TOWARDS AN INTERNATIONAL MARKET-BASED INSTRUMENT TO FINANCE BIODIVERSITY CONSERVATION:

A GREEN DEVELOPMENT MECHANISM

TECHNICAL BACKGROUND PAPER

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INTRODUCTION: FINANCIAL MECHANISMS AS SOLUTION TO BIODIVERSITY DECLINE

Biodiversity decline is a long-standing and on-going process. This is in part because the diversity of life forms is a one-time endowment, irreplaceable on any relevant timescale. More specifically, the process of human development has long been linked with the decline of diversity. Human societies have made changes in the habitats and the life forms with which they live, and these changes have resulted in losses of both. This much is to be expected because human societies are acting to convert the world in which they live into one that is more amenable to human production and human progress.

After thousands of years of losing and disturbing natural habitats, it is now recognised that human production and progress relies upon the diversity that remains. Not only do individual components of biodiversity provide important forms of value, but also the total amount of biodiversity remaining provides the insurance and the information that protects and preserves the human production system. So, individual components (such as a particular wildlife species or a particular watershed) are known to be highly valued in their natural form, but it is also known that there are values to be realised from the protection of even the unknown species and the relatively undervalued habitats. The conservation of the remaining undisturbed areas is believed to be important for the sustainable and resilient functioning of the entire production system, no matter where it exists. For this reason many of the values of biodiversity are of the nature of global public goods, requiring international cooperation for their realisation.

To this end the international community has adopted an international agreement entitled the Convention on Biological Diversity (CBD). This agreement provides that the member states will take coordinated actions for the purposes of protecting and conserving diverse biological resources. Importantly, the CBD also recognises the sovereignty of individual states over domestic biological and genetic resources, thereby making individual states the agents that must act to conserve the resources within their boundaries. The CBD also recognises the importance of incentive mechanisms in providing these states with the reason and capacity to act.

This brief introduction provides an outline of the problem that must be solved by the parties to the CBD. The values of biological diversity flow to the global community at large. But most of the resources that generate them exist as domestic resources within the boundaries of an individual state. Add to this disjunction between owner and beneficiary the fact that the costs of biodiversity conservation lie primarily with the hosts (rather than the global community), and the need for international cooperation is clear.

This international cooperation needs to take the form of the transfer of resources to those agents making the decision to continue to host biodiversity or, equivalently, to make these transfers to those foregoing activities that cause damage to natural habitats. In addition, since development is an investment decision, this transfer of resources must be perceived by the hosts to be an ongoing flow of funding permanently associated with the decision not to undertake irreversible actions. Finally, the amount of the funding must be adequate to compensate for the opportunity costs of foregone development. Together, these three conditions are sufficient to create and maintain incentives for the retention of the subject habitat.

Such a system of transfers qualifies as a *financial mechanism* (rather than simple funding) because it sustains incentives for biodiversity conservation. This system of transfers also qualifies as a *green development mechanism* because it provides incentives by paying amounts sufficient to compensate for foregone conversion, but linked to sustained biodiversity conservation.

To date there is little sign of this sort of financial mechanism being organised under the CBD. There have been projects organised to aid conservation, and investments in other forms of development, but there has been little attempt by the organised international community to develop a mechanism that will recognise and transfer values in recognition of investments in biodiversity conservation.

On the other hand, there have many recent attempts by private firms and domestic governments aimed at transferring some of the values between some users and some hosts. Some of these attempts have been relatively local efforts at making private contracts between providers of some natural good or service (such as a watershed) and those making use of it (such as a municipality or bottled water firm). Others of these attempts have been government efforts at establishing efficient market-based supply mechanisms, by transferring values to those bidding to supply the good or service at least cost. There are also firms and governments imposing voluntary or mandatory restrictions on certain forms of development. Such systems are promoting the idea of a complete market in development rights, by fostering innovations such as offset markets and offset banking.

The objective of this discussion paper (and this discussion) is to outline the nature of these attempts at innovation in the field of financial mechanisms – in order to provide some structure to the discussion of these practices at international level. The international community – probably through the CBD – needs to foster the notion of a financial mechanism for biodiversity conservation. Current efforts must necessarily remain limited and informal, until there is a broader structure in place to enable the transfer of the broadest forms of value.

In order to aid this discussion, this paper proceeds as follows: Part I outlines the basic argument for the use of financial mechanisms to address the problem of biodiversity conservation, and the basic components of such mechanisms necessary to address the problem. Part II provides a structured discussion of the nature of the financial mechanisms available for biodiversity conservation, both the possible and the plausible. This includes discussion of both the general nature of comprehensive mechanisms that could exist at he global level, and the specific nature of existing mechanisms providing values at local and national levels. Finally, Part III lists eight specific financial mechanisms currently in use, for discussion about the limits and potentialities of these specific approaches.

In total, the discussion paper provides a means for considering: 1) the abstract nature of the problem and solution to biodiversity conservation (Part I); and 2) the specific financial mechanisms currently in use in biodiversity conservation (Parts II and III). The objective is to compare the two things (goals and practices) and to ascertain whether there are specific designs or practices that make sense to move toward a higher level of organisation, such as the CBD.

PART I: THE NATURE OF THE PROBLEM AND SOLUTION CONCEPT - A GREEN DEVELOPMENT MECHANISM

This first Part of the paper establishes a framework for thinking about the nature of the economic problem of biodiversity conservation, and the features of a mechanism that could address this problem. We briefly outline existing evidence of biodiversity loss and its impacts on global welfare, along with the key factors that drive such losses. It is argued that much conversion of, and disturbance to, natural resources is the result of human development processes, and that these processes do not fully internalise the general public good values that biodiversity conveys. The solution concept recommended by this framework is the institution of a *green development mechanism*: an institutional development capable of permanently altering the terms of trade between conversion and conservation. The mechanism design issues concern both how to aggregate demand for very general public good values (such as information and insurance) and how to efficiently determine the supply of biodiversity conservation.

1 The General Nature of the Problem and the Solution

1.1 Purpose

This section lays out the general argument concerning why it is important to invest in institutions enabling "green development". We also provide a description of what the general nature of such institutions might be, based on the nature of the biodiversity problem.

1.2 What is "the biodiversity problem?

The Millennium Ecosystem Assessment (MA) provides evidence that human-induced changes in land cover have resulted in significant losses in biodiversity, and that this in turn has major impacts on the functioning of ecosystems. Furthermore, these impacts disproportionately affect the poorest members of society who rely most heavily on the natural environment.

The Convention on Biological Diversity defines biodiversity as:

> 'the variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems' (CBD, 1992).

This definition highlights the complexity that arises from the many dimensions of biodiversity. These various dimensions make the measurement of levels or changes in biodiversity an especially challenging task.

Measurement of ecosystem diversity is complicated by the inter-relationships between ecosystems in different locations and at different scales. This means that it is not always possible to delineate clear boundaries between ecosystems in order to measure their diversity, although attempts have been made to define areas that have particular internal linkages and common ecological characteristics e.g. WWF Priority Ecoregions or Conservation International's Biodiversity Hotspots.

For the purposes of assessing progress toward the 2010 targets, the Convention on Biological Diversity defines biodiversity loss to be "the long-term or permanent qualitative or quantitative reduction in components of biodiversity and their potential to provide goods and services, to be measured at global, regional and national levels" (CBD COP VII/30). Under this definition, biodiversity can be lost either if the diversity per se is reduced (such as through the extinction of some species) or if the potential of the components of diversity to provide a particular service is diminished (such as through unsustainable harvest).

Trends

One way that changes in biodiversity are considered in practice is to examine the rate at which species go extinct. Extinctions have occurred throughout the history of the planet, and the exact rate at which they occur is extremely difficult to measure due to uncertainty about the species that exist at any point in time and the fact that positive evidence of extinction is unlikely to be available (a species can only be considered extinct in the absence of evidence of its continuing existence) (CBD 2004). However, despite this uncertainty about human induced changes in the rate of species extinction, estimates suggest that it may have increased by up to 3 orders of magnitude (MA 2005).

Another way that changes in biodiversity are measured is based on the numbers of species that are judged to be threatened with extinction. The IUCN Red List is based on five biological criteria relating to extinction risk, including the rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation. The Red List indicates that 25% of mammals and 12% of bird species are 'threatened' with extinction.

Declines have also been observed in both the extent and the diversity of particular ecosystems. For example, as a result of human land conversion, global forest area has been reduced by 40% over the past 300 years, and continues to decline at a rate of 13 million ha per year (FAO 2005). The consequences of this are most severe in warmer temperate and subtropical areas, as these areas have a higher diversity of species, many of which are localised, and therefore in general more vulnerable to extinction. Similarly, southern hemisphere temperate forests are generally isolated from each other and have a high proportion of localised and threatened species (CBD 2005).

Existing data suggests that species in marine ecosystems are less prone to extinction than terrestrial or freshwater species. However, despite this, certain marine ecosystems remain under threat, particularly in coastal areas. For example, analysis of Caribbean corals indicates that average hard coral cover on reefs has declined from 50% cover to 10% over 30 years (Gardner et al. 2003), while 35% of mangroves are known to have been lost in the last 20 years (MA 2004). Worm et al. (2006) find evidence of declines in biodiversity in both coastal ecosystems and large marine ecosystems, which are accelerating over time.

Assessments of freshwater ecosystems such as rivers, lakes and wetlands indicate that they are suffering the negative impacts of human activities to a greater extent than any other types of ecosystem. Rivers and lakes are subject to pollution and sedimentation as well as alteration due to the construction of dams and reservoirs, while wetlands may be converted altogether. It is estimated that 50% of wetlands have been lost since 1900 (Moser 1996). One result of these changes is that, on average across approximately 20 countries that have been assessed,

almost 20% of inland water fish fauna and 30% of turtles and tortoises are found to be threatened.

Overall, the WWF's Living Planet Index, which estimates time trends in populations of 555 terrestrial species, 323 freshwater species, and 267 marine species, shows a decline in the full population index of 40% between 1970 and 2000, including a 30% reduction in each of the terrestrial and marine species indices and a 50% reduction in the freshwater species index (Ricketts et al. 2005). Related to this, between 20% and 50% of 9 out of 14 of the world's biomes have been converted to cropland, with highest rates of conversion in tropical dry forests where almost half of the native habitat has been replaced with cultivated land. Temperate grasslands, temperate broadleaf forest and Mediterranean forests have also experienced 35% or more conversion (Ricketts et al. 2005).

One important feature of biodiversity is that it is not evenly spread around the globe. Specifically, diversity tends to increase towards the equator, and the most species rich environments are moist tropical forests. These cover 7% of the world's surface and may hold up to 90% of the world's total species. Coral reefs and areas of Mediterranean climate in South Africa and southwest Australia also have high levels of biodiversity (CBD 2004).

Impacts of losses in diversity on ecosystem services

There are two key ecological consequences of biodiversity loss. The first relates to losses of ecosystem function, and the second to reductions in the resilience of ecosystems. The relationship between biodiversity and ecosystem functions is not fully understood, but there is a certain amount of evidence to suggest the form it might take. Experimental and observational studies have tended to show ecosystem functions initially increasing with species richness, but a plateauing or even declining relationship at high levels of biodiversity (Thompson and Starzomski 2006).

However, species composition is understood to be more important than species richness for ecosystem functioning. This is because the specific traits of the dominant species in an ecosystem tend to determine the ecosystem's processing of matter and energy (MA 2005). The result is that it is necessary to conserve the biological composition of ecosystems as well as the number of species. In addition to species composition, species interactions are important for ecosystem functions. Specifically, the complexity of the inter-relationships within ecosystems means that if linkages between species are interrupted by changes in the presence or abundance of any individual organisms, then the functioning of the ecological processes may be affected. Alternatively, single keystone species may in some cases be critical for the continuation of the ecosystem as a whole (Hooper et al 2005).

The second way in which biodiversity contributes to human wellbeing, and indeed survival, is through its impact on the resilience of ecosystems. Diversity within ecosystems increases the likelihood that they can recover from shocks and stresses (Holling et al. 1994, cited in OECD (2002)). As discussed by Pearce (2002), this relationship between diversity and resilience also applies at other levels. For example, genetic diversity enables a species to adapt to changes in external conditions. What is less well understood about the relationship between diversity and resilience is the extent to which certain species are more important than others for driving change and adaptation. Given the high degrees of uncertainty about whether some species could be redundant, or which these might be, maintaining diversity in

general is a more reliable way of ensuring ecosystem resilience.

In addition to the impacts of biodiversity on ecosystems, biodiversity will in some cases be important in itself for directly providing a range of goods and services that are valuable to people, such as food, fibres, medicines and construction materials. Biodiversity can also provide less tangible cultural services, for example by contributing to cognitive development, cultural traditions or spiritual inspiration. Recreational enjoyment is another service that may be provided directly by ecosystems with high biodiversity. This is particularly clear in the case of tourism for wildlife viewing, where tourists tend to gain more enjoyment from viewing more species. More generally, individuals may consider natural landscapes to be more attractive or interesting where diversity is higher.

Within the framework of the Millennium Ecosystem Assessment, the contribution to ecosystem function can be considered a regulating service, while the direct impacts on providing goods and services and cultural benefits are the provisioning and cultural services respectively. Lastly, the importance of biodiversity for maintaining resilience is referred to as a supporting service of biodiversity.

1.3 Determinants of biodiversity loss

Direct drivers

The most significant direct driver of biodiversity loss is habitat destruction, primarily when land is cleared for agricultural production. Agricultural land is currently expanding in 70% of countries, declining in 25%, and stable in 5% (Hardner and Rice 2002; Ricketts et al. 2005). Marine and freshwater habitats can also be destroyed or degraded through human activities. For example, trawling, fishing and coastal development can cause irreversible damage to the seabed and coral reefs, while construction of hydroelectric dams or reservoirs can disturb the habitats of river species. As well as the negative consequences of reductions in the total area of particular types of ecosystem, fragmentation of habitats has severe impacts on the survival of species, especially those that require large areas of habitat, that are highly specialized to a certain habitat, or those that have naturally unstable populations or low rates of population growth, will be most vulnerable to habitat fragmentation (Ricketts et al. 2005).

In addition to habitat destruction or fragmentation, other factors driving biodiversity loss are the introduction of invasive species, disease, overexploitation, pollution and climate changes (MA 2005). The spread of invasive species is growing over time due to increased travel and trade as transport costs fall (Gaston et al. 2003). Invasive species may act as predators or competitors to native species or they may introduce new diseases or modify habitats (Ricketts et al. 2005). As well as increasing the risk of invasive species, globalization increases the spread of infectious diseases. Baillie et al. (2004) estimate that introduced diseases may have contributed to the global extinction of seven amphibians, three birds and one plant over the past 20 years.

Unsustainable harvesting levels constitute another significant threat to biodiversity, in particular marine species and some trees and mammals. The majority of commercial fisheries are fully or over-exploited (FAO 2006), and there is evidence that severely depleted marine populations may not recover even if harvesting is stopped. Mammals, birds and amphibians may also be subject to unsustainable levels of harvesting for food, medicinal purposes or pets.

For example, almost all species of turtles and tortoises are under threat in southeast Asia where they are harvested for human consumption and medicines, primarily in China (Baillie et al. 2004).

Pollution can affect many types of plants and animals, but is particularly damaging to aquatic species in both marine and freshwater ecosystems. Nutrients such as nitrogen and phosphorus from manure and manufactured fertiliser on agricultural land can be released into groundwater. This leads to eutrophication of inland and coastal bodies of water, whereby high levels of nutrients encourage excessive plant growth, for example algal blooms, and crowd out existing species (CBD 2004).

Lastly, anthropogenic climate change is increasingly understood to be a driver of biodiversity loss, and it is predicted that it could result in extinction of up to 30% of species (Thomas et al. 2004). The effects are observed through a combination of changes in species distributions, population sizes, and the timing of reproduction or migration events, as well as an increase in the frequency of pest and disease outbreaks, especially in forested systems (Nelson 2005). The extent to which climate change results in biodiversity losses will be significantly affected by rates of habitat destruction because reductions in habitat area, or increases in fragmentation will limit the potential for migration by species (Nelson et al. 2005).

Proximate and Underlying causes of biodiversity loss

There are many proximate causes of biodiversity loss. Any incident that results in a decline in natural resources and systems (pollution, invasion, exploitation) has the prospect of having an impact on biodiversity. It is argued here, however, that the systematic forces driving decline are more development-based.

Although the retention of the evolutionary endowment of biodiversity renders important benefits to all life forms and thus to human societies as well, it is clear that the depletion of diversity has also generated important benefits for human societies. Human societies have been expanding and developing for many centuries through processes closely linked to biodiversity depletion.

For example, one of the fundamental avenues to human development has been the conversion of the naturally-existing forms of assets to other forms more highly valued by human societies. This trade-off, between the benefits and opportunity costs of conversion, constitutes a fundamental problem of biodiversity management.

These conversions occur because there is increased value to the land-holders from the change in use. Countries that have retained large and diverse estates do so at their own expense. There is a clear and inverse relation between those states with diversity-wealth and those with development-wealth. To a great extent, habitat conversion is centred in the developing world precisely because: a) the developing world is developing/converting; and b) the developed world has already concluded doing so. For example, the area of increased croplands in the developing world increased by 37% in the developing world over the past 4 decades while remaining approximately constant in the developed (Swanson 2001).

Beyond land conversion, many of the other drivers of biodiversity losses are also ultimately the result of development processes. The spread of invasive species and diseases are a by-product

of global trading activities, which have had vast economic benefits through history. Similarly, losses of biodiversity due to pollution or anthropogenic climate change are fundamentally related to industrialisation.

Therefore, the development process has been closely linked with diversity decline over the course of human history. This implies that there have been significant associated benefits, and that there are significant opportunity costs to attempting to halt the decline. Any attempt to conserve biodiversity will require generating alternative forms of value to existing and still-undisturbed habitats and resources.

1.4 The Values of Biodiversity: Public Goods and Biodiversity-Associated Goods & Services

There are very specific and real values to the retention of biodiverse resources, although the purest forms of value are very indistinct and generally inappropriable. This is the basic problem faced by the biodiversity conservation community. How is it possible to generate and target appropriable flows of value from non-conversion? This might be possible by creating institutions that make distinct and appropriable some of the values of biodiversity.

Biodiversity in itself is the existence of diversity that has resulted from the evolutionary process. As stated above, this is the total breadth of the genetic resource that exists from a several billion year long process. It is more precisely the size of the set of elements that the gene pool exists (Weitzman 1992). This size of the set of elements translates directly into two specific forms of value: 1) information and 2) insurance. These are the most "public good" sorts of values related to this resource.

The Informational Value of Biodiversity

The mere existence of greater diversity (irrespective of the specific components of that diversity) has value. One of the most important services rendered by diversity is information. The process of evolution guarantees that most biological resources will contain biologically active ingredients (Mabberley 1992). These types of chemicals necessarily result in the context of interaction within a biological environment. Hence, most plants, insects and animals contain chemicals that act upon the higher organisms that interact with or prey upon them.

The activity of these chemicals can be very constructive in some instances, if properly applied. The search for active chemical compounds is an ongoing and well-financed undertaking in the pharmaceutical industry. The screening process can be rendered even less random by means of the use of the information accumulated by the human communities living in contact with diverse resources. These people gather this information simply by interacting with their biological environment. This is what a biologist would expect, and it provides the impetus behind industrial investments in research into indigenous peoples' traditional medicines.

The information emanating from diverse resources is used by industries other than the pharmaceutical. For example, many communities raising traditional non-specialised crops have known of useful traits of these species which were not incorporated into the standard commodities. The most closely related varieties - known as "landraces" - have periodically been used for improvements to the standard varieties. The crop breeding enterprise is in fact a major international industry.

