Silver bullet or fools' gold?

A global review of markets for forest environmental services and their impact on the poor

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Executive summary

Market-oriented approaches to environmental management are increasingly common in all sectors of the economy. Forestry is no exception. As forestry sectors around the world open their doors to growing private sector participation, governments have been increasingly attracted to market-based instruments as a new set of tools for guiding private investment. Of the many instruments available to policy-makers, by far the most ambitious to date is the development of markets for forest environmental services, such as carbon sequestration, biodiversity conservation, watershed protection and landscape values. Markets are thought to offer an efficient mechanism for promoting and financing forest protection and sustainable forest management.

However, policy-makers' enthusiasm for market development is not matched by practical understanding. Very little guidance is available on the mechanics of market evolution, or on the consequences of markets for human welfare. Unanswered questions abound. What drives market development? How should markets be established? What costs are involved? Will markets improve welfare? Will some stakeholders benefit more than others? How does performance vary between market structures? What is the role for governments?

Of particular concern is the lack of knowledge related to what market creation means for poor people. The critical question is whether markets for forest environmental services can contribute to poverty reduction, while at the same time achieving efficient environmental protection. In short, do markets for forest environmental services offer a "silver bullet" for tackling economic, social and environmental problems in the forestry sector, or are they simply "fools' gold"?

Drawing on ideas in New Institutional Economics and recent thinking on forests and poverty, this paper attempts to shed light on these questions through (1) the development of a conceptual framework for guiding research; and (2) the application of this framework in a global review of emerging markets for carbon sequestration, biodiversity conservation, watershed protection and landscape beauty. In total, 287 cases are reviewed from a range of developed and developing countries in the Americas, the Caribbean, Europe, Africa, Asia and the Pacific. For each service, the paper considers six central questions:

- *What form do markets take?* Markets vary tremendously between locations and services sold. This review considers seven key features to help describe market form: the commodities, the characteristics of participants, the level of competition, payment mechanisms, the geographical extent of trading, the level of maturity and the degree to which markets are embedded in broader institutional contexts.
- *Why do markets evolve?* Markets evolve in response to changing demand and supply conditions. Understanding what is driving changes in demand and supply is a critical first step in developing strategies in market creation.
- *How do markets evolve?* Institutional development tends to be slow, iterative and path dependent. It is closely intertwined with shifting power relations and changing incentive structures. Understanding the complex processes through which change occurs is essential for those wishing to foster market development.
- *What does market development mean for human welfare?* With market development driven by certain individuals and/or groups, there can be no presumption that markets will improve social welfare. Economic, social and environmental impacts need to be measured. Transaction costs associated with establishing and running market mechanisms must also be considered.
- *What do markets mean for poor people?* Impacts on poor people are of particular concern. To help guide this assessment the review considered how markets are impacting on assets (including financial, human, social, physical, natural and political) held by these groups.
- *What are the key constraints to market development?* Lessons on constraints to market development need to be drawn out from answers to the above questions. Ultimately this is critical as a basis for identifying prerequisites for welfare-enhancing markets.

Emerging insights on these questions are offered for individual service markets.

Markets for biodiversity conservation

The process of commercialising the diversity of nature is not easy. This is immediately clear from the review of 72 emerging payment schemes. Not only are the services provided by biodiversity numerous (ranging from the maintenance of ecosystem functioning through to option and existence values), but most are intangible which makes them difficult to package for sale. Moreover, services are rarely consumed by a clearly identifiable clientele, and threshold effects in the supply of biodiversity (which mean that forest areas below a certain size will fail to deliver the demanded biodiversity) makes it difficult to portion out the services to individual buyers.

In spite of these problems, governments, international non-governmental organisations (NGOs) and private companies are paying for forest biodiversity conservation. Growing public awareness of biodiversity benefits and threats of loss are the main drivers. As funds have started to flow to biodiversity protection, individual and community land stewards have become increasingly proactive sellers of their services.

The growth and diversification in market participation has produced significant innovation in the design of commodities and payment mechanisms. Expensive and complex project-based deals are giving way to intermediary-based transactions (especially trust funds), pooled investment funds, transactions that piggy-back on retail sales (e.g. shade coffee) and even over-the-counter sales of standardised products. In its own way, each mechanism seeks to cut market risks, overcome threshold effects and to minimise transaction costs. As risks and costs come down, market participation is likely to continue to rise.

Despite significant progress in recent years, for the most part payments for biodiversity services remain nascent and, to a large degree, experimental. Major constraints to market development remain, not least the significant transaction costs associated with setting up and implementing trades. For the most part, constraints are greatest in poor communities of developing countries.

While few assessments of the impacts of these markets on local or global welfare have been undertaken, widespread perceptions of gains need to be balanced with critical evaluations of costs. Particular attention needs to be given to the distribution of benefits and costs, and the repercussions for social equity. Early indications suggest a need for caution. Far from gaining from increased income, a more diversified asset base and the development of new skills, the livelihoods of poor communities may be threatened by the market through increased exclusion, lower incomes and a weaker asset base.

Markets for carbon sequestration

The signing of the Kyoto Protocol in 1997 set the stage for the emergence of a market in carbon offsets, including those based on forest sequestration and storage. This review considers 75 examples of payments for forest-based carbon offsets. Even before details of the Protocol were finalised in Marrakech and before its ratification by signatories, the carbon offset market has been evolving quickly. Not only are national governments passing laws to ensure emission targets are met, but greenhouse gas emitters, brokers, consultants, NGOs, communities, and potential suppliers are responding directly to international policy processes. This report examines key features of the evolving market, with particular attention given to forests-based carbon offsets.

As with other markets for environmental services, the process of market development for carbon offsets has not been smooth, nor is there a single unified trading platform. Rather, transactions have occurred at a number of levels (i.e. local, national, regional and international), through a variety of payment mechanisms (from bilateral to exchange-based) and with varying degrees of government participation.

The most sophisticated trading systems are being set up in industrialised countries as a result of concerted government efforts to introduce emission caps and establish clear rules and regulations to guide market development. In these

situations, voluntary *ad hoc* transactions aimed at gaining experience and generating favourable publicity are being replaced with more systematic trading of a defined carbon commodity – normally 1 tonne of carbon dioxide equivalent – aimed at minimising the costs of compliance. Yet, to date emerging national trading schemes have been isolated efforts and few allow for forestry activities, reflecting recent uncertainties in the Kyoto Protocol. International trade in Joint Implementation and Clean Development Mechanism carbon offsets have been primarily generated through complex and individually negotiated projects. Investment in the development of an international market architecture remains limited.

However, recent breakthroughs at the Conference of the Parties 6 and 7 have boosted prospects for an international market for carbon offsets. In an effort to become market leaders, an increasing pool of organisations (private, public and NGOs) are setting up international brokerage services, investment funds, clearing-houses and even exchanges. Insurance companies, consultants and certification suppliers have been quick to offer potential buyers and sellers services to support international trade. A number of these ventures cater for forest-based offsets.

As the market matures, it offers expanding opportunities for learning. This review has struggled to keep up with new information. Descriptions of individual transactions, progress being made in individual trading schemes and new entrants offering more sophisticated services is plentiful. However, there remains a lack of analysis of these experiences. Guidance on the process of market creation and on its impacts is particularly lacking. Critically, it remains unclear whether the carbon market will act as a force in favour of, or against, poverty alleviation. Emerging evidence that poor smallholders in developing countries face serious constraints in accessing market opportunities is cause for concern. While allowing space for learning-by-doing is important, governments have an essential role in acting early to head off emerging problems. As the market for carbon offsets takes off following Marrakech, governments need to put in place those policies and regulations that will ensure efficient and equitable climate change mitigation.

Markets for watershed protection

Forests – either on their own or as part of broader multiple-use landscapes – produce a number of watershed services valued by society. While services vary between sites, forests are credited with, amongst other things, protecting water quality, regulating water flows, preventing floods, controlling soil salinisation and maintaining aquatic habitats. Whereas, historically, the protection of critical watersheds has been the preserve of government, the review highlights the growing role of private companies, individual landholders, NGOs and communities in delivering and financing for watershed services. This report reviews 61 efforts to broaden participation through the establishment of markets for watershed services.

The emergence of a market for watershed services has not been associated with significant competition in supply or demand. Because watershed services benefit groups of individuals and are characterised by threshold effects, cooperation in demand and supply is key. Market development depends on strengthening cooperative and hierarchical arrangements to allow beneficiaries and providers to come together to formulate group payment strategies and to tackle free riding. At the same time where cooperative or hierarchical arrangements exist, but have come under strain due to inequitable benefit-sharing and high costs, markets are being introduced to ease tensions and facilitate financial and in-kind transfers.

Given the large number of stakeholders involved in watershed protection, payments tend to be channelled through intermediaries, allowing buyers and sellers to contract out the negotiation and conclusion of deals, overseeing implementation and enforcing contracts. Intermediaries are also valuable mechanisms for pooling funds from a group of beneficiaries and/or collecting user fees. In more advanced countries, over-the-counter trading using pre-packaged commodities is being promoted, in some cases alongside clearing-house systems.

For the most part, markets have emerged as a result of a growing willingness to pay amongst beneficiaries. This is often the result of improved understanding of the benefits provided by watersheds and growing threats they are facing. In more developed countries, new government regulations for improved water quality has been the major force behind investment. Due to the difficulties of excluding non-payers from watershed services, suppliers have generally lacked leverage for demanding payments. Yet, as commodities and payment mechanisms become increasingly sophisticated, supply-driven markets are no longer unthinkable.

Amidst the flurry of activity to promote payments for watershed protection, little attention has been given to impacts. Questions need to be asked as to whether market provide a preferable mechanism for delivering watershed services to tried and tested regulatory systems. The literature provides little insight on this issue. For the most part, studies offer superficial reviews of economic, social and environmental benefits with virtually no assessment of costs. Moreover, the literature fails to convince us that markets offer the optimal way of achieving improved watersheds. The lack of attention to equity impacts of emerging payment schemes raises a number of concerns.

Concerns over equity impacts are reinforced by the analysis of constraints to market development. Even where the gains from trade are significant, the significant transaction costs involved introduce serious barriers to entry for anyone lacking financial resources, managerial and coordination skills, technical knowledge and political connections. Moreover, the costs of participating in emerging markets rise the greater the number of individuals living in a watershed, the weaker the government's regulatory capacity, the less

reliable hydrological data, and the less secure property rights. While developing countries face severe hurdles in establishing markets for watershed protection, it is the poorest groups in these countries that risk marginalisation. Governments have a critical role to play in ensuring markets work for the benefit of all sections of society, not just the most powerful.

Markets for landscape beauty

While the provision of landscape beauty represents a critical ingredient into the market for ecotourism, payments for this input have been slow to develop. Not only have tour operators taken landscape beauty as a free input, but protected area managers have rarely sought to capture consumers' willingness to pay. This situation is unsustainable, and in many locations supplies are threatened. Efforts to establish a market for landscape beauty are long overdue.

It is clear from the 51 cases reviewed that market evolution is not a simple process. The introduction of payment mechanisms where none existed before involves the creation of new institutional arrangements and the involvement of new stakeholders. As tour operators begin to establish themselves as paying customers, communities and private landowners are seeking to compete with publicly owned protected areas. At the same time, intermediary organisations are responding to the demand for support in searching for, negotiating and implementing deals.

Despite the broadening of stakeholder participation, little progress has been made in developing sophisticated payment mechanisms such as auctions or clearing-house mechanisms. For the most part payments are based on site-specific negotiations or reformed entrance fees. More recently, the establishment of community-based ecotourism operations and joint ventures has allowed land stewards to tap tourists' demand directly. However, far from creating a more transparent and efficient market for landscape beauty, vertical integration internalises of the market for landscape beauty within a new enterprise.

Thus, despite its claim to being the oldest market of the four forest environmental services considered in this review, the market for landscape beauty remains relatively immature. Constraints to market development are well established and shifts in power balances are difficult to make. As long as tour agencies resist paying for landscape beauty, land stewards' opportunities for being rewarded for the services they provide lie in establishing themselves as marketing enterprises. Yet, without the skills to administer and manage complex international businesses, this route is fraught with difficulties – particularly for poor people. Some more forward-looking agencies and communities believe that ecotourism must ultimately involve a joint effort and the pooling of skills and resources. Whatever the model, for landscape beauty to be protected into the future, it is clear that providers must receive fair compensation for their inputs.

Markets for bundled services

Environmental service bundling receives minimal attention in the literature. However, practical experience is expanding as those demanding and supplying services seek to capitalise on complementarities between services. Based on the 28 examples reviewed in this report, two approaches to developing markets for a suite of services are emerging: (1) merged bundles and (2) shopping basket bundles. While merged bundles do not permit services to be sub-divided and sold individually, they offer a useful control on transaction costs. The shopping basket approach is more sophisticated, permitting sellers to subdivide packages of services for sale to different purchasers. The result is likely to be a more efficient allocation of resources and higher returns to sellers. Yet, given the technical, informational and institutional requirements for successfully marketing a suite of services to separate buyers, for most forest managers the shopping basket model is a distant goal.

Distilling key messages – market form, drivers and processes

While market forms, drivers, and the process of market development vary between cases, the review points to a number of cross-cutting lessons:

Different commodities work in different contexts. While commodities in existing markets are easily identified, this is often one of the most challenging aspects of market creation. It is also one of the most important steps for determining whether or not the market will take off and be sustained. In the case of environmental services, commodities must overcome the hurdles of non-excludability and non-rivalry to make the service marketable and ensure that payments for the commodity translate into payments for the service. Achieving this is extremely difficult. From this review, it is clear that finding single commodities to proxy individual services is not always possible. The central challenge facing policy-makers is finding an effective balance between commodity-precision and implementation costs.

Markets are multi-stakeholder affairs. While the private sector tends to be the main player, local NGOs, communities, governments, international NGOs and donors also play key roles as buyers, sellers, intermediaries and suppliers of ancillary services. Efforts to promote markets for environmental services should seek to capitalise on a range of stakeholders' enthusiasm and avoid alienating particular groups that may block market development. In certain cases targeting influential players for participation may be justified to kick-start market development, but targeting needs to be balanced with efforts to avoid marginalisation of weaker groups.

Competitiveness is difficult to establish in nascent markets. The level of competition in a sector has critical implications for the welfare impacts of markets. In general, the higher the competition, the greater the benefits. Policy-makers have a role in preventing anti-competitive behaviour in environmental service markets. However, rules of thumb for assessing market competitiveness

are less effective in nascent markets for a number of reasons. By their nature, young markets experience relatively high levels of price volatility and high concentration in supply and demand. Policy-makers need to show care that efforts to curb anti-competitive behaviour do not stifle market development.

Immaturity predominates, but momentum is growing. Despite their rapid growth in popularity amongst academics and policy-makers, in the majority of situations markets remain nascent affairs characterised by unsophisticated payment mechanisms, low levels of price discovery, high transaction costs and thin trading. Yet, the picture is changing. The growth in pooled transactions has given the market a boost as more and more buyers come together to spread risks and the emergence of over-the-counter trades reflects a growing confidence amongst suppliers who are beginning to set the terms of deals. Gradually, case-specific negotiations are being replaced by trading systems that seek to promote a greater volume of payments at lower costs. Retail-based trading, clearing-house mechanisms, investment funds and exchange-based platforms are all testimony to this trend. This is not to say that increasing sophistication is always desirable. More advanced payment mechanisms cost money to implement and some cost more than others. To help decide which payment mechanisms are most appropriate, these costs need to be weighed against benefits. In some cases, more than one payment mechanism may be optimal.

Governance is critical for emerging markets. The extent of markets depends not just on the nature of the service, but also on market design. Global services, such as carbon sequestration or biodiversity conservation, do not necessarily give rise to global markets. Just as the creation of a clear and stable regulatory environment at the national level is essential to promoting domestic investment, flexible and low-cost international payment systems depend on the development of an effective system of global governance. Given the difficulties of defining internationally recognised property rights and regulatory oversight, local markets for global services may offer the best starting point for market development. In the longer-term, flexible and low-cost international payment systems depend on strengthening global governance.

Markets are not the only show in town. Markets do not exist in isolation and should be evaluated with reference to their interaction with other hierarchical, cooperative or market structures. Not only do markets mould to fit existing institutional landscapes, they also have repercussions on these landscapes. Successful markets often depend on the emergence of supporting regulatory and cooperative arrangements and may lead to the abandonment of outdated institutions. Efforts to build markets as alternatives to non-market institutions are misplaced. Rather, energy should be directed to building a combination of market, cooperative and regulatory arrangements that suit local conditions.

Drivers are inter-linked and dynamic. Drivers for markets for environmental services are dynamic and inter-linked. One driver may kick-start events and processes that generate new drivers. While demand-side drivers are most closely

associated with market creation to date (e.g. based on a growing appreciation of benefits provided by forests and awareness of threats to supply of services), suppliers are becoming increasingly forthright in demanding payment. Government environmental regulations are also key in stimulating market development. As market prospects expand, intermediaries and ancillary service providers can play a catalytic role in realising market opportunities. An evaluation of the range of drivers, points to a number of leverage points for policy-makers keen to stimulate market development. Those that stand out include: awareness-raising, reducing transaction costs and trading risks, providing secure property rights and raising environmental standards.

Development takes time and effort. A number of steps are involved in establishing payment mechanisms for environmental services. Steps will differ between contexts to take account of local power relations, policies, regulations, culture and history. Nevertheless broad lessons are increasingly apparent. Policy-makers have clear roles in fostering market establishment and shaping market form to maximise welfare. Services need to be identified and clearly linked to forestry activities that will ensure their delivery, costs and benefits evaluated and potential resistance pin-pointed, willingness to pay established, property rights and commodities defined and the trading infrastructure set up. Where equity is a concern, action must be taken to ensure a level playing field and market access for all. Time is needed for piloting, feedback and gradual improvement. The process can be long and may involve setbacks.

Markets and the poor – pitfalls and opportunities

Very few thorough assessments of the costs and benefits of emerging markets were found in the literature. For the most part, market descriptions are general, *ad hoc* and vague. Moreover, because literature tends to be written by proponents of markets, there is a heavy emphasis on benefits, and little critical analysis of costs. The lack of critical analysis is particularly prevalent when it comes to the impacts of emerging markets for poor communities. Notwithstanding data constraints, this report points to emerging insights on costs and benefits of markets, with a particular emphasis on impacts for poor people. Constraints facing poorer groups in accessing market benefits are discussed and preliminary thoughts on ways to overcome them are highlighted.

What the case studies tell us

Evidence of market impacts on poor communities is scarce. Where it does exist it is often biased. While benefits are widely applauded, costs are poorly recorded. By helping poor groups transform natural capital embodied in forests into financial flows, markets are praised for providing local people with greater flexibility in exploiting their natural assets and helping them to reduce vulnerability by diversifying their income base. Markets are also thought to provide an effective mechanism for ensuring a sustained flow of services to beneficiaries. These services are often most critical for the livelihoods of poorer groups.

Yet, the few references to negative impacts raised in the literature highlight important concerns. Because poor people often lack property rights, they are likely to struggle for a share of business, and to fight to retain control over, and access to, the resources on which they depend. Poor individuals lack the requisite skills and knowledge, as well as resources, for participating in emerging markets. Transaction costs, which are already high, are even higher for poorer players. Ultimately, however, poor people lack power. Where poor groups have little voice in the development of markets, there is a real risk that they are marginalised from market benefits.

Pro-poor markets face serious obstacles

Uncertain property rights, *ad hoc* and incomplete regulatory frameworks, inadequate skills and education, inadequate finance, poor market information and contacts, insufficient communication infrastructure, inappropriately designed commodities, high coordination costs and weak political voice are important constraints to market development. They are also mutually reinforcing. Poor market information and lack of contacts, for instance, raise transaction costs facing marginalised groups.

While the hurdles facing poor people's participation in emerging markets are formidable, they are not insurmountable. Ways need to be found to ensure markets act as a force for equitable growth. This review highlights the impressive ability of markets to change shape to overcome hurdles. Innovations range from pooling demand, specialised intermediaries, insurance schemes and retail-based trading. The question is not so much whether markets can be made more equitable, but how governments can channel private energy towards developing pro-poor markets.

