1988. Rural development : World Bank experience, 1965-1986. World Bank, Washington, D.C.

World Wildlife Fund (WWF). 1995. Project de Conservation et de Développement Intégrés Andohahela. Programme Annuel de Travail 1995 (Mars). Antananarivo, Madagascar.

Endnotes

¹ This essay is a revised version of a paper of the same title presented at the conference “Adaptive Collaborative Management for Protected Areas: advancing the potential.” September 1998, Ithaca, NY. The author acknowledges the financial support of the Institute for the Study of World Politics and the U.S. E.P.A. STAR program. Thanks also to Katrina Brandon, David Lee, Jeffrey Langholz, Kristin Rowles, James Hafner, Greg Nagle, Matthew Hatchwell, Arlyne Johnson, David Simpson, Kerry Krutilla and three anonymous reviewers for useful comments on earlier drafts.

² The development of hybrid seed corn in the U.S., for example, took in excess of forty years from the initiation of research to the seed’s widespread adoption (Barry 1998).

³ Although the CRP’s original objective was to reduce soil erosion, the 1990 Food, Agriculture, Conservation and Trade Act put greater emphasis on improving water quality and wildlife habitat.

⁴ Conflict may also derive from situations in which local agents in one area receive contracts, but in another area, local agents are expected to provide ecosystem services free of charge.

⁵ The Middle East includes 741,000 square kilometers in two Saudi Arabian protected areas.

⁶ Some economists, however, are dubious that commercial eco-entreprises (Simpson and Sedjo 1996) or infrastructure investment in remote frontier areas (Chomitz and Gray 1996) can provide significant net economic returns.