In sum, biological diversity contains informational value because it maintains a wider choice set. This generates something that economists term the value of information, i.e. the value of retaining a wider set of choices in the event that the decision making environment shifts to render the retained choices relevant. Much of the value of biodiversity lies in this aspect of its diversity (Sarr et al. 2008).

Insurance Value of Diverse Resource Stocks

Diversity also represents value on account of the contribution that it makes to the aggregate value of a production portfolio. Biological assets are necessarily productive assets, in the sense that they naturally generate growth with time. The tendency towards specialisation in biological assets generates a global production method that is increasingly at risk, precisely because it necessarily generates a narrowing of the global portfolio.

There are two distinct sources of increased variability resulting from increasing specialisation. The first is the loss of the "portfolio effect" across a geographical region when homogeneous production methods are adopted. In short, when a given territory is converted to the same sorts of crops and methods, the fortunes of all producers then move together. If conditions are favourable to the chosen method, all do better; if conditions are not favourable, all do worse.

The second reason for increased variability is the less significant contributor proportionately, but the more serious problem. This variability is inherent in the development of specialised species. The reduction of the diversity of the genetic base of a given crop reduces its own resistance to pests. In essence, the existence of variety within the species serves the same purpose of that variety across productive assets: it provides insurance. With increasing genetic uniformity at the level of the species (with regard to various high yield varieties in use), there is a loss of a "portfolio" of potential resistance.

Values Associated with Biodiversity's Existence

In addition to these two most abstract values, there are other values that might often be associated with the naturally diverse places on the planet. These need not be associated with all sites of biodiversity, and it can also be the case that non-diverse areas might generate certain of these values. These are the biodiversity-associated goods and services whose conservation might also be used as instruments in the conservation of the broader good of biodiversity. These values of biodiversity can be categorized within the framework of Total Economic Value, which includes direct and indirect use values, non-use values, and option values of biodiversity. Furthermore, each of these types of value may be experienced by different groups of people, so values of biodiversity can also be distinguished by whether they are obtained at the local, national, international or global level.

Local values

At a local level, the primary value of biodiversity is often in the use of biological resources (Pearce 2004). Specifically, biodiversity will frequently have both consumptive and productive direct use values. These uses include the harvest of food products such as fish, bushmeat, fruit, and fungi, as well as fuel, fibres, medicines, oils and timber, for either immediate consumption or for sale. These mainly provide private benefits and therefore should not be subject to market failure. However, exceptions to this may be where poorly

defined property rights mean that groups using the land for harvesting food and non-food products are separate from those making decisions about land conversion, for example, harvesting timber from forests.

Biodiversity also contributes to the productivity and stability of agricultural production, for example through pollination services provided by bird and bee species. Ricketts et al (2004) estimate the value of pollination, by wild bees from fragments of tropical forest, for a single coffee farm at approximately $60,000 per year. In addition, many households in rural areas of developing countries rely on the use of diverse natural resources as a way of coping with economic fluctuations, for example in commodity prices. For example, Erikson (2000) finds that in surveys of poor households in Tanzania and Kenya, 94% rely on activities that use indigenous plants for food and non-food purposes in cases when harvests fail or unexpected expenses are faced.

The local uses of biodiversity may be relative small in terms of their monetary value, but they are frequently of most importance to the poorest communities, and therefore may be highly relevant in equity terms.

National values

At the national level, indirect use values arising from well-functioning ecosystems are an important benefit of biodiversity. These include values such as the protection against flooding and water quality improvements by intact mangroves or wetlands. Such values can be extremely large for those using coastal land for agriculture or waterways. Similarly, downstream communities can be significantly affected by upstream changes in water regulation and water purification by forests or other vegetation within a watershed.

Where these values occur, they are unlikely to be captured through the market because they frequently do not accrue to those who bear the opportunity costs of ecosystem conservation. This means that some form of intervention will be required to incorporate the values into decisions about land use or habitat change. However, because the benefits are most often experienced at a national level, they can in principle be addressed through national level policy mechanisms.

International values

The international values of biodiversity are the benefits that accrue to specific individuals or groups outside the country in which the biodiversity is located. There are important international direct use values that result from both travel and trade between countries. Tourism is a well-recognised example of an international value of biodiversity, although it can provide national benefits as well, particularly within developed countries. As an example of the developing country context, a study of five national parks in Africa showed that a significant majority of the consumer surplus from visiting the parks was gained by international visitors (OECD 2002). Case studies of tourists in particular locations indicate that the value of the experience increases with higher levels of diversity, although the presence of specific charismatic species such as lions, gorillas or pandas can also be important (Pearce et al. 1999).

The benefits experienced through tourist activities are private benefits, and can be captured

through charges for entry to national parks or fees payable by foreigners on entry to the country. However, these benefits are not always fully captured by host countries in practice.

Global values

In addition the information and insurance values of biodiversity described above, there are also indirect use values that are experienced at the global level, such as the extent to which biodiversity contributes to functioning ecosystems that provide carbon sequestration benefits.

Importantly, at the global level, individuals hold non-use values for both biodiversity in general and also for specific species. For example, Bienabe and Hearne (2006) find that Costa Rican and foreign residents are willing to pay $3.87 and $6.62 per year respectively for an increase in biodiversity protection in Costa Rica, while Kontoleon and Swanson (2006) estimate the willingness to pay of foreign residents for protection of the Giant Panda in its natural habitat at $15 per person per year. These non-use values are not only difficult to measure, they are also difficult to capture due to their public good nature. However, as they can be aggregated over many people, they are potentially very large.

Size of values

Table 1: Summary of values for tropical forests

Forest good or service	Range of values (US$/ha/year)
Timber	
Conventional logging (NPV)	200-4400
Sustainable logging (NPV)	300-2660
Conventional logging (annuitised)	20-440
Sustainable logging (annunitised)	30-266
Fuelwood	40
Non-timber forest products	0-100
Genetic information	0-3000
Recreation	
General	2-470
Forests near towns	750
Unique forests	1000
Watershed benefits	15-850
Climate benefits (GPV)	360-2200
Contribution to resilience and insurance	?
Non-use values	
Option value	n.a.
Existence value	2-12
	4400 (unique areas)

Source: Pearce (2001)

As an illustration of the magnitudes of the various types of value, Table 1 shows the ranges of values from different studies of tropical forests, which are an important source of biodiversity. The details of the estimates would differ for other ecosystems, but the categories of benefit would be similar.

Relative Importance? Public Good or Private Goods?

Biodiversity constitutes individual elements and examples of living resources, such as a

particular wildlife specimen or a plant or tree. It also consists of a set of such elements, such as the trees and wildlife making up a forest or watershed. Finally it also consists of the size itself of the full set of living resources (i.e. "diversity") – an informational and insurance value.

The specific components of this mass of living resources have changed a lot. It could be that individuals and societies value biodiversity on account of specific goods and services rendered by specific individual specimens or sets of specimens. This would be the argument that biodiversity's value lies primarily in the specific agglomerations or resources that occur and that are highly valued, e.g. a particular species (African elephant, Giant Panda, white-tailed deer) or a particular setting and services (national forest, city's watershed, coral reef). In this instance, it is not the size of the mass or the size of the set that matters, it is only the occurrence of particular life forms and systems that we have learned to value highly.

At the same time, the overall size of the set of diversity has become much smaller. This has implications for the amount of information and the extent of insurance available to human society.

The latter specification of biodiversity (*qua* diversity) is the global public good, and very difficult to provide via any sort of market transactions. The former are more likely to be regional or local goods, and are more likely to be able to be handled in markets or by national governments. The nature of the good (and value) of concern determines the mechanism of choice.

1.5 The Regulation of Biodiversity: Incentives to Conservation or Disincentives to Conversion

The management problem for biodiversity is usually described as a need to intervene in the local decision maker's calculus in order to correct for the divergence between private and social costs in conversion and development. The private costs and benefits may be those of individual farmers, private firms, or consumers who make use of biodiversity or natural resources, while the social costs and benefits may be experienced at the level of the community, the country, the region or at the global level (Pearce and Moran 1994).

The first reason for the divergence in private and social costs and benefits may be market failure, specifically that private uses of natural resources have social costs and there is no incentive for the private producer to account for those costs when making decisions. Dixon and Pagiola (OECD 2004) give the example of farmers deciding whether to clear an area of forest for agricultural use. In making this decision, they would consider the net benefits they expect to derive from increased crop production, and may also consider the loss of some goods and services from the uncleared area, such as fuelwood or pasture for livestock, since converting the area would mean having to find alternative sources of fuel and fodder. However, they are unlikely to consider the loss of benefits such as watershed protection, since they will not bear the costs of downstream flooding and sedimentation – these costs will be borne by people living far downstream. Balmford et al. (2002) review over 300 case studies of the market and non-market costs and benefits of land conversion and find that the value of maintaining intact habitats consists largely of local and global non-market benefits while conversion provides private benefits.

Related to this, biodiversity can provide global public benefits such as the existence of particular species or a diversity of species, or regulation of the climate. These benefits are experienced by all individuals regardless of which country they are generated in. However, where there are trade-offs between conservation and development, if a country that hosts certain diverse habitats or ecosystems does not receive any form of compensation from other countries that benefit from the existence of the resources, it will not have an incentive to invest in the conservation of biodiversity. In this case, the problem is one of missing markets rather than market failure. It also results from insufficient alternative institutions that could transfer resources at the global level.

How is it possible to address this divergence of private and social costs? It is usually the case that the interests of the local peoples actually living with the resources are determinative of this question. Although there are many reasons to halt the conversions even where human-sourced benefits are not sufficient (thereby preserving more of nature's life forms), the individuals living with the resources will usually make the actual conversion decision, and they will usually make it by reference to the alternative flows of benefits which they expect to receive from the decision.

Once human-sourced benefits are taken to be determinative of the fate of biodiversity, a straightforward mechanism for the conservation of diversity commends itself. Given that these resources are the assets of the local livelihoods, the decision will usually be taken with regard to the relative investment-worthiness of conversion versus alternative choices. This implies that it is the longer-term expected and appropriable flow of benefits that is determinative of the decision, not a one-off payment.

Therefore, these "hosts" must perceive diversity as investment-worthy, if they are going to avoid the conversion option. This approach to biodiversity conservation recognises that the proximate causes of species decline (poaching, unmanaged exploitation etc.) are equally the effects of the more fundamental problem of investment-worthiness, i.e. the failure of hosts to acquire a sufficient proportion of future flows of value to warrant the investment.

And this framework points to the nature of the intervention required to halt conversion. There is a need to create a "premium" that is to be conferred upon hosts investing in their diverse resources. This premium performs the function of changing the calculus of these hosts, so that the conversion process is halted sooner than it would otherwise be.

1.6 Institution-Building for Biodiversity Conservation: Green Development Mechanisms

The solution to the environmental problem of biodiversity losses is easily stated in the abstract; it is to compensate the suppliers for the stock-related services that they render. The more difficult problem by far is the creation and implementation of the institution or institutions that will perform this task.

Much of this paper now addresses the particular characteristics such an institution must have in order to be effective. We are interested in defining the characteristics of the mechanism that is capable of altering the conservation/conversion calculus of local hosts as described above. This translates into the creation of institutions capable of altering the perceived investment-worthiness of unconverted assets.

One important facet is that an effective institution must provide some manner of assurance of a future flow benefits if it is to impact upon the investment decisions of hosts. This is because investment decisions are decisions regarding assets and the anticipated flows regarding them; a host will only deviate from its perceived first-best investment path if the present value of the entire flow of future net benefits from such an alteration would appear to warrant it. Therefore, in order to have a permanent impact on decision making concerning the selection of development paths, it is necessary to make an impact on the perceived benefits from alternative pathways into the future, not just at the present time.

This indicates that institution-building should be directed to the permanent alteration of the relative benefits between investments based on development and non-development. At present the benefit flows are biased toward development on account of the relative rates of appropriability of benefits. Institutions need to provide the basis that will level the playing field between the two options. These institutions must provide the basis for demanders of biodiversity to increase the appropriable level of benefits by potential suppliers.

The argument here is that institution-building must focus primarily on the creation of *alternative pathways to development* or on the acquisition of a host's right to develop. Investing in diverse pathways for development is therefore synonymous with investing in institutions that support a broad range of these resources and systems. What is required is a diversity of institutions at the top of the system promoting alternative paths to development; otherwise, the uniformity at the top will dictate the prevalence of uniformity throughout. In short, a diversity of institutions is a necessity if a diversity of social systems and hence natural systems is to prosper in this world.

In this view a *green development mechanism (GDM)* can take any form that will enable: a) the ongoing and continuing transfer of values; b) from the demanders of biodiversity or biodiversity-associated goods and services; c) to those hosts who make the choices regarding assets (usually lands) that are capable of supplying them. Such a mechanism will then have the characteristics of a permanent alteration of the terms of trade between the choice between conversion and conservation. Then, if individuals exercise this choice in favour of non-conversion, they are at the same time electing to pursue the path of development in combination with "green" (i.e. unconverted) assets.

2 Problems with Existing Approaches: Funding versus Funding Mechanism

It has been argued that the nature of the solution concept for biodiversity conservation is a *green development mechanism*: an institution capable of permanently altering the perceived terms of trade between conversion and conservation. The primary problem faced by current project-based and programme-based approaches to biodiversity conservation lies in two factors: a) the failure to provide incentives for alternative development; and b) the impermanence of project-based programmes.

Incentives for Green Development

Any programme that attempts to dictate a solution to the problem without altering the underlying incentive situation of the local decision makers is bound to have little impact. The problem of biodiversity conservation has continued to be mishandled because interventions do too little to shape the underlying situation. The long-standing approach has been simply to

impose almost-completely restricted development on particular communities, with little effort at re-routing the local development options. This has usually resulted in conflict between local peoples and more distant authorities, and continuing erosion of the resource. It is typified by the problem of “paper parks” in the protected areas system.

The protected areas system fails to fulfill its promise when local decision makers are not given incentives to fully comply with their conservation commitments. This gives rise to the problem of "paper parks". Despite the existence of large numbers of protected areas in all parts of the world, there is very little real protection being afforded to many of these habitats and to their resident species. This is because protected "status" alone is insufficient to guarantee the conservation of the resources within the designated area; it is essential to back up such commitments on paper with real, and costly, efforts on the ground. For example, the US budget for the management of its national protected areas exceeds $2 billion (for 98 million hectares) or a mere $20 per hectare, in one of the richest countries on earth where there is little pressure for further conversions. Few other states with substantial protected areas are able to make such expenditures, and they are subject to much greater pressures on their lands. For example, Indonesia had had 20 million hectares under protected status with a ten-year budget of only $45 million, or $2 per hectare for the decade (Swanson 1992). As a general rule, management budgets for parks and protected areas across the world are closely associated with national incomes, with the developing countries only able to afford to spend a fraction of that being spent in the developed (James 1995).

Why does low management spending result in loss of real parks and protected areas? Management spending is closely associated with real protection for the resources within these areas. For example, one study analysed the relationship between protected area budgets and rhinoceros poaching throughout eastern and southern Africa, and a close correlation was found between the amounts spent and the rate of change in rhino populations (Leader-Williams and Albon 1990). Another example, cited previously, concerns the change in elephant populations in various African states in the 1980s; almost half of the continental elephant population was lost in four owner-states whose budgets ranged between $5 and $15 per square kilometer (as compared with those states with stable populations - South Africa and Zimbabwe - whose budgets were $4300 and $475 per sq. km., respectively) (Swanson 1993). Therefore, real "protected status" requires real resources, and many of the existing protected areas lacking such resources have constituted little more than "parks on paper".

Paper parks exist because countries find it virtually costless to designate certain areas as protected so long as they do not need to commit real resources to accompany that determination. An unreinforced designation may be adequate to solicit the international response that is desired, but it is clearly inadequate for the conservation of biodiversity. This is evident not only in levels of spending, but in much more basic ways as well. For example, recent protected areas reviews of one developing country's protected area network indicated that 60% of the national parks and 92% of the sanctuaries had not even achieved an adequate legal basis within that country; virtually nothing had been accomplished beyond its listing with the IUCN (WCMC 1992).

Permanent alteration of incentives versus temporary projects

The problem is to provide the institution which permanently alters the perceived terms of trade between conservation and conversion. Too often individual projects and programmes for

biodiversity conservation provide a short term horizon of funding (3-5 years) that then disappears and leaves the decision making in the same situation as before.

This is the difference between "funding" and a "funding mechanism". This is a difference with real meaning and importance for the conservation of biodiversity. A funding mechanism for biodiversity conservation would take the form of an instrument through which local decision makers are assured that additional biodiversity conservation will translate into additional funds into the indefinite future. The need for funding is a critical component of conservation; as noted above, protected areas cannot survive in the absence of adequate funding for their protection.

The difference between a "funding mechanism" and simple funding is the presence of a permanent institution which assures permanent alteration in the terms of trade. Aid without incentives relies more upon good intentions, and is distinct from a "mechanism" for supplying a particular mix of private and public goods. Much of the international development assistance that flows to the Third World does so without a dynamic framework of incentives, and therefore does not provide much incentive for long-term investments in international resources which primarily benefit global welfare. The pursuit of an alternative development path requires the creation of stable institutions promising long-term flows of funding to these investments, and a funding mechanism for biodiversity conservation must take this form.

A project-based mechanism for funding biodiversity conservation is the Global Environmental Facility initiated at the World Bank. This fund has been established by World Bank donors in order to allow a programme in globally important environmental projects to be considered. The facility initially consisted of Bank Special Drawing Rights in the amount of $1.2 billion, of which approximately $500 million was allocated to biodiversity conservation projects (UNEP 1991). Once the biodiversity convention was signed, the GEF was designated as the funding mechanism for the convention on a temporary basis. Since that time it has passed through several additional funding phases, but it has not developed many of the characteristics of a true funding mechanism.

The basis on which the GEF funds biodiversity contains some of the elements of an efficient funding mechanism; however, once again there is no provision for a permanent dynamic incentive structure within the system of projects that it funds. The breakthrough in the case of the GEF occurred in that the terms on which the funds are allocated expressly recognised the importance of allowing compensation to countries for externally supplied benefits. That is, the GEF charter provides that the funds are to be allotted to projects where the domestic benefits would not warrant the project, but the inclusion of benefits flowing to other countries would provide a reasonable return to the investment. Clearly then this allows for the payment of compensation to countries which devise "projects" which contain public goods as a significant component of their product.

However, the GEF funds biodiversity chiefly on the same basis as any other World Bank project, with the exception of the global benefit clause. There is no provision for ongoing compensation for these public goods, and so there is no incentive to provide for their existence beyond the time horizon of the funded project. This means that the GEF focuses on "projects" rather than "development paths". In a traditional development banking context, this approach to funding would be advisable, since the objective would usually be to put into place a new capital structure in the country that would then allow that country to continue operations on a

sustainable basis. This is the manner in which development projects are usually funded, by financing the acquisition of capital that then becomes self-financing by virtue of its efficient implementation.

The need for a funding mechanism in the case of biodiversity is of a very different character. As was indicated earlier, the problem of biodiversity lies in the external uncompensated benefits that diverse resources render to the global community. No matter what values become appropriable by local communities, these external values will continue to exist, and it is necessary to re-channel these values to the local communities if the correct quantities of diversity are to be retained. The biodiversity problem is **not** an instance of assisting developing countries in the conversion to reliance upon new capital stocks, but it is instead the need to aid them in the development of the flows of revenues from their existing assets.

A funding mechanism for biodiversity must put into place a permanent institution that generates a flow of funding so long as certain forms of development are pursued. It cannot be based on the funding of alternative capital assets that generate their own returns, simply because the biodiversity problem emanates from the existence of natural capital that generates values that are not appropriable. The GEF "project based" lending may aid in the appropriation of certain values (such as tourism or extraction) but these are largely based on developing other capital stocks (associated with biodiversity) rather than the flow of benefits to biodiversity. The fundamental task of a biodiversity funding mechanism is to provide long-term incentives for investments in the provision of the **nonappropriable** values of diversity, informational and insurance. For these values, a very different form of funding mechanism will be required.