Potential ways forward in developing pro-poor markets

Seven possible steps for promoting pro-poor markets are identified:

- *Formalise forest service property rights held by poor people*. Formalisation of natural resource rights is essential to giving marginalised groups control over, and rights to, returns from environmental service sales.
- *Define appropriate commodities*. Simple and flexible commodities that can be self-enforced, that fit with existing legislation and that suit local livelihood strategies need to be developed in poorer areas.
- *Devise cost-effective payment mechanisms*. In areas where regulatory capacity is weak, trading skills in short-supply and market infrastructure under-developed (e.g. communication, information systems, transport, monitoring), simpler payment mechanisms are likely to be most effective.
- *Strengthen cooperative institution*s. Cooperation is critical in allowing poor landowners and service beneficiaries to share the costs associated with market participation. It is also essential for achieving a minimum level of supply or demand, thereby permitting market participation.

- *Invest in training and education.* Training in marketing, negotiation, management, financial accounting, contract formulation and conflict resolution are important prerequisites for effective participation. Technical skills relating to forest management for environmental services are also needed.
- *Establish a market support centre.* Information is power. To improve poor people's ability to participate in emerging markets, a central market support centre could offer free access to market information, a contact point for potential buyers, sellers and intermediaries, and an advice bureau to support the design and implementation of contracts.
- *Improve access to finance.* Where finance is needed to negotiate and conclude environmental service deals, the government may have a role to play in supporting access to funds.

As with any desk study, this review has been restricted in what it can achieve by the availability and quality of written material. The aim is not to provide definitive answers to all questions relating to market development and welfare impacts. Rather, the authors have sought to achieve three things:

- to provide an overview of available information on markets for environmental services and, thus, a reference point for others considering how their experiences fit into the bigger picture;
- to develop a framework for analysis to guide research and identify gaps in our understanding of markets; and
- to draw out insights on market form, drivers, processes of market development and impacts for welfare, with a particular emphasis on opportunities and constraints facing poorer individuals and groups.

It is hoped that the ideas put forward in this report will focus minds on the issue of pro-poor markets, stimulate discussion as to potential ways forward and generate further research.

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Acronyms

AIJ	Activities Implemented Jointly
CBD	Convention on Biological Diversity
CDM	Clean Development Mechanism
COP	Conference of Parties
FAO	Food and Agriculture Organisation
GEF	Global Environment Facility
GHG	Greenhouse Gas
INBio	National Biodiversity Institute (Costa Rica)
JI	Joint Implementation
NGO	Non-governmental organisation
NTFP	Non-timber forest product
NPV	Net Present Value
SFM	Sustainable forest management
tC	Tonne of carbon
tCO^2	Tonne carbon dioxide
UNFCCC	United Nations' Framework Convention of Climate Change

1. Introduction

1.1 What this report is about and why it is important

In 1988, Applied Energy Services, Inc., a U.S. electrical power producer, invested US$2 million in a number of agroforestry projects in Guatemala to absorb the carbon dioxide emitted from a new 183 megawatt coal-fired power plant in Connecticut. In May 2000, Earth Sanctuaries Ltd. listed on the Australian stock market in an effort to transform the company's growing biodiversity investments into working capital – 6,800 individuals paid A$12 million for shares. Surrounded by civil strife and violence, farming communities in the Guabas River watershed in Colombia have not been deterred from their efforts to negotiate deals with upstream landowners to adopt improved land management practices, including reforestation, to maintain dry-season flows. In the Langtang National Park of Nepal, frightened that rapid deforestation and degradation will undermine tourist interest, lodge operators in Syabrubensi village have agreed to pass on payments to local communities to protect over 170,000 hectares, including some of the best preserved silver fir and rhododendron forests in the country.

Hardly a week goes by without new stories, like those above, of innovative deals involving payments by beneficiaries for a range of forest environmental services. Each new tale adds to the growing evidence of a rapidly evolving environmental service sector. Yet, the *ad hoc*, sensationalist and often superficial nature of these stories leaves us with a hazy understanding of these markets. How common are payments for environmental services? What form do payment systems tend to take? How exactly do they evolve? What impacts do they have for human welfare? And do they benefit or harm poorer people?

Notwithstanding these uncertainties, such stories have been surprisingly successful in capturing the imagination of cash-strapped governments, non-governmental organisations (NGOs) and entrepreneurs keen to exploit new market opportunities. Yet, as market creation gains momentum, the lack of critical analysis is becoming more acute. Policy-makers are launching market development initiatives with little understanding of the risks they are taking. There is an urgent need for practical guidance.

In this report we take a tentative step forward through an analysis of 287 cases of emerging markets for four forest environmental services, including carbon sequestration, biodiversity conservation, watershed protection and landscape beauty. The paper seeks to achieve three objectives:

- to develop a **framework for analysis** which sets out the key questions which need to be addressed to develop our understanding of how markets evolve, how they differ, their benefits as well as their potential pitfalls;
- to apply this analytical framework to the review of environmental service markets to **provide an overview of the evidence** – a reference point for others considering how their experiences fit into the bigger picture; and
- to **draw out preliminary lessons** on market form, drivers, the process of market development, welfare impacts and constraints to inform policy-makers and to stimulate discussion. Particular attention is given to impacts for poorer households and tentative thoughts are put forward on how policy makers might promote more equitable markets.

1.2 Moving beyond the "government versus market" debate

Free market economists, generally suspicious of government solutions to environmental problems, eagerly trumpet the attractions of markets for forest environmental services. Government intervention, they argue, is too often characterised by overstaffed and inefficient bureaucracies, hampered by heavy information and coordination costs and vulnerable to rent seeking. Even where governments have the will and capacity to deliver efficient forest management, they often lack the means. In a world where public authorities are constrained by low budgets, imperfect information and low levels of motivation, free-market proponents argue that market solutions should be pursued wherever possible.

At the opposite end of the spectrum are those who have an inherent distrust of markets and fear a world where cooperative action and accountable systems of governance are marginalised to make way for the "invisible hand". For these groups, the benefits provided by forests go far beyond those goods and services traded for financial gain. Not only do forests provide an array of non-marketed benefits, they are also critical in the livelihoods of poorer groups and provide an invaluable social safety net. Leaving decisions over production, investment and resource allocation to independent market actors is thought to jeopardise current and future welfare. These arguments resonate with economists who point to pervasive "market failures" in the forestry sector and the need for government intervention. Allowing the private sector free reign would, the argument goes, end in rapid forest depletion and welfare loss.

While debates between market proponents and detractors are interesting, their presentation of government and market systems for resource allocation as mutually exclusive is not very helpful. In reality, not only are markets and governments interdependent, they should also be seen in a broader context

which takes account of cooperative systems of governance and resource utilisation. Markets, for instance, depend critically on legal and judicial systems set up and monitored by governments, while the effectiveness of government intervention may often be improved through the creation of "internal markets". Trust, social customs and informal enforcement mechanisms are also key ingredients underpinning the efficient functioning of trading systems. Equally, markets have been known to reinforce incentives for cooperative action. The key question is, thus, not whether we should promote markets instead of government intervention, but what is the optimal combination of market, hierarchical and cooperative systems for governing forest sector utilisation and management?

1.3 This study – key questions and methodology

Keeping the need for a more integrated understanding of government regulation and market mechanisms in mind, this paper seeks to explore how markets for forest environmental services are emerging, how they fit into their broader contexts and what they mean for welfare. The aim is to respond to demands for practical guidance in market creation.

Drawing on insights from New Institutional Economics the paper identifies six central questions to guide research:

- What form do markets take?
- Why do markets evolve?
- How do markets evolve?
- What does market development mean for human welfare?
- What do markets mean for poor people?
- What are the key constraints to market development?

The paper is based on a global review of empirical data on market development for carbon sequestration, biodiversity protection, landscape beauty and watershed protection undertaken between February 2000 and July 2001. Information was gathered from published and unpublished documents, internet searches, email and telephone interviews. In total, 287 cases have been covered from developed and developing countries all over the world. Figures 1 and 2 below provide a breakdown of these cases by service type and region.

As with any desk study, this review has been restricted in what it can achieve by the availability and quality of written material. Because material is limited in both detail and scope, the review does not seek to provide definitive answers to all the questions raised above. Rather, it attempts to develop a framework for analysis and preliminary insights.

For some this report may appear overly concerned with theoretical and conceptual issues and place excessive emphasis on the systematic application of the framework for analysis. We would argue, however, that the approach taken is necessary for such a new field of research. Not only do we hope to learn lessons in this review, but we also hope that the paper provides a baseline for future investigations.

Figure 1: Breakdown of forest environmental service markets reviewed

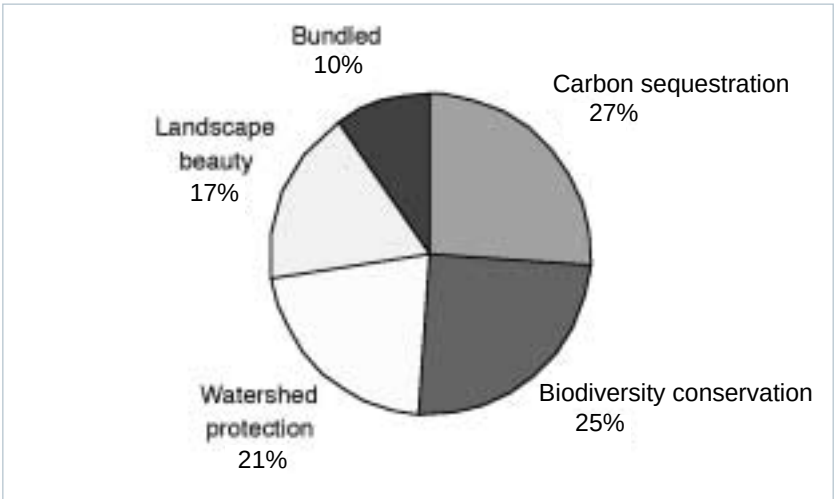
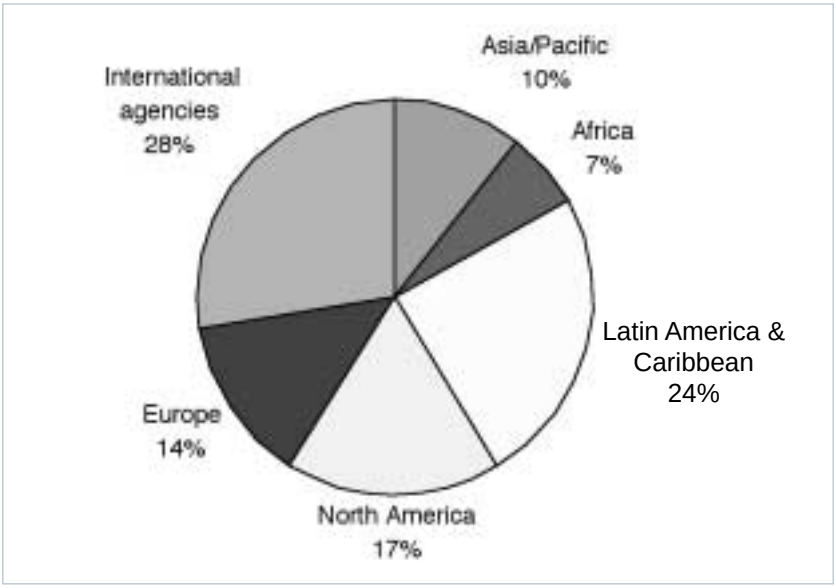


Figure 2: Regional breakdown of cases reviewed



Finally, it should be stressed that two economists have written this report. Despite our best efforts to avoid using language and preconceptions that non-economists might find hard to follow or accept, there are likely to be parts of the paper with which readers disagree. We do not seek to avoid debate, and very much hope that by provoking a reaction this paper will stimulate wider discussion.

1.4 Structure of this report

The report is structured as follows. In Section 2, following a brief review of the theory behind market failure, market creation and forests and poverty, we turn to practical issue of developing a framework for analysis. This framework guides the review of markets for biodiversity conservation, carbon sequestration, watershed protection and landscape beauty undertaken in Sections 3-6 respectively. In Section 7 attention is turned to the emergence of markets for bundled services, i.e. more than one service marketed together. Section 8 is split into two parts. The first part draws out lessons relating to market form, drivers and the process of market development. The second part focuses on how markets impact on poor communities and draws out tentative lessons for policy-makers interested in promoting pro-poor markets. To help those unfamiliar with market "jargon" and to guide readers with respect to unusual terminology used in this report, a Glossary is provided in Annex 1. Annex 2 lists the cases reviewed, broken down by environmental service.

2. Market failure and creation: a conceptual framework

Forest goods and services benefit both local and global communities, but not all forest uses generate financial returns commensurate with their "true" economic value. This is because several forest benefits, notably environmental services, are not traded in markets and have no observable price. There are many reasons why markets often fail to reflect environmental values. This section starts by describing why markets may fail in the case of forest environmental services before outlining how government initiatives to tackle market failure have evolved over time. Emphasis is placed on the rapid adoption of market-based approaches in forestry sectors around the world and, in particular, growing interest in the potential for market creation to overcome market failure. Interest in market creation is, however, proceeding ahead of any systematic analysis of the costs and benefits of these initiatives. The discussion draws on recent advances in New Institutional Economics and thinking on forests and poverty to inform the development of a conceptual framework to guide research.

2.1 Why markets for forest environmental services fail and why this matters

In most parts of the world, forest environmental services such as watershed protection, carbon sequestration and biodiversity conservation cannot be bought and sold and markets fail to ensure adequate supply. There are several reasons markets fail to emerge. One of the most important is that many environmental services provided by forests fall into the category of *positive externalities* or *public goods* (Cornes and Sandler, 1996).

A positive externality is any uncompensated benefit. Positive externalities associated with forest protection include, for example, erosion control, reduced risk of flooding downstream and water quality maintenance. Markets typically fail to compensate those who produce positive externalities due to the absence of property rights or other legal means to require payment for services rendered.

Forest environmental services can also be characterised as public goods. These are a special class of externalities distinguished by their *non-excludability* and *non-rivalry*. Non-excludability means that consumers cannot be prevented from enjoying the good or service in question, even if they do not pay for the privilege. For instance, it is difficult, if not impossible, to exclude downstream communities from benefiting from improved water quality associated with

forest regeneration upstream[1]. Where goods are non-rival the consumption of a good or service by one individual does not reduce the amount available to others. In this situation there is no competition in consumption since an infinite number of consumers can use the given quantity supplied. A good example of a non-rival forest service is carbon sequestration. Once carbon is sequestered the global community benefits from this in terms of a reduced threat of global warming.

Where non-excludability and non-rivalry exist they undermine the formation of markets since beneficiaries of the good or service have no incentive to pay suppliers. As long as an individual cannot be excluded from using a good they have little reason to pay for access. Similarly, where goods are non-rival, consumers know that where someone else pays, they will benefit. In both cases beneficiaries plan to "free-ride" based on others' payments. However, where everyone adopts free-riding strategies, willingness to pay for public goods will be zero and the product will not be supplied.

The failure of markets to materialise for positive externalities and public goods has serious repercussions for welfare. In the case of forest environmental services, the lack of payment for these services results in under-investment in the protection, management and establishment of forests. Apart from the loss of the valuable environmental services, resulting forest degradation frequently translates into a loss of critical timber and non-timber forest products (NTFPs) that is critical to a wide range of stakeholders' livelihoods. A more detailed discussion of the role played by forests in supporting local welfare is provided in Section 2.3.2.

It should be stressed that goods and services are not always neatly classified as public. Goods can be characterised by varying degrees of non-rivalry and non-excludability. The extent of non-rivalry and non-excludability will determine the degree of market failure. For instance, where goods are non-excludable, but rival they are described as common pool resources since they tend to be most effectively supplied through cooperative action. Woodlands used by local communities without any formal mechanisms for restricting entry are an example of a common pool resource. Goods that are excludable and non-rival are described as toll goods since markets can be set up in the form of tolls. An example of a toll good is that of roads in national parks where entry is controlled. Where goods are both excludable and rival they are described as private as they may be easily supplied by the private sector based on market transactions. Table 1 places public goods in this wider framework.

1. A key assumption here is that the forest is already supplied. In the case of a landowner making a decision about planting trees, or cutting trees down, beneficiaries can be excluded through a decision not to keep the area forested. Here we are distinguishing between *ex-poste* exclusion, which is impossible, and *ex-ante* exclusion (Aylward and Fernandez Gonzalez, 1998).

Table 1: Excludability and rivalry of forests goods and services		
Excludability	Rivalry	
	Low	High
Low	Public goods, e.g. most forest environmental services	Common pool resources, e.g. community woodland
High	Toll/club goods, e.g. forest park roads	Private goods, e.g. timber and NTFPs

In addition to there being a range of degrees of rivalry and excludability, goods and services' non-excludability and non-rivalry is dynamic. In the case of the national park roads, for instance, usage may raise congestion and thus rivalry. A commodity's excludability may also rise as new techniques are developed to control access. In response to increasing congestion in parks, authorities may introduce park entrance fees to control access. The dynamic nature of rivalry and excludability underpins changes in the public or private status of goods and services.

2.2 Seeking a solution: from state provision to market creation

For economists, public goods represent a central justification for government intervention. The textbook approach to tackling the public good problem is for the government to be given responsibility for the provision of these goods and services. While this does not necessarily mean the government produces the goods (production may be contracted to the private sector), it has responsibility for ensuring supply.

In the forestry sector, governments around the world have heeded this advice and taken responsibility for forest protection in areas high in biodiversity, landscape beauty or critical for their watershed protection functions. For the most part governments have taken direct control for forest protection through public ownership and often elaborate regulation of extractive uses.

However, governments have their own failings associated with imperfect knowledge, misaligned incentives, inefficient bureaucracies and rent seeking. Furthermore, as pressure mounts on governments to curtail spending and cut budget deficits, their ability to invest adequately in the provision of public goods and services is called into question.

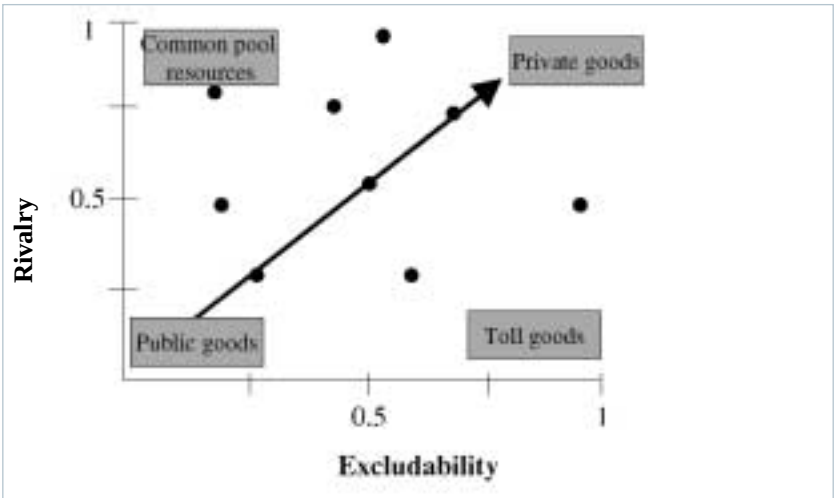
Where public authorities have been unable to tackle the public good problem, they have searched for ways to involve non-governmental actors. Efforts to transfer responsibility for forest environmental services out of the public sector have relied on a combination of regulation and market-based approaches, though the latter have become more prominent in recent years. Market approaches aim to alter incentives facing forest owners and users so that they

act in ways consistent with government policy. Experience has shown that well-designed market-based instruments can achieve environmental goals at less cost than conventional "command and control" approaches, while creating positive incentives for continual innovation and improvement (Stavins, 2000). Examples of such instruments in the forestry sector include stumpage value-based forest revenue systems, financial and material incentives, long-term forestry concessions, trade liberalisation, forest certification and the promotion of markets for non-timber forest benefits including forest environmental services.

In a review of experiences in 23 developing countries, IIED found that amongst the most common market-based instruments used has been the promotion of markets for non-timber benefits (Landell-Mills and Ford, 1999). Market development is attractive to governments since it enables governments to transfer a large share of costs of environmental service provision to non-governmental actors. Unlike financial incentives, which depend on government subsidies, markets require that beneficiaries pay for the service provided. In addition, because markets determine the "price" of a good or service by equating demand and supply, they are thought to offer important efficiency gains over government set "prices" which rely on complex calculations of social benefits. Expected cost savings and efficiency gains have meant market development is receiving unprecedented attention from policy-makers.

Proposing market development to tackle market failure might appear counterintuitive. If markets fail, then logically we need to look to other solutions. While this may be true in the short-term, the argument for market creation is based on the recognition that the conditions that underlie market failure, namely non-rivalry and non-excludability, are dynamic (see Section 2.1 above; Aylward and Fernandez Gonzalez, 1998; Merlo *et al*, 2000). Where

Figure 3: Classifying goods and services according to their degree of rivalry and excludability



markets were unable to develop in the past, they may be successfully established today. The dynamic nature of goods and services is expressed diagrammatically in Figure 3 above. As we move up and to the right, goods lose their public good features and are increasingly likely to be produced privately.