3 Conclusion: The Need for a Green Development Mechanism

The conservation of biological diversity has been argued here to be: a) the implied outcome of an aggregate restriction on the continuing conversion of the biosphere; and b) the necessary prerequisite to the provision of the public good values of biodiversity. As development has always been driven by asset conversion, and these values of biodiversity continue to be public goods, there is the need for some form of intervention that will halt the conversion process prior to its otherwise unavoidable endpoint.

The means for halting conversion will necessarily lie in the permanent alteration of the terms of trade between conversion and conservation – within the decision making framework of the resource hosts. Those local peoples living with un-converted resources are usually the hosts of the resources, with the *de facto* decision making powers to decide whether conversion takes place. This means that intervention must take the form of altering their decision making framework.

The means of doing so must come from investment in institutions that are capable of permanently altering the terms of trade. This is the meaning of a *green development mechanism*: it is an institution capable of changing permanently the perceptions of the relative flows of benefits from converted and un-converted resources.

Given the nature of the problem, the nature of the mechanism may be of any of three forms: 1) a mechanism for the efficient supply of biodiversity as a public good; 2) interventions to facilitate the development of market demands for biodiversity-associated goods and services; and/or 3) creation of an aggregate constraint on development.

PART II: ISSUES IN MECHANISM DESIGN – HOW TO CREATE GREEN DEVELOPMENT MECHANISMS

This section examines the nature of the financial mechanisms available to address the biodiversity conservation problem described previously. In Section 1, the range of possible financial mechanisms is listed and defined: 1) Payments for Environmental Services (PES); 2) Efficient Government Contracting systems (EGC); and 3) Transferable Development Rights (TDR). In Section 2 we formulate the description of two fully comprehensive systems for biodiversity conservation – global efficient contracting and global development rights – in order to illustrate the nature of theoretical financial mechanisms based on the assumption of full international cooperation and scale. In Section 3 we list the partial systems for biodiversity conservation, relying on less universal cooperation and scale. In Section 4 we give examples of these systems. In Section 5 we conclude by stating the necessary elements of financial mechanisms for biodiversity conservation.

1 Various Financial Mechanisms for Biodiversity Conservation

To a large extent, the instrument for dealing with biodiversity will depend upon the scale of the externality involved. As discussed above, many of the values of biodiversity are of the nature of global public goods and it would require a global scale of instrument (and full international cooperation) to devise such. Many other values are from biodiversity-associated goods and services, and these may be designed to capture some proportion of total value, with some smaller amount of cooperation. In the listing below, we indicate these types of values and the types of instruments associated with them.

The more localised values of biodiversity-associated goods (ecosystems, watersheds) can often be captured in markets, by simply matching willing buyers with willing providers of the biodiversity-associated good or service. So long as it is possible to describe and define the good to be provided (by reference to an area of habitat and its use), it is usually possible to enter into contracts for the good or service. This is the realm of the movement for **"Payments for Environmental Services" (PES).**

PES do not reach all of the values of biodiversity but it is feasible to harness markets to give expression to some of the more tangible representations of biodiversity-associated goods (e.g. watersheds, forests). PES are necessarily biased towards those goods that are more concrete and straightforward to specify in a contract (e.g. wildlife species), and is therefore biased away from some of the more abstract and public good-based values of biodiversity (e.g. information). It is necessarily partial in the scope of biodiversity values it addresses, but the most complete in the fact that it attempts to assemble both the demand-side and the supply-side of the market for these forms of biodiversity-associated goods and services.

Benefits of biodiversity that are experienced at a much larger scale (such as continental or national) may be difficult to handle via a single bilateral contract. For example, it may be the case that the good or service required (agro-biodiversity, e.g.) might require hundreds or thousands of individual participants or providers in order to secure it. Theoretically, it may be possible for markets to match willing providers and willing demanders, but it may be more

efficient for government to aggregate this sort of demand and express it through contracting. In these situations, forms of government intervention to represent the public good may be used to address the market failure, and the goal is to design the system in a way that focuses on generating the most efficient supply of conservation; these methods will be referred to as **"Efficient Government Contracting (EGC)".**

These forms of systems are widely used by governments in the provision of public services by private operators (Savvas 1990). Although there is no mechanism for the expression of market-based demand within these mechanisms, they do provide for the efficient organisation of the supply side of the market for biodiversity conservation.

It is possible to imagine comprehensive systems created to generate and channel the broadest values of biodiversity toward the largest possible group of suppliers. This would be possible by means of the creation of a surrogate right that might be marketed, one that proxied for a marketable right in "biodiversity". This approach sees the problem of biodiversity as one of a missing market in the commodity, and the solution as one where the closest possible market in surrogate rights is generated. It is to be distinguished from the PES process above by its attempt to focus on proxies that go to the core of the problem of biodiversity conservation, as opposed to a focus on the more tangible components of biodiversity that are amenable to contracting.

If the core of the problem of biodiversity is sourced in the development/conversion process, these systems could operate via agreements that place caps on various forms of development. Constrained development/conversion is then acting as a proxy instrument for the more nebulous idea of enhanced biodiversity conservation. It is possible to identify and define the nature of development constraints, and the fundamental assumption is that their enforcement will then translate into broad biodiversity benefits.

A system of constraints on global development could be implemented at the global level in order to generate the broad public good values of biodiversity, but would require global cooperation to be fully devised and implemented. Partial systems can also be implemented at more regional levels if this is what is feasible. Any program that involves capping development rights, followed by the endowment of holders with quotas and the need to acquire such rights (through trade or substitution) in order to pursue development may be termed a "**Transferable Development Right (TDR)"** system.

A comprehensive TDR system focuses on the precise specification and endowment of development rights in all remaining unconverted habitats. The specification of these rights enables the demanders of biodiversity to express their willingness to pay. The endowment of these rights in those holding unconverted habitats enables the generation of a stream of revenues to those deciding not to convert (through sale of their rights). In theory, a comprehensive TDR system is capable of allowing biodiversity demand to express the marginal value of biodiversity and of channelling these values as a stream of benefits to those conserving biodiversity.

A partial TDR system can be partial in many respects. It may be geographically limited, in that the endowment of rights covers only one political jurisdiction and thus regulated development and enables trades only within that jurisdiction. It may be partial in that it does not set out all parts of the TDR system, e.g. it may not specify all endowments of

development rights, but only specify the restrictions inherent in the underlying (implicit) endowment. This is the case when a system specifies that all owners of a particular habitat are constrained from development (partially) but that some amount of trading or substitution is allowed within that category. Such a system implicitly is creating TDRs, but without carefully specifying the precise rights created and how all of the ways in which they might be traded.

Finally, an important form of TDR system currently in operation is the voluntary sector-based one. This system relies upon a certifying agency that is non-governmental, and a system of restrictions that is voluntary. It is discussed further below – in regard to offsets and banking.

2 The Future – Global Regulatory Systems for Biodiversity Conservation

Global Public Good Provision – Comprehensive Global Development Mechanisms

If it is accepted that many of the values of biodiversity are of the nature of global public goods (information and insurance), then this points to the importance of ultimately providing a fully international mechanism for conserving biodiversity. Even if such a system is theoretical now, it is instructional to briefly consider how the system might operate, in order to understand the over-arching objective of biodiversity management, and to see how partial systems operate relative to the complete one.

Example: A Comprehensive Tradable Development Rights System

Comprehensive TDR System - Essential Components

Such a system would recognise that there are costs to any incremental development decisions (defined as the continuing conversion of biological resources) or, equivalently, benefits from retaining significant stocks of unconverted resources. The goal of the **comprehensive system** would be to have universal agreement on each of the following components:

a) An agreement on an overall *global cap* on development (restriction on the amount of conversion that would continue to occur);
b) An agreement on the *distribution* of the aggregate quota of development rights resulting from this cap;
c) An agreement on a *trading system* (or other method of substitution between those holding capped development sites and those holding development rights) between any individual at a capped site and any individual holding developing rights;
d) An agreement on the method for *certifying* any valid or authorised development, and authorised acquisition of rights to develop;
e) An agreement on the method for *monitoring and sanctioning* for invalid development; and
f) An agreement on the *agency* that would monitor, certify and sanction the system.

Comprehensive System – Trading at the Marginal Value of Biodiversity Conservation

The goal of a complete Green Development Mechanism for biodiversity conservation would be: 1) to cap all further development (in the sense of conversion of natural systems); 2) to

distribute the capped level of development rights; and 3) to create a market in these rights as a means for compensating communities for non-development decisions.

In this way, development rights become a instrument for generating the marginal value of biodiversity. Any demanders of biodiversity may enter the market and purchase development rights from the holders, driving the price of biodiversity up to their marginal willingness to pay. Any demanders of development must pay the marginal value of biodiversity in order to acquire the right to develop. The market for development rights should clear where the marginal value of biodiversity (represented by willingness to pay by any individual, group or state) was equal to the marginal value of development.

Following the example of the climate change emission trading system, this comprehensive GDM could take the form of a global cap-and-trade system. The cap might take the form of a global restriction on conversion-based development, and an agreed distribution of quotas to individual states or communities. States or communities could then trade their quotas to those demanding either development rights, or further biodiversity conservation, or they could simply exercise their quotas.

Comprehensive System – Endowing Rights and Generating Incentives

Such a system would be effective as a Green Development Mechanism if it distributed the bulk of the development quotas to those communities or states holding significant quantities of biodiversity. For example, it could be agreed that every state would receive rights in proportion to the area available for potential conversion (say, as a percentage of un-converted area) for any given year. If the system agrees a distribution of rights into the future in this way, communities holding biodiversity would be able to trade away rights – current and future – so long as they continued to hold the unconverted area. The value that any community would receive would equate to the marginal value of biodiversity, and the marginal opportunity cost of foregone development. The existence of the market in development rights (and the endowment of rights based on current holdings) would cause the community to perceive a stream of benefits flowing from the decision to continue investing in retaining biodiversity. Any loss of un-converted area would result in a decline in the number of trade-able rights, and so reduce the stream of benefits from retaining biodiversity.

Comprehensive System – Mechanism Design

In addition to the importance of a clear and universal agreement on the methods of right creation, distribution and trading, the comprehensive approach is equally reliant upon the creation of a mechanism design that will certify, monitor and sanction the valid or invalid exercise of development rights. Communities must be endowed with rights only to the extent that they continue to adequately protect and preserve unconverted areas. Monitoring and certification are essential on a periodic basis prior to the vesting of that period's endowment of development rights.

Finally, it would be important to recognise that a fully trade-able quota system would have important spatial implications (due to the different impacts of different areas of biodiversity) and so it may be important to design quotas that were spatially differentiable. For example, it may not be considered viable or desirable to enable the trade-off of one development right based upon a hectare of coral reef for a development right based upon a hectare of temperate

forest. For this reason, any system built upon trading development rights must also design the quota system to enable trading between equivalent rights, or at exchange rates that represent differential benefits from different systems. This points to the likelihood of a more complex development rights system, with several levels or types of rights being created (and only enabling trading within levels), e.g. tropical forest rights, marine systems rights, wetland area rights, etc. If a spatially differentiable system is necessary, then the certifying agency must also certify trades as valid within the trading rules.

Example: A Comprehensive Efficient Government Contracting System

The idea here is for the establishment of a "global habitats planning authority": an agency that that has the responsibility for devising a plan to ensure that a diversity of (primarily) land uses continues to exist across the globe, and that is vested with the capacity to generate the resources necessary to ensure that its plan is given effect. It is assumed that the demand-side of the problem is resolved through standard government aggregation, and the backing of the authority's bonds that issue in accordance with its charter. Then the effective exercise of planning authority is a supply-side issue, i.e. the objective is to allocate funds to secure the most effective conservation of the highest valued global biodiversity. Of course, the effectiveness of the exercise of this authority depends upon demand-side issues (satisfaction of broad preferences) as this is important for the replenishment of the authority's resources.

Comprehensive Efficient Contracting System – Essential Components

Such an authority would undertake the following steps in order to pursue efficient contracting for the supply of biodiversity:

a) An agreement on the establishment of an inter-governmental agency – a "habitats planning authority" - with powers of contracting and with powers for the issuance of long term bonds backed by the charter state governments;
b) Including in the charter a statement on the *habitat preservation objectives* to be pursued by a "habitats planning authority" and establishment of the principles by which these objectives are to be pursued;
c) establishment of a *land use plan* by the scientific authority of the habitat planning directorate;
d) announcement of *tender documents* by the habitat planning directorate, specifying the forms of land uses, the rights desired, and the types of biodiversity to be conserved, in addition to the methods of monitoring and penalties for enforcement to be required;
e) announcement of *designated franchisees* and the form of continued monitoring of contract performance for periodic payments funded by sales of long term bonds.

Charter for a Habitats Planning Authority
The charter for the Planning Authority needs to specify the basic objectives it is intended to fulfill (in regard to land use management) and also to vest it with specific powers of contract and bond issuance in the pursuit of these powers. The latter set of powers are essential to the establishment of its credibility in contracting. The former set of restrictions is essential to the delimitation of that authority.

Development of Global Land Use Plan.
The first step in the implementation of this global land use planning authority is the

development of some sort of a scientific plan for the implementation of its chartered objectives - incorporating the range of land uses that should be retained and in what approximate proportions. The object of such a plan is to create a generally agreed direction for conservation, in order to inform the contracting process.

Contracts - Specification of Restrictions and Conditions.
The second step toward the creation of the financial mechanism is the creation of a standard form of conservation contract that is the basis for its tenders. This contract would detail all of the conditions that must be satisfied (by certification of the authority's standards committee) at the end of each year of the term of the agreement. It would provide for a clear delineation between those rights to be reserved for the authority, with the residual to be recognized as retained by the owners. It is imperative that the contracts recognize that residual property rights remain with the owners, and that only carefully specified (and monitorable) restrictions are acquired by the agency. For example, the LUA could develop a thirty-year agreement for the acquisition of all rights to clearing and burning in a 100,000 hectare area of tropical forest, with all other residual rights to development remaining with the owners. If the conditions of the contract are fully satisfied over the entire territory subject to the contract, then the full agreed rental rate is paid and the contract continues. If only partially fulfilled, then the penalty for derogations should be specified (e.g. rental rate is paid on a per hectare basis, and the remainder of the contract is terminable at discretion of authority).

Tender of Contracts
The contract for these land use restrictions is then put out to international tender. It is advertised, with the full terms of the contract available to all interested parties. The tender announcement states a date and time by which any interested party must make its bid for the contract. Bids should be made by the host state where it is the owner of that area, or by a private individual owner with the support of the host state. The bid should specify: i) willingness to accept the terms of the contract; ii) the territory to be subject to the terms of the agreement (indicated on a fully specified map); and iii) the per hectare annual rental payment required by the host state (and/or owner) for the acceptance of the agreed restrictions. The tender specifies that the auction will select bids on the basis of combined price and quality of bid.

Acceptance of Bids - Designation of Agreed Restricted Territories
Once the bids are received the agency then must ascertain the number of the bids to accept. Once accepted, the agency's responsibility is to enter into the specified contract, issue the underlying bonds, and then to undertake inspections to ensure compliance with the restrictions within the agreement. The payments for the restricted land uses flow to the contracting party (usually the host state), which then enforces the division of land uses between the agency and the local communities. When the agency certifies the status of its zoned territories and distributes its funding between them, it simultaneously announces its list of desired acquisitions in a call for additional funding from all sources.

Mechanism Design - Efficient Government Contracting

Efficient government contracting is the efficient pursuit of the supply-side of biodiversity conservation. It operates through the proper specification of: a) the agency to perform the exercise; b) the objectives of the conservation exercise; c) the global plan; d) the contract offer; and e) the monitoring and penalty mechanism. The comprehensive approach would rely upon

the international community establishing the agency and investing it with contracting and fund-raising powers restricted to the chartered objectives. To some extent, this supply-side approach could branch over into the demand-side of the problem - if the effective exercise of these powers was seen to be the reason for the amount of funding that it was able to raise in each cycle.

Potential Allocations of Rights in Biodiversity Conservation Region
(The Range of Possible Divisions of Land Use Rights)

Development Rights primarily allocated to:

Global Community			Owner
		Title for Zone:	
Intl. Wilderness	Intl. Park	Extraction Reserve	Non-Burning Area
		Allowed Uses:	
Limited Tourism	Tourism	All Extraction	All Uses but burning

3 The Present – Partial Financial Mechanisms for Biodiversity

Assuming that the pursuit of a fully comprehensive and international framework for global public good provision is some way off in the future, then a less than global financial mechanism might take a less-comprehensive form but still with the object of transferring some values to some of those communities hosting biodiversity.

These mechanisms attempt to create rights in biodiversity-holding communities, and create systems for paying these communities to invest in their biodiversity. The difference with the comprehensive system lies in the absence of any universal system of rights distribution, and in the absence of a universal mechanism/agency for certifying and enforcing that system. These mechanisms are partial in the sense that they operate to transfer some part of the values of biodiversity to some communities hosting biodiversity, rather than attempting to generate a complete market in biodiversity's total economic value.

There are three primary mechanisms for channelling values from the broader (but less than global) community towards those communities that conserve biodiversity, as follows:

1) Payments from beneficiaries to providers of biodiversity-associated goods (PES);

2) Provision of Biodiversity by the State under Efficient Governmental Contracting (EGC); or

3) Adoption of Partial Development Restriction Systems.

A) Payments for Ecosystem Services

One important mechanism for biodiversity conservation in many contexts is Payments for Ecosystem[1] Services (PES). PES schemes do not have a single, universal definition, and as such the term may be used to describe a wide range of programmes, including the 'Pagos por Servicios Ambientales' (PSA) programme in Costa Rica. Wunder (2005) uses the following five criteria to describe the PES principle:

- voluntary transactions
- relating to well-defined environmental services, or land uses likely to secure those services
- environmental services or land uses are 'bought' by at least one buyer
- environmental services or land uses are provided by at least one provider
- payments are conditional on provision of the environmental service or land use.

In relation to biodiversity, PES schemes may be used to protect diversity though payments for setting aside land or managing it in particular ways or for avoiding use of designated bodies of water.

PES mechanisms can be used as a way for the private sector to provide incentives for biodiversity conservation. In this case, the buyer of the services may be one or more private sector firms, individuals or donor institutions. It is also possible to combine funds from different sources to create a single payment for landowners.

B) Efficient Government Contracting for Biodiversity Provision

Some values are too diffuse to be easily appropriable and contractible by individual agents. This may be the case if the appropriable value of the biodiversity is not very concentrated (e.g. spread across all consumers in the society rather than just those in a particular city or watershed) or if it is subject to large-numbers problems (e.g. difficult to organise groups, such as those existing across many different political jurisdictions). When this is the case, it may be necessary for the particular value to be aggregated and expressed by some governmental body.

When the values are more easily appropriable by a government body rather than a private agent, then it remains possible to solve the problem of acquiring an efficient supply of biodiversity via the use of market mechanisms. Many public bodies now contract out or franchise systems of provision through organised supply from large groups of potential suppliers. For example, many if not most public services in municipalities (waste collection, public transport, park maintenance) are provided now by means of organised competition for supply contracts or limited-term franchises. (Savvas 1996)

Efficient contracting is most effectively used when it uses an auction-based approach for the allocation of funding between different suppliers. An auction enables the purchasing body to specify in the tender documents the sorts of characteristics being sought in the acquisition, and to request bids relative to specific tenders of rights. This enables the contracting body to

[1] Alternatively referred to as 'environmental' or 'ecological' services.

allocate the funding available in order to acquire the most useful areas of habitat at the least cost.