While the concepts of excludability and rivalry underlying public good theory are helpful in setting out the necessary conditions for the "privatisation" of public goods, they offer little insight into the process of market development and what market development will mean for welfare.

2.3 Do markets offer a solution?

The failure of public good theory to deal with the issue of market development is linked to its roots in neo-classical economics, an essentially static theory. The principal concern of neo-classical economics is not how markets evolve, but whether and when markets ensure welfare maximisation. Markets are prized for their ability to achieve allocative and productive efficiency, although market failure is also of central interest. However, because the analysis is static it focuses on government policies to offset market failure, rather than on how to initiate a process of market creation.

Thus, neo-classical economics is not designed to answer questions relating to the mechanics of market development and the associated welfare impacts. An alternative model is needed to guide empirical research on these issues. In what follows we consider insights offered by New Institutional Economics as well as recent thinking on forests and poverty. Building on these, we develop a framework for analysing empirical experiences of market development in the forestry sector.

2.3.1 Insights from New Institutional Economics

New Institutional Economics emerged out of orthodox economic models of exchange and theories of pareto optimality (Coase, 1937, 1960; North, 1990; Williamson, 1985; and Stiglitz, 1986)[2]. It is rooted in a desire to link economic theory more closely to reality by challenging three central neo-classical assumptions:
(1) that all economic actors are perfectly rational,
(2) that information is perfect, and
(3) that market exchange is cost-less (i.e. there are no transaction costs).

In fact, humans are often "irrational" since they fail to exhibit stable preferences and they lack the computational ability to evaluate complex choices

2. It is worth stressing that insights offered by New Institutional Economics also overlap with other schools of thought, most notably classical institutional economics (e.g. Commons, 1957), political economy and more recently Ostrom, Gardner and Walker's (1994) Institutional Analysis and Development Framework.

in a systematic manner. Irrationality is compounded by the fact that economic actors are rarely fully informed. Taken together, limited computational ability and imperfect information mean people act with "bounded rationality"[3]. In other words, they make the best decisions they can, given what they know and their capacity to analyse this information.

Where information is incomplete, asymmetric and people lack the ability to analyse complex choice sets, possibilities for individuals to act opportunistically in exchange arise. For instance, where it is difficult to monitor labour input, employees have an incentive to minimise their effort. To overcome risks of such behaviour, individuals invest in measuring the multiple dimensions of the good or service being traded, protecting rights, policing and enforcing decisions. These activities are costly. In an empirical study of transaction costs, Wallis and North (1986) calculated that financial transaction costs associated with market exchange in the USA (e.g. in banking, insurance, wholesale and retail trade) came to 45% of national income in 1970. In an application of Wallis and North's approach to a developing country, Dagnino-Pastore and Farina (1999) estimate that the "Transaction Sector" amounted to 34.6% of GDP in Argentina in 1990. These figures are not only striking, but they underestimate transaction costs since they exclude costs associated with time spent collecting information.

The rejection of these three neo-classical assumptions has critical implications for how New Institutional Economists view markets. Markets are no longer always the optimal arrangement for allocating resources, but are one of a multitude of institutional arrangements that guide decision-making and resource allocation. In certain instances markets may be less effective than centralised hierarchical systems that rely on planning, rules and the stratification of authority. Similarly, cooperative arrangements involving voluntary participation guided by informal rules (e.g. codes of conduct, norms of behaviour or social conventions) may be optimal where hierarchies and markets fail (Thompson *et al*, 1991).

In the majority of cases, however, markets, cooperative arrangements and hierarchies are likely to evolve together, each supporting and shaped by the others' weaknesses (Bradach and Eccles, 1991; North, 1990). For instance, informal institutions such as honesty support the functioning of markets and hierarchies. Similarly markets may provide a tool for managing hierarchies, e.g. internal markets in large multinational companies. The resulting matrix of interlocking institutions is likely to be a mix of complementary and competing arrangements that are tailored to specific historical, economic, social and environmental features.

3. The term "bounded rationality" was first coined by Williamson and developed by others, most notably by Simon (1957). The concept is taken up widely by New Institutional Economics theorists.

In contemplating the optimality of markets New Institutional Economics encourages us to consider the following factors:

- *Market creation and use is costly*. Market exchange involves transaction costs.
- *Markets are multi-faceted*. Markets are not uniform, but vary in several ways, such as in the degree of competition (e.g. monopolies, oligopolies, monopolistic competition), characteristics of participants, geographical extent, and maturity.
- *Markets cannot be evaluated in a void*. Markets are embedded in an array of informal and formal institutional arrangements that impact on their efficiency.
- *Markets are dynamic*. As their context changes, markets evolve. Change is likely to be iterative and slow.
- *Market development is intimately linked to power relations*. Markets evolve in response to actions by economic agents who have their own objectives. The more powerful the agents, the more influence they have over this evolution.

While New Institutional Economics highlights key issues that need to be considered when assessing the optimality of markets, it does not deal with the questions of poverty alleviation and whether markets offer opportunities or hurdles for marginalised groups. In what follows, recent literature on forests and poverty is briefly reviewed to provide a basis for examining the ways in which markets may impact on the poor. Building on these insights, in Section 2.4 we develop a framework for analysis setting out key questions that should be investigated in a review of markets for forest environmental services.

2.3.2 Forests, poverty and markets

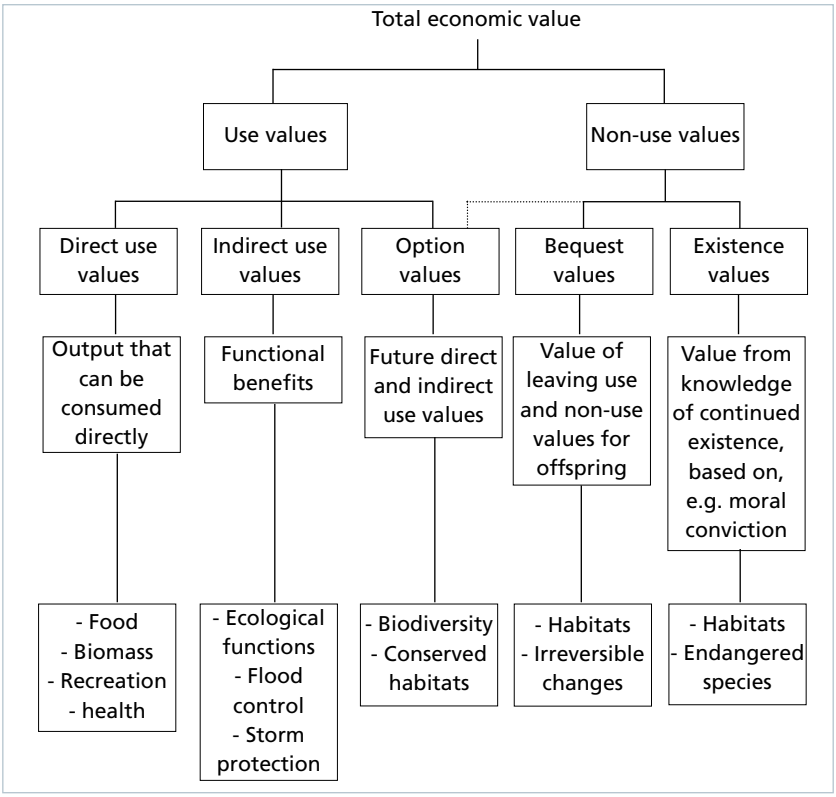
Forests and the poor

Forests provide numerous benefits to humans. These benefits may be direct, e.g. in the form of timber and food they provide, or indirect through their contributions to production processes, e.g. the protection of valuable agricultural land. They may also be intangible, e.g. cultural values. The Total Economic Value framework helps to break down the numerous benefits forests offer[4]. The framework is presented diagrammatically in Figure 4 below.

While Figure 4 is largely self-explanatory, it is worth briefly describing option values, bequest values and existence values. Option value refers to the value people place on maintaining the forest resource to ensure they have an option to use it in the future. In other words it is the value people place on keeping their options open. Existence values refer to the benefits people derive from the knowledge that forests exist, even when they never plan to visit or use these forests. For forest-dependent populations in developing countries, existence values are often associated with forests' religious or cultural meaning. Bequest value is the value people place on being able to pass forests on to future generations.

4. See Barbier (1991), Pearce and Turner (1990) and Munasinghe (1993)

Figure 4: Total Economic Value



Source: derived from Munasinghe (1993)

A large empirical literature exists on welfare impacts of forests[5]. It deals with a number of localities, regions and countries and focuses on different forest products and aspects of welfare. Using the total economic value framework, some of the most significant ways in which forests have been found to influence local well-being in developing countries are listed in Table 2.

Not only do forests provide a means of living, but they also provide security for households in times of shortage. Moreover, forests are not just valued for their immediate benefits, but they are also assets on which people can rely in the future[6]. In addition, for many communities, forests are central to their cultural and spiritual identity.

Yet, Table 2 says nothing about how benefits are distributed. In particular, it is unclear whether forest benefit poorer sections of society. A critical factor

5. Useful summary material is found in Bishop (1999), Byron and Arnold (1997), Shepherd *et al* (1999), FAO (1995), Schmidt *et al* (1999), Wunder (2001).
6. The impact will depend on whether returns are reinvested in maintaining forests or other forms of capital, e.g. human or physical, that provide adequate substitutes for natural capital and provide a basis for welfare improvements.

Table 2: Potential local livelihood benefits from forests

Forest benefits	Livelihood benefits
Direct Use Values	
• Timber products and NTFPs (fuelwood, forest foods, rattan, latex, resins, etc.)	• Direct use/consumption (construction, heating, cooking, food, medicines, etc.) • Income from sales • Income and benefits in kind (infrastructure development) from third party use • Form of saving • Risk management by diversifying asset base • Employment in forest enterprise (income and personal job satisfaction, accumulation of skills) • Health improvements • Building/strengthening cooperative arrangements
Indirect Use Values	
• Watershed protection: reduced flooding, reduced soil erosion, increased groundwater[7]	• Improved agricultural productivity • Improved on and off-site fishery productivity • Improved quantity and quality of water supplies • Improved hydroelectricity generation • Improved health
• Soil fertility (nitrogen fixing)	• Improved agricultural productivity • Improved health
• Landscape value	• Income from ecotourism • Recreation
• Biodiversity protection	• Resistance to pests and ecosystem shocks, e.g. sudden changes in weather – reduced vulnerability • Income from bio-prospecting and other uses of genetic resources
• Carbon sequestration	• Income from carbon credit sales • Reduced threat of global warming (e.g. sea level rise for low-lying countries)
Option Value	• Security
Bequest Value	• Peace of mind
Existence Value	• Cultural/ religious benefits • Social identity • Education

determining the distribution of benefits will be access to forests. As with other natural assets, the more valuable the benefit from forests, the greater the competition for control is likely to be. In competitive environments, poorer and marginalised groups are vulnerable to exclusion.

Detailed cross-sectional or time series studies that examine the links between different welfare levels within communities and forest use are scarce. Nonetheless, a review of *ad hoc* case studies on forest livelihood impacts in different locations provides valuable insights. Byron and Arnold (1997) and

7. Forests' role in watershed protection is often disputed. See Box 21.

later Arnold (1998) undertake just such a review for tropical forests[8]. Their analysis highlights three main types of people-forest relations, including:
(1) people living in forests (e.g. hunter gatherers, shifting cultivators),
(2) farming communities drawing on forests (both landholders and landless), and
(3) livelihoods based on commercial forestry (artisans, traders, small enterprises and large forest industries).

The groups are distinguished according to the relative importance of forests in livelihood strategies with respect to the time allocated to forest use, the share of forest benefits in household utility functions, the impact on livelihoods associated with reduced forest access and the likely future importance of forests to welfare.

While the boundaries dividing these groups are not fixed and people will move between groups over time, the typology helps to highlight how the level and nature of forest dependency can vary within poor communities and how these

Table 3: Summary of people-forest relationships in poor rural communities

Forest-based livelihood strategy	Forest benefits	Potential for welfare improvements
Populations living in forests • Hunter gatherers • Shifting cultivators	Main source of livelihoods • subsistence goods • environmental services • cultural benefits	Low – generally associated with low returns to labour input; improved welfare depends on moving to moving to a new livelihood strategy.
Farming communities drawing on the forest • Wealthier farmers and landowners • Poor farmers and landless	Forest benefits supplement returns to non-forestry activities • Subsistence use and environmental services • Income • Security during periods of shortage	Depends on a number of factors including access to resource and resource characteristics. Wealthier farmers tend to gain control over the more valuable forests and are better able to maximise the benefits from these forests.
Livelihoods based on commercial forestry • Artisans, traders, small enterprise entrepreneurs • Employees in forest industries	(1) Income (2) Develop new skills	Depends whether part-time or full-time and market conditions. Increased income may be associated with boom and bust cycles.

Source: Byron and Arnold (1997)

8. Key references cited include: Falconer and Arnold (1989), Falconer (1990), FAO (1995), Townson (1995) and de Beer and McDermott (1989).

relationships are related to differences in welfare. In Table 3 above some of the main points from Byron and Arnold's (1997) discussion are summarised.

A critical insight brought out by Byron and Arnold (1997) is that even though it is the poorest who tend to be most dependent on forests, it is often the better-off who benefit most from forest use[9]. This is due to a variety of factors including the latter's greater access to complementary assets (e.g. machinery and skills), better training and education, preferential access to markets, and informal arrangements which allow them rights to the most valuable forests (e.g. through connections with those with authority over the resource). Whereas the better-off are able to capture the greatest benefits from forests, the poorest are often trapped in a low-income livelihood strategy associated with subsistence use (Byron and Arnold, 1997; Arnold, 1998; Hussein and Nelson, 1999).

A range of local institutional and contextual factors is critical to unlocking benefits for the poor. It is just this insight that has been behind renewed interest in asset-based approaches to poverty alleviation[10]. Rather than focusing entirely on livelihood outcomes such as income improvement or health, asset-based approaches draw attention to the basis for generating these benefits and the institutional frameworks in which disadvantaged groups operate. While assets are critical for providing potential welfare improvements, institutions and other factors determine the extent to which welfare benefits are realised. Figure 5 illustrates the central role played by contextual and institutional factors in a recently developed asset-based approach: the Sustainable Livelihoods Framework.

The Sustainable Livelihood Framework was developed by the UK's Department for International Development (DFID) in the late 1990s to provide an analytical tool for thinking about poverty in a holistic way and for identifying entry points for poverty reduction initiatives[11]. The framework places people at its centre, and seeks to highlight the complex and dynamic ways in which individuals' well-being is determined. Emphasis is placed on the sustainability of people's asset base, which may include natural, physical, social, financial and human capital[12]. The approach also promotes a multi-dimensional understanding of well-being which takes account of income, health, education, vulnerability, etc. Critically, the framework makes explicit the role played by context in determining the extent to which sustainability and welfare goals are achieved. The arrows in Figure 5 seek to emphasise the relationships and inter-linkages of different factors, rather than causality.

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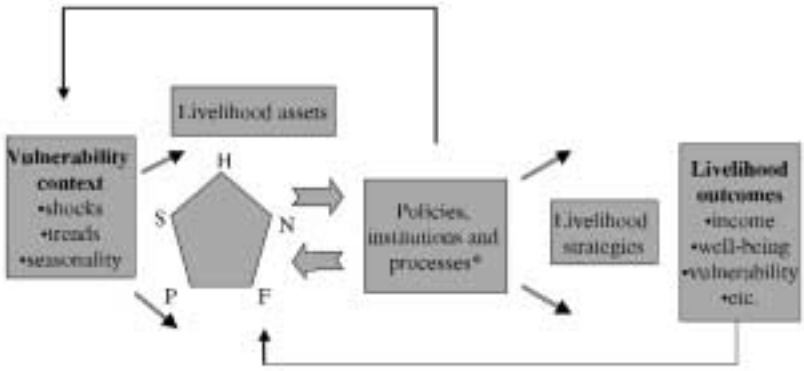
9. A similar lesson was brought out by Jodha (1991) in relation to common property resources, including forests, in India.
10. Rooted in work by Sen, recent work on the asset-based approach include Chambers and Conway (1992), Leach *et al* (1997), Scoones (1998) and Bebbington (1999).
11. While the Sustainable Livelihoods Framework was developed by DFID, it builds on work by a range of organisation, from research groups such as the Institute for Development Studies to NGOs such as CARE and Oxfam to other development agencies such as UNDP (Carney *et al*, 1999).
12. See Figure 5 for definitions of these assets. More recent work has emphasised the importance of political (e.g. Bauman, 2000) and cultural capital (e.g. Bebbington, 1999).

Figure 5: Sustainable livelihoods framework



Key:
H = Human capital: skills, knowledge, ability to labour and good health important to the ability to pursue different livelihood strategies.
S = Social capital: the social resources (networks, membership of groups, relationships of trust, access to wider institutions of society) upon which people draw in pursuit of livelihoods.
N = Natural capital: the natural resource stocks from which resource flows useful for livelihoods are derived (e.g land, water, wildlife, biodiversity, and wider environmental resources).
P = Physical capital: the basic infrastructure (transport, shelter, water, energy and communications), the production equipment and means that enable people to pursue their livelihoods.
F = Financial capital: the financial resources which are available to people (whether savings, supplies of credit, or regular remittances or pensions) and which provide them with different livelihood options.

* previously referred to as "Transforming structures and processes"

Source: DFID (2001); Ashley and Carney (1999)

While Figure 5 helps illustrate these concepts graphically, it is not intended to tell the livelihood story for all situations. The picture will vary between contexts. From the perspective of forest-based communities, the framework is useful for highlighting how forests are not the only assets in individuals' portfolios and that, while forests provide a wide range of benefits to the poor, it is not necessary that they provide more than an alternative asset base. Moreover, the benefits derived from forests will rely to a large extent on how they are combined with other assets, e.g. machinery and skilled labour, as well as the existing institutional framework.

What can markets offer?

Markets offer a potentially critical channel for realising forest-based welfare benefits (Arnold, 1998; Byron and Arnold, 1997; Brock, 1999; Hussein and Nelson, 1999). Where markets do not exist, or where markets exist but the poor lack access to them, individuals' ability to generate returns from their asset base is compromised. Without recognised property rights and access to markets, assets become "dead capital" unable to generate returns over and above that associated with their direct use (de Soto, 2000). It is in the transformation of poor people's assets into real flows of benefits that markets have the potential to play a critical role in boosting welfare. Markets may also have positive spin-offs for welfare where they stimulate the strengthening of cooperative and hierarchical arrangements on which the poor often depend.

While markets offer significant potential benefits, the real question is whether they deliver in practice. A concern is that markets actually damage poorer

groups who find themselves excluded from forest resources on which they have traditionally depended. The central question is thus whether poor communities have access to markets, and whether market access offers these groups opportunities for improving their welfare. Low levels of education, inadequate transport links, lack of formal property rights, information gaps or unequal bargaining power are all reasons the poor may be excluded. Even where poor people gain access to markets, these same factors mean the extent to which disadvantaged groups benefit will vary.

On the buying end, a further concern is that poor groups will be harmed by new demands for payments for services that they have previously received for free. While in the longer-term markets are being put in place to benefit all those that depend on continued supplies of services, there may be short-term trade-offs. Furthermore, the distribution of benefits may not reflect the distribution of payment obligations. Where poorer groups are asked to pay for environmental services, but lack the assets to benefit from improved environmental flows, there may be serious negative equity impacts. For instance, where a community negotiates payments for watershed protection to improve the quality and regularity of water supplies, landless households are likely to benefit least since they do not use water to the same extent as local farmers.

2.4 Assessing market arrangements: developing a framework for analysis

As set out in Section 2.2, markets for forest environmental services have captured the imagination of policy-makers seeking new tools to encourage improved forest management. However, few know how to create or manage markets and there is little empirical evidence indicating how markets impact on welfare and poverty. This report seeks to shed light on these issues through a global review of market creation. To help guide this review, a framework for analysis is developed below, building on lessons from New Institutional Economics and the literature on forest-poverty relationships.

2.4.1 What form do markets take?

Market structures vary between locations and goods. Economists concerned with efficiency have traditionally been preoccupied with the degree of market competition. However, where we are examining markets that are dynamic, involve varied participation and that are embedded in a wider institutional framework, it is important for us to examine an array of features. Seven features are used in this study to distinguish between different market forms:

- *The commodity*. The key ingredient in any market is the commodity that is being bought and sold.
- *Characteristics of participants*. Participants include those demanding environmental services, those supplying services and intermediaries involved in facilitating transactions. Participants may include the private sector, the public sector, non-government sector, civil society or a combination.