If habitats are relatively inter-changeable with respect to biodiversity conservation effectiveness, efficient contracting schemes can minimise the costs of conserving biodiversity by targeting the areas of habitat with the lowest opportunity costs. The nature of efficient contracting programmes is such that if a flat rate payment is used, information does not need to be collected on the opportunity costs of land. This is an advantage relative to protected areas, where the value of alternative land uses is generally unknown, making it difficult to minimise opportunity costs. An auction-based scheme involves offering a payment at a particular level so that only those with opportunity costs below that level will choose to participate, and high value land is automatically excluded.

C) Transferable Development Rights (including offsets and banking)

A full system of transferable use rights would involve placing a cap on the total amount of land conversion (or development) to be allowed. This cap may be fixed at the current level of development, or it may allow for either a planned reduction in species and habitat loss or requirements for further development at a set rate. Within the total cap, individual organisations or landowners can use their allotted development rights, or else sell permits to others. Alternatively, those who wish to undertake development activities that damage biodiversity must buy permits in order to do so. This mechanism unbundles the property rights to land and other resources, separating the right to use the resource in ways that are harmful to biodiversity from the ownership rights to the resource.

Within a TDR, there is a choice about how the initial rights are distributed. They may be allocated free of charge under various possible decision rules, e.g. on the basis of previous activity or taking account of equity consideration. Alternatively, there may either be no distribution of rights (zero quota), or the rights to biodiversity-damaging activities may be auctioned initially. Montgomery (1972) shows that regardless of how the permits are initially allocated, the mechanism will still produce the most cost-effective solution as the permits will ultimately flow to the highest-valued uses.

An appropriately defined TDR can minimize the cost of reaching a predefined environmental target (Baumol and Oates 1971). In a perfectly competitive market, development rights will flow towards their highest-valued use. Those that would receive lower value from using the rights (for example because the benefits from developing an area of land are lower) have an incentive to trade them to someone who would value them more. The specification of the right enables both demanders of the good to express their willingness to pay, and the suppliers to see the benefits of their rights holdings (Tietenberg 2003).

Fully transferable use rights may be considered the more comprehensive version of restriction-based systems. More restricted trading systems may disallow full trading, and enable only very specific forms of substitutions between habitats. For example, offsets and biodiversity banking will usually specify a very limited set of trades or substitutions that are available for a given development right. We turn to these below:

Limited TDRs - Biodiversity Offsets (Regulatory and Voluntary)

Biodiversity offsets are defined by ten Kate et al (2004) as "conservation actions intended to compensate for the residual, unavoidable harm to biodiversity caused by development projects, so as to ensure no net loss of biodiversity". This is a TDR type of system that implies that all development of the subjected habitats is restricted, and that substitution of obligations between regulated parcels is allowed only after careful examination of the proposed substitution.

In the regulation of the environment, offsets have been used as restricted trading systems for many years. The enactment of the Clean Air Act Amendments included the possibility of offsets between sites, or within particular projects ("bubbles") as a means of substituting obligations. (Stavins 1995) This is a trading system that is being operated "within the firm" rather than across all agents within a particular political jurisdiction. Hence, offsets have been defined as fairly restricted forms of trading systems, where one obligation may be traded for another under the scrutiny of the regulator.

For example, large infrastructure projects are often scrutinised through an environmental impact assessment, in which alternative solutions are considered, including the possibility of not continuing with the project, and impacts are avoided or minimised. However, there are some impacts, often connected to biodiversity loss, which cannot be avoided or properly minimised. Those impacts on biodiversity may then sometimes be offset at other sites - in order to avoid net loss of biodiversity. The purpose of offsets is therefore to ensure that unavoidable adverse environmental impacts of development are counterbalanced by environmental gains, with the aim of achieving a net neutral or beneficial outcome.

Offsets may be legally required in order to obtain permission for particular development activities. For example, the Canadian Fisheries Act (1985) prohibits the destruction of fish habitats, but if proposed developments cannot be relocated or redesigned, and mitigation is not possible, developers may compensate for the negative impacts through creation of new habitat or improvement to existing habitat elsewhere. Further examples of legal offset schemes are discussed below.

In addition to regulation-based offset arrangements, private companies will sometimes voluntarily offset the impacts on biodiversity generated by a given activity or proposed project. This plays the role of a self-imposed development restriction, implying that aggregate levels of development are not being impacted by a given project. Certification of a voluntary offset (by an NGO or other body) places the credibility of that organisation behind the proposer's assertion that overall development levels are not being impacted.

As discussed above, most biodiversity is located in poor, tropical countries, where preventing an increase in aggregate levels of development is not the locally preferred option. Voluntary offsets allow development to go ahead in these regions, while preserving the self-imposed development constraint by imposing restrictions elsewhere (in other jurisdictions). In this way, voluntary offsets are capable of bridging across jurisdictional boundaries, where regulation-based offsets are not.

Of course much of the impact of voluntary offsets depends upon the credibility and longevity of the certifying body. If the body does a good job of selecting and certifying the substituted habitat, then the substitution can enhance biodiversity conservation; otherwise, the impact may be limited to the value of the certifying body's reputation. The body is also (at least

implicitly) relied upon for assurance that the substituted restriction remains in place and in force in perpetuity. These are difficult tasks to assign to voluntary bodies, whose existence and reputation is un-regulated.

Limited TDRs –Offsets with Biodiversity Banking

A mechanism that is connected to the use of offsets is biodiversity banking. This involves the certification of areas of protected land that can be used as the basis for selling biodiversity credits to those with a need to offset their activities. Land can be certified on the basis of the ecological quality of the habitat, or the presence of particular species that are endangered or considered to be important. In general, land that is in better ecological condition, or that contains many important species will obtain more credits than the same area of land of poorer quality. In addition, the certifying agency may give more credits for connected areas of land that contribute to a single large area or an ecological corridor between protected areas.

The key importance of biodiversity banking is that it generates an implicit market for unconverted lands for purposes of biodiversity conservation. The prices paid for banked lands become the means for expressing the demand for biodiversity conservation. And these banked lands may be acquired by developers and conservation groups alike, enabling the expression of the willingness to pay for either development or biodiversity conservation. To a large extent, a biodiversity bank is able to operate like the market in TDRs that is the objective of a comprehensive system.

4 Examples – Existing financial mechanisms for biodiversity conservation

This section describes how the mechanisms discussed above can work in practice, using specific case studies.

4.1 Payments for Ecosystem Services (PES)

One of the best known examples of a PES scheme is the Pagos por Servicios Ambientales (PSA), which was introduced in Costa Rica in 1997. The PSA permits the government to enter into binding contracts with landowners for the provision of four services: sequestration of carbon, water quality and quantity (i.e., for drinking, irrigation or hydroelectric power), biodiversity conservation, and aesthetic beauty for ecotourism (Salzman 2005). Landowners agree a management plan, which is adapted into a conservation easement attached to the land title. Most contracts last for five years, but they can be up to 20 years.

The PSA programme provides a framework to link the buyers and sellers of ecosystem services, so the funding for the payments come from a variety of sources. A government agency called the National Forestry Financing Fund (FONAFIFO) has been set up to negotiate the agreements, monitor compliance and administer the payments. The majority of its funding comes from a national tax on fuel, but it also receives income from donors such as the GEF, and from public and private companies with specific interests such as watershed protection for hydropower operation, or conservation of areas of scenic beauty that are used for ecotourism purposes (Rojas and Aylward 2003). The private donors can choose to target particular forest locations through FONAFIFO in order to obtain specific environmental services.

Due to the local nature of many ecosystem services, PES schemes are frequently implemented at the local level, although they may be funded at the local, national or international level. For example, in the case of the Pimampiro watershed in Ecuador, the Pimampiro municipality has established a fund, into which domestic water users in the town pay a fee for water provision. This fund is used to make monthly payments of $0.5-1/ha to upstream landowners for managing forest land (Echevarria et al. 2004). Similar schemes, involving payments from urban residents to upstream farmers, have been developed in many other locations including Nicaragua (Perez 2005), India (Kerr 2003), and Brazil (Landell-Mills 1999).

PES agreements can also be made between individual companies and upstream landowners. For example, in Mt Kanla-On National Park in the Philippines, conservation of forest land within the park is financed by charges that are levied by the park board for use of the park's natural resources, including watershed protection benefits. These are then used to compensate residents in the park for conservation activities. It was estimated that the benefits of forest protection for SMC-Viva, a mineral water company, were approximately $4,000-18,000 per year (Rosales 2003).

A similar example is the case of Perrier Vittel, the largest bottler of mineral water in the world. In the early 1990s, seeking to reduce the nitrates and pesticides entering the springs around its bottling operations in northeastern France, Perrier Vittel employed a range of payment mechanisms to change land uses in the catchment area. For an estimated $9 million, Perrier Vittel paid above market prices to purchase 1500 hectares around its water springs. They then offered to give back free usufruct rights to the land to the prior owners if they followed prescribed management practices. Perrier Vittel also signed long-term (eighteen to thirty years) contracts with forty farmers covering an additional 10,000 hectares, paying them to use less intensive dairy farming techniques. The net result of these initiatives has been a reduction in non-point source pollution and significant changes in local dairy farming and animal waste management practices while eliminating corn cultivation and use of agricultural chemicals (Salzman 2005).

Another method of linking demand for ecosystem services with their supply is through the use of eco-labelling, whereby consumers pay for products produced in an environmentally beneficial manner. In relation to forest biodiversity, an important certification scheme is run by the Forest Stewardship Council (FSC), an international NGO representing forest producers, environmental bodies, and other interested groups. FSC certification for forest producers involves following internationally-agreed Principles of Responsible Forest Management, and undergoing inspection by independent auditors. While the specified management practices do not necessarily encourage greater forest biodiversity, they do include a requirement to maintain the ecological functions of the forest and its biodiversity. As well as this, the additional tracking involved in the certification process means that illegal logging of tropical forests is more difficult to disguise.

A different type of eco-labelling that offers the potential to protect biodiversity is shade-grown coffee. This is a traditional coffee cultivation process that involves growing the coffee plants below canopies of native trees. These tree canopies are observed to contain high avian biodiversity (Moguel and Toledo 1999). Modern methods of growing coffee without shade produces higher yields, but very low biodiversity. Pagiola and Ruthenberg (2002) have

looked at attempts to certify shade-grown coffee from El Salvador and Mexico, which are both areas that currently have relatively large areas that have not yet been converted to sun-grown techniques.

A less obvious example of eco-labelling is the development of green investment funds. Mountford and Keppler (1999) highlight the emergence in the Netherlands of investment funds that invest in environmentally beneficial activities. These are certified by the government in order to receive tax advantages, which mean that loans can be given for 'green' activities at a more favourable interest rate than the standard rate. Significantly, although the returns are generally lower than for other investment funds, even accounting for the tax advantages, Dutch consumers have displayed high willingness to invest in the funds. The process of certifying the funds for tax purposes has created a separate market for consumers who have preferences for environmentally-friendly investments.

Demand for ecosystem services can also be used to create incentives for conservation through the capture of nature-based tourism benefits. One way to do this is to charge entrance fees for national parks and other protected areas. These may be fees charged by the government for public parks, which can then be used to finance the operation of the parks as well as other state activities. In addition, funds can be used for local development activities. For example, the Park's Revenue Sharing Program in Uganda ensures that 20% of park fees from parks such as the Mgahinga Gorilla and Bwindi Impenetrable National Parks (as well as other donated funds for the management of the parks) are used for social projects in nearby communities (Rainer et al 2003). Part of the intention of this is to improve local attitudes towards the parks, and to reduce rates of encroachment.

The benefits of conservation for tourists can also be captured by charging fees for entrance to private parks and reserves. The Monteverde Cloud Forest Preserve in Costa Rica is owned by the private, non-profit Tropical Research Centre, and has become one of Costa Rica's most successful tourist destinations (Aylward et al 1996).

It is not necessary to charge entrance fees to protected areas to benefit from the tourist enjoyment of diverse forest areas. This is because the protection of natural resources that attract tourists to an area can also create economic opportunities in that area. There has been fairly extensive experience with community wildlife conservation projects, where communities protect wildlife in return for income and employment as safari or hunting guides, and earnings from tourist lodges, often in cooperation with the private sector. The well-known CAMPFIRE programme in Zimbabwe, and similar programmes such as the Community Conservancies in Namibia, are examples of mechanisms that provide communities with the responsibility for wildlife management and also the potential to benefit from wildlife-based tourist activities.

4.2 Efficient Contracting for Public goods

The mechanisms that will be described in this section treat biodiversity or environmental quality as public goods that are purchased by the state on behalf of the national population. Market-based instruments are used as efficient means to provide incentives for the supply of the public goods.

Within the EU Common Agricultural Policy, individual states have implemented various

types of Agri-Environment programme. These provide subsidies to farmers in return for the adoption of agricultural practices that use land more sustainably; lead to lower levels of water and air pollution; improve local landscapes; or protect biodiversity. The UK Environmental Stewardship Scheme has two levels: farmers who participate in Entry Level Stewardship (ELS) choose from over 50 options, such as hedgerow management, stone wall maintenance, low input grassland, and buffer strips, each of which earns set points. They receive £30 per hectare per year for all the land entered into the scheme as long as they deliver 30 points per hectare of land entered. Participants in Higher Level Stewardship (HLS) carry out more complex land management changes, and payments are related directly to the changes made. ELS contracts last for five years, while HLS contracts last for ten years and involve a detailed Farm Environment Plan. In both cases, payments are made every six months by the Rural Payments Agency, who also carry out inspections of farms to ensure that the scheme requirements are being met.

Mechanisms to purchase public goods on agricultural land are common in other parts of the world as well. The US Conservation Reserve Programme invites bids from landowners who are willing to set aside areas of land. The proposed areas are rated on the basis of the environmental benefits, such as erosion control, wildlife habitat, water quality, and air quality, that would arise from taking the land out of production, and the payment rate requested. These are combined into an 'Environmental Benefits Index' (EBI), which scores the cost-effectiveness of the bid. Those that rate highest according to the EBI are selected for inclusion into the programme. Part IV discusses the design and operation of the Conservation Reserve Programme in more detail.

The Australian BushTender Programme is a similar scheme, aiming to preserve remnants of natural vegetation on private land. Landowners who wish to enter the programme contact the Department of Natural Resources who send field staff to the site to explain to the landowners which remnants of vegetation are important, and which management changes would be most beneficial. Interested landowners can then submit bids, with management plans detailing the management changes they would introduce and the areas of land they are willing to conserve, along with the amount they would be willing to accept for doing so. The Department of Natural Resources select the bids that offer greatest value for money based on the biological value of the site, as assessed by the field staff, and the cost per hectare of the bid.

An example of a scheme targeting forest land rather than agricultural land is the METSO Programme, or the Forest Biodiversity Programme for Southern Finland. The first phase of the programme ran from 2003 to 2007, and a second phase has now been introduced for the period 2008-2016. While there is an extensive network of protected areas in Northern Finland, most of the forests in Southern Finland are privately owned. As a result, the forest biodiversity programme primarily aims to encourage forest owners to conserve ecologically valuable features in their own forests, and provides incentives for such voluntary conservation. Forests may be purchased by the State, or conserved or suitably managed under temporary or permanent agreements, depending on the nature of their valuable ecological features. Forests with a lot of decaying wood and old-growth, for instance, may be preserved for periods of 10 –20 years to benefit hole-nesting birds and other species that depend on such habitats. The scheme operates on a voluntary basis, within which landowners can offer land to be permanently protected, or used in a way that preserves biodiversity. Each agreement is negotiated with the Regional Forest Centre, which surveys the site to assess its biological value to determine whether it can be included in the programme. The level of

compensation is also agreed at this stage.

There are fewer case studies of mechanisms through which governments purchase public goods in developing countries. However, some important examples have been implemented recently in China. The Sloping Land Conversion Programme is primarily focused on watershed protection and poverty alleviation, but also includes biodiversity objectives. It operates by paying subsidies to farmers in return for converting steep hillsides to forests and grassland. The subsidies are paid at a flat rate (although there is some regional variation in the rate), in the form of cash, grain and tree seedlings. Participating farmers can plant either 'commercial' trees or 'ecological' trees. The former provide a potential financial return through the harvest of non-timber products such as fruit, nuts or oils, while the latter only provide environmental benefits. Farmers who plant 'commercial' trees receive subsidies for a period of five years and farmers who plant 'ecological' trees receive subsidies for eight years.

Another Chinese programme that creates demand for the public good benefits of biodiversity conservation is the Forest Ecological Benefits Compensation Fund. This fund is used to make payments to communities that manage natural forests in ways that maximise the ecological benefits of those forests. However, the payments currently only cover the costs of forest management and not the opportunity costs of protecting the land. Furthermore, the monitoring and enforcement of the programme are thought to be minimal, particularly in terms of the ultimate environmental outcomes (CCICED, 2002).

The main strength of these schemes is argued to be their cost effectiveness. In particular, they have been compared with Integrated Conservation and Development Programmes (ICDPs) and Community-based Natural Resource Management, which encourage the maintenance of biodiversity by helping communities to use it sustainably, for example for NTFP harvesting or eco-tourism, or by providing alternative sources of income or other social benefits. Ferraro and Simpson (2002) compare the theoretical cost of an instrument that subsidises either the cost of capital inputs to biodiversity-friendly activities or the price of outputs, with the cost of an instrument that provides direct incentives for biodiversity protection. They find that direct incentives are necessarily more cost-effective than indirect incentives because the payments are only made for protection of biodiversity, and not for other activities. Using an empirical example of conservation in Madagascar, they find that for a given increase in forest protection, the overall cost of the indirect approach is 12 times greater than the direct approach.

4.3 Restrictions on development - tradable quotas, offsets and banking

Tradable use rights

The standard model of tradable use rights is a cap and trade mechanism for achieving reductions in emissions of particular pollutants. An early example was the US system of tradable permits for sulphur dioxide emissions, which was aimed at reducing acid rain damage at minimum cost. More recently, the most significant example of a cap and trade system for atmospheric pollution is trading of greenhouse gas emissions under the Kyoto Protocol. The developed countries that are signatories to the agreement have committed to emissions quotas, and those who reduce their emissions to a greater extent may sell credits to countries not reaching their quota. Within this system, there is also increasing use of tradable permit systems in individual countries or regions. The EU Emissions Trading Scheme (ETS)

is the largest of these, and involves the trade of greenhouse gas emissions across the countries of the EU. The emissions permits were initially allocated free of charge on the basis of historical emissions, but the system is moving over time to the auction of permits. The permits can be traded across national boundaries, and also, to a restricted extent, over time.

In addition to trade in emissions permits, the ETS provides funding for carbon reductions in developing countries through the Clean Development Mechanism, in which credits can be obtained through investment in projects that reduce greenhouse gas emissions in developing countries. This has implications for biodiversity, particularly if avoided deforestation is included in the mechanism at a future date in line with the REDD proposals. However, the impacts may be positive or negative because on the one hand there will be increased funding for maintaining forested land, which could protect biodiversity, but at the same time, there are trade-offs that mean that managing resources for optimal carbon sequestration will not necessarily result in high biodiversity values. The Proactive Investment in Natural Capital proposal of the Global Canopy Programme aims to address this through the development of an additional instrument to combine payments for carbon reductions with financial incentives for the provision of other ecosystem services and biodiversity.

Another relevant example of tradable use rights are those used within the zoning regulations of many municipalities. In Boulder County, Colorado, in the US, a threshold is placed on the size of single-family residences. However, the rights to build up to a given size can be traded among developers. The effect is that those who intend to build larger residences must buy permits in order to do so, and a financial incentive is created to either build smaller residences or leave land undeveloped, as those who do so can sell permits. The objectives of the regulations are to maintain smaller-scale homes and a diversity of housing stock, and also to promote and preserve vacant land.

Lastly, New Zealand, like a number of other countries, uses a system of Individual Transferable Quotas (ITQs) to manage its fish stocks. Quotas are created in two dimensions: species and location. In 1998, the total number of species covered by the program was 33, which were traded to varying degrees in 157 markets (i.e. there are numerous geographical regions but not all species are traded in all regions). Each year, the Minister of Fisheries sets a total allowable catch for each species that is based primarily on a biological assessment of the stock, but also accounts for environmental, social and economic factors. This allowable catch is the basis on which the transferable quotas are created. Consultations occur between government departments, scientists, industry and environmental representatives to determine the allowable catch. The explicit objective of setting the allowable catch is to move the fish population to the level that will support the maximum possible sustainable annual catch.

Since ITQs are individually held by fishers, changes in the allowable catch would have to be reflected in changes in the ITQs. If the government had to buy ‘excess’ ITQs in order to ensure the allowable catch was respected, it would be assuming all risk inherent in annual changes. On the other hand, if an ITQ specified that it represented a certain fraction of the allowable catch, then fishers would bear the annual risk. In New Zealand, the choice was made to have the fishers bear the risk so the ITQ is specified as a percentage of the allowable catch (OECD 2004).

TDRs with Offsets

At the national level, there are two relevant examples of the use of offsets that have been implemented in Brazil. They each show how different types of regulation can be used as the basis for offsets. The first is implemented through the 1965 Forest Code, which states that fixed percentages of each landowner's land must be maintained under natural vegetation. If a landowner cannot, or does not wish to, maintain sufficient natural vegetation to comply with the regulation, they offset their requirement elsewhere, preferably be within the same watershed (Chomitz et al 2003). The second use of offsets in Brazil is through the National System of Conservation Units, within which developers of proposed large scale projects must submit to an Environmental Impact Assessment, and must pay a fee of at least 0.5% of the costs of the project, which is allocated to conservation expenditure. The exact fee amount is decided by the environmental agency responsible for approving the project, and varies according to the likely environmental impacts. These two schemes will be described in greater detail in Part IV.

The Business and Biodiversity Offset Progamme (BBOP) has a number of pilot projects intended to test the effectiveness of offsets as a mechanism for biodiversity conservation. These are described in the BBOP Consultation Paper (2008). One pilot project is the Akyem Project, in which Newmont Mining Corporation will voluntarily offset the impacts caused by the development of an open pit mine in Eastern Ghana, including the Ajenjua Bepo Forest Reserve. The proposed offset site is the Mamang Forest Reserve, which is a similar ecosystem type and in better condition than the section of the Ajenjua Bepo Forest Reserve that will be disturbed. On the offset site, the main activities will be to strengthen the management of the Forest Reserve through additional patrolling and monitoring, and to address the underlying drivers of biodiversity loss in the area.

Another example of an offset of the biodiversity impacts of mining activities is being implemented by AngloPlatinum in the Limpopo Province of South Africa. In addition to the loss of habitat resulting from expansion of an existing mine, this project is expected to have significant social impacts due to the necessary relocation of 956 families and the loss of access to land for grazing and fuelwood collection for others. As a result, the offset needs to account for both biodiversity and social factors. The social element of the offset consists of the construction of new houses for the displaced families and the provision of appropriate water, sanitation and road services. Further compensation in the form of land is also offered to make up for the loss of access to natural resources. The biological offset will be implemented on two farms owned by the company, on which habitat restoration and development of woodlots will be carried out. In addition, some of the original megafauna will be introduced and farmed, providing opportunities for limited trophy hunting and the operation of a game lodge. This last factor is intended to contribute to both the biological and social benefits of the offset.

Other activities to offset the biodiversity impacts of mining are also underway within the BBOP framework in Qatar, Madagascar and New Zealand. In addition to these, an offset pilot has been set up by the City of Bainbridge Island to offset the impacts of real estate development. The intention is to have multiple offset activities, but the first project involves offsetting the impacts of a residential development in Blakely Harbour by restoring degraded forest habitat elsewhere on the site and moving the existing shoreline road inland. This would potentially allow removal of the rock bulkhead along the shoreline road and restoration of the adjacent intertidal habitat.

As well as the BBOP pilot activities, numerous other voluntary offset activities are taking place in relation to different types of high impact development project. As an illustrative example, BHP Billiton Petroleum have offset the impacts of the development of offshore installations and an onshore gas terminal, close to a highly populated area in Liverpool Bay in the UK. The site consists of a shallow, tidal marine ecosystem, ecologically and recreationally valuable intertidal areas, and largely developed coastal land. In addition to mitigation of identified impacts where possible, BHP Billiton Petroleum purchased and modified land adjacent to the project site in order to maintain an area of wetland in compensation for a lost roosting area. Support was also given for the improvement of the dune areas near to the gas terminal, both for recreational purposes and for biodiversity protection, with the re-introduction of the Natterjack toad.

In the context of marine biodiversity, Wilcox and Donlan (2007) propose a mechanism for offsetting the impacts of seabird bycatch by fishing fleets. Despite mitigation measures such as the prohibition of setting longlines during daylight hours and mandatory use of heavily weighted lines, the Australian Eastern Tuna and Billfish Fishery still kills several thousand shearwaters per year (Priddel et al 2006). However, the seabirds are also subject to other threats such as habitat degradation, predation by invasive predators and ingestion of plastic. Wilcox and Donlan (2007) therefore use a bioeconomic model to investigate the potential for offsetting the impacts of the fishing fleet through the eradication of the rat population (a key invasive predator). They estimate that the closure to fishing of a 750km radius around Lord Howe Island, which is the majority of the fishery, would cost US$3 million and raise the growth rate of the shearwater population by 6%, while eradication of the rat population would cost US$500,000 and increase the growth rate of the shearwater population by 32%.

TDRs with Biodiversity Banking

The 1973 Endangered Species Act prohibits activities that jeopardise the continued existence of any species listed as endangered, or result in the destruction or adverse modification of designated critical habitat of such species. However, developers of land that subject to the Endangered Species Act can obtain an 'incidental take permit' subject to preparation of a Habitat Conservation Plan, which includes requirements to 'minimise and mitigate the impacts' of the proposed activity (ten Kate et al. 2004). The mitigation may be carried out through the purchase of species-specific conservation credits from conservation banks. These conservation banks are set up by public or private organisations, including timber corporations, NGOs, family ranches and municipalities, and may sell credits to third parties or use them to address internal mitigation needs (Fox and Nino-Murcia 2005).

A number of issues have been highlighted in relation to conservation banking in the US. The first is the need for an active market, on both the supply and demand-side. A large potential pool of credit buyers is necessary in order to create the incentives for establishment of conservation banks. This in turn relies on effective enforcement of mitigation requirements and related regulatory controls. A second important issue is the ratio in which credits can be exchanged for impacts that need to be mitigated. A credit ratio is assigned to both the conservation bank and the purchaser of the credits, each reflecting the ecological value of the habitat, and each based on the judgement of the awarding agencies. The result of this is that on the one hand, this provides the flexibility to award high ratios to particular areas of land in order to encourage the banking of those sites. However, the bank owner has incentives to inflate the ecological value of the land while the mitigation seeker is motivated to minimise

the value of their site. As a result, impact assessments may assign lower credit ratios than surveys to support banking agreements, which would mean that when the two are matched up there may be a net loss of ecological value. A caveat to this is that the benefits of conservation on larger areas of land and ensuring appropriate protection in perpetuity may outweigh losses resulting from imprecise credit ratios.

As well as conservation banking, the US has a system of wetland mitigation banking. The scheme is another form of habitat trading programme and has been in use for over a decade. As with conservation banking, it involves public and/or commercial entities creating or restoring an area of wetlands, that make up a "wetland bank". Private developers must then purchase wetland credits from these banks in order to offset the damage they will cause to another comparable wetland. Purchase of such credits is a precondition for being granted their development permit. The scheme has flourished since its inception in the mid-1980s with over 70 commercial mitigation banks currently in operation in the US. Between 1993 and 2000 95 km^2 of wetlands were developed in exchange for 165 km^2 restored in mitigation form. However, it has been argued that the methods for assessing the equivalency of traded wetlands tend to be very crude, relying on basic metrics such as size (hectares) and habitat function. Furthermore, in order to ensure that 'unbalanced' trades are not made, there are numerous constraints on what may be traded (Salzman and Ruhl 2002).

A form of banking has also arisen in the context of the Brazilian system of Legal Forest Reserves (LFR). As discussed above, landowners who are unwilling or unable to maintain the required area of natural vegetation can protect an area of vegetation in an alternative location. This may be done through renting or purchasing an additional area of land, or landowners can purchase LFR Equivalent Areas. These are provided by landowners who have voluntarily protected areas of land in addition to their own set-aside requirements, and can therefore sell LFR credits to those who need to offset their land clearance activities.

BioBanking in New South Wales, Australia, is based on a regional conservation plan in which areas are identified as "green-light", "amber-light" and "red-light", based on the level of biodiversity values. Development may take place in "green-light" areas without any requirement to offset; in "amber-light" areas, development requires a rule-based method to determine the likely biodiversity loss, which must be offset; and "red-light" areas are the targeted locations for restoration activities. Within this framework, landowners and other entities can manage land in order to maximize the biodiversity value, and receive credits for doing so. These credits can be sold to developers with a requirement of offset their activities. They may also be sold to those wishing to invest in conservation outcomes such as charitable organizations and governments.

The scheme is administered by the Department for Environment and Climate Change, and they register, audit and enforce BioBank agreements. Catchment management authorities also help landowners establish BioBank sites where appropriate. The number of credits assigned to a site is calculated using the BioBanking Assessment Methodology, and is a function of the ecological value of the site and its importance within a landscape context. Site can obtain ecosystem credits, based on the vegetation on the land, and species credits, based on the presence of targeted species. Credits may then be sold at a price determined by the supply of, and demand for, credits (NSW Department of Environment and Climate Change 2007).

5 Mechanism Design Issues for Biodiversity Financial Mechanisms

This section has highlighted the essential features of financial mechanisms for biodiversity conservation, and indicated the extent to which (and the manner in which) existing mechanisms fulfill these criteria.

5.1 Mechanism Design Issues – PES

A PES system represents an attempt to aggregate and express market-based demands within existing institutions. It uses contractual methods, general government support and judicial enforcement to establish the basis through which the demand for a particular good or service may be expressed.

A PES system has a relatively limited set of objectives, in that it attempts to provide a market-based mechanism for registering the demand for some limited biodiversity-associated good or service. Since these biodiversity-associated goods and services may be very concrete and tangible, it is possible that they are readily contractible and trade-able in the market.

The effectiveness of such a system hinges upon:

a) Specification of relatively concrete or tangible biodiversity-associated good or service;
b) Identification of communities across which good or service is trade-able;
c) Drafting of careful contract specifying level of provision of good or service;
d) Monitoring and sanctioning performance of contract; and
e) (if between jurisdictions) Specification of agency capable of monitoring and enforcing the contract.

PES systems are based on what is feasible within existing institutions, and so they are usually based within a single jurisdiction (where existing institutions exist) and are best framed around goods and services that are readily-specified. Otherwise, these are basic contract-drafting exercises, and they are limited by the ability to aggregate demand for a particular good or service (when the demanders may be very diffuse) and by the non-existence of institutions that perform the tasks of monitoring, sanctioning such contracts. To a great extent, these very real limits of PES are the main reasons that the other forms of financial mechanisms are necessary for biodiversity conservation.

5.2 Mechanism Design Issues – EGC

Efficient governmental contract is the simple exercise of organizational efficiency in the provision of public goods. Increasingly, formerly public goods and services are provided by means of more efficient government contracting, e.g. contracting out exercises and franchising. The objective here is to aggregate demand by means of standard governmental methods (valuation, cost benefit analysis, political mechanisms), and then to supply the public good by access to market methods. Once again, the usual approach is through the use of standard contractual methods and judicial enforcement, but this is now combined with governmental payment for the public good. This enables a far larger set of public goods and services to be purchased and provided, than simply those which are able to be contractually specified within market relations.

The effective design of EGC is comprised of the following:

a) Specification of the good or service to be provided;
b) Call for bids to supply the good or service, with careful specification of terms and quality of service;
c) Merit rank offers to bidders, based on combined quality/price of offer;
d) Contracts with bidders specifying good or service, price of provision;
e) Monitoring and sanctioning of contracts.

These mechanisms are of course limited in that they do not continue to provide a price for the good or service, but only to the extent to which the programme is in effect and assured. If the government wishes to instill permanent incentives for biodiversity conservation, it must provide some mechanism for assuring that the programme is credible and continuing at existing levels of support.

5.3 Mechanism Design Issues - TDR

The most complete approach to biodiversity conservation is one that attempts to address both sides of the market – supply and demand. To do this, it is necessary to specify some surrogate right that correlates closely with biodiversity. Then it is possible to specify a permit based system, that regulates aggregate exploitation in relation to the surrogate right (and hence correlated biodiversity) and determines the distribution of resource-based rents via the distribution of those rights. Such systems have previously been used in regard to regulating the exploitation of the atmosphere (carbon, SOX) and such living resources as fisheries (ITQs).

In the case of biodiversity, it is possible to specify a system in the inversely correlated right to conversion-based development. Then the opportunity cost of increased development is the marginal value of biodiversity. Aggregate quotas in development rights inversely determine the amount of biodiversity conserved. Distribution of development rights determine the distribution of rents from regulation of biodiversity.

The criteria for a comprehensive TDR system are as follows:

a) Imposition of aggregate development restriction;
b) Distribution of development rights quotas;
c) Implementation of some manner of rights trading regime (full, partial, spatially defined or restricted);
d) Monitoring and sanctioning of rights and obligations under system;
e) Specification of agency responsible for all of the above.

Such a system has the advantage of creating an overall market in development rights – a mechanism for expressing the willingness to pay for habitat to remain unconverted. It also provides the mechanism for creating the incentives for conserving un-converted lands – in order to supply this market into the future.

The effectiveness of the system hinges upon: a) the efficiency and credibility of the certifying agency; b) the enforcement of the development restriction; and c) the perceived fairness of the rights distribution.

PART III: EXAMPLES OF MECHANISM DESIGN – EXISTING SCHEMES

In Part III we list eight examples of existing financial mechanisms that are currently used in the conservation of biodiversity. There are three distinct sections relating to the three basic mechanism designs described above: PSA, EGC, and TDRs. We have also attempted to provide examples that cover a range of different design formats: governmentally-provided and market-provided. The latter refers to examples of mechanisms that require no further government intervention, other than those already-existing institutions (judicial, contractual) in most states.

We break these down as follows:

Part A lists two PES mechanisms. Annex A1 is a description of the Costa Rican governmental framework for assisting in the development of payments for environmental services. Annex A2 is a description of the Vittel privately organised contract providing for the payment for environmental services.

Part B lists two EGC mechanisms. Annex B1 is a description of the Australian Bush Tender programme for efficient provision of biodiversity. Annex B2 is a description of the US Conservation Resource Program.

Part C lists four mechanisms that are attempting to deal with the more comprehensive development rights sort of system. These lie logically within the realm of "transferable development rights" systems, although they all focus more on the problem of the trading (or offset) system than on the development of aggregate rights restrictions or development quotas. Annex C1 is a description of the EU Compensatory Measures under the Habitats Directive, establishing an offset system for developments within established habitat reserves. Annex C2 is a description of the US offset system for wetlands under the Endangered Species Act. Annex C3 is a description of the Brazilian offset system for lands restricted from development under its Forest Law. Annex C4 is a description of guidelines developed by the BBOP programme for voluntary offsets dedicated as a result of development activities.

In this part we consider each of these sorts of financial mechanisms in light of the discussion in Part II regarding the important components. The objective here is to consider how each system performs a) as a solution to the biodiversity conservation problem; and b) in respect to the necessary components of an effective financial mechanism.

By examining the details of how existing mechanisms operate in practice, we can learn about feasible options regarding the institutional arrangements that are required for implementation; the details of implementation such as how contracts are designed and how benefits are measured; and the methods used for monitoring and enforcement of the mechanisms.

A) EXISTING SYSTEMS - PAYMENTS FOR ENVIRONMENTAL SERVICES

A1) COSTA RICAN PAGOS POR SERVICIOS AMBIENTALES (PSA)

Source: Pagiola (2007) and Rojas and Aylward (2003)

Background

The Costa Rican PSA programme provides an mechanism through which buyers of ecosystem services can be linked with sellers. It takes the form of the Forest Law No. 757, which provides the regulatory basis for the government to contract with landowners for the services provided by their lands, and a financing mechanism which has been established for this purpose, the National Fund for Forest Financing (FONAFIFO).

When the PSA programme was created, Costa Rica already had in place a system of payments for reforestation and forest management, and the institutions to manage it. The Forest Law built on this base, with two major changes. First, it changed the justification for payments from support for the timber industry to the provision of environmental services. Second, it changed the source of financing from the government budget to an earmarked tax and payments from beneficiaries.

Specifically, individual ecosystem services can be funded by different beneficiaries through FONAFIFO. For example, a large part of the funding for the scheme comes from a GEF grant of $8 million, which is used primarily to support the global public benefits of biodiversity conservation, by targeting resources to priority areas within the Mesoamerican Biological Corridor. At the same time, Energía Global de Costa Rica, Hidroeléctrica Platanar, and Compañia Nacional de Fuerza y Luz, three private power companies that own hydropower plants in different parts of Costa Rica, have all signed agreements with FONAFIFO to purchase watershed services from local landowners.

Institutional set-up

To implement the PES scheme, a formal mechanism was established in 1997 that designated the National Forestry Financing Fund (FONAFIFO) as the administrator of the national PES programme. FONAFIFO is a relatively autonomous government agency that forms part of the State Forestry Administration within the Ministry of Environment. It was created in 1991 to distribute subsidies to the forestry sector and is responsible for managing the funds and making the payments for environmental services. The intention was to provide a single national broker in the market for forest environmental service payments.

FONAFIFO's governing board is composed of three representatives of the public sector (one each from the Ministry of Environment and Energy, the Ministry of Agriculture, and the National Banking System) and two representatives from the private forest sector (appointed by the board of directors of the National Forestry Office). An Executive Director is responsible for running the day-to-day operations and four departments are responsible for executing the projects and the organisation’s mandate. FONAFIFO's status gives it a relative degree of autonomy in making personnel decisions and in managing funds, but it remains subject to a variety of governmental restrictions. Its budget must be approved by the Ministry of Finance,

while payment levels and priorities are set annually by executive decree. Delays in these administrative procedures have often hampered FONAFIFO's work.

A series of other government agencies, NGOs, donors, and private companies have different types of relationship with FONAFIFO. For simplicity's sake the role of these organizations can be grouped functionally as funding, mediation, and implementation. FONAFIFO's funding comes mainly from a tax on fuel. Costa Rican petrol consumers are therefore the main financiers of the PES scheme. Two additional sources of funding are donors (such as the Global Environment Facility) and private or public companies. Companies usually make payments for PES in a specific area of their interest. A third source of funds is an extra tariff charged in utility bills. However, only one utility in the country (ESPH) has implemented this alternative.

FUNDECOR is a foundation that acts as an intermediary between the companies and FONAFIFO. It has signed agreements with private hydropower producers. FUNDECOR plays a role in promoting the PES scheme in the watershed, where it also acts as an intermediary between forest owners and FONAFIFO. This is changing with the increased use of Environmental Services Certificates, as discussed below.

OCIC is the government agency that certifies projects for mitigating climate change. In exchange for the PES, landowners transfer their credits for carbon mitigation to FONAFIFO, who in turn transfers them to OCIC to seek international purchasers (often the carbon purchaser is identified prior to initiating the project). Another intermediary is RECOPE, the Government monopoly on imports of oil and fuel. RECOPE sells petrol to distributors and collects taxes on the sales. Taxes collected are transferred to the National Treasury, which then disburses a percentage to FONAFIFO.