- *Level of competition*. The level of competition determines the extent to which individual market players can influence prices – often referred to as market power. Conventionally we measure competitiveness by the number of players in a market: the fewer the players (e.g. in the case of monopolies and monopsonies), the greater each participant's market power and the less competitive the market. Competitive markets involve several participants. However, it is critical to distinguish between explicit and effective competition. Even where markets are highly concentrated, if there is a credible threat of entry by competitors the market may be competitive.
- *Payment mechanism*. Several options exist for transferring funds from buyers to sellers, including direct negotiation, broker-based markets, auction systems, and exchange-based markets.
- *Geographical extent of trading*. Trades may be local, national, regional or international depending on the market and its location *vis a vis* political boundaries.
- *Level of maturity.* Market maturity may be defined in a number of ways. Four useful criteria include: the time period since transactions were first initiated (i.e. the age of the market), the degree of price discovery attained to date, market participation and liquidity, and the level of sophistication in the payment mechanism employed.
- *Nested nature*. Markets evolve in a context. Not only may markets replace existing institutional arrangements, but they build on institutional arrangements which will influence the form they take. It is important to understand this context and the nature of inter-institutional relationships.

These features are not independent and a change in one is likely to be linked to changes in others. For instance, immature markets are likely to have higher levels of public sector participation (reflecting government efforts to promote institutional development), simpler payment mechanisms and lower levels of competition than fully established markets. As competition picks up, governments are likely to become less interventionist and payment mechanisms more sophisticated.

2.4.2 Why do markets evolve?

As with all institutions, markets evolve in response to changing incentives embodied in the institutional framework. North (1990) highlights two major sources of change: altering individual preferences and changing relative prices and costs. In other words, changing demand- and supply-side factors.

In the case of market development for forest environmental services, drivers may be split between those that increase demand and willingness to pay for environmental services; and those that increase investment and supply of these services. Relating this back to public good features (see Section 2.1), increased demand should raise rivalry, while supply side advances should increase excludability. Together these factors move environmental services towards private goods. The key question is, thus, what are the major forces driving changes in willingness to pay and supply? In this study, we attempt to shed light

on underlying drivers for market development in the forest environmental service sector.

2.4.3 How do markets evolve?

Institutional development is, in the main, a slow and iterative process. New institutions evolve out of the old, and this process depends on economic agents recognising the need for change and acting on this knowledge. Imperfect information, uncertainty and limited computation abilities mean it takes time for change to take place. Moreover, because individuals drive institutional change, the path taken will be intimately linked to the existing power structure. As North (1995) puts it:

> *"Institutions are not necessarily or even usually created to be socially efficient; rather they… are created to serve the interests of those with the bargaining power to create new rules." (p. 20)*

The importance of power relations in determining institutional development helps to explain the slow nature of change. Where it is the powerful that promote the development of a particular arrangement, these individuals have a vested interest in maintaining the *status quo*. Only where these incentives alter and agents perceive that they may improve their wellbeing through a modification in institutional arrangements, will change occur.

The source of change, as noted in Section 2.4.2, could be due to a changing cost and price structure (e.g. due to technological change) or changing preferences. For these stimuli to be taken on board, however, organisations must learn. Institutional change depends on the speed and quality of organisation learning. Consequently, welfare-enhancing institutional change depends on incentives for high-quality learning. Competition is likely to be an important ingredient in such an incentive framework.

As already stressed, markets evolve to form part of an array of existing formal and informal institutional arrangements. Different combinations of institutions will produce different market performance. Understanding the nature of institutional interactions, and identifying those combinations that are mutually supportive, as opposed to competitive, is an important part of improving our understanding of the process of market evolution.

While emphasis is placed on the gradual, iterative nature of institutional change, "revolutions" may occur where change cannot be accommodated within the existing structure (North, 1995). This may itself be linked to the emergence of new constituencies of players who are dissatisfied with existing arrangements. However, we cannot assume that a sudden change in formal rules will lead to changes in informal institutions. Informal rules tend to be slower to change and where they contradict formal rules, they may render the latter meaningless. With respect to market development, this point warns us against approaches that focus simply on changing formal rules, e.g. property rights, without any effort to promote change in informal routines/conventions.

The state often plays a central role in orchestrating change. With particular reference to market development in transitional economies, both Fleck (1999) and Nee (1999) highlight the important function of governments in building a constituency of supporters for market development, both inside and outside government. While this process requires time and confidence building, where governments fail reforms may be derailed.

In addition to building political support for market development, it is the responsibility of governments to establish the market infrastructure, e.g. legal, enforcement and judicial institutions (Nee, 1999). These measures are critical for lowering transaction costs and making market exchange attractive.

In sum, understanding the process of market development for forest environmental services requires an examination of:
- the stages in market development – changes in formal and informal rules;
- institutional nesting – the changing network of complementary and competitive institutions; and
- stakeholder roles – their incentives for change, the distribution of power and the key proponents.

2.4.4 What do markets mean for welfare?

With market development driven by certain individuals and/or organisations, there can be no presumption that markets will improve wider social welfare. It is critical that impacts are measured. Social cost-benefit analysis offers a tool to guide such calculations.

In undertaking a cost-benefit analysis market arrangements must be set against the next best arrangement for governing the supply of forest environmental services. Often the most realistic alternative will be that currently in use. The estimation of net benefits of market arrangements involves the calculation of the costs and benefits that they will bring forth over time compared to existing institutional arrangements. These costs and benefits are converted into present values using a discount rate and then the difference between the two, or the net present value of markets (NPV_m), is calculated. The NPV is expressed mathematically below.

$$NPV_m = \sum \{\{(B_{et} + B_{st} + B_{nt}) - (C_{et} + C_{st} + C_{nt} + TC_t)\} / (1 + r)^t \}$$

where

B_{et}, C_{et} are the economic benefits and costs in year t
B_{st}, C_{st} are the social benefits and costs in year t
B_{nt}, C_{nt} are the environmental benefits and costs in year t
TC_t is the transaction cost in year t

A NPV greater than zero suggests markets will have a beneficial impact on welfare, while a NPV less than zero suggests a project will diminish it.

Before a cost-benefit analysis can be undertaken, information needs to be gathered on the costs and benefits associated with the new institutional arrangement. These costs and benefits are normally split into three groups:

- *Economic* costs and benefits relate to changes in output, income and employment.
- *Social* costs and benefits include impacts not captured in an economic evaluation, such as impacts on health and education.
- *Environmental* costs and benefits include impacts on natural resource assets and flows.

Where impacts cannot be expressed in financial terms, they should be described quantitatively or qualitatively to ensure they are not overlooked in a final evaluation.

A major set of costs that is often overlooked is the transaction costs associated with the creation and operation of markets. Costs of market creation include, amongst other things, defining property rights, setting up exchange systems, educating market participants, establishing monitoring and enforcement mechanisms and building confidence in the system. Market operation includes costs of information gathering, negotiation, contract formulation, monitoring and enforcement. Ostrom *et al* (1993) provide the following breakdown of market operational costs:

- *Ex-ante* costs associated with obtaining relevant information needed to plan, negotiating agreements, making side-payments to gain agreement and communicating.
- *Ex-post* costs associated with monitoring performance, sanctioning and governance, re-negotiation when the original contract is unsatisfactory.
- Strategic costs associated with shirking, free-riding and corruption. Strategic costs are associated with both *ex-ante* and *ex-post* transaction costs.

Transaction costs are not only financial. Time and other in-kind contributions should be measured and, wherever possible, monetary values of these inputs calculated.

2.4.5 What do markets mean for the poor?

Social cost-benefit analysis helps to determine the aggregate impact of markets on welfare. In this paper we are equally concerned with the distribution of costs and benefits and, in particular, implications for the poor. Focused cost-benefit analysis for the poor will go some way to uncovering how markets affect this group, but should be supplemented with measures of intangible impacts on livelihoods, e.g. increased security or social institution building.

An asset-based approach helps to focus attention on impacts on assets that underpin livelihood strategies of poor communities. In addition to the five assets highlighted by DFID's original sustainable livelihood framework (i.e. natural, physical, human, social and financial – see Figure 5, Section 2.3.2), a strong case may be made for evaluating impacts for political capital. Political capital determines peoples' ability to influence decision-making and is a critical component of individuals' armoury of assets that underpins wellbeing. Some of the indicators will be qualitative, while others may be quantifiable.

2.4.6 Constraints to market development?

Constraints to market development may be linked to specific biophysical features, characteristics of demand and supply, capacity for implementation, etc. By drawing on lessons from the above, it should be possible to identify key factors that are hindering market creation. Insights should also merge on specific constraints facing poor individuals and groups in accessing markets.

2.5 This survey

Sections 3-7 begin to assess emerging markets by drawing on experience of four forest environmental services: biodiversity conservation, carbon sequestration, watershed protection and landscape beauty. The review is guided by questions set out in Section 2.4 and seeks to indicate what we already know, or can derive from existing analysis, and what questions require further investigation. Annex 2 provides a list of payment systems reviewed. Further information on details of individual case studies, e.g. the commodities marketed, demand, supply, the payment mechanisms and the status of market development, can be obtained from IIED on request (see front inside cover for details).

In terms of information sources, this paper has drawn on a wide array of material collected between February 2000 and February 2001. Literature in the form of published books, journals and conference proceedings is supplemented by internet material, oral interviews and correspondence. Grey, or unpublished, sources of information have proved extremely important in a field that is rapidly evolving.

While the questions posed in Section 2.4 provide a clear direction for research, they are not going to be answered quickly or easily. This inquiry is limited by the extent to which the issue of market development has been touched on in the literature. In general, existing literature has dealt with the question of market development only tangentially and the discussion is often superficial. Moreover, heavy reliance on grey literature involves risks since such material has not been as rigorously reviewed as published material.

3. Markets for biodiversity conservation

If current trends continue, it is estimated that 24% of mammal species and 12% of bird species face a "high risk of extinction in the near future" (FAO, 2001). It is widely accepted that the primary cause of extinction is habitat loss, followed by overexploitation, species introduction and predator control. Tropical deforestation is of particular concern, responsible for the loss of an estimated 5-15% of the world's species between 1990 and 2020. This rate of extinction is unparalleled in modern history and was most recently exceeded only at the end of the Cretaceous Era, 65 million years ago (Reid and Miller, 1989).

The loss of biodiversity is of great concern the world over, and the loss of tropical forest biodiversity has been singled out for urgent attention. Calls for action to stem the disappearance of forest habitats have intensified as early warnings have been criticised for failing to generate sufficient protection. In 1997, protected areas covered 1.32 billion hectares (8.7% of the world's surface), but approximately 46% of these permitted utilisation (1997 United Nations List of Protected Areas). The critical importance of finance and the growing recognition of western governments' limited willingness to pay, lies at the heart of increasing efforts by conservationists and others to seek innovative solutions, including the promotion of market for forest biodiversity protection services.

This section seeks to look in more detail at emerging trends associated with markets for forest biodiversity. A cross section of payments systems from a range of geographical settings, varying stages of development and involving a complex array of participants from public and private sector backgrounds are examined. The section applies the analytical framework set out in Section 2.4 to shed light on five central features of these markets: market form, drivers, the process of development, the impacts of markets for human welfare and key constraints restricting market evolution. First, an overview of the markets examined is presented.

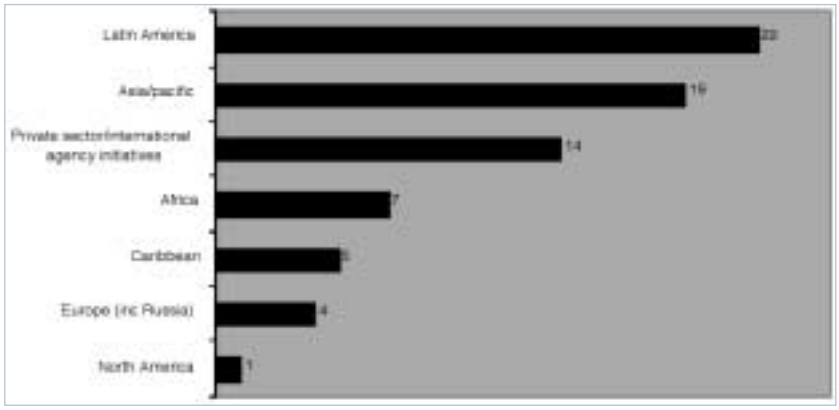
Photo: Ina T Porras

Butterfly farms have become an important economic activity for many rural communities in Costa Rica, where diverse forest ecosystems have offered a fertile breeding ground for a wide range of species.

3.1 Overview of biodiversity case studies

Seventy-two cases of markets for forest biodiversity protection services in thirty-three countries are reviewed in this paper. Figure 6 presents the geographical breakdown of cases reviewed.

Figure 6: Regional breakdown of biodiversity markets reviewed



A full list of these cases is presented in Annex 2. It should be emphasised that this section does not cover cases where biodiversity protection is marketed alongside other forest environmental service. These cases are considered in Section 7 under "Bundled services".

3.2 Biodiversity market form

3.2.1 Defining commodities for biodiversity protection

As a first step, it is important to clarify what we mean by biodiversity. The issue is critical and often confused in the literature.

The Convention on Biological Diversity (Article 2) 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".*

As such, the diversity of life may be measured at three main levels: genetic, species and ecosystems. However, measuring biodiversity under each category is not always straightforward. How can we measure species biodiversity? Do we simply count the number of species that exist in a unit area, thereby valuing each species equally? Or are we interested in measuring the level of species endemism (i.e. uniqueness), taxonomic diversity (e.g. which is more diverse? 10 species in 1 genus, versus 5 species in 5 genus) or functional diversity (e.g. species which perform a range of functions from pollinator to predator to scavengers)? These questions require subjective decisions, making it difficult to arrive at a common unit of measure for species biodiversity[13].

Measuring ecosystem diversity is also notoriously fraught. The term ecosystem was coined by Tansley (1935) to emphasise the inter-relationships of species with each other and their physical environment. No attempt was made to define spatial boundaries, consequently there is no universally accepted method for classifying different ecosystems. Without a clear separation, it is difficult to see how a measure of ecosystem diversity may be achieved. As a result, broadly defined ecosystem types have evolved, and a key method of distinguishing ecosystems is based on their species content (OECD, 1996).

Genetic diversity is easier to handle and has often been the focus of studies on biodiversity. This is partly because those sectors that have managed to commercialise biodiversity are interested primarily in genetic diversity, e.g. pharmaceutical companies, biotechnology companies, crop and breeding companies.

The inability of people to arrive at a universally accepted measure of biodiversity has critical implications for the feasibility of market creation. If we intend to market forest biodiversity, it is essential that we are clear what we are selling. Unless a unit of biodiversity can be defined, we must resort to the use of proxies, i.e. items that can be marketed in place of biodiversity to achieve

13. Despite the inherent difficulties, efforts have been made to derive a measure of "bioquality" that includes scores for: global rarity, taxonomic relatedness, ecology, local abundance and even social and economic importance. See: Bass *et al* (2001); Vane-Wright (1996); Williams *et al* (1991) and Hawthorne (1996).

desired goals. The challenge of identifying a proxy is in finding a tangible and marketable item that changes in line with biodiversity. A particularly complex aspect of defining such a proxy, is the need to reflect threshold effects associated with preservation. Threshold effects exist where a minimum area of forest is necessary to deliver the desired biodiversity service. Where forests shrink below the designated threshold, the service is not delivered. Therefore, either a unit of the proxy must translate into a large enough unit of biodiversity to generate improvements, or marginal units of the proxy will need to change in value according to the total size of the purchase. Below a certain threshold, marginal units may be worthless, whereas above a minimum threshold they add value.

In the process of finding methods for commercialising biodiversity, the greatest risk is that the link between the proxy and biodiversity is lost. Throughout the literature we find a tendency of authors to equate the marketing of biological resources with biodiversity. Biological resources, it is often argued, represent the manifestation of biological diversity and without biodiversity, biological resources would cease to exist. Taking this logic a step further, it is argued that by marketing the full range of biological resources, we effectively market biodiversity (e.g. see McNeely *et al*, 1990; Asquith, 2000; Reid and Miller, 1989).

Table 4: Commoditising biodiversity protection services

Biodiversity service	Commodity	Number of cases
Ecosystem, insurance, option and existence values	Protected areas	16
Option value	Bioprospecting access rights	12
Pest and disease control functions, insurance and choice values	Biodiversity-friendly products	11
Global ecosystem, insurance, option and existence values	Company shares	9
Ecosystem, insurance, option and existence values	Debt-for-nature swaps	7
National ecosystem, option and insurance values	Biodiversity credits/offsets	4
Ecosystem, insurance, option and existence values	Management contracts	3
Ecosystem, insurance, option and existence values	Land acquisition	3
Ecosystem, insurance, option and existence values	Land lease/conservation concession	2
Ecosystem, insurance and option values	Conservation easements	1
Ecosystem, insurance, option and existence values	Logging rights/development rights	1

This approach represents a worrying de-linking of the proxy and the service it intends to reflect. Aylward (1991) stresses that equating biological resources and biodiversity may reduce welfare when applied to conservation project evaluation and land use decision-making. Take for instance the case of two competing land uses, A and B, which are found to be identical in terms of their output of biological resources. However, land use A is also found to have a higher level of biodiversity than B. Where biodiversity is thought to be valuable, option A is preferable to B. However, where biodiversity is valued in terms of the sum of the biological resources, decision-makers may not choose A over B.

The importance of distinguishing between efforts to market biological resources and those that tackle the more difficult challenge of marketing the diversity of nature is clear. This review has focused on identifying examples of the latter. These cases point to a range of values associated with biodiversity, including its:

- *role in maintaining ecosystem functioning* – valued by local and global communities, with particular services (e.g. pest and disease control functions) valued by specific stakeholders;
- *option value* – biodiversity provides a valuable stock of genetic and chemical information that keep options open for future uses. Option value is captured by the public at large, and specifically by companies engaged in bioprospecting;
- *insurance value* – this is derived from greater resilience of diverse environments to external shocks and is valued by national and global communities;
- *choice value* – the provision of greater choice for users, thereby offering a greater satisfaction; and
- *existence value* – values attributed to global biodiversity protection, but not associated with expected uses noted above.

To capture these values, a range of "commodities", i.e. proxies, is used in emerging markets, from protected areas, to biodiversity credits and bioprospecting rights. A list of commodities identified in this review, and the specific service they represent, is provided in Table 4 above. Box 1 defines these commodities. In what follows we examine in more detail some of the key features of these varied markets for biodiversity.

Box 1: Commodities used to market biodiversity protection services

Key commodities used to market forests' biodiversity protection services are described below in alphabetical order:

Biodiversity business shares. Biodiversity-friendly companies may attempt to capture willingness to pay for biodiversity protection by issuing shares in their business. Share purchase becomes a vehicle for expressing demand for biodiversity protection.

Biodiversity credits/offsets. Biodiversity credits are being explored in Australia as a mechanism for generating finance for biodiversity protection. Biodiversity

credits would be introduced as part of a broader regulatory programme that requires developers to achieve a minimum standard of biodiversity protection. Where development results in reduced biodiversity, developers would be required to offset this damage through biodiversity enhancement elsewhere. Defining what qualifies as a biodiversity offset or credit is subjective, but is likely to take account of diversity (range of taxa), abundance (biological productivity), uniqueness (taxonomic significance) and relative rarity (Shields, 2000).

Biodiversity-friendly products. Where biodiversity-friendly products attract a price premium, the price difference reflects consumers' willingness to pay for biodiversity protection. As such biodiversity protection is sold through existing commodity markets.

Bioprospecting rights. Bioprospecting rights allow for the collection and testing of genetic material from a designated forest area. They are often purchased from responsible government authorities in return for an up-front payment. They also may set out details of rent sharing, especially where bioprospecting leads to the development of commercial products. Purchasers of these rights may include pharmaceutical companies, biotechnology companies and research institutes.

Conservation easements. These refer to contracts between landowners and those who wish to protect or expand certain natural ecosystems (e.g. native forests, wetlands or grasslands), whereby the landowner is paid to manage their land in ways that achieve the desired conservation objective. Easements are normally signed in perpetuity, and where the land is sold, the easement is transferred to the new owner. Conservation easements are similar to development rights in that the seller often gives up the right to develop an area of land, but they are normally tied to a particular piece of land and are not tradable.