Landowners were initially contracted by the national conservation area system (SINAC). FONAFIFO took over this task in 2003, establishing eight regional offices to handle applications, sign contracts, and monitor implementation.

To participate, landowners must present a sustainable forest management plan prepared by a licensed forester. These plans describe the proposed land use, and include information on land tenure and physical access; topography, soils, climate, drainage, actual land use, and carrying capacity with respect to land use; plans for preventing forest fires, illegal hunting, and illegal harvesting; and monitoring schedules. Once their plans have been approved, landowners begin adopting the specified practices, and receive payments. The initial payment can be requested at contract signing, but subsequent annual payments are made after verification of compliance (by the foresters, with a sample being audited). The foresters charge a fee for these services. They may work independently, or for an NGO or a consortium of foresters that provides professional services to forest owners.

Design of contracts

The 1996 Forestry Law established PES for three activities: reforestation, forest management for timber production, and forest preservation. These follow very closely, if not exactly, the system of subsidies established for the forestry sector in the 1980s and 1990s, where there was a subsidy for reforestation (CAF and CAFA), forest management (CAFMA) and forest conservation (CPB/CCB).

Forest conservation contracts provide for equal annual payments over the five year lifetime of the contract. These contracts are renewable by mutual agreement. In contrast, timber plantation contracts front-load most of the payment into the early years of the contract: 50% of the payment is paid in the first year, 20% in the second year, 15% in the third, 10% in the fourth, and 5% in the fifth. These contracts call for participants to continue with the agreed land use for 15 years, a restriction that is written into the land title so that it transfers to the new buyer should the land be sold. The landholder must establish a management plan for the property and it must be drawn up by a professional forester. The management plan becomes an integral part of the contract.

The annual per hectare payment is paid as compensation to landholders for the bundle of all four services, and no distinction is made between ecosystems or any of the individual environmental services. Landholders receive a different payment if they intend to conserve forest (~$40/ha/yr) or reforest a parcel of land (~$100/ha/yr). A minimum of 1 ha is required to receive a PES for plantations while the minimum for forest conservation is 2 ha. The maximum area that can receive PES is 300 ha, except in the case of Indian reservations which can have a maximum of 600 ha. In the case of a group of landholders that apply together as a package, the maximum limit is 50 ha per landowner (Camacho et al. 2000).

As part of its search for innovative ways to raise additional funds for the PES scheme, FONAFIFO established the Environmental Services Certificate (CSA). This mechanism, officially launched in March 2002, is a means of giving flexibility to the existing PES scheme. The CSA is a certificate issued by FONAFIFO, which can be purchased by individuals or organizations interested in paying for the environmental services of forests. The purchaser can choose to allow FONAFIFO to allocate the funds to an area it selects, or can indicate a specific area that FONAFIFO must target to invest the resources collected through that particular CSA. Although the CSA is not a financial instrument in that it does not commit FONAFIFO to any financial compensation (i.e. interest rate or return of capital), the CSA can be deducted from gross income tax. CSAs are certified by a third party to guarantee to the purchasers that the process is transparent and that all the technical, legal, and administrative requirements have been fulfilled. FONAFIFO hopes that CSAs will be tradable at some point, which will allow the market to establish the value of environmental services (FONAFIFO 2002). It is important to note that CSAs are not intended as a mechanism to compensate for environmental damage caused by the purchaser. This means that the CSA is not a form of environmental mitigation.

There has been an increase in the number of financing agreements with water users since the introduction of CSAs. Rather than negotiating each agreement on an *ad hoc* basis, FONAFIFO can now sell interested water users the appropriate number of certificates. Recent agreements include bottlers, municipal water supply systems, irrigation water users, and hotels. The amounts paid have also risen: early agreements saw water users paying for a quarter of conservation costs (based on the notion that water services are one of four services that the law said forests provide), while recent agreements involve water users paying the entire cost of conservation, as well as covering FONAFIFO's administrative costs.

Monitoring and enforcement

Since FONAFIFO does not have field staff, it delegates the responsibility for permanent

monitoring of projects to professional foresters. These foresters are accredited professionals whose reports are legally binding. They work for the forest owners, but legally they are expected to be impartial evaluators of forest management practices. Foresters must submit reports to FONAFIFO at least once a year. Annual payments to landowners are conditional on verification of compliance with the contract, as observed by the professional foresters. Non-complying participants also forfeit any further payments. A sample of the forester reports are also audited centrally, and foresters who incorrectly certify compliance can lose their license.

With the financial support of the Ecomarkets Project, FONAFIFO has established a state-of-the-art database to track compliance. They also subcontract periodical monitoring of land cover using GIS, through which they determine if there has been any loss in forest cover in areas receiving PES. Finally, FONAFIFO carries out periodic external evaluations and audits, including a bi-annual technical review of its PES programme. As of 2002, FONAFIFO had contracted two external evaluations of its PES programme, one in 1999, and the most recent one in 2001. These are, however, fairly narrow audits, focused on the direct performance of the programme in terms of expenditure and lands incorporated into the programme.

There are no specific contract conditions to prevent participants from clearing one area even as they enroll another in the PSA Programme, though the ban on clearing would apply.

A2) VITTEL PAYMENTS FOR ECOSYSTEM SERVICES

Source: Perrot-Maître (2006)

Background

The PES scheme implemented by the in the Vittel region is an example of the purchase of environmental benefits through private markets. There is one buyer and 26 sellers, who participate on a voluntary basis.

Vittel mineral water originates in 'Grande Source' ('Great Spring') located in the town of Vittel at the foot of the Vosges Mountains in north-eastern France. Water comes from a 6,000 ha aquifer 80m below ground and is lifted naturally to the surface through a natural geological fault. This water was long thought to have beneficial properties, and has been bottled for mineral water since 1882. The brand and bottling plant are now owned by Nestle Water, a division of Nestle Inc.

Vittel waters are labelled 'natural mineral waters'. This implies that water must come from a well-protected specific underground source and the composition of the water must be stable. The water must also be bottled at the source. Vittel waters are characterised by a total absence of nitrites and a particularly low level of nitrates. To be labelled 'Vittel', the water cannot contain more than 4.5 mg of nitrates per litre and must not contain pesticides. In comparison, the maximum nitrate rate in France is 15 and 50mg/l for mineral and tap water respectively. French legislation dictates that, if mineral concentration changes, the right to use the 'natural mineral water' label (and therefore the business associated with the brand name) is lost. In addition, no treatment is allowed for 'natural mineral water' apart from elimination of natural unstable elements such as iron and manganese.

Since the 1980s, when intensive maize-fed cattle production began to replace more extensive hay-based ranching, nitrate levels have been increasing in the Vittel catchment due to fertiliser leaching and poor management of animal wastes. This posed a risk to the Vittel mineral water brand.

Business case for PES

Depres et al. (2005) describe the five options available to the Vittel company in the face of increased pollution of the water source:

- Do nothing.
- Relocate to a new catchment where risks are lower.
- Purchase all lands in the spring catchment.
- Require farmers to change their practices through legal action.
- Provide incentives to farmers to voluntarily change their practices.

Doing nothing would have implied closing the business altogether because of the sensitivity of mineral water sales to the quality of the product, while relocation would have meant losing the 'Vittel' brand and the 'natural mineral water' label, which constitute significant elements of the value of the product (for example, Aquarel water, a Nestle brand which comes fromunnamed springs, is sold in France for half the price of Vittel water). The third

alternative was not permitted within French legislation, which prohibits the sale of agricultural land for non-agricultural purposes, and the fourth was not possible because the nitrate levels were within the limits required by law. This left the option of providing a system of incentives to persuade farmers to change their agricultural practices.

Negotiation process

A number of practices were identified to ensure nitrate levels of less than 4.5 mg/l in the aquifer, and zero pesticide levels. These were:

- Give up maize cultivation for animal feed (land under maize production shows nitrates rates of up to 200mg/l in the root zone).
- Adopt extensive cattle ranching including pasture management (hay and alfalfa rotation so that farms produce all animal feeds themselves).
- Reduce carrying capacity to a maximum of one cattle head per hectare.
- Compost animal waste and apply optimally in the fields.
- Give up agrochemicals (chemical fertilizer replaced with composted manure, no pesticides).
- Balance animal rations to reach optimal milk productivity and farm profitability.
- Modernise farm buildings for optimal waste management and storing.

These represent significant changes in management practices, as well as major capital investments. Due to this, and due to heterogeneity in the characteristics of the farms within the catchment, the process of convincing all farmers to change their practices, and bargaining over the compensation payments lasted 10 years.

The transactions costs involved in reaching agreement were high because each farmer had the potential to 'hold out' on the basis that they could individually influence the nitrate levels in the spring, and therefore jeopardize the whole process. This shows the disadvantage for private companies purchasing ecosystem services, compared with government who can exercise rights of eminent domain to avoid 'hold out' problems. One counterbalance to this is that the mineral water company was a major employer within the region, giving many farmers (with family members reliant on the employment) an interest in its continued operation.

Agreement with farmers

The features of the final agreement are as follows:

- Long term security through 18- or 30-year contracts.
- Abolition of debt linked to land acquisition, and land acquired by Vittel left in usufruct for up to 30 years.
- Subsidy of, on average, about 200 euros/ha/year over five years. This is to ensure a guaranteed income during the transition period and reimburse the debt contracted before entering the programme for the acquisition of farm equipment. The exact amount is negotiated for each farm.
- Up to 150,000 euros per farm to cover the cost of all new farm equipment and building modernisation.

- Free labour to apply compost in farmers' fields. This is to address the labour bottleneck and ensure optimal amounts are applied on each plot. These amounts are calculated for each plot for each farm every year, and individual farm plans are developed every year.
- Free technical assistance including annual individual farm plans and introduction to new social and professional networks. This is particularly important as giving up the intensive agricultural system alienated farmers from traditional farming networks and support organisations such as the Farmers Federation and the Chamber of Agriculture.

Terms of contracts such as the time horizon, guaranteed income during the transition period, and farm equipment investment are discussed with each farmer and adjusted accordingly.

Monitoring and enforcement

Agrivair, an intermediary institution of Nestle (which purchased the Vittel brand as the contract negotiations were ongoing), was created to facilitate transactions, lead negotiations, co-ordinate design and implementation, and monitor compliance.

Around 1,700 ha (or 50%) of the land located in sensitive areas was also acquired by Agrivair from farmers wishing to retire of cancel their long term debt. The land was then given in "prêt à usage" (usufruct) in exchange for signing a 18- or 30-year contract. The "prêt à usage" is a legal category that was specifically created for this programme. At least in principle, it allows Vittel to take the land back from farmers who do not comply with the terms of the contract. However, this has never happened and is not expected to happen since once farmers have adopted the new farming system and made all the investments necessary it does not make economic sense to revert to the former system.

B) EXISTING SYSTEMS - EFFICIENT GOVERNMENT CONTRACTING

B1) STATE OF VICTORIA (AUS) BUSHTENDER PROGRAMME

Source: BushTender information sheets (www.dse.vic.gov.au)

Background

In Australia, the State of Victoria's Department of Natural Resources and Environment has developed the BushTender program to conserve native vegetation remnants on private property. In exchange for payments from the state government, the landholders commit to fencing off and managing an agreed amount of their native vegetation for a set period of time.

BushTender is an auction-based approach to improving the management of native vegetation on private land. Under this system, landholders competitively tender for contracts to better protect and improve their native vegetation. Successful bids are those that offer the best value for money, with successful landholders receiving periodic payments for their management actions under agreements signed with DSE. These actions are based on management commitments over and above those required by current obligations and legislation.

The principle behind the use of an auction mechanism is that it can reveal hidden information so that better choices can be made about where to invest, overcoming what is recognised as one of the key impediments to good investment. In the case of biodiversity outcomes, some of the information needed resides with government agencies that have knowledge of different environmental assets and the actions that might be taken to protect or improve these assets – landholders will not necessarily know this information. Landholders, on the other hand, know about the costs involved in changing landuse or management from current practices to those that improve biodiversity – this information is not known by government.

Scheme operation

The stages involved in agreeing contracts with landholders are as follows:

1. *Expressions of Interest* – landholders with native vegetation on their land located in the project area can register an expression of interest with the Victoria Department of Sustainability and Environment.

2. *Site Assessments* – a BushTender Regional Implementation Manager contacts each landholder who has registered interest to discuss eligibility and arrange a site visit. The BushTender Field Officer assesses the significance and quality of the native vegetation and discusses management options with the landholder.

The Field Officer assesses the Biodiversity Significance of the land by identifying the type and extent of native vegetation, the quality of the vegetation, and how it fits into the wider landscape. The site is compared with a benchmark that represents the average characteristics of a mature stand of the relevant vegetation type in fully natural condition. Existing databases and information from the landholder are used to determine the native plant and animal species habitat likely to be present. The Field Officer also calculates a Habitat Services Score,

which is a measure of the improvements in the quality and security of native vegetation arising from management commitments and actions that are proposed as part of the management agreement.

The Habitat Services Score is revealed to the landholder. However, in order to minimise the risk of collusion, the Biodiversity Significance Score is used for assessing the bids, but is not revealed to the landholder.

3. *Development of draft Management Plans* – each landholder identifies the commitments and actions they are prepared to undertake and the Field Officer prepares a draft Management Plan as the basis for a bid. Landholders may choose a five-year management agreement **or** a five-year Management Agreement *plus* permanent protection option.

The actions agreed in the management plan must be over and above those required under pre-existing management plans, agreements or licenses, or the requirements of legislation. Management commitments may include:

- fencing to address grazing impact by domestic stock;
- adapting grazing practices to maximise habitat quality outcomes;
- weed and pest animal control above current responsibilities;
- retaining standing/fallen timber; and,
- supplementary planting into existing patches of vegetation.

4. *Submission of Bids* – each landholder submits a sealed bid that nominates the amount of payment being sought by them to undertake the agreed Management Plan. All landholders have the same amount of time to consider the price they will tender.

5. *Bid Assessment* – all bids are assessed objectively on the basis of the current conservation significance of the site, the estimated gain in vegetation condition and/or security offered through the agreed landholder management actions, and the amount of payment being sought by the landholder. In order to do this, the index of biodiversity benefit considers the conservation significance of the site, the estimated habitat service score (ie. gain in vegetation condition) and/or security offered and the cost of each bid. The index is determined by the following calculation:

$$\text{Biodiversity Benefits Index} = \frac{\text{Biodiversity Significance Score} \times \text{Habitat Service Score}}{\text{Cost required by landholder}}$$

Using this Index, each bid is placed in merit order and the available funds are allocated to those representing the best "value for money" subject to an assessment of previous BushTender results.

6. *Management Agreements* – successful bidders sign a final Management Agreement based on the previously agreed draft management plan. The five year fixed-term agreements are contracts under common law, while the permanent protection option is registered on the land title and binds all future owners.

7. *Reporting and Payments* – periodic payments to landholders and reporting occur over the five years as specified in the agreement.

Monitoring and enforcement

Landholders are required to submit an annual report that details the actions undertaken during the preceding 12 months and describe their progress towards targets. They are encouraged to include photos of specific work undertaken such as fences constructed to exclude stock, as well as to show changes in vegetation over time.

The agreed annual payments are dependent upon receipt of these reports of agreed scheduled management actions and commitments for the period. At least once during the five-year agreement, a BushTender Project Officer will arrange a visit with the landholder to assess progress on the management activities and discuss any management concerns the landholder may have. If the required management activities have not been carried out satisfactorily, annual payments may withheld until they have been completed. Any outright breach of an agreement results in the cessation of annual payments.

B2) US CONSERVATION RESERVE PROGRAMME

Source: Cowan (2008) and US Farm Service Agency information.

Background

The Conservation Reserve Program (CRP) is a federal level PES scheme in the US that constitutes the largest voluntary land set aside programme for private land. It was enacted by the US Congress in 1985 to help control soil erosion, stabilize land prices and control excessive agricultural production (Cowan, 2008). The specific authorising authority is the Food Security Act of 1985, and regulations published in 7CFR, part 1410. The programme has evolved as acts of the various US Farm Bills from the mid 80's onwards as well as linked to other pieces of legislation. The embedding of the CRP programme in a wider set of legislative and institutional initiatives is a defining element of the specific mechanism design. Through the years the program's aims have been augmented to incorporate environmental goals.

The program is administered by USDA's Farm Services Agency (FSA), with technical assistance from USDA's Natural Resources Conservation Service (NRCS) and funding from USDA's Commodity Credit Corporation (CCC). [2]

The FSA through the CCC makes annual rental payments based on the agricultural rental value of the land, and provides cost-share assistance for up to 50% of the participant's costs in establishing various approved conservation practices (e.g., planting a cover crop on the land to reduce erosion). Participants enroll in CRP contracts for 10 to 15 years. (Cowan, 2008).

Eligibility, enrolment and incentive mechanisms

Under general signings (see below) contracts are awarded by FSA based on their assessment of the land's environmental value as well as its cost effectiveness using the Environmental Benefits Index (EBI). If the land is accepted for inclusion into the CRP, the landowner receives annual rental payments and is required to maintain the land under an approved conservation plan. Farmers can sign up under two ways, general and continuous sign ups. In 2008, there were a total of 768,749 CRP contracts across the US, affecting 431,085 farms (approximately 20% of all US farms). Due to its sheer size annual random inspections (audits) are carried out to a proportion of farms. With the completion of a specific CRP contract, federal payments cease and re-enrolment is not automatic. In the case where the land in question is "highly erodible" (about 75% of the land enrolled in the CRP meets this definition) and participants decide to return the land to production, they must manage this land under a NRCS-approved conservation system if they wish to be eligible for other federal farm programs (including commodity payments).

Eligible farmers are those who have owned highly erodable or cropped wetlands and for at

[2] A detailed MoU between these parties specifies the how they cooperate and divide responsibilities amongst themselves. Accessed at
http://www.nrcs.usda.gov/programs/crp/MOUCRPFSACCC.pdf

least one year.[3] To be eligible for placement in CRP, land must be either cropland that has been planted with an agricultural commodity 4 of the previous 6 crop years, and which is physically and legally capable of being planted in a normal manner with an agricultural commodity. Also certain marginal pastureland that is enrolled in the Water Bank Program or suitable for use as a riparian buffer or for similar water quality purposes is eligible.[4]In addition to the eligible land requirements, cropland must also meet one of the following criteria:
- Have a weighted average erosion index of 8 or higher;
- Be expiring CRP acreage; or
- Be located in a national or state CRP conservation priority area.

General sign-ups are pre determined enrolment rounds during which a national bidding process allocates CRP funds to farmers that have a EBI above a predetermined cut off point determined by the FSA (after obtaining technical assistance from the NRCS). Almost 88.2% of CRP land (30.6 million of 34.7 million) is enrolled through general sign-up. The EBI is in essence the mechanism that provides a point system to rank the suitability of farms that have been put forward for inclusion in the CRP. Points are awarded for ecological and habitat related characteristics of land as well as on compensation requested by the farmer.

As the CRP has been expanded to include broader environmental goals, FSA has adjusted the categories and points awarded under the EBI. For example, FSA announced in June 2003 that, for the first time, it may award points to projects which have the potential to sequester carbon (reducing greenhouse gas emissions). Other factors include wildlife habitat benefits from planted cover crops, water quality benefits from reduced erosion, and whether benefits will endure beyond the contract period. FSA ranks all applications nationally, and then sets an EBI score cut-off above which applications will be accepted (Cowen, 2008). In particular, the FSA uses the following EBI factors to assess the environmental benefits for the land offered with maximum number of points noted in parenthesis:

- Wildlife habitat benefits resulting from covers on contract acreage (100);
- Water quality benefits from reduced erosion, runoff, and leaching(100);
- On-farm benefits from reduced erosion (100);
- Benefits that will likely endure beyond the contract period (50);
- Air quality benefits from reduced wind erosion (45);
- Cost (150).