Debt-for-nature swaps. This involves the purchase of discounted developing country debt, which is exchanged for domestic financial resources to invest in conservation. Payments are made in a number of ways, generally by the central bank. Funds may be channelled through trust funds, or local NGOs that act as intermediaries. These intermediaries will have detailed instructions on how funds are to be spent to achieve biodiversity conservation. Swaps have become less popular in the late 1990s as debt has become more expensive and redemption rates offered by debtors less attractive.

Development rights. Development rights have been used in several contexts – mainly in the USA for the conservation of historical buildings, archaeological sites and wetlands – and are increasingly being used to promote forest conservation. Governments typically introduce development rights to increase the flexibility of land development restrictions in a conservation area. The idea is to allocate development rights up to the selected limit, and to allow these to be purchased by landowners. Increasingly these rights are tradable so that once purchased they can be resold and the rights are not attached to a particular piece of land. Where trading is not constrained to certain locations, landowners who wish to develop more than they are permitted by their existing rights allocation must purchase additional rights from others who choose not to

exercise them. Conservationists may purchase development rights to prevent others from using them.

Land lease/conservation concession. Conservation International pioneered "Conservation concessions" in Guyana in 2001. Conservation concessions are essentially a land lease, involving the allocation of forest use rights in a defined area to the lessor who commits to protecting the forest from unsustainable timber and NTFP harvesting. The right to protect forests is purchased from the government for an up-front payment and annual fees.

Land acquisition. Amongst the simplest approaches to capturing demand for biodiversity protection is to sell the land on which biodiversity exists.

Management contract. Management contracts detail biodiversity management activities, and payments attached to the achievement of specified objectives.

Protected areas. Protected areas are formally designated by national authorities to protect a range of environmental services, including biodiversity. Different levels of protection may be awarded. The World Conservation Union (IUCN) identifies six categories of protection from strict nature reserves and wilderness areas managed mainly for science and wilderness protection to managed resource protected areas where sustainable use is permitted.

Research permits. These are issued to customers interested in researching different types of plants, animals and ecosystems.

3.2.2 Public to private participants in biodiversity protection markets

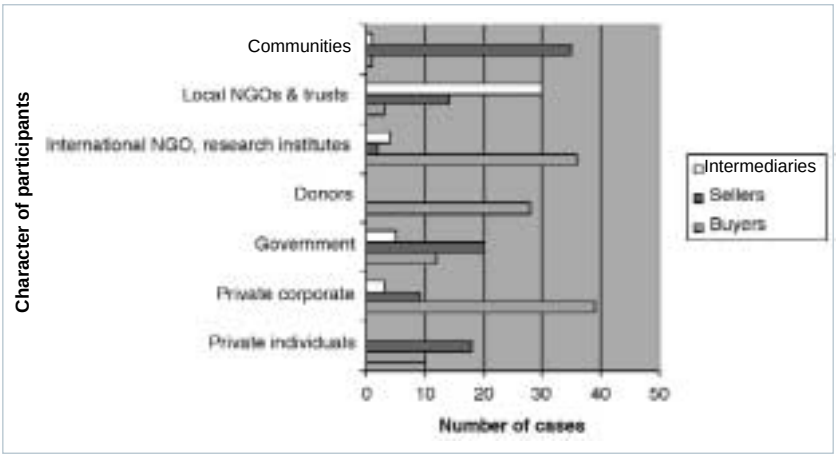
Traditionally the market for forest biodiversity services has been dominated by the public sector. Donor funds channelled through bilateral and multilateral agencies has helped to finance protected areas and conservation by government forestry, natural resources, national wildlife and environmental authorities.

Despite a lack of macroeconomic statistics on financing biological conservation in the forestry sector (see Joshi, 1999; Vorhies, pers. comm. 2001; Bayon, pers comm. 2001), this review points to a notable shift in market participation in the 1990s (see Figure 7).

On the demand side we see greater involvement of international NGOs and private corporations. A growing awareness of forests' important role in maintaining the earth's life support functions, increased scrutiny of corporate activities and pressure for improved social and environmental performance have all contributed to this shift (see Section 3.3 for a discussion of drivers). In addition, the importance of biodiversity protection for some of the world's largest industries is increasingly recognised.

The seed and crop industry is the largest user of genetic material in terms of value, followed by the pharmaceutical industry, which sells between US$75-150

Figure 7: Characteristics of participants in markets for forest biodiversity protection services



billion worth of natural products per year. The natural component of personal care and cosmetic products' sector is estimated to come to about $2.8 billion per year and the global market for crop protection derived from genetic material between $0.6 billion and $3 billion a year. Forests offer some of the most diverse stores of genetic material available. While the use of synthetic material in place of natural material is increasing, natural products remain critical to the generation of ideas and products. Moreover, while synthetic alternatives may be cheap to develop, new molecular biological techniques mean natural material can be evaluated more quickly. Finally, increasing concern for the environment and health has meant greater interest in environmentally-friendly products. Box 2 provides brief descriptions of the importance of biodiversity in three sectors: seed production, pharmaceutical development and crop protection.

Box 2: Biodiversity as a basis for seed production, pharmaceutical development and crop protection

Bioprospecting – or the search for commercially valuable biochemical compounds or genetic material in the wild – underpins some of the most productive sectors in the world. The importance of forest-based genetic material for the seed, pharmaceutical and crop industries is briefly set out below.

Seed industry

The seed industry is the biggest commercial user of genetic resources. Seed producers are constantly seeking new genetic material to improve their plants yields, resistance to pests and disease, cold tolerance, sugar content, etc. With just 30 crops providing 95% of human plant derived dietary energy, vulnerability to unexpected shocks is high and maintaining a diverse seed base is critical. Moreover, plant breeders cannot use synthetic inputs in new variety development, but rely on cross-pollination, cell and tissue culture, embryo rescue and molecular genetics. While most private plant breeders obtain their genetic inputs from *ex situ* collections (e.g. universities, government breeding

institutions, genebanks, research institutes, commercial brokers and international organisations), these sources collect genetic material from the wild. Their role in sourcing primitive material is essential for broadening the gene pool from which breeders work.

The pharmaceutical sector

Genetic material is critical to product discovery. In 1993 in the USA, 57% of the top 150 prescription drugs contained at least one major active compound from biological resources, and an estimated $43 billion worth of medicines originated from plants used by indigenous people (Grifo *et al*, 1996). Farnsworth *et al* (1985) found that between 1959-1980 25% of prescriptions for commercial pharmaceuticals in the USA contained plant extracts. With only between 5-15% of the 250-500 thousand species of higher plants investigated to date, there is significant potential for new discoveries. As in the seed industry, pharmaceutical companies tend to source their natural products from *ex situ* collections, which in turn source their material from the wild. Plants are the most important sources of natural products, followed by micro-organisms, marine life, fungi and insects. Many of these are sourced from forests.

Crop protection products

All forms of crop protection require genetic material. Chemical protection draws on natural as well as synthetic compounds. Natural products are taken from plants, fungi, microbes, insects or other animals. With respect to plants, about 2,000 plants are known to contain toxic principles effective against insects, but only a few are used. In value terms, between 2-10% of the crop protection product market of US$30 billion were developed from natural genetic material.

Source: ten Kate and Laird (1999); Rosenthal (2000)

While there are numerous businesses that benefit from biodiversity protection, not all pay for its use. Traditionally, access to genetic material has been free. The principle of unrestricted access was formalised in the Food and Agricultural Organisation's (FAO's) International Undertaking on Plant Genetic Resources' that refers to the "universally accepted principle that plant genetic resources are a heritage of mankind and consequently should be available without restriction". Rather than rewarding providers of biodiversity, payments have tended to be made for "improvements" resulting from expertise in breeding.

Increasing use of Intellectual Property Rights and the spread of acceptance of benefit sharing under the Convention for Biological Diversity (CBD) is changing matters. While arrangements differ between cases, a "best-practice" approach to benefit-sharing has begun to emerge and involves payments by bioprospectors in two main forms:

- *Monetary payments* – including payments for samples, payments for access, grants for research, profit sharing, equity stakes and royalties from sales. The precise royalty paid depends on a number of factors, including: the importance of the genetic material in the final product (the degree of derivation), contribution to development, information provided with samples, novelty of samples, likely market share of a final product and current market

rates for royalties. Where a raw material is used directly, Biotics (1997) suggests a royalty range of 3-5%; where the natural product is converted to a chemical derivative, rates fall to 2-3%; where the natural product is synthesised, rates are only 0.5 -1%.[14]

- *Non-monetary "payments"* – including a range of elements, most notably: the sharing of results with source countries, participation in research and joint ventures, technological transfer, employment, training, infrastructure development (e.g. laboratory construction) and support for conservation and local development. With regard to promotion of local conservation, only a few deals have attempted to incorporate a targeted payment for conservation, e.g. Costa Rica's National Biodiversity Institute (INBio), Western Australia and International Cooperative Biodiversity Group deals (see Annex 2).

The growth in private and international NGO finance for biodiversity conservation does not mean international donors no longer play a role. The Global Environment Facility (GEF) stands out as a major initiative to streamline donor support for global environmental services provided by developing countries. Biodiversity, is one of four focal areas, also including Climate Change, International Waters and Ozone Layer Depletion. Forests represent the most important recipient of finance under the biodiversity focal area, receiving $505.92 million, or 43% of the total between 1992-2000 (Kumari, 2001). While this total is small when compared with private and international NGO spending, the GEF plays a significant role in leveraging non-governmental financing (generally more than 50% of projects).

On the supply-side, we have seen a diversification away from governments investing in protected area systems, towards investment in local NGOs', individuals' and communities' biodiversity protection activities in mixed landscapes. This is partly a reflection of the entrance of new buyers (international NGOs and private corporations), that have fewer ties to governmental authorities, and partly a realisation that non-governmental bodies frequently offer a more effective and direct means for achieving conservation. Where local people act as *de facto*, if not *de jure*, guardians of natural resources, it is they who should be rewarded for supplying protection services.

In parallel with the shift towards a broader set of suppliers in the biodiversity protection market, funds are being channelled through specialised agents, such as Trust Funds. Local and international NGOs, as well as government agencies and private companies have also been active intermediaries. The trend towards greater intermediary-based transactions is discussed in Section 3.2.4.

3.2.3 Competitiveness in the market for biodiversity protection

Competition can be assessed from the perspective of those purchasing biodiversity protection and from those selling the service. Buyers are interested in maximising the biodiversity protection they achieve for a given payment.

14. Cited in ten Kate and Laird (1999)

They are most likely to maximise their benefits where there is competition amongst suppliers vying to attract conservation finance. Similarly, sellers aiming to maximise their returns to biodiversity protection will have a better chance where buyers are competing. Assessing the degree of competition in the market for forest biodiversity is complicated by the fact that no single market exists, but a number of niche markets for specific biodiversity commodities, e.g. bioprospecting access rights or debt-for-nature swaps.

On the supply-side, the conservation opportunities are potentially huge. Biodiversity is not found in particular locations, but is a feature of the natural environment. However, ecosystem, specie or genetic richness is not equally distributed, and those demanding biodiversity protection services tend to focus on biodiverse habitats that are under greatest threat. Depending on the focus of the buyer, supplies may be limited. The "biodiversity hotspot" strategy developed by Myers and taken up by Conservation International and others, for instance, seeks to prioritise conservation efforts by focusing on the twenty-five "areas featuring exceptional concentrations of endemic species and experiencing exceptional loss of habitat" (Myers *et al*, 2000). These highly threatened regions are found on 1.4% of the planet's surface and are reservoirs for about 44% of the world's plant species and 35% of vertebrates. In contrast, the World Resources Institute's broader focus on "Bioregional management" identifies a much wider supply-base.

While statistics on international NGO, donor, and private demand for conservation are not readily available, it is widely believed that the supply of conservation opportunities far outstrips willingness to pay for conservation. This is true even for narrower definitions such as Myers *et al*'s (2000) "hotspots". Moreover, the growing tendency of public sector and NGO buyers to pool their demand through jointly financed projects may actually reduce total willingness to pay (see Section 3.2.4 on pooled transactions). The incentive to pool funds is high since a larger area can be conserved[15], economies of scale may reduce transaction costs per dollar spent, and cooperation awards buyers a degree of monopsony power in determining prices at which they purchase conservation. Also, because biodiversity is subject to uncertain threshold effects (i.e. below a certain area a particular ecosystem may not be viable), there is an incentive for buyers to work together to conserve contiguous blocks rather than conserving areas in a piecemeal fashion.

High levels of competition in supply and relatively low competition in demand will tend to push prices for biodiversity conservation towards suppliers' reservation price, i.e. the minimum they can accept to make conservation worthwhile. The reservation price is determined by returns to alternative land uses, such as agriculture. The fact that conservation projects aim to cover

15. Also because the benefits from biodiversity conservation are non-rival, there is no need to distribute benefits when donors pool funds. All benefit equally from conservation. However, where donors have conservation targets, they may be required to attribute the conservation share they purchased in a project.

suppliers' opportunity costs associated with conservation and nothing more (e.g. Conservation International's purchase of logging rights in Bolivia, the World Wildlife Fund's Wasur Project in Indonesia, Northern Chihuahua in Mexico) reflects how buyers frequently have the upper hand.

In the case of national biodiversity payment systems (e.g. Austria's Landscape Fund, the Netherlands Ecological Compensation Programme or Costa Rica's Payments for Environmental Services scheme), the government acts as a price setter, offering a given price for particular activities[16]. However, where the government has a conservation target, it may be forced to alter its prices to achieve this. In general, governments wield considerable market power and will tend to drive prices for conservation towards landowners' reservation price.

A lack of competition between buyers of biodiversity conservation also applies in the bioprospecting sector. Pharmaceutical companies' low willingness to pay for access to biodiversity is well documented (see Pearce *et al*, 1999 for a recent overview). Several authors believe this is a result of the abundance of biodiversity resources as well as other factors such as the inability of resource owners to regulate use (Simpson *et al*, 1996; Rausser and Small, 2001; Barbier and Aylward, 1996; Swanson and Goschl, 2000). It may also reflect the relatively high level of concentration in the sector (ten Kate and Laird, 1999; Dyer and Griffith, 2001) and lack of transparency in access agreements. Where prices are paid for biodiversity access, e.g. through up front fees and royalties, they tend to be confidential and obtaining information on payments is extremely difficult (ten Kate and Laird, 1999).

Nonetheless, there is evidence that competition amongst bioprospecting companies increases where bioprospecting rights are clear (their excludability ascertained), secure and backed up by a streamlined regulatory environment. Suppliers who invest in building the necessary infrastructure lower transaction costs and risks for bioprospectors, and thus may attract a higher level of competition for their biodiversity. Costa Rica's establishment of a one-stop shop in the form of INBio in 1989, supported by a clear regulatory framework and high quality services, e.g. collection, taxonomic labelling, extraction, has allowed it to attract considerable business and generate relatively high returns for biodiversity protection (see Box 8, Section 3.2.4).

Markets for biodiversity-friendly products provide another case where competition for biodiversity protection services is more balanced. In the cocoa market, for instance, the high level of competition for certified biodiversity-friendly and organic cocoa beans has resulted in Cloud Nine, a USA chocolate manufacturer, paying price premiums of 20-30% (US$150-200/metric tonne) over conventionally produced cocoa. In the biodiversity-friendly coffee sector, a market survey by the North American Commission for Environmental

16. Costa Rica's payments for environmental services system is classified as a market for bundled environmental services, not just biodiversity protection, and discussed in Section 7.

Photo: Ina Ruthenberg

Photo: Ina Ruthenberg

Markets for biodiversity-friendly coffee and cocoa are increasingly driven by the private sector, and the organic market in which they are sold has grown considerably in Europe and North America. Shade-coffee farms provide an ideal habitat for a range of wildlife species-birds, insects, mammals and reptiles.

Cooperation in 1998/1999 indicates a 2-2.5% market share for shade coffee and possible price premium of 5%. These figures relate, however, to coffee consumers, and may not necessarily reflect the premium paid by retailers to coffee producers.

The market for biodiversity would appear to be dominated by buyers. Yet, it is important to distinguish between what is a "natural" level of market concentration and uncompetitive behaviour resulting from efforts by buyers or sellers to manipulate prices. While buyers of biodiversity services do cooperate, this often reflects the need for joint conservation strategies to tackle threshold effects associated with ecosystem sustainability. Moreover, pooling funds allows buyers to overcome transaction costs and spread risks, thereby increasing market participation.

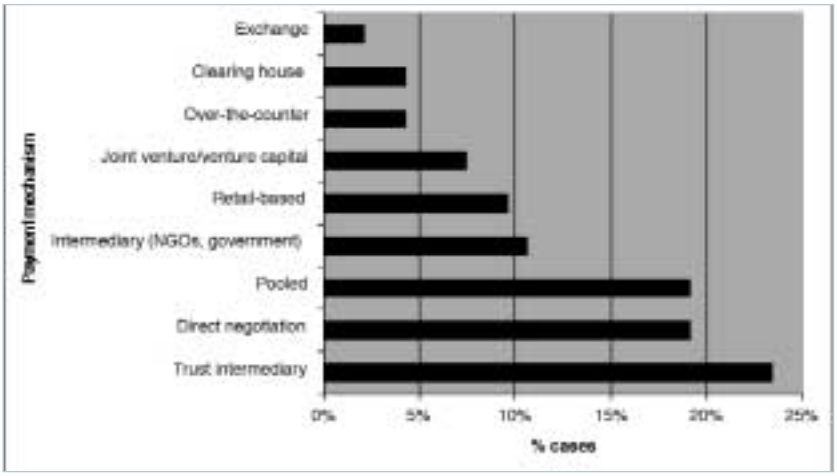
Notwithstanding the need to avoid hasty conclusions, the situation in the bioprospecting market is worrying. The large size of individual bioprospectors, low levels of transparency in negotiations, and poor regulation of access rights combine to increase the power of bioprospectors *vis a vis* land stewards. In their defence, bioprospecting companies argue that the contribution of raw genetic material is low and requires significant value-added through research and development to generate returns (ten Kate and Laird, 1999). Increased transparency in deals between bioprospectors and local communities would help to shed light on this issue.

3.2.4 Payment mechanisms for biodiversity protection

Eight payment mechanisms have been used to channel finance towards biodiversity protection in the cases reviewed:

- *Direct negotiation*. Payments are often embedded within projects (e.g. integrated conservation and development projects) and often involve a lengthy process of bargaining.
- *Intermediary-based transaction*. Intermediaries help to reduce transaction costs associated with searching, negotiating and completing deals. In addition, they may lower trading risks by building up skills to identify better transactions and vetting participants. Trust Funds, local and international NGOs are the most common forms of intermediary.
- *Pooled transactions*. This approach controls trading risks by sharing the investment among several buyers. In addition, the pooled fund may be large enough to diversify investments.
- *Joint venture/venture capital*. Payments involve investors offering equity input into a start-up company and channelling payments for environmental services through this new enterprise in the form of profit sharing, cheap finance, technical assistance, direct grants, etc.
- *Over-the-counter trades*. These occur where the commodity is pre-packaged for sale, or buyers offer to purchase a pre-packaged product.
- *Clearing-house transactions*. A sophisticated intermediary which offers a trading platform for buyers and sellers of standardised products.

Figure 8: Relative importance of payment mechanisms for biodiversity conservation



- *Retail-based trades*. Payments are attached to existing marketed goods and services.
- *Exchange-based trades*. These exist where the commodity has been standardised and can be resold in secondary and, in some cases, derivative markets such as futures or options markets.

The frequency with which mechanisms are used in the cases reviewed is set out in Figure 8. In what follows, examples are provided to illustrate the use of different mechanisms.

The simpler, the more popular

In terms of the mechanisms currently in use, trust fund intermediaries, direct negotiations and pooled transactions are clear favourites. In several instances, two or more mechanisms are combined. Trust funds and pooled transactions are a frequent mix. This is not surprising since, trust funds are a popular mechanism for donors and international NGOs to join forces for investing in conservation. They are also viewed as a useful mechanism for leveraging co-financing from the private sector. Box 3 below provides an overview of trust fund mechanisms, and Box 4 sets out example of the Critical Ecosystems Partnership Trust used to pool donor and NGO finance.

Box 3: Trust funds to channel payments for biodiversity conservation

Trust funds emerged in the early 1990s to channel money generated by debt-for-nature swaps to biodiversity conservation. Since then they have attracted attention from bilateral and multilateral donors (especially the GEF), private foundations, national governments and even the private sector. In 1994 there were 21 funds oriented towards forest conservation. By 1997, the number had increased to 46, mostly in Latin America and the Caribbean. Currently, at least another 11 funds are being developed and 45 have been proposed (Bayon *et al*, 2000).

According to Mikitin (1995):

"The basic legal concept behind a trust device is that property is managed by one person or group (usually referred to as "trustee(s)") for the identified goals or benefit of a second person or group (usually referred to as "beneficiary(ies)")."

Trusts set up by a donor to support forest conservation are normally capitalised with a lump sum grant, and governed by a group of trustees often including representatives from key donor, the government, local NGOs and community groups. The trustees, through their Board of Directors, control how the trust's capital assets are managed and how income is spent. They are legally bound to act in accordance with the objective of the trust and may have to follow a trust administrative manual. Trustees frequently contract out asset management to an independent private investment firm.

Trusts may be permanent (the original capital investment is maintained over time), sinking (capital is drawn down over a fixed period), or revolving (funds are regularly replenished), on-shore or off-shore, charitable or private, have one or several investors, and may differ greatly in the conditions attached to their management. Despite their variety, trusts share a number of attractions (Mikitin 1995):

- *Independent of government intervention* – the government must agree to trust establishment and conditions attached that ensure its independence and its commitment to trust objectives.
- *Facilitate donor co-ordination* – allows easy pooling of resources.
- *Leverage additional funds* – by offering a ready-made mechanism for investing.
- *Increased flexibility in disbursement* – while project funds are generally administered according to work plans and strict time-tables, disbursement from trusts can be adjusted.
- *Long-term horizons* – permanent trusts are popular where there is a need to establish long-term sources of finance, and move away from donors normal short-term project lifecycle.
- *Local ownership* – easily designed to achieve a high level of participation in operations.
- *Local empowerment* – local involvement in the trust may strengthen organisational and management skills of communities who apply for funds.

Trusts also have drawbacks. Not only are they complex, but where trusts are permanent they require a large initial investment to yield relatively small resources for distribution. For an off-shore trust a minimum of US$5 million is normally sought. If a multilateral is managing the funds, then the minimum is thought to be closer to US$10 million, to take account of lower investment returns. Where conservation needs are pressing, funds may yield greater benefits by being used immediately, rather than invested through a trust and disbursed over the long-term.

Sources: Landell-Mills (1999); Bayon *et al* (2000); Mikitin (1995)

Box 4: Critical Ecosystems Partnership – trust funds to pool conservation finance

Launched in February 2001, the Critical Ecosystem Partnership represents a collaborative effort by Conservation International, the World Bank and GEF to generate finance for biodiversity conservation in critical ecosystems around the world. Each founding institution has pledged $25 million over the next five years, and additional finance is being sought from other donors to reach a capitalisation of US$150 million.

The fund aims to provide grant finance to local communities, NGOs, the private sector and other civil society groups to protect biodiversity. Finance will be project-based and used to support training, natural resource planning, local dialogues with extractive industries, conflict resolution, consensus building, capacity building, and the facilitation of partnerships with the private sector in protected areas. Initially, the fund will focus on hotspots (i.e. highly threatened regions where about 60% of all terrestrial species diversity are found on only 1.4% of the planet's surface) in Madagascar, West Africa, and the Tropical Andes. Every year 5 additional critical ecosystems will be added to the list of recipients.

To provide strategic guidance, a Donor Council oversees the fund. This Council will review and authorise proposals for funding. Decision-making is supported by the production of "ecosystem profiles" for each potential recipient location. Profiles outline the current status of biodiversity threats, existing initiatives to counter this threat and how the proposed investment will add value. Funds will be disbursed through four approaches, depending on local conditions:

1) The consortium approach – involving participation of a range of civil society groups in a hotspot location.
2) Competitive requests for proposals based on an advertised theme.
3) Private foundation approach where particular implementers are sought for their expertise and matching objectives.
4) Small grants approach.

In terms of the breakdown in responsibilities Conservation International serves as the Fund manager, will develop guidance for investments and will supervise regional hotspot alliances created through the Fund. The GEF and World Bank will facilitate technical and information links through their national offices and Fund projects. The Fund aims to add value to World Bank and GEF projects by being agile, flexible and responsive to emergencies. In addition to the Fund sponsors, the Biodiversity Conservation Information System – a consortium of 12 international conservation organisations – will provide information and communications support.

Source: Conservation International (2001)

Direct negotiations are a less sophisticated mechanism for transferring funds for biodiversity protection, but are especially effective where uncertainties are significant. Traditionally, funds are tied to conservation by forest stewards, be they government agencies, local communities or NGOs. As local community participation has gained recognition through the 1990s, conservation projects have expanded their ambit to incorporate local developmental goals. Integrated conservation and development projects are used for paying for biodiversity

conservation in several of the cases reviewed. Most notably conservation and development projects have been an overarching theme in International Cooperative Biodiversity Group initiatives in Suriname, Nigeria, Cameroon, Vietnam and Laos. Box 5 describes the Suriname example.

Box 5: Conservation and development through the International Cooperative Biodiversity Group in Suriname

Suriname's International Cooperative Biodiversity Group was established in 1993 to explore plant biodiversity for commercial drug development. The project is one of several sponsored by the US National Institute of Health, the National Science Foundation and USAID (recently replaced by the US Department of Agriculture). A key feature of the International Cooperative Biodiversity Group programmes is that they are designed to comply with the CBD principles. In particular, they aim to provide incentives for biodiversity conservation and to maximise the benefits from bioprospecting to local communities, whilst promoting drug development. The initiative represents a break with conventional private bioprospecting deals which are estimated to return an average 0.0001% of profits from plant-based drug development to local communities.

The initiative is unusual for the variety of institutions collaborating in drug development. While it is co-ordinated by Virginia Polytechnic Institute and State University; research is implemented by a number of players, including: Conservation International-Suriname, the Saramake Marron tribe (about 17,000 people), the publicly owned pharmaceutical company (Bedrijf Geneesmiddelen Voorziening Suriname), the Missouri Botanical Gardens and the multinational Bristol-Myers Squibb Pharmaceutical Research Institute.

Given each participant's skills and investment in the project, a range of agreements has been developed setting out responsibilities and the sharing of benefits. These agreements may be split into two groups: those that deal with longer-term benefit sharing in the event of a drug being developed; and those that deal with immediate payments for biodiversity access, biodiversity protection and ethnobotanical information. The overarching framework for the project is that of an integrated conservation and development project.

Long-term benefit sharing

A Grant Research Agreement signed with the International Cooperative Biodiversity Group covers longer-term benefit-sharing. It deals with ownership, licensing and royalty allocation once a drug is developed. The agreement formalises the right to joint ownership over a patent between the local communities that contributed raw materials and ethnobotanical information. It also sets out Bristol-Myers Squibb's right to exclusive access to raw materials for a set period.

The allocation of royalties between Bristol-Myers Squibb, Suriname and other stakeholders will depend on the drug developed and the partners' relative contributions. Where the drug is based on ethnobotanical information, 50% of funds go to a Forest People's Fund and 30% to a range of conservation-based institutions (e.g. the Foundation for Nature Preservation in Suriname; the Forest Service and Conservation International-Suriname). The remaining 20% is split

The International Cooperative Biodiversity Group seeks to promote drug discovery consistent with biodiversity conservation and economic development. Local villagers, like the woman in this photo, receive training in field botany, botanical research and collection management.

Photo: Jim Miller (www.mobot.org/MOBOT/research/applied_research/icbgsuriname.shtml)

between the government pharmaceutical company and an allocation for "future institutions". Where the drug is based on random sampling, 30% goes to the Forest People's Fund, 40% goes to conservation groups and 30% goes to the government pharmaceutical company and an allocation for "future institutions".

Short term benefit sharing

In the shorter-term, benefits are yielded through capacity-building of the local research institutions (Bedrijf Geneesmiddelen Voorziening Suriname, the National Herbarium and universities), training and educational initiatives, equipment provision, and employment. Also, investments are being made to establish a programme aimed at developing a drug to treat local diseases, notably malaria.

Forest People's Fund

The Forest People's Fund is a revolving trust fund set up to allocate both short term and longer-term benefits to indigenous tribes that contribute samples and knowledge to the project. The Fund was established in 1994 with an initial grant by Bristol-Myers Squibb of US$50,000, and topped up in 1996 with an additional $10,000. In future, royalty payments will be channelled to the Fund. A Board of Directors – composed of Conservation International, tribal and Bedrijf Geneesmiddelen Voorziening Suriname representatives – then allocates money to members of the contributing tribe. To receive funds, tribe members must submit project proposals that conform to the Funds criteria. Emphasis is placed on local community development and biodiversity conservation. Six projects had been accepted by 1998, including local transport development projects, support for small enterprises and training projects.

Source: Rosenthal (2000); Guerin-McManus *et al* (1998)

The example of the Suriname International Cooperative Biodiversity Group outlined in Box 5 highlights how payments for forest biodiversity protection may be embedded in complex projects that bring together hierarchical, cooperative and market arrangements. The case also illustrates how payment mechanisms may complement one another. In the Suriname case, payments are made through both direct contributions, e.g. in the form of training, technical assistance, equipment provision and employment, and via a revolving Forest People's Fund. The project also relies on pooled funding to spread risks, increase funds committed and involve a multidisciplinary set of institutions.

NGO intermediaries have grown in prominence as donors and governments have decentralised natural resource management and finance to local institutions. Decentralisation has generated a demand for local financial intermediaries. Non-governmental bodies have been favoured due to their perceived links with local beneficiaries. Moreover, their small size allows them to be more innovative and flexible in channelling payments for biodiversity protection (Landell-Mills, 1999).

Retail-based markets for biodiversity protection services are expanding rapidly. In addition to the nine existing retail-based markets identified in this review, six proposals were highlighted. Almost all of these markets are in Latin America and the majority are in the coffee (6) and cocoa (4) sectors. In both cases biodiversity-friendly production techniques rely on the inter-cropping of trees with plants and the application of organic production techniques. Agroforestry not only yields significant biodiversity benefits, but provides pest and disease control services that are critical where farmers do not utilise chemical fertilisers and pesticides. Where biodiversity-friendly coffee yields a price premium, this premium reflects, in part, customers' willingness to pay for biodiversity conservation[17]. To the extent that this payment is passed on to farmers who invest in biodiversity-friendly production techniques, there is a retail-based market for biodiversity protection. An example of an emerging retail market for shade cocoa in West Africa is described in Box 6.

Box 6: Launching a retail-based market for biodiversity: Conservation International's experience with shade cocoa

Conservation International recently launched an initiative to promote biodiversity-friendly cocoa through the combination of cocoa with tree planting (shade cocoa) in West Africa. The work is targeting the Upper Guinean forest, an identified threatened tropical ecosystem, or "hotspot". Since 70% of the world's cocoa comes from West Africa, efforts to make cocoa production biodiversity-friendly is key for protecting diversity in this region. The work will be conducted in Ghana – building on an existing Conservation International programme with Kuapa Kokoo Union – and in the Cote d'Ivoire, the world's largest producer of cocoa. Key components of the scheme include research, pilot cocoa enterprises and marketing.

17. It also may reflect willingness to pay for associated health benefits. This review found no studies that break down willingness to pay attributable to environmental *vis a vis* health benefits.

Shade cocoa protects biodiversity by maintaining tree ecosystems on farms and by preventing the conversion of tropical forests to cocoa plantations. Whereas under monocropping loss of soil fertility means farmers eventually move to new land (e.g. after 25 years in Cote d'Ivoire), with shade cocoa soil fertility is maintained and no new land is required.

In addition to providing valuable global environmental services, significant local benefits are associated with shade cocoa production. Shade cocoa provides weed control, maintains soil fertility through the provision of organic matter and controls soil erosion. Through its support for beneficial insects, shade cocoa also reduces farmers' requirements for chemical fertilisers and pesticides, which in turn has positive spin-offs for local health. Trees also offer additional sources of income and sustenance in the form of timber and NTFPs.

Conservation International seeks to promote shade cocoa in the two following ways. Firstly, through improved information, education and training in shade cocoa techniques. Secondly, through the promotion of an export market for shade cocoa in Europe and the USA.

With respect to developing a market, Conservation International is seeking to tap the organic products market. In 1998 the estimated value of the organic food and beverage market in Western Europe, North America and Japan was US$13 to $13.5 billion, and growing at between 5 to 40% a year (International Trade Centre, 1999). Since shade cocoa production applies many of the principles demanded by organic certification schemes, farmers can use existing certification providers and retailers. Conservation International has already committed to paying 5% premium over government recommended prices for shade cocoa in Ghana. Conservation International also offers post-harvest bonus payments to farmers. In 1998 farmers produced 650 tonnes of shade cocoa. By 1999, this quantity had more than doubled.

Source: Conservation International (1999); International Trade Centre (1999)

The emergence of more sophisticated mechanisms

More sophisticate mechanisms such as venture capital financing, over-the-counter trading, clearing-house approaches and exchanges are used less often. Nonetheless, these mechanisms provide a valuable indication of the future for biodiversity protection markets and deserve careful attention.

A significant development has been that of venture capital financing used by donors and international NGOs to purchase shares in biodiversity businesses and leverage private investment in biodiversity. The International Finance Corporation has been at the forefront of multilateral efforts to develop innovative approaches to biodiversity venture capital and is currently managing two major programmes: the Small and Medium Enterprise Programme and the Terra Capital Fund[18]. The Small and Medium Enterprise Programme is described in Box 7.

18. International Finance Corporation website August, 1999.

Box 7: Paying for biodiversity through venture capital: the Small and Medium Enterprise Programme

The Small and Medium Enterprise Programme was set up with US$16 million of GEF funds to:

"stimulate greater involvement of the private sector small and medium scale enterprises in addressing two specific GEF objectives – the sustainable use and conservation of biodiversity and the reduction of greenhouse gases." (IFC/GEF SME Program Summary)

Sustainable forestry projects are encouraged where they contribute to the protection of biodiversity. Drawing on its experience with establishing dedicated credit lines for small and medium enterprises through local financial intermediaries, the International Finance Corporation has established a similar approach in the environmental sector. Not only does this approach lower lending risks by using local knowledge, but it has positive spin-offs for the domestic capital market by demonstrating the profitability of biodiversity-friendly investments and improving local financial intermediaries' ability to evaluate such projects.

Financial intermediaries may be private entities, such as venture capital funds, or NGOs. They are selected based on their experience with the small and medium enterprise sector and their financial viability. They must also have access to environmental expertise that they can use in evaluating projects. Once selected, the financial intermediary signs a loan agreement with the International Finance Corporation that will specify how funds should be used and the maximum funding that can be provided to any one enterprise. While conditions for each intermediary and country may vary, a broad set of rules is set. Financial intermediaries may receive between US$500,000 and US$1,000,000 in the form of a long-term (up to 10 years) low interest (about 2.5% per year) loan. The intermediaries can in turn lend at the market rate, or invest, up to US$250,000 in an approved enterprise. This money should be supplemented by finance from the intermediary or another investor. The total asset value of any project cannot exceed US$5 million.(IFC/GEF SME Program Summary)

The main incentives for financial intermediaries include the initial soft loan, service fees paid by International Finance Corporation to help cover the costs of identifying, preparing and monitoring projects and the possibility of keeping up to 50% of the initial capital if funds are successfully disbursed. To date the Programme has agreed 15 loans with financial intermediaries worth US$11 million. Approximately US$4 million has been disbursed, a large share to the forestry sector. All projects have repaid their loans (Salloum pers. comm. July, 1999).

While it is still too early to draw final lessons from the Small and Medium Enterprise Programme, it is worth highlighting a few key points. These include (Asad, 1997):

- the need to select a qualified intermediary with adequate financial and technical skills;
- the importance of risk-reducing measures such as through technical assistance and regular advice to clients; and
- the need to avoid subsidised interest rates that distort the market.

Source: Landell-Mills (1999); Salloum (pers. comm. July, 1999); Asad (1997)

The International Finance Corporation's initiatives rely on local financial intermediaries to channel venture capital funds to biodiversity business. An alternative approach is illustrated by the US Overseas Private Investment Corporation – a publicly funded export promotion agency – and by the Multilateral Investment Fund of the Inter-American Development Bank. These institutions link up with international financial intermediaries who search for private investments in developing countries. More recently, international NGOs have also shown their interest in the venture capital arena. In 2000, The Nature Conservancy and the Inter-American Development Bank launched an Eco-Enterprises Fund, and the World Conservation Union (IUCN) and the International Finance Corporation announced plans for an African-oriented Kijani Fund.

While venture capital funds expect to generate returns to their investments, their purchases of shares in various biodiversity businesses reflects their sponsors' interest in promoting biodiversity protection. Moreover, in almost all cases examined, investments are backed with grants for technical assistance. In the case of the EcoEnterprise Fund, for instance, $3.5 million of a total $10 million will go towards technical assistance.

Exchange-based markets are an extension of the emerging venture capital funds. The central difference being that, rather than accessing equity finance from venture capitalists, biodiversity companies seek equity finance through public offerings. Earth Sanctuaries Ltd. in Australia is an example of a company that has taken this route. Exchange listing is possible because the companies are already (or expect to be) profitable and have complied with various regulatory requirements associated with share listing (e.g. independent auditing). In many cases those that purchase shares in these businesses do not expect to earn returns. In the case of Earth Sanctuaries Ltd. shares have been donated to the company or dividends returned.

Over-the-counter trading and clearing-house markets are complementary. Clearing-house trading involves a centralised system of buying and selling a standardised commodity. Where governments have legislated to create such a commodity, it is in their interest to establish a trading platform to minimise transaction costs and maximise market liquidity. Box 8 describes Costa Rica's efforts to establish a clearing-house system for marketing bioprospecting permits.

Box 8: A clearing-house approach to trading bioprospecting rights: Costa Rica's National Biodiversity Institute

Costa Rica is a global leader in attracting bioprospecting investment. Its success hinges not just on is vast store of genetic resources, but also on its clear legal and policy framework which offers investors a "one-stop-shop" for negotiating deals, streamlined approval systems and guaranteed contracts. Costa Rica's National Biodiversity Institute (INBio) acts as the central clearing-house.
INBio was set up in 1989 as an independent, not-for-profit institution to capture payments for Costa Rica's biodiversity. With approximately 5% of the world's biodiversity, and approximately 25% of the country protected under the

National Systems of Conservation Areas, INBio has a large resource to market. So far, INBio has commercialised access to biodiversity in the form of sales of access rights, information, samples of species, samples of active principles to biotechnological companies.

INBio has signed several agreements with private companies wishing to have access to its reservoirs of genetic information. Its first deal was with Merk and Co. in 1991. Others include:
- Bristol Myers Squibb for pharmaceuticals (1993)
- Givaudane Roure for fragrances (1994)
- Diversa Corp for gene prospecting (1995)
- INDENA for phytochemicals and phytomedicine (1996)
- Analyticon for research (1996)
- La Pacifica and the British Technology Group for bio-nematicide (1994)
- Phytera for cell culture from plants (1998)

By 2000 Merk and Co. alone had paid US$1.2 million for conservation, over $700,000 to universities, and $700,000 to other programmes. In addition to monetary payments in return for INBio's services and royalties, non-monetary benefits are often received through technology transfer, training and equipment.

Source: ten Kate (1999)

Photo: Ina Porras

INBio's mission to promote awareness of the value of biodiversity is partly achieved by INBioparque, an educational and recreational centre where visitors are exposed to samples of the biological diversity found in Costa Rica. INBioparque has been partially funded by the Costa Rican government and international donations.

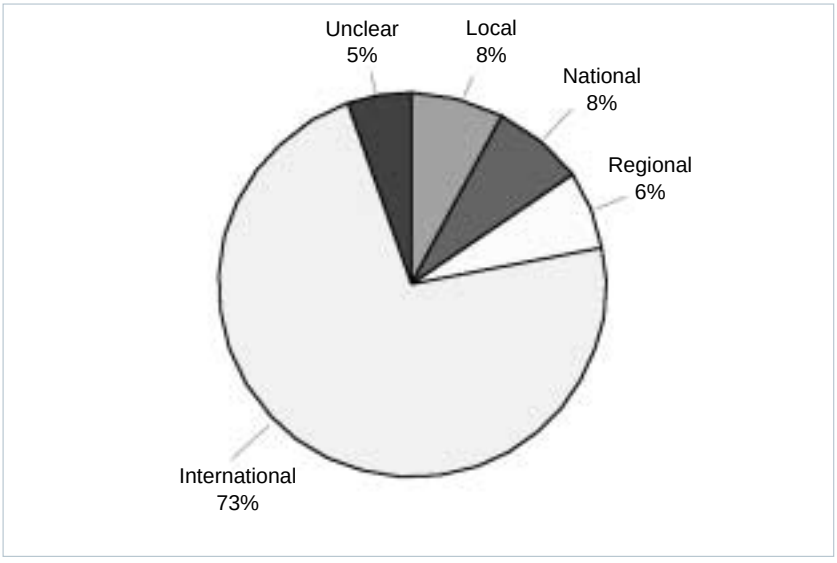
3.2.5 From global to local trading in biodiversity protection

As is clear from Figure 9, the market for forest biodiversity protection is primarily international. This is not surprising given the global nature of demand for the service. As was highlighted at the start of this section, forest biodiversity is valued for a range of features, from its role in maintaining a stock of information for potential future use to its existence value. For the most part, these services are consumed internationally. While demand is broad-based, expressed willingness to pay is concentrated in the West. As we have seen in Section 3.2.2, this willingness to pay is translated into real payments for biodiversity protection by national governments, international NGOs and increasingly private companies.