Continuous sign-up concerns environmentally desirable land devoted to specific conservation practices with high environmental benefits. These lands may be included in the CRP at any time for 10-15 years[5] Offers are automatically accepted (provided the land and producer meet certain eligibility requirements) and are not subject to competitive bidding. Contracts usually include additional incentive payments. Within the continuous sign-up program there are some options tailored to certain conservation needs, such as restoring floodplain wetlands

[3] Some exceptions apply, most notably: the new owner acquired the land due to the previous owner's death; the ownership change occurred due to foreclosure where the owner exercised a timely right or redemption in accordance with state law; or the circumstances of the acquisition present adequate assurance to FSA that the new owner did not acquire the land for the purpose of placing it in CRP (FSA, 2007).
[4] US FSA, CRP 2007 factsheet.
[5] Specific conservation practices include filter strips, riparian buffers, grass waterways, shelterbelts, field windbreaks, living snow fences, salt-tolerant vegetation, shallow water areas for wildlife, wetland restoration, and wellhead protection areas (Cowan 2008)

and native hardwood trees in wetlands. There are additional initiatives that are included under continuous sign-ups including the Conservation Reserve Enhancement Program (CREP) which is a joint federal-state continuous sign-up program that targets geographic areas with agriculture-related environmental problems. Unlike the general sign-up, CREP both encourages landscape-scale conservation efforts and offers the flexibility to address locally identified needs. In 2008, approximately 1.1 million acres were enrolled in CREP, nearly 100,000. Another scheme under continuous sign up is the Farmable Wetlands Program (FWP) which was authorized under the 2002 farm bill, Under FWP farmable wetlands may be enrolled in the CRP on a continuous basis. Up to 100,000 acres may be enrolled from any state (this may be increased to 150,000 acres after three years) while funds available through the farm bill have made provision for an estimated one million acres for farmable wetlands enrollment. In 2008, there were 182,267 acres enrolled (Cowan 2008).

FSA via the CCC provides the following type of incentive instruments[6]:
(a) Rental Payments: In return for establishing long-term, resource-conserving covers, FSA provides annual rental payments to participants. FSA bases rental rates on the relative productivity of the soils within each county and the average dryland cash rent or cash-rent equivalent. The maximum CRP rental rate for each offer is calculated in advance of enrollment. Producers may offer land at that rate or offer a lower rental rate to increase the likelihood that their offer will be accepted.
(b) Maintenance Incentive Payments: CRP annual rental payments may include an additional amount up to $5 per acre per year as an incentive to perform certain maintenance obligations.
(c) Cost-share Assistance: FSA provides cost-share assistance to participants who establish approved cover on eligible cropland. The cost-share assistance can be an amount not more than 50 percent of the participants' costs in establishing approved practices.
(d) Other Incentives: FSA may offer additional financial incentives of up to 20 percent of the annual payment for certain continuous sign-up practices.

Base line

By design the CRP is driven by a budget constrained costs effectiveness approach. Through provisions in the various Farm Bills the CRP specifies the total amount of money it is to spend (around 2 billion for 2008) as well as the ultimate cap in the total acreage that can be enrolled. The 2008 Farm Bill specified this to be at 32 million acres. Further the scheme puts a limit of $50,000 per accepted application per fiscal year. With a limited amount of money available, the FSA and the NRCS can only allow the most qualified land to be given incentive payments (via the procedures specified in the general and continuous sign-ups (FSA 2008).

Monitoring, enforcement and penalties

There are three main agencies involved in the CRP program, the United States Department of Agriculture (USDA), Commodity Credit Corporation (CCC), and the Farm Service Agency (FSA). The USDA is the governing body that works to form the CRP program with every Farm Bill and they are the top of the chain of command when it comes to the program. The CCC is the actual corporation, which is controlled by the USDA,that landowners enter into contracts with when enrolling in the program.[7] The FSA is the administrative body that runs

[6] See FSA 2007 fact sheet for more details.
[7] "CRP Sign-Ups." Conservation Programs. Farm Service Agency. 30 Nov 2008 <

the program for the USDA so that they don't have to over see every aspect of the program. Lastly, technical assistance is provided from the USDA's Natural Resources Conservation Service (NRCS). The NRCS provides technical input on land eligibility determinations, conservation planning and practice implementation. Other technical assistance is provided by the USDA Cooperative State Research, Education, and Extension Service (CSREES) as well as state forestry agencies; local soil and water conservation districts; and private sector providers of technical assistance. We thus see various agencies being involved in the management, implementation, monitoring and enforcement of the scheme. This is unavoidable and in fact necessary for such large scale biodiversity PES program.

Further due to its sheer size annual random inspections (audits) are carried out to a proportion of farms. Hence dealing with such a vast scheme compliance is enhanced by addressing pre-contractual problems of asymmetric information and other agency issues instead of dealing with them post-contractually as the latter is both not feasible and very expensive.

In recent years high grain prices have made contract termination more attractive to some producers. Yet, contract termination come with a penalty fee of 25% on rent payments paid, plus repayment, with interest, of all the funds already paid to the producer. This includes any cost-share payments. Hence there are no penalty-free terminations. Penalties would apply to any contract holder who re-enrolls or extends acreage and then decides to terminate the contract. An expiring contract that is extended and then later terminated would have penalties based on the original contract, not just the period since contract extension. Expiring acreage that is re-enrolled is under a new contract and would incur penalties only on the period covered by the new contract (Cowan 2008).

As enforcement is mostly addressed pre-contractually (and not ex post via audits), the CRP is continuously adjusted (mostly through provisions through Farm Bills) to address issues that have to do with strategic bidding (leads to adverse effects such as lower levels of environmental protection or higher compensation levels that would have been required), additionality, slippage etc.

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http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic

C) EXISTING SYSTEMS - TRANSFERABLE DEVELOPMENT RIGHTS SYSTEMS, OFFSETS AND BIODIVERSITY BANKING

Source: Bezerra (2007); Dodd (2007); EU (2007)

C1) COMPENSATORY MEASURES WITHIN THE EU HABITATS DIRECTIVE

Background

The key purpose of the Habitats Directive is to achieve the favourable conservation status (FCS) of species and habitats listed in the Annexes to the Directive as of Community Interest. In addition, while not explicitly stated, the EC has argued that the obligation to achieve FCS extends to the Birds Directive as well.

Within this context, the Natura 2000 network is the key mechanism by which the FCS of species and habitats of European Community importance are maintained or, where appropriate, restored. Natura 2000 is a network of sites made up of 'Special Protection Areas' (SPAs) designated in the 1979 Birds Directive and 'Special Areas of Conservation (SACs) designated in the 1992 Habitats Directive. Through this mechanism, the Habitats Directive seeks to establish a coherent European ecological network of conservation sites throughout Europe, containing specific natural habitat types and species. By encompassing the Birds Directive, it also provides a transboundary answer to the protection of migratory species.

Baseline

The Habitats Directive calls for an 'appropriate assessment' of any plan or project likely to have a significant effect for a Natura 2000 site. The general rule is that authorisation can only be granted to plans and projects not affecting concerned sites. However, there are exceptions to this rule, specifically in cases where 'in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature'. In these situations, 'the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected'.

Importantly, these exceptions can only be applied if all conditions are fulfilled, falling on the party interested in the plan or project to prove that required conditions are met in the particular case. Furthermore, an EU Commission Guidance Document (2007), which has no binding effect, clarifies the exceptions, underscoring that: 'compensatory measures should be considered only when the application of other safeguards, such as mitigation measures, is not sufficient. The compensatory measures adopted must always be communicated to the Commission.' The Guidance Document clarifies that the compensatory measures should be submitted to the Commission after the decision authorising the realisation of the plan or project and before its actual realisation and implementation of the concerned measures. It also states that it is not the Commission's role to suggest the compensatory measures, but only to appreciate if the conservation aims of a specific site are being pursued.

Implementation of offsets

The Habitats Directive provides no definition for 'compensatory measures'. However, the

Guidance Document defines compensatory measures as being those measures "independent of the project" and "intended to offset the negative effects of the plan or project so that the overall ecological coherence of the Natura 2000 network is maintained". It is widely recognised that the compensatory measures must be additional to the normal practices foreseen by EU Conservation Law, aiming ultimately at offsetting the negative effects of a project, conforming to the additionality principle. Another basic principle of biodiversity offsets recognised by EC laws - mitigation hierarchy principle - requires that offsetting must constitute a last resort, only exercised to offset the negative effects of an indispensable plan or project ('of overriding public interest') for which no alternative solutions could be envisaged.

The Guidance Document also sheds some light on the concept of 'overall coherence', stating that: "In order to ensure the overall coherence of Natura 2000, the compensatory measures proposed for a project should therefore: a) address, in comparable proportions, the habitats and species negatively affected; b) provide functions comparable to those which had justified the selection criteria of the original site, particularly regarding the adequate geographical distribution. Thus, it would not be enough that the compensatory measures concern the same biogeographical region in the same Member State. The distance between the original site and the place of the compensatory measures is not necessarily an obstacle as long as it does not affect the functionality of the site, its role in the geographical distribution and the reasons for its initial selection." The Guidance Document therefore recognises that on-site offsets are preferred, but are not an absolute criterion for allocating compensatory measures. Furthermore, it indicates that the option of habitat banking as compensatory measure is of very limited value due to the tight criteria mentioned in relation to the need for compensation to ensure the protection of the coherence of the network

Compensatory measures appropriate or necessary to adverse effects on Natura 2000 site can consist of:

- Restoration or enhancement in existing sites: restoring the habitat to ensure the maintenance of its conservation value and compliance with the conservation objectives of the site or improving the remaining habitat in proportion to the loss due to the plan or project on a Natura 2000 site;
- Habitat Recreation: recreating a habitat on a new or enlarged site, to be incorporated into Natura 2000;
- As described above and in association with other works, proposing a new site under the Habitats and Birds Directive.

Guidance on the extent of offsetting activity required for the compensatory measures to be effective is based on the quantitative and qualitative aspects inherent to the elements of integrity (i.e. including structure and functionality and their role in the overall coherence of the Natura 2000 network) likely to be impaired and to the estimated effectiveness of the measures. Consequently, compensation ratios are recommended to be set on a case-by-case basis and must be initially determined in the light of the information managed during the Environmental Impact Assessment and ensuring the minimum requirements to meet ecological functionality. The ratios may then be redefined according to the results observed when monitoring the effectiveness, and the final decision on the proportion of compensation must be justified. Compensation ratios of 1:1 or below can only be considered when it is demonstrated that with such an extent, the measures will be 100% effective in reinstating structure and functionality within a short period of time (e.g. without compromising the

preservation of the habitats or the populations of key species likely to be affected by the plan or project).

Monitoring and enforcement

The EC Guidance Document states that a Natura 2000 site must not be irreversibly affected before compensation is in place. In addition, the result of compensation should be effective at the time the damage occurs on the site concerned. However, under certain circumstances where this can not be fully achieved, overcompensation would be required for the interim losses.

Member States have responsibility for monitoring and enforcing the compensatory measures under Natura 2000. However, the Guidance Document indicates that they should ensure that the long term financial and legal requirements for implementation, protection, monitoring and maintenance of the compensatory sites have been met before any impacts on habitats or species occur. This may involve the following:

- Devising binding enforcement tools at the national level aimed to ensure the full implementation and effectiveness of compensation (e.g. linked to liability under EIA directive, if applicable, or to the Environmental Liability Directive when in force; subsidising plan or project approval to the robustness of the relevant provisions for implementation of compensatory measures).
- Devising the necessary legal means in case land or rights purchase is deemed essential for the effective implementation of the measures according to good practice (e.g. typified procedures for compulsory purchase on grounds of nature conservation).
- Establishing monitoring programmes for the whole life of the project, including objectives, responsible bodies and resources needs, indicators, and requirements on reporting to the Commission. This could be best performed by independent bodies specifically set up for the purpose and in close coordination and cooperation with the Natura 2000 authorities.

C2) US ENDANGERED SPECIES ACT – REGULATORY OFFSET BANKING

Sources: Shabman and Scodari (2005); ten Kate et al (2004); and Salzman and Ruhl (2005)

Legal/institutional framework and agencies involved

From a legal point of view wetland mitigation banking is based first on Section 404 of the Clean Water Act (1972) which requires a permit for discharges of dredged or fill material into the waters, including wetlands. Secondly, it rests on Section 10 of the Rivers and Harbors Act dating back to 1899 which specifies that "it shall not be lawful to excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity of, any port, roadstead, haven, harbor, canal, lake, harbour of refuge, or Enclosure within the limits of any breakwater, or of the channel of any navigable water of the United States, unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of War prior to beginning the same" (33 U.S.C. 403). Thirdly, it is based on the wetland conservation provisions of the Food Security Act (1985), know as the 'swampbusters' provision of this act (Title XII, subtitle C) which denies farmers federal benefits if they convert wetlands for food production. (see Hallwood 2007). The details of mechanism are included in the Federal Guidance for the Establishment, Use and Operation of Mitigation Banks (1995) which has been established by the Departments of Agriculture, Interior and Commerce, the Army and the Environmental Protection Agency.

These pieces of legislation provide the basis for establishing the key mechanism details of private or, third party 'entrepreneurial' mitigation banking, namely the definition of the 'commodity' unit traded as a mitigation credit, the time at which credits are awarded to a mitigation bank for wetland restoration, and how quality of wetland functions is measured. Institutional details of mitigation banking are described inter alia in Bonnie (1999), Castelle et al. (1992), E.L.I. (2006), Government Accounting Office (2005), Federal Register (1995), Sheahan (2001), and Weems and Canter (1995).

Incentive mechanism

Developers whose plans may cause damage to wetlands must obtain permits from the US Army Corps of Engineers under the US Clean Water Act 1972 and the US Army Corps of Engineers regulations. The Corps follows a sequential approach in granting these "wetland permits" (ten Kate et al 2004; Salzman and Ruhl 2000 & 2005). First, developers must prove that the damage to the wetlands is "unavoidable". They then must then try to minimize any negative impacts on those wetlands that cannot be reasonably avoided. Finally, they must offer "compensatory mitigation" for the damages that they cannot avoid after all minimization measures have been pursued. In principle, for every unit of wetland destroyed, an a specified (usually additional amount of a comparable wetland must be restored or recreated within the defined "service area" (ten Kate et al 2004)

As a result of the shortcoming of initial problems with in-kind and on site offsets highlighted various problems we focus on Credit Resale Mitigation Banking. Under this more evolved banking scheme the central government allocates some initial funding for setting up the scheme. This start up fund is allocated between assessing the likely demand for credits and setting up an implementing agency. The implementing agency (Corps of Engineers) receives bids from potential credit suppliers who bid for credits in auction. The agency then purchases

back the best "value for money" credits. The agency finally resells credits (so as to recover full costs) to future developers or permittees. An important feature of the program is that it allows for up front payment from the credit supplier (in total or in predefined instalments). It also entails limited credit demand uncertainty as well as full cost recovery on behalf of the government. As the credit inventory is depleted, new auctioning of credits is offered. The scheme offers a promising avenue for securing the supply, quality, and price advantages of a competitive market for wetlands credits (Shabman and Scodari 2005)

An example of this scheme is the North Carolina Ecosystem Enhancement Programme (NCEEP). [8] During the mid-1990s, the North Carolina Department of Transportation (NCDOT) began to experience increased project delays in its transportation-infrastructure program because of unavoidable environmental impacts in its development projects. At the time, the NCDOT attempted to satisfy most of its mitigation needs through internal staffing and outsourcing to the private sector. In 1997 the state then founded the Wetlands Restoration Program, a wetlands-oriented mitigation program for development under the N.C. Department of Environment and Natural Resources (NCDENR). The NCDOT and NCDENR mitigation programs functioned independently with different operating processes, a situation that failed to meet the satisfaction of either federal and state regulatory agencies, or environmental interest groups. To address this situation, a cooperative process-improvement initiative in North Carolina involving more than 10 state and federal natural-systems agencies convened in 2001. Obstacles identified in the initiative included inadequate communication, undefined roles and responsibilities, poor synchronization in executing existing mitigation and permitting processes, and a lack of clearly understood mitigation-success objectives. This panel's conclusions led to recommendations that mitigation should be provided years in advance of project impact, and be designed to replace unavoidable functional losses to wetlands and riparian buffers. The panel also conceived and set into motion events leading to the creation of the Ecosystem Enhancement Program. Over the subsequent two years, business and operational planning occurred that encompassed funding authorization, consensus-building with environmental- and mitigation-interest groups, legal support, regulatory-agency agreements, and transition plans for staffing and logistics. A Memorandum of Agreement between NCDOT, NCDENR and the U.S. Army Corps of Engineers established the EEP's procedures on July 22, 2003. The MOA recommended a two-year transition period in which the EEP will complete operational and organizational development. As a result, North Carolina has created a *national model* for wetlands mitigation through EEP.

Also, the EEP partners with the private sector on two fronts to offset unavoidable environmental impacts. The program's alliance with local and regional land trusts across the state, believed to be unprecedented in the nation on this scale, harnesses the expertise, innovation and local knowledge of 22 separate trusts to promote land acquisition and open-space protection. The partnership's aim is to provide fair economic return to landowners while achieving open-space protection for the state. The EEP also partners with more than 20 private biological-engineering and mitigation-banking companies on wetlands restoration and enhancement programs across the state.[9]

Shabman and Scodari (2005) observe that under the NCEEP the auctioning process can be costly (though this could be reduced as prospective bidders increase and more experience

[8] See http://www.nceep.net/. All legal details can be found at
[9] See http://www.nceep.net

with auctioning attained). Also, this may bring about the exhaustion of permitted wetland restoration sites in one area. They argue that extending the program to providing other forms of mitigation credits (e.g., stream restoration, nutrient reduction, etc.) required by different pollution control programs could add to the number of auctions issued in any year. Also, expanding the wetlands credit resale program concept regionally or nationally should be considered (see Shabman and Scodari 2005).

Further, the auctioning process has focused on a very limited geographic area. This entails that the availability of suitable lands for credit production will decrease and this undermines the market for credits. This could be mitigated by developing credits for "wetlands functions and services" rather than wetland assets (e.g. land area). For example Shabman and Scodari suggest water quality and hydrologic services (these are site dependent) as well as habitat services (less site dependent). Also issuing credit auctions for wetlands habitat services at larger eco-region scales could lead to an increase in the pool of land parcels that would be suitable sites for credit production and this would enhance competition for credit supply contracts. Lastly, there is need for auxiliary regulation for securing the provision of local site dependent watershed services (e.g. for non-wetland alternatives such as riparian buffers.

Base line

Banking schemes aim to contribute towards attainment of "no-net-loss" of a predefined baseline level of biodiversity. In principle, the aim is to attain no-net-loss of biodiversity *services* and not simply retaining of a fixed amount of land (acreage) or of type of lands (e.g. marsh lands). Yet, in practice striving for a no net loss of services remains the main challenge for banking as this requires an approach for assessing the 'fungability' between restored and developed areas that is based on services as opposed to land type or even specific land use benefits (Saltzman and Ruhl 2005).

Monitoring, enforcement and penalties

A prospective bank sponsor must submit a prospectus to the Corps. The relevant federal and state agencies, known as the Mitigation Bank Review Team, use the prospectus to evaluate the merits of the bank pursuant to the sequencing approach and other preferences applicable to compensatory wetlands mitigation in general. The agencies and the bank sponsor then negotiate a banking instrument outlining all the details of bank objectives, ownership, operation, and enforcement. Finally, the proposed bank instrument is submitted for public notice and comment before a final bank instrument is implemented. A number of states have also provided statutory or regulatory frameworks for using commercial wetlands mitigation banks in satisfaction of state wetlands protection laws (Saltzman and Ruhl 2002)

One of the main weaknesses of banking schemes is that require a strong institutional basis to ensure enforcement and monitoring. Unlike mobile pollution markets the market itself does not have the incentives to self enforce the trading scheme (Salzman and Ruhl 2002). Hence, monitoring and enforcement all falls almost exclusively under the remit of the implementing agencies (i.e. the Corps.).