Despite the international nature of biodiversity benefits, there are also national and even local markets for biodiversity protection. Apart from national governments investment in biodiversity conservation on behalf of their citizens, the existence of localised pockets of demand reflects increased recognition by private actors of the local-level benefits associated with conservation. It also reflects more pro-active efforts to ensure payment for conservation through regulation.

With respect to increased local appreciation of biodiversity values, this is often associated with the emergence of local value-added capacity. For instance in Kerala, India the development of a local plant-based drug has spurred payments by pharmaceutical companies to forest communities. The Kerala story is briefly outlined in Box 9.

Figure 9: Geographical extent of markets for biodiversity protection



Box 9: Localising the market for biodiversity protection: the case of Kerala's Kani tribe

In the late 1980s, a group of tribals in Kerala (the Kanis) introduced the Tropical Botanical Garden and Research Institute to the fruit of the *Trichopus zeylanicus travancoricus* plant. Within India, the plant is endemic to the Western Ghats area. Subsequent analysis by the Research Institute showed that the fruit and its leaves have anti-fatigue, anti-stress, anti-hepatotoxic and immunodulatory properties. Based on this discovery, the Research Institute combined the active compounds from this fruit with those from three other medicinal plants to develop the Jeevani drug. This drug was then sold to a private pharmaceutical company (Arya Vaidya Pharmacy Ltd) for manufacturing and sale without consulting the Kanis The contract agreed was for 7 years and involved the payment of approximately $25,000 to the Research Institute for a licensing permit. In addition, the Research Institute negotiated a 2% royalty associated with any future drug sales.

Following its agreement with Arya Vaidya Pharmacy, the Research Institute reconsidered its failure to compensate the Kanis for their intellectual input and their stewardship of their forests, essential to the drugs future. They decided to split the proceeds from the license fee with the Kanis 50:50, and agreed that 50% of any future royalty income would go to the tribals. In addition, the pharmacy agreed to pay the Kanis for future supplies of the plant leaves of up to 5 tonnes/month. An estimated 500-1000 families could be employed in leaf cultivation and harvesting.

Payments made to the tribals are to be channelled through a trust fund called the Kerala Kani Samudaya Kshema Trust (Kerala Kani Community Welfare Trust). The objectives of the trust are to support welfare and development of the Kanis, the preparation of an ethnobotanical register, and local biodiversity conservation. The aim is to ensure all adult Kanis become members of the trust and can receive funding to implement the trust's objectives.

Source: Anuradha (1998)

The development of regulatory frameworks that require local payments for biodiversity conservation is less common, but often the most innovative approach. Examples are found in Brazil, the Netherlands and the USA[19]. Given the importance of a strong administrative infrastructure for implementing regulation-based systems, wealthier countries tend to have a comparative advantage. In Brazil, however, discussions are currently underway on a system of reserve requirement offsets, which could offer an opportunity for wider application. Box 10 outlines the proposal.

19. The USA experiences with creating local markets for biodiversity tends to be part of a wider programme for marketing a range of environmental services. It is thus described in Section 7.

Box 10: Localising the market for biodiversity protection: a proposal for tradable reserve requirements in the Amazon

In 1965, Brazil passed a new Forest Code that requires legal reserves of native or regenerated forest to be established on private property. The size of legal reserves varies for different locations, but in the south it is normally about 20% of private land, while in the north between 50-80% can be reserved. While a strong conservation measure on paper, this regulation has been sporadically enforced.

Recently the authorities have begun to put in place mechanisms for the implementation of these reserve requirements. As a result, the inefficiencies of the system have come to the fore. The requirement is economically inefficient since it takes no account of varying costs of implementing the measure for different properties. It would make more sense to achieve the same level of protection on land that is less valuable for agriculture. The measure is environmentally inefficient since it takes no account of the value of environmental services provided in different forest plots and is likely to result in fragmented forest protection, which may undermine ecosystem services.

Given these difficulties, the introduction of a provisional regulation "Medida Provisoria 1736" in 1998 offers a way forward. The regulation, which is currently under discussion, would permit "off-site compensation" for loss of legal reserves in the Amazon region. In other words, where landowners have failed to comply with the reserve requirement, they may be permitted to offset the loss in biodiversity protection through the protection of equally valuable forests in another area. As set out in the regulation, off-site compensation must take place in the same state and ecosystem and have as least as much ecological value.

If passed, this regulation could form the basis for a system of tradable "reserve requirement offsets" whereby landowners with surplus forest protection (i.e. in excess of the minimum required by law) are permitted to sell offsets to landowners who have inadequate reserves (i.e. less than that required by law). Landowners would be responsible for ensuring that the sum of forest area and forest offsets meet requirements.

Source: Chomitz (1999)

3.2.6 Market maturity is variable

As highlighted in Section 2.4.1, market maturity may be gauged using four indicators: the time period since transactions were first initiated, the degree of price discovery attained to date, market participation and liquidity, and the level of sophistication in payment mechanisms. While information of these factors is not always readily available, broad assessments are made below.

Taken as a whole, the market for biodiversity protection is best characterised as a nascent market. However, this assessment paints over variations between market niches. Below, the maturity of three market niches is briefly considered: donor and international NGO conservation finance, bioprospecting and retail-based markets.

The market for donor and international NGO conservation finance is the most well-established as reflected in the level of innovation in payment mechanisms (e.g. trust funds, venture capital trusts) as well as commodities (e.g. debt-for-nature swaps, conservation concessions). Some international NGOs such as Conservation International have even established research departments aimed at developing new biodiversity markets. At the same time the rapid rate with which new commodities are being introduced produces a confused picture when it comes to assessing price discovery.

In the case of bioprospecting, the picture is less advanced. The most sophisticated payment mechanism has been developed by Costa Rica (see Box 8), followed by systems developed under the International Cooperative Biodiversity Groups (e.g. in Suriname, Fiji, Nigeria, Cameroon and Vietnam). Yet, price discovery is only partial, and payment mechanisms remain complex and opaque.

Biodiversity-friendly product markets are developing rapidly. In 1999 the value of the organic foods market (which include biodiversity-friendly products) world-wide was US$14.5 billion, and growing at 20-30% a year in the developed world. Moreover, the price premium being offered range from 20 to 200% (International Market for Organic Foods, 2000). However, the rapid expansion in retail markets masks the slower pace with which price premia paid by customers are being transferred along the supply chain to land stewards. Wholesalers are only beginning to explore how much they need to pay to generate supplies of biodiversity-friendly inputs.

3.2.7 Markets are nested in broader institutional frameworks

Evolving markets build on, and interact with, hierarchical and cooperative institutional arrangements. Markets never emerge in a void but are moulded over time to fit their surroundings. Consequently, no two markets, even when they involve the same commodities, are identical. Consider the market for bioprospecting rights. The International Cooperative Biodiversity Group agreements in Nigeria, Cameroon, Suriname, Vietnam and Laos emphasise how markets have evolved to suit national legislative and policy frameworks, administrative capacity, community institutions and even local expectations. Comparing these with INBio's efforts to sell bioprospecting rights in Costa Rica accentuates this point.

Where markets have succeeded in taking root, they typically have knock-on effects for other institutions. These may be negative, e.g. they may undermine cooperative arrangements, or they may be positive, e.g. they stimulate the creation of new government regulations, agencies, private sector companies and social structures. In some cases, conflicts with existing institutional arrangements may mean that markets fail.

A good example of markets undermining cooperative arrangements is provided in the case of drug development in Kerala, India (see Box 9). In this case, the development of a successful drug based on a forest plant in a tribal area led to a compensation payment tied to biodiversity conservation by the research institution to the Kani tribe. However, the resulting contract which involved extraction from forested lands, was undermined by resistance from the Kerala Forestry Department, which had been excluded from the market (Anuradha, 1998).

Markets may also stimulate positive developments. In the global market for conservation finance, for instance, the creation of NGO intermediaries and trust funds in developing countries has spurred capacity building in these countries, both within the intermediary itself and outside. Those entrusted with managing funds are provided with training and education, as well as funds to establish the necessary infrastructure. Recipients of funds are also frequently provided with support. In some cases funds are channelled towards the creation of new community associations to implement projects. This is also true in the case of national markets. In Madhya Pradesh, India, for instance, government support for forest biodiversity protection is channelled through newly created Village Protection Committees as part of Joint Forest Management and eco-development programmes.

Thus, for market implementation to be successful it is crucial that existing institutional arrangements are taken into account. Markets will be most successful where they are designed to fit into existing institutional arrangements. Where new markets are likely to bring about significant change, the involvement of members of different institutional arrangements early in the market design process is essential to insure against conflicts. These issues are all critical and taken up in Section 3.4 on the process of market evolution.

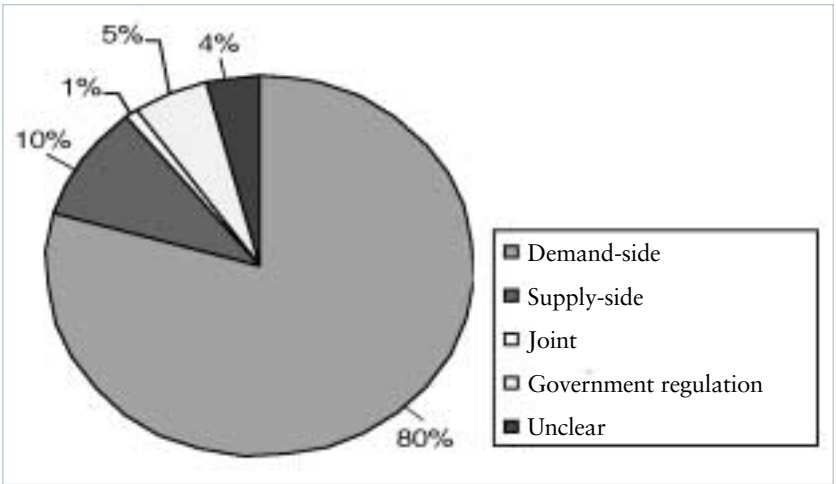
3.3 Driving the development of markets for biodiversity protection

Drivers may be broken down according to whether they emanate from the demand- or supply-side of the market or, in some cases, whether they are a result of regulatory action. Figure 10 sets out the relative importance of drivers identified for the cases reviewed.

Demand-side factors are the main powerhouse behind market emergence, associated with about 80% of the markets considered. While supply-side drivers are less significant, accounting for only 10% of markets, they are a growing force.

The most significant factor driving demand has been increased public recognition of the role played by global biodiversity in maintaining ecosystem functioning, keeping future options open and in insuring against unexpected

Figure 10: Main drivers in markets for biodiversity



shocks. This appreciation, combined with heightened awareness of threats to biodiversity supplies, has generated demands for action, especially in the West.

Most immediately, peoples' concerns have translated into private and government willingness to pay for biodiversity protection. Environmental NGOs such as Conservation International, The Nature Conservancy and the World Wildlife Fund have benefited enormously from heightened public willingness to pay. In 1993, in the USA alone, a total of US$3.19 billion was raised for environmental causes and in 1999, The Nature Conservancy raised US$700 million to acquire and protect habitats in the USA and elsewhere. Donor support for biodiversity protection is also prominent throughout this review. The GEF channelled $1.18 billion towards biodiversity conservation in 123 countries between 1992-2000. Even in developing countries, governments are giving the environment more attention in their budgets. In some cases (e.g. the Philippines and Brazil), dedicated environmental funds have been established. On the international front, these efforts are reflected in the adoption of international agreements for action, most notably the CBD.

Public demand for increased spending on biodiversity conservation has also generated support from private companies, particularly those that benefit directly from biodiversity protection, e.g. bioprospectors, or damage biodiversity. Companies that fail to heed public opinion face serious risks, as was recently driven home by a high profile media campaign against pharmaceutical companies for failing to contribute enough for social causes.

The largest multinationals (e.g. Glaxo Wellcome, Novo Nordisk, Xenova, Bristol-Myers Squibb and Shaman) have begun to take on board these demands, by integrating principles set out in the CBD in their contracts with suppliers of genetic and chemical materials (ten Kate and Laird, 1999). Slowly, rents from

(mainly) drug development are being more equitably shared with stewards of biodiversity and investments made in forest conservation. Even companies that are not directly associated with biodiversity extraction have expressed their desire to invest in biodiversity protection to improve public relations. Coca Cola's participation in the purchase of a private protected area in Belize and Ford Motor Company's support for biodiversity conservation in Mexico's El Triunfo Biosphere Reserve provide good examples.

In some sectors companies are looking beyond the threats, towards market opportunities associated with changing consumer concerns. Ecotourism companies have been front runners[20]. Organic cocoa and coffee manufacturers and retailers have made more recent inroads. To allow companies to translate their positive environmental deeds into market rewards, various certification and labelling schemes have been developed. Moreover, by joining forces with international NGOs, private companies have managed to reduce market development costs. Montana Coffee, Café Ibis and Starbucks have, for instance, cashed in on Conservation International, The Nature Conservancy and Rainforest Alliance's willingness to pay start-up costs and market research. In some cases, donor support (e.g. GEF, USAID) has been forthcoming.

The growth in willingness to pay is stimulating supply-side initiatives. In this review seven cases stand out:

- Costa Rica's introduction of INBio;
- Earth Sanctuaries Ltd.'s effort to capture willingness to pay through a stock market listing in Australia;
- China's Four Forest Parks' listing on the Shanghai stock market;
- Australia's State Forest New South Wales' investment in designing biodiversity credits to capture consumer surplus;
- Western Australia's search for bioprospectors to invest in drug exploration;
- the Belize government's imposition of a range of charges on biodiversity beneficiaries, e.g. tourists and forest users, to feed into its Protected Areas Conservation Trust; and most recently
- Ghana's efforts to establish a debt-swap window whereby it can standardise the sale of debt-for-nature and other swaps.

Where there are clear users of biodiversity, suppliers have also been more aggressive. This is in part a response to improvements in techniques to exclude non-payers, new methods for commoditising biodiversity protection services and falling transaction costs.

Finally, it is worth pointing to the few instances where markets have been driven by government regulation. The Netherlands system of compensatory investments to offset biodiversity damage and Brazil's proposed systems of reserve requirement offsets are good examples (see Box 10). In both instances,

20. While ecotourism companies mainly market landscape beauty (see Section 6), in many cases they have played on their biodiversity benefits to gain a market edge.

governments have introduced markets to minimise the costs of achieving environmental goals.

International agreements relating to trade in biodiversity do not appear to represent major drivers in market development. This may change as national governments implement commitments under the CBD and the World Trade Organisation's Agreement of Trade-Related Intellectual Property Rights. Both agreements seek to clarify property rights over genetic resources. The CDB assigns ownership of genetic resources to individual countries, with the national government able to allocate property rights as it sees fit. In contrast, members of the World Trade Organisation are pushing for the extension of private intellectual property rights to genetic resources. Whichever approach dominates, the establishment of property rights over biodiversity is likely to spur market development.

In sum, to date markets have been predominantly driven by demand in the West. This trend, however, is shifting as demand becomes more widespread amongst developing country citizens and their governments and, significantly, as suppliers become more market savvy. There are potentially significant returns to be made by those that invest in supply-side development and gain first-mover advantages. Moreover, as experience is gained on how to launch supply-side initiatives, new entrants may be able to cut costs and leapfrog incumbents. While suppliers have become more proactive, governments are also being increasingly aggressive. This is especially true as authorities begin to operationlise their commitments under international treaties such as the CBD, and seek new mechanisms to achieve environmental objectives at least cost.

3.4 Biodiversity market evolution

Markets develop in different ways in different contexts, and the speed with which they evolve reflects their interactions with existing institutional and power structures. Where powerful stakeholders resist implementation, market development may be held up, or even reversed, e.g. Del Ora's experience in Costa Rica (see photo below). Where markets build on and complement existing institutional structures they are more likely to evolve unhindered.

Take for instance Conservation International's "conservation concession" being piloted in Guyana. The attraction of this commodity, is its simplicity and its convergence with local forestry laws. Guyana, like many developing countries, issues logging concessions to timber producers in its National Forest. The introduction of a conservation concession requires no adjustments to Guyana's Forestry Law, no changes to its monitoring and enforcement structures and poses no obvious threat to existing power structures. Rather, it is designed to fit into the current institutional environment, whilst offering a mechanism for biodiversity protection to generate revenue.

Photo: Alexander Bonilla

Some innovative private deals in marketing biodiversity services do not reach maturity despite the willingness to collaborate from the parties involved. In the case of Del Oro, a private orange juice company based in Costa Rica, a deal with the Guanacaste Conservation Area was eventually abandonned due to resistance from competitors and internal problems that eventually led to court intervention.

Simple land acquisitions used by the World Land Trust in the Philippines as well as Coca Cola Foods Inc. and the "Adopt-an-Acre" programme in Belize is another system which avoids hurdles associated with setting up new market structures. Similarly, the sale of shares in Earth Sanctuaries Ltd. takes advantage of an existing market platform – the Australian stock exchange – and purchasers' familiarity with equity investment.

Yet, designing markets to complement existing local institutional arrangements may not always be possible. New markets often require new laws, regulations and infrastructure. Changes affect stakeholders in different ways. The more sophisticated the market, the longer the process is likely to be. The establishment of Brazil's proposed reserve requirement offsets (see Box 10), for instance, will demand new legislation permitting trading, regulations relating to the trading mechanism, agencies to monitor and enforce trades and a trading platform.

While more sophisticated markets require greater planning and investment, and face a greater risk of failure due to resistance, they may generate higher rewards. Likewise, too much effort working around existing structures may produce a market that suits nobodies' needs and that reinforces inequitable

power structures. Where markets are disruptive, they may offer a catalyst for positive change. A balance must be found. Identifying what this balance is, however, requires careful analysis and stakeholder consultation as a basis for calculating relative costs and benefits and probabilities of failure.

Given the importance of context, drawing out guidelines on steps for establishing a market for biodiversity is extremely difficult. An attempt is made to highlight broad stages in market development below:

- *Generation of demand* – e.g. through awareness building related to the value of the service and marketing exercises.
- *Definition of commodity and supply* – identification of a proxy that is closely tied to the service and activities that will deliver this commodity.
- *Definition and establishment of payment mechanism* – e.g. intermediary-based transaction, retail-based market or pooled transaction.
- *Establishment of any supporting institutions* – e.g. community-based organisations, trading platform, monitoring and enforcement systems
- *Implementation/payments*
- *Feedback and improvement* – revision of the payment mechanism or the introduction of new commodities to overcome identified problems.

Not all these steps are always followed. Nor is this order necessarily adhered to. Some steps may be undertaken simultaneously, e.g. the definition of commodity and payment mechanism, or the identification of a payment mechanism to suit supply, while others may be reversed, e.g. the identification of supply prior to investment in marketing.

In terms of what this means for policy-makers, there is significant potential for governments and others to play a positive role. Apart from acting as a market participant on the demand or supply side, governments have a critical role to play in establishing supporting institutions, including new legislation, regulations and monitoring and enforcement systems. Governments can also level the playing field in which markets operate to ensure markets offer equitable solutions, e.g. through a process of empowering weaker participants.

3.5 What biodiversity markets mean for welfare and poverty

None of the cases reviewed provide a detailed and systematic cost-benefit analysis of the transactions they describe. Those that review impacts focus on benefits and rarely undertake financial calculations. Little effort is made to analyse the distribution of these benefits. Instead *ad hoc* lists of economic, social and environmental benefits are produced, often dispersed through the text. The lack of attention to costs reflects the fact that the cases tend to be described by market proponents, rather than independent parties. Moreover, in many cases intended (rather than actual) impacts are emphasised. For instance, because payment systems aim to improve biodiversity conservation, the environmental impacts are assumed to be beneficial. Few cases describe field

investigations to test whether improved biodiversity is really achieved. Evaluation of spin-offs for other environmental factors is even more rare. Notwithstanding these data constraints, in what follows an effort is made to draw out key insights on costs and benefits.