C3) OFFSETTING WITHIN BRAZIL'S CONSERVATION LAW

Source: Bezerra (2007)

Background

Brazilian national law allows for two different types of biodiversity offset, both of which are related to mandatory land-use regulation. The first of these ('forest offsets) is a requirement for all landowners to maintain a set percentage of land under native vegetation, with the percentage varying between regions of the country. Where more than the permitted percentage of land is cleared of native vegetation, the clearance can be offset through the protection of additional vegetative cover elsewhere in the vicinity. The second mechanism that is used for biodiversity protection ('development offsets') is a requirement to compensate for development activities such as large infrastructure projects. This compensation takes the form of a fee levied as a proportion of the total cost of the project. However, the fee can be considered to be a form of offset, rather than a tax on development because it varies according to the environmental impact of the programme, which is determined through negotiation with the regional environmental agency. Furthermore, it must be spent directly on the protection of ecologically valuable land.

Brazil's case study is of particular interest owing to its wealth of biodiversity. Brazil holds about 30 percent of the Earth's remaining tropical rain forest, harbours many unknown species and is thought to house one-third of the world's bird species, at least one-third of the world's plants and probably the same proportion of other species.

The conservation of biodiversity in Brazil is enshrined in the 1988 Brazilian Federal Constitution, which contains a full section on environmental protection, stating that every person has a right to an ecologically well-balanced environment. Under Brazilian law, environmental protection is the responsibility of the government, as well as of the entire community. According to the constitution, this implies a duty to "preserve and restore the essential ecological processes and provide for the ecological treatment of species and ecosystems," and to "preserve the diversity and integrity of the genetic patrimony of the country", in addition to defining "territorial spaces and their components which are to receive special protection".

This implies that rights to environmental assets are public. Thus, the developer of a project that causes unavoidable and immitigable negative impacts to the environment or the rural landowner who does not comply with its obligation of maintaining legal required LFR must offset society in order to avoid misappropriation of public assets and so that society does not have to bear the negative external effects of the developers activities or the illegal use of land.

Establishment of baseline

The baseline for the forest offset mechanism is fixed through the system of Legal Forest Reserves (LFRs). These are specially protected territorial spaces situated within rural real estates, aiming at the sustainable use of natural resources, the conservation and rehabilitation of ecological services and biodiversity. The Forest Code requires that rural landowners must maintain a fixed minimum percentage of natural vegetative cover on their property, ranging

from 20% to 80% depending on the region (Amazon Forest = 80%; Amazon Savannah = 35%; all other areas = 20%). On LFR land, clearing of forest is not permitted and the only admissible use is through the sustainable forestry regime. The location of LFRs must be approved by the state environmental agency which must take into account the social role of the real estate, its proximity with other LFRs or other specially protected areas and any existent environmental spatial planning instrument. The Forest Code also requires that LFRs must be perpetually recorded in the respective Real State Registry.

According to the Forest Code, those landowners who do not meet the LFR minimum percentage of vegetative cover for their property are required to adopt one or more of the following measures: (i) replant vegetation to comply with its property LFR obligation; (ii) allow the natural regeneration of vegetation; and/or (iii) compensate.

The baseline for the development offset is much less clearly defined than for the forest offset, but is implied by the requirements of the Environmental Licensing System. The Brazilian constitution states that it is incumbent upon the Government to "require, in the manner prescribed by law, for the installation of works and activities which may potentially cause significant degradation to the environment, a prior environmental impact study, which shall be made public". This "prior environmental impact study" is conducted through the Environmental Licensing System, which involves the approval of three environmental licenses: At the preliminary stage of a project or activity, a Previous License is granted approving its location and conception, certifying its environmental feasibility and establishing basic conditions to be met at the next stages of its implementation. At this stage, an Environmental Impact Assessment might be required. The following step is the Installation License which authorises the installation of the project or activity in accordance with the specifications contained in the approved plans, programs and projects, including the environmental control measures and other conditions. Finally, after the verification of the effective compliance with the conditions set forth in the previous licenses, an Operation License is granted, authorising the operation of the project or activity.

Importantly, the Environmental Impact Assessment is only required in cases where a project "may potentially cause significant degradation of the environment". In these cases, the developer must compensate for the impacts through the payment of a fee that will be used for biodiversity conservation elsewhere. This suggests a baseline position that development projects with 'major' impacts cannot go ahead without generating an environmental improvement elsewhere. However, other development activities are permissible, with the implication that some biodiversity loss is accepted.

Certification processes

Forest Offsets: The Forest Code specifies the type of offsets that are permitted within the LFR requirements. It states that in-kind solutions must be favoured, and equivalence is addressed by requiring that the offset is of the same type of ecosystem within the watershed. If that is not possible due to lack of natural vegetation, the offset should be as close as possible to the land lacking LFR and within the same river basin and State. There are two other possibilities for off-setting the required LFR. The first is through the rent of a LFR or an 'LFR Equivalent Area'. The second one is through an LFR Quota. In either case, the environmental agency must approve the offset proposed.

An LFR Equivalent Area is an area of land, excluding the areas of mandatory LFR and other protected areas, voluntarily established by landowners already complying with their properties' LFR obligations and willing to create temporarily or permanently, additional areas equivalent to LFRs. The restrictions to the use of these "LFR Equivalent Area" must be at least as strict as the mandatory LFR regime and it must be also recorded in the competent Real Estate Registry.

LFR Quotas are a new instrument that takes the form of a title representing preserved native vegetation, either under the typical LFR regime but voluntarily established, the LFR Equivalent Area regime or under the regime of a *Reserva Particular do Patrimônio Natural* (a specific type of protected area). The Forest Code provides that specific regulation, which has not yet been promulgated, will establish the legal nature, characteristics, terms and mechanisms to assure that the LFR Quotas actually represent properly managed protected areas. These third party offsets may eventually evolve into formal banking arrangements with government oversight. Presently, state governments are discussing land and ecosystem registration systems that might make it possible. A variant within this system are "condominium" arrangements where groups of landowners establish private conservation banks to offset their collective liabilities off-site.

Development Offsets: Compensation is only mandated for projects that an Environmental Impact Assessment, i.e. those that are judged by the environmental agency to "potentially cause significant degradation of the environment". These projects must offset their impacts through payment of at least 0.5% of the cost of the development to the 'System of Conservation Units' (SCU). The SCU is a network of protected areas that may be categorised in two ways: Complete Protection Units are largely publicly owned and allow for no economic uses, and Sustainable Use Units are generally on private land, and must be used in a sustainable manner.

As there is no cap on the maximum percentage of the compensation payment, it is generally higher than 0.5% in practice. The amount is negotiated on a case-by-case basis by the environmental agency responsible for licensing a project, and is often around 2-3% of the total costs, with variation according to the scale of the environmental impacts. The compensation rate must take into account specific technical appraisal criteria, although the specific methodologies are not disclosed by the environmental agencies.

The whole payment must be used for the creation and maintenance of a Complete Protection Unit, in which no economic activity is allowed. The general rule is that the developer of the project proposes how the payment should be spent and the environmental body, with a considerable amount of discretion, makes the final choice. Thus, the offset may be directed to any Complete Protection Unit within the SCU, with the exception that, if the development directly impacts a specific conservation unit or its buffer zone, this unit must be benefited by the payment.

The Environmental Compensation Chamber, within the Brazilian Institute for the Environment and Renewable Resources (IBAMA) decides about the priorities for the distribution of environmental compensation funds to be applied on the existing or future conservation units, and proposes plans for the use of offset payments. Approximately, the priorities are: (i) land tenure regularization and land demarcation; (ii) preparation, revision and implementation of the conservation unit's management plan; (iii) acquisition of goods

and services for the establishment, management, monitoring and protection of the conservation unit, including its buffer zone; (iv) studies necessary for the creation of new conservation unites; and, (v) research necessary for managing the conservation unit and its buffer zone.

While the development offset provides funding for conservation activities, there is not a direct link between the improvements to biodiversity protection, and the losses arising from the project. Furthermore, developers are not required to be directly involved in conservation actions. It therefore does not ensure an outcome of 'no net loss'. However, advantages are that payments are more easily made available for investment in conservation measures, and the measures are implemented by conservation agencies who already have objectives of maximising environmental benefits.

Monitoring and Enforcement

IBAMA ensures that beneficiary conservation units from the development offsets have detailed plans and projects in order to be entitled to receive payments, and that payments are not made for projects that have already been implemented. It also monitors the implementation of the agreed activities.

The system of offsetting LFR requirements was introduced in an attempt to improve the enforcement of the original regulation, which stated that each property had to have a minimum level of vegetative cover. As landowners can meet their minimum reserve area more easily if it does not necessarily involve reforesting land that was illegally cleared in the past.

The current LFR requirements are monitored using satellite data on fires and deforestation from the National Space Agency, in combination with maps of reserve areas and field inspections by the environmental agencies. The sanctions include fines, embargoes, seizure of goods and arrests. However, the resources for monitoring and enforcement are limited, relative to the size of the countries, for example, in recent years there have been around 8000 charges of illegal activity per year, to be pursued by 22 IBAMA lawyers. Current proposals are for additional sanctions such as credit restrictions and penalties for buyers of embargoed products from illegally deforested areas.

C4) BUSINESS AND BIODIVERSITY OFFSET PROGRAM (BBOP)

Source: BBOP Consultation Documents (2008)

Background

BBOP is a partnership between companies, governments and conservation experts. It aims to use pilot projects to demonstrate the practical potential for using biodiversity offsets to counteract the negative impacts on biodiversity that inevitably result from large scale infrastucture projects. The pilot projects will also provide the opportunity to test out a 'toolkit' of best-practice methodology and guidelines for the implementation of biodiversity offsets on a voluntary basis. Such guidelines are necessary so that the private companies that undertake voluntary offsets can ensure that these are seen as socially acceptable and scientifically credible.

At present, the contents of the 'toolkit' have been proposed, and the pilot projects have been selected. However, not all of the decisions on the details of the pilot offset activities and on the form that the guidelines should take have been finalised.

The fundamental principles that are proposed for voluntary biodiversity offsets are as follows:

1. ***No net loss:*** A biodiversity offset should be designed and implemented to achieve *in situ*, measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a net gain of biodiversity.
2. ***Additional conservation outcomes:*** A biodiversity offset should achieve conservation outcomes above and beyond results that would have occurred if the offset had not taken place. Offset design and implementation should avoid displacing activities harmful to biodiversity to other locations.
3. ***Adherence to the mitigation hierarchy:*** A biodiversity offset is a commitment to compensate for significant residual adverse impacts on biodiversity identified after appropriate avoidance, minimization and on-site rehabilitation measures have been taken according to the mitigation hierarchy.
4. Limits to what can be offset: There are situations where residual impacts cannot be fully compensated for by a biodiversity offset because of the irreplaceability or vulnerability of the biodiversity affected.
5. Landscape Context: A biodiversity offset should be designed and implemented in a landscape context to achieve the expected measurable conservation outcomes taking into account available information on the full range of biological, social and cultural values of biodiversity and supporting an ecosystem approach.
6. Stakeholder participation: In areas affected by the project and by the biodiversity offset, the effective participation of stakeholders should be ensured in decision-making about biodiversity offsets, including their evaluation, selection, design, implementation and monitoring.
7. Equity: A biodiversity offset should be designed and implemented in an equitable manner, which means the sharing among stakeholders of the rights and responsibilities, risks and rewards associated with a project and offset in a fair and balanced way, respecting legal and customary arrangements. Special consideration should be given to respecting both internationally and nationally recognised rights of indigenous peoples and local communities.

8. Long-term outcomes: The design and implementation of a biodiversity offset should be based on an adaptive management approach, incorporating monitoring and evaluation, with the objective of securing outcomes that last at least as long as the project's impacts and preferably in perpetuity.
9. Transparency: The design and implementation of a biodiversity offset, and communication of its results to the public, should be undertaken in a transparent and timely manner.
10. Science and traditional knowledge: The design and implementation of a biodiversity offset should be a documented process informed by sound science, including an appropriate consideration of traditional knowledge.

Considerations for offset design

Site selection: The process of identifying a set of potential sites for a biodiversity offset and ultimately selecting from these the site or sites where the offset will take place is a fundamental part of offset design. The process of site selection assists the developer in designing an offset that ensures each of the key biodiversity components relating to species, communities and ecosystems is present, and that each of these components is considered at the appropriate scale to achieve no net loss of biodiversity. In some cases, offset sites satisfying these requirements may be found in close proximity to the area affected by the project, while in others appropriate sites meeting certain key biodiversity criteria may only be found within a broader landscape. To deliver all the key biodiversity components necessary, a biodiversity offset consisting of a composite in more than one location, covering more than one component of the landscape, may be required.

A fundamental factor driving the site selection process is a comprehensive assessment of the biodiversity components that must be offset in order to satisfy the goal of no net loss, or a net gain, of biodiversity. While the process used to identify and prioritize these components may take several different forms, developers should capture the species, communities and/or ecosystem levels as well as those ecosystem services delivered by the landscape that support lives and livelihoods (e.g. use and cultural values of biodiversity) which must be offset. It is important to look at both the 'pattern' and process aspects of biodiversity within the landscape. Pattern aspects might consist of species, communities, ecosystem and/or habitat type occurrence within the landscape, while process aspects would include linkages and connectivity between ecosystems, opportunities in the landscape for corridors to allow ecological and evolutionary processes to continue over time (e.g. along river systems, across altitude or soil type interfaces and climate gradients).

The nature of the biodiversity components of the project site will in turn form the basis for the site selection process and will most likely determine whether a landscape-level approach should be used for site selection, linking in with any regional plans, or whether individual sites should be investigated to assess their similarity to the project site. This is because the degree of relevance of locating the offset in the wider landscape context will vary according to the nature of the 'value' being considered:

The wider landscape context will be most relevant for those biodiversity components identified based on their intrinsic values. The location of any offset for the existence values of biodiversity impacted will be defined by relatively objective criteria based on both biodiversity pattern and important processes that enable that pattern to persist. As a result, the

area from which offsets are selected should coincide with the distributional area of the impacted species, communities, habitat or ecosystem.
The wider landscape context can also help developers, policy-makers and stakeholders determine whether the offset should be 'like for like' (i.e. the offset conserves broadly equivalent biodiversity components to those impacted) or whether 'trading up' to an 'out of kind' offset is more appropriate. (In this case, residual impacts on intrinsic biodiversity value are compensated by offsetting in habitat or ecosystems of a higher conservation value or priority.) Where 'trading up' is the better approach, site selection would seek a spatial area in which the offsets would tally with the distribution of that higher value ecosystem/habitat.
The impact site-based approach will be more relevant for offsetting community cultural and use values, as these types of offsets will need to occur quite close to the affected communities. The location of such offsets will be defined by stakeholder preferences and requires their close involvement.

Regardless of the approach taken, project developers should be sure to scan for existing national and/or regional plans that have identified priority areas for conservation.

Quantifying losses and gains of biodiversity: Another key issue is how to compare losses in biodiversity at the project site with gains at the offset site. The intention in the BBOP guidelines is that biodiversity offsets should ensure 'no net loss' in the persistence of species' populations, their chance of survival or their retention in the landscape. Similarly there should be no net loss in the availability of and access to suitable habitat for individual species, or the persistence probability of recognisable assemblages of species (ecological communities). This raises the question of how to ensure that sufficient biodiversity is protected at the offset set to compensate for what has been lost from the project site.

The BBOP approach to measuring losses and gains in biodiversity is based on a comparison with benchmarks at the level of the biotope, species habitat or species population. For biotopes and species' habitat, equivalence of impacts and offsets is calculated on the basis of 'habitat hectares', taking into account area, type and quality as measured on the basis of key attributes. To measure quality, a benchmark example of a healthy or pristine version of the biotope or habitat is selected, and used to define reference levels of various attributes. The project site and offset site are then given scores according to their current quality with respect to the chosen attributes relative to the benchmark example, and for their expected quality after the project and the offset. The losses and gains are measured by the expected changes in the scores over time, accounting for the risk that some outcomes may not be obtained.

For certain species of conservation significance, detailed assessments of loss and gain may be required, particularly where these species might experience impacts other than, or in addition to, habitat degradation or conversion, such as intensified hunting pressure, increased disturbance or interruption to migration or disturbance. In such cases metrics based on habitat proxies may not be particularly informative and it may be necessary also to carry out population assessments.

Implementation issues

Institutional framework for managing offset site: The first question is who will manage the site. This can in principle be the developer themselves, the government, an NGO, a local community group, or a combination of these. It is also necessary to ensure that when the

developer is no longer active at the project site, for example if a mining concession ends, that the commitments to the offset site continue to be met. One way to ensure permanence and avoid questions of future responsibility is for the original developer to establish the biodiversity offset as legally autonomous and fully finance it while that developer still owns the project. In that case, if the developer subsequently sells its interest, the viability of the offset is secure, since it will be managed into the long-term whether or not the company which takes over the project supports the offset or not. Another option is for the original developer to ensure that a condition in the contract for transfer of ownership of the project to the third party is that third party takes on the original developer's ongoing responsibilities for the biodiversity offset.

There may be existing institutions such as park authorities or international NGOs with the capabilities to carry out the management of the offset site, and the delivery of the offset activities. Alternatively, a new institution may be need to be created, in which case a process of capacity-building will be important. A PES scheme is one option for the implementation of the necessary land-use changes, through which the developer could pay individuals to enact the changes.

Financing: After determining the cost of implementing the offset, offset planners need to determine where the financial resources to meet these costs will come from, and how they will be managed. At a minimum, the developer needs to ensure viability of the offset for at least as long as the impacts endure, and, ideally, in perpetuity.

Ensuring the success of biodiversity offsets will generally require the creation of a long-term funding mechanism to guarantee their permanence and sustainability. Conservation trust funds, or environmental funds, have become increasingly popular as mechanisms to secure long-term support for conservation projects, from the local to the national level. In considering the nature and purpose of environmental funds, the 1998 GEF *Evaluation of Experience with Conservation Trust Funds (recently updated by the Conservation Finance Alliance in Rapid Review of Conservation Trust Funds, May 2008)* observed that conservation trust funds 'are not simply financial mechanisms, but must be viewed as institutions that have several roles to play, in addition to channeling funds. These include roles as key actors in the development of national conservation strategies, as technical experts who can work with public and private agencies to develop agile and effective management approaches and, in some countries, as capacity-builders and nurturers of an emerging group of non-governmental organizations becoming involved in biodiversity conservation.' (IPG 1999) When setting up a fund to manage and implement an offset, developers are, in effect, creating a long-term financial and institutional mechanism for the benefit of conservation.

Monitoring and enforcement: Two major types of biodiversity indicator can be identified. The first set are implementation indicators, which measure the degree to which project activities have been implemented; the second set are impact indicators, which measure the success of project activities in influencing the status of biodiversity on the ground. An example of the former would be 'Number of staff employed'; an example of the latter would be 'Change in bird species diversity as a result of offset intervention'. In order to determine progress in achieving no net loss of biodiversity, the BBOP guidance states that it is important to measure and evaluate changes in both these types of indicator over time.

The offset management plan proposed in the BBOP Toolkit includes guidance about

monitoring both implementation and outcomes, which may be done by those managing the offset site or by a third party. It is recognized that a certification process would enhance the credibility of the offset activities, but such a system does not exist at present.

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