3.5.1 Economic costs and benefits

An overview of economic costs and benefits highlighted in the literature reviewed is provided in Table 5.

Economic costs and benefits tend to be evaluated from the national perspective, and focus on increased income (and associated foreign exchange earnings) generated by the sale of biodiversity and related products, including NTFPs, organic agricultural produce and ecotourism. In more thorough analyses, a wider range of benefits associated with investments' physical capital is highlighted, though rarely valued in financial terms. Reviews of bioprospecting deals stand out for their emphasis on non-monetary benefits including investments in local infrastructure and technology transfer (see Box 2, Section 3.2.2).

Costs of biodiversity protection are only mentioned in three cases, none of which is comprehensive. Nevertheless, these cases warn against an overly optimistic view of market impacts. In addition to costs of supplying biodiversity protection, opportunity costs associated with foregone land uses and transaction costs may be significant. Moreover, to the extent that the provision of biodiversity protection leads to the narrowing of production alternatives from forest areas, markets will raise vulnerability to unexpected shocks.

Table 5: Economic costs and benefits of markets for biodiversity

Economic benefits	Economic costs
• Income/profits • Efficiency gains associated with removal of market failure • Diversified production base – lower risks of shocks • Employment • Improved research infrastructure • Technological transfer • Spin-offs for ecotourism, NTFPs, agriculture and carbon sales • Foreign exchange earnings	• Costs of supply: forest protection and management • Opportunity costs of forgone land uses • Transaction costs: searching for buyers, negotiations, contracting, establishing new intermediaries, monitoring and enforcement, certification • Increased exposure to shocks where biodiversity protection narrows production base by excluding other forest uses

3.5.2 Social costs and benefits

Four categories of social benefits are touched on in the literature:

- Education benefits – environmental education as well as broader education through support to local schools and universities.
- Training – generally in fields relating to biodiversity use, e.g. sample collection and identification required for bioprospecting.

- Health – associated with social development programmes introduced as part of payments mechanisms (e.g. International Cooperative Biodiversity Group spending on local health projects), and as indirect benefits associated with biodiversity protection (e.g. reduced water and air pollution associated with shade coffee and cocoa production systems).
- Strengthening of social institutions – investments in building local cooperative arrangements are frequently made to support markets, e.g. markets for shade coffee rely on strong producer associations.

Where measurements of social impacts are made, they tend to be in terms of the number of people affected. For instance the bioprospecting deal between the Strathclyde Institute of Drug Research, the University of South Pacific and Verata involves the training of 6 people in collecting and preparing samples, 6 people in the methods of biodiversity monitoring and 6 people in methods of socio-economic monitoring. In addition village based enterprises are supported and 6 monthly community workshops in resource management and development are held.

Where financial values are attached to social benefits, an input value approach tends to be adopted. This means that the value of investment in social benefits, rather than the value of the output of this spending, is recorded. For instance, in West African (Nigeria and Cameroon) International Cooperative Biodiversity Groups, 30% of royalty income in Nigeria will be invested in countering local disease. This is not necessarily a reflection of the actual impacts for local health, since no cures or treatments may be developed.

None of the cases describe social costs associated with market development. This reflects the fact that deals are described by those implementing the project. A particular gap is the lack of attention to opportunity costs associated with spending. For instance, money channelled to "education in conservation" may serve the investors' interests of creating local demand for biodiversity protection, but questions may be raised about the broader value of such training where it is not easily transferable to other sectors. Also, negative social impacts may result where markets lead to the exclusion of local people from forest use. The issue of harmful impacts for poor local people is returned to below in Section 3.5.4. It is clear that the figures recorded in many cases present only a partial – and generally over-optimistic – picture.

3.5.3 Environmental costs and benefits

As with social and economic impact analyses, assessments of environmental impacts are largely superficial and biased towards an emphasis on benefits. Apart from biodiversity improvements, four main environmental benefits are identified:

- water benefits – water quality maintenance, reduced chemical pollution;
- soil benefits – reduced soil erosion and maintenance of fertility, moisture and nutrients;

• air benefits – controlled air pollution and carbon sequestration; and
• landscape beauty.

These benefits are generally not measured. In many cases deals take place in land that is already protected and the value of additional biodiversity benefits may be negligible. Where measurements are produced, they are often based on extrapolation from existing scientific studies, rather than on local data. Conservation International, for instance, makes reference to work by the Smithsonian Institution Migratory Bird Centre in Chiapas, Mexico which shows that shade coffee is associated with 140 bird species, while sun farms housed only 5-6 species. ACRI stands out for its emphasis on the need for primary data collection in Latin America and Africa. It has chosen to undertake this research prior to setting up payment systems for shade cocoa. The research will extend beyond looking at impacts for biodiversity, to consider how shade cocoa impacts on soil fertility, soil erosion and pest and disease resistance (ACRI, 1999).

3.5.4 Impacts for poor people

As markets for biodiversity protection spread and are increasingly responsible for generating wealth, understanding how the poorest are impacted is critical. Apart from ethical concerns, poor communities living in or near forests are often key stakeholders in delivering forest protection. Yet, the literature is virtually silent on the issue of distribution. The explicit or implicit assumption of numerous studies reviewed in this paper is that the list of economic, social and environmental costs and benefits highlighted above will be captured by marginalised groups living in and near forests. Such an assumption, however, is potentially misleading. Not all people living around forests are poor, nor is it necessarily those adjacent to forests that benefit from payments for biodiversity services. Notwithstanding the absence of recorded evidence, in what follows observations are made on the likely opportunities and risks of markets for poor people.

The long list of economic, social and environmental benefits highlighted above suggests significant potential for poor forest stewards to gain. In addition to offering new streams of income, markets introduce forest dependent households with an opportunity to diversify their livelihood base and reduce their vulnerability to shocks. For subsistence households, the additional security brought by a diversified income base is extremely valuable.

Markets may also bring a number of longer-term gains. Increased education, training and improved health all contribute to both current welfare and build human capital which provides opportunities for the future. The strengthening of social and political capital is also key, providing poor households with new tools with which to tackle community problems and increasing their power to influence the broader policy debates. Improvements in natural assets (e.g. water, soil, air and landscapes) provide local communities with a firmer base for investing in complementary natural resource based activities, e.g. fishing, NTFP production and/or agriculture.

While the potential rewards for poor groups from market development are alluring, a number of risks should be flagged. Critically, the extent to which poor households gain access to markets or realise their positive spin-offs is not clear. As has been highlighted in the literature, setting up and participating in markets can involve heavy transaction costs. For poor families, these costs may block market access. This is particularly true since transaction costs are likely to be highest for small forest holders who lack basic organisational, forest management and marketing skills. Monitoring and certifying delivery of biodiversity management, for instance, will tend to be more expensive for a number of small plots than for larger landholdings. Where a minimum area is required to qualify for a biodiversity protection contract, additional costs are born by smallholders who must co-ordinate amongst themselves before negotiating with buyers.

The risks for poor people do not rest solely with the fact that they may be excluded from market benefits. There are also serious concerns that they may be negatively impacted. As markets for biodiversity protection raise the value of biodiversity rich forest areas, competition for control over these areas can only intensify. Poor communities living in these areas without formal title may be pressured to leave. Far from strengthening forest stewards' natural assets, markets may lead to exclusion. In such cases wealthier newcomers would capture the benefits, while the costs are born by poor people.

3.6 Constraints to biodiversity market development

This review has pointed to three categories of constraints to market development in the biodiversity sector:

- *Factors that raise transaction costs and undermine market viability*. Complex and uncertain legal and policy contexts in source countries are the main culprits, raising the risk associated with biodiversity transactions and thus transaction costs[21]. The lack of guidelines for obtaining access rights, unclear authority over biodiversity reserves, non-existent mechanisms for negotiating with local communities, lack of property rights legislation, conflicting and changing policies all introduce risks and impose costs on market participants.
- *Factors that undermine supply*. Willingness to supply is not only determined by the price offered for biodiversity commodities, but also depends on cultural factors such as whether payments for biodiversity services are an "acceptable" transaction. Even where transactions are culturally acceptable, suppliers may hesitate where they lack an understanding of deals. Furthermore, supply depends on capacity to bring the commodity to the market and abide by the terms of transactions. This capacity may be lacking in many developing countries.

21. While none of the studies reviewed measure transaction costs, there is wide appreciation of the importance of costs to market development (ten Kate and Laird, 1999; Rosenthal, 1997; Environmental Policy Studies Workshop, 1999; Perelet, 2000; Guerin-McManus *et al*, 1998).

- *Factors that undermine demand*. Technological change, the existence of substitutes and the lack of scientific evidence about biodiversity's benefits all reduce willingness to pay for biodiversity protection.

Each set of constraints is briefly described below, followed by an examination of those constraints which fall hardest on poor people.

3.6.1 Factors that raise transaction costs

Unclear biodiversity property rights

Property rights are essential to market development. Historically, property rights over biodiversity have not been delineated, and ownership has been assigned to "humankind". Consequently, genetic material has often been treated as an open access resource.

While the CBD provides some clarification, assigning governments the authority to determine national property rights over biodiversity, implementation of the CBD's principles has been slow. While 174 countries had signed up to the CBD by 1999, only 41 countries had passed, or were developing, legislation to implement its principles. Even where the CBD has been ratified, governments have been slow to define property rights systems. Furthermore, where they have, it frequently conflicts with customary laws causing confusion and insecurity.

The difficulty of defining biodiversity property rights is compounded by the existence of cheap alternatives. Not only are there vast *ex-situ* collections of genetic material (e.g. in museums, botanical gardens, plant germplasm collections, national collections) which can be accessed for free, but alternative *in-situ* sources are frequently available. Hence, where one nation attempts to regulate access, buyers will look elsewhere for supplies. Unless controls over access are co-ordinated by all suppliers, property rights will be difficult to enforce (Vogel, 1996).

Where payments schemes have evolved despite unclear property rights, transaction costs tend to be high and participation restricted. The experience of the International Cooperative Biodiversity Group in West Africa is illustrative. Buyers have tried to involve *de jure* and *de facto* owners of biodiversity through a complex array of partnerships and contracts. These agreements attempt to cover all eventualities and to placate all potential claimants on ensuing rents. Given the complex partnerships established, involving participants from the private sector, government, local communities and NGOs, it is not always straightforward defining who has contributed what. Assigning rewards is thus difficult.

Lack of clear monitoring and enforcement systems

Bioprospecting in Cameroon has been seriously hamstrung by the lack of clarity in authority. Responsibility for allowing access to biodiversity has shifted

between agencies over time. While the government took little interest in regulating biodiversity access prior to 1993, following a deal between the Centre for the Study of Medicinal Plants in Yaounde and the National Cancer Institute of the USA, it claimed authority. In 1994, however, the government distributed responsibility for monitoring and agreeing access contracts between several entities, including the Ministry of Environment and Forestry and the Ministry of Scientific and Technical Research. To circumvent this problem the International Cooperative Biodiversity Group developed benefit-sharing arrangements which involve a range of "payments" to different stakeholders at different stages of the bioprospecting process. While this approach has had limited success, it is extremely costly and would have been unfeasible with out donor support (Environmental Policy Studies Workshop, 1999).

Cameroon's case contrasts with the successes achieved by Costa Rica's INBio and the Philippines' National Integrated Protected Areas System. In both cases streamlined regulatory environment and the creation of a "one-stop shop" for bioprospectors has provided a competitive edge in the market for bioprospectors (see Box 8, Section 3.2.4).

Multi-stakeholder participation costs money

Local participation is crucial for ensuring support for biodiversity agreements, conveying commitment by purchasers and establishing trust between partners. It represents a valuable risk management tool for investors, and in countries where property rights are unclear it is essential. In these cases failure to ensure local participation raises risks that deals will become unenforceable.

For these reasons the International Cooperative Biodiversity Group projects place local participation at the heart of their transactions. In addition to seeking consent from local communities, NGOs and government agencies, foreign investors have established local offices to cement relationships. This strategy has fostered mutual understanding and permitted swift action to head off problems (Rosenthal, 1997; Moran, 1998).

But participation is costly (Landell-Mills, 1999b). This is particularly true where numerous stakeholders are involved. The higher the costs, the less attractive are deals for biodiversity protection.

Excessive and *ad hoc* controls

While government failure to introduce a straightforward regulatory system has helped undermine market development, in other instances governments are over-zealous in their efforts to control markets. Excessive regulations can stifle emerging transactions. This problem is illustrated by the Pippa Horticulture Company Ltd.'s experience in Nanjing, China. Not only have government controls on foreign investment meant the investment could only go ahead through a joint venture, but numerous restrictions over collection, exporting

and the exchange of plant reproductive materials have posed serious transaction costs on the company (ten Kate and Laird, 1999).

3.6.2 Factors that undermine biodiversity supply

Lack of capacity to deliver biodiversity services

Unless owners of biodiversity can guarantee supplies of the commodities demanded, it will be difficult for them to find buyers. The lack of government capacity to deliver conservation promises has, for example, been a major hurdle in debt-for-nature swaps transactions (Perelet, pers comm. 2000). Capacity limitations – both technical and financial – have also plagued the shade/organic coffee and cocoa sectors (Conservation International, 1999).

To overcome this problem, increasing emphasis has been placed on the role of intermediaries in sorting out supplies. In Nigeria, for instance, a key attraction of the buyers in this deal has been the existence of strong local capacity in the International Centre for Ethnomedicine and Drug Development and the National Botanical Gardens and Herbaria. The high level of drug development skills offered by Costa Rica's INBio has also given it an advantage in attracting demand. In the shade/organic coffee sector, Conservation International has offered its intermediary services to a number of private retailers and manufacturers interested in accessing organically produced inputs. For instance its flagship shade coffee programme was partly funded by Starbucks coffee, a multinational specialist coffee retailer.

Cultural resistance

In certain societies, the idea of payments for biodiversity protection is not easily accepted. This has been particularly true where payments have been associated with restricted land use rights (Gullison *et al*, 2000). Complaints have been made that the purchase of land use rights by international NGOs represents a new form of colonialism. By locking up natural resources in protected areas, NGOs are accused of undermining local development. Where the impacts of market development are inequitable, these complaints are likely to grow.

Lack of knowledge and suspicion

The importance of advertising willingness to pay for biodiversity protection services and of having prominent local "champions" to argue in favour of these deals is emphasised in the case of Tasmania's conservation covenant scheme. In this case the national government of Australia had committed A$30 million to paying for biodiversity protection in private forest lands through conservation covenants, but there was initial hesitation and some suspicions about the scheme. Following significant time spent discussing the programme and convincing prominent landowners of the government's positive intentions, the scheme has begun to take off. Since the scheme's start in 1997, 57 covenants have been approved or implemented, covering 9,989 hectares. In addition 3,266

hectares have been purchased outright due to their exceptional biodiversity values. A further 87,000 hectares are planned by December 2003.

Low prices due to anti-competitive behaviour

Whereas the evidence that the market for global biodiversity services is characterised by price fixing amongst donors and international NGOs is weak, the case is less clear in the market for bioprospecting rights (see Section 3.2.3). Where prices are held down by uncompetitive behaviour, supply will fall below its efficient level.

3.6.3 Factors that undermine demand

Substitutes for *in situ* biodiversity

Willingness to pay for access to *in situ* biodiversity in the bioprospecting sector depends on costs of alternatives, including synthetic substitutes developed through combination chemistry, genomics and bioinformatics, *ex situ* collections and *in situ* supplies in other countries (ten Kate and Laird, 1999). The majority of new raw material accessed by private pharmaceutical, plant breeding, and crop protection companies comes from in-house collections or other *ex-situ* sites since supplies from these tend to be free (see Box 2).

However, direct costs of access (e.g. fees) must be added to transaction costs (e.g. costs of negotiating entry, costs of finding local partners, risks of political instability, etc.). Where a country introduces an access fee, but also invests in creating a business-friendly environment with streamlined administration and support services, it may win business.

Technological change in the bioprospecting sector

There are varying views as to whether technological change in the pharmaceutical sector will lead to increased or reduced demand for *in situ* biodiversity protection (ten Kate and Laird, 1999). Those arguing that technological advancements have reduced, and will continue to reduce, demand for access to wild material highlight three main points:

- New approaches to product discovery and development reduce the need for new material. Advances in combinational chemistry have allowed companies to produce new synthetic compounds more quickly and cheaply for testing in high throughput screens. Because synthetic compounds structure are already known they are the preferred option as long as they produce equivalent prospects for discovering new drugs. Moreover, advances in genomics allow more thorough use of existing *ex situ* collections.
- Mass collections of samples in the 1980s means emphasis will now be on gap filling, thereby reducing total collections from the wild.
- Increasing use of existing collections – either in house or ex situ collections held by public and private institutions, e.g. botanical gardens and genebanks.

Those arguing that demand for biodiversity will increase point to:

- new tools for exploring and using genetic material. Advances in screening increase the attractiveness of natural product testing, especially random sampling. Moreover, advances in molecular biology, bioinformatics and genomics allow for the development of more "targets" for testing new compounds which may be sourced from the wild; and
- increasing consumer demand for "natural" products

Thus, while synthetic compounds are simpler and less costly to develop, they lack the diversity and novelty of new genetic material. Moreover, the development of synthetics itself depends on having new structures which come from the wild.

Arguments for and against the importance of natural products in drug development have shifted back and forth over time. In the 1990s we have seen a reduction in interest and the share of research and development budgets allocated to natural products is only a small percentage of total budgets. Nonetheless, all top ten pharmaceutical companies are engaged in natural product discovery. Over time, natural products are likely to continue to be a crucial element of drug discovery, though accounting for a small share of companies' budgets, which will be increasingly channelled towards molecular biology and genetic engineering.

Lack of scientific evidence for biodiversity benefits

While the benefits associated with biodiversity are widely acclaimed, scientific evidence is often lacking. The American Cocoa Research Institute, for instance, believes there is not currently sufficient evidence to show that biodiversity-friendly agroforestry techniques provide widely attributed pest and disease control, and soil fertility maintenance services. Without clear evidence of service supply, market development will be restricted.

Lack of supporting regulatory frameworks

Government regulation can provide a powerful driver for market development. Yet, in practice, few governments have put their weight behind the introduction of regulatory systems that would stimulate market development in the biodiversity sector.

3.6.4 Constraints fall hardest on the poor

While these constraints restrict market development throughout the world, they tend to be most significant in poor countries. Moreover, poor groups within developing countries are often hardest hit so that even where markets evolve, they are least able to access them. Those constraints that are most acutely felt by poor individuals and groups include:

- *Unclear property rights*. Problems associated with weak property rights are particularly significant in developing countries, which often lack the capacity

to implement and enforce rights even where they are established in law. Given the difficulties of enforcing property rights domestically, poor countries are likely to be the least able to co-ordinate an international system for regulating access to biodiversity. Where deals are reached in developing countries, they will tend to be agreed with suppliers that already have clearly defined rights. In most cases, this will exclude poor groups.

- *Lack of monitoring and enforcement*. Even where property rights have been assigned, they are only meaningful where they are effectively enforced. Inadequate monitoring and enforcement capacity in developing countries, especially amongst poorer groups, is a serious constraint.
- *Complex multi-stakeholder participation*. Poor people in developing countries are at a significant disadvantage with respect to costs of participation. This is because most sellers will control only small plots and deals will necessarily require high levels of participation. As buyers look for deals that minimise negotiation and contracting costs, they will seek larger landowners.
- *Low capacity for service delivery*. In general, capacity constraints are greatest amongst poor suppliers in developing countries who lack the skills and the financial resources to ensure service delivery.
- *Cultural resistance*. The extension of the biodiversity market will be most difficult in regions that have least experience with the monetary economy. Poor rural communities in developing countries are likely to be most resistant.

3.7 Summary

Commercialising the diversity of nature is not easy. Not only are the services provided by biodiversity numerous (ranging from the maintenance of ecosystem functioning through to option and existence values), but most are intangible making them difficult to package for sale. Moreover, services are rarely consumed by a clearly identifiable clientele, and threshold effects in the supply of biodiversity make portioning out the service to individual buyers difficult.

In spite of these problems, governments, international NGOs and private companies are paying for forest biodiversity. Growing public awareness of biodiversity benefits and threats of loss are the main drivers. As funds have started to flow, individual and community land stewards have become increasingly proactive sellers of their services.

The growth and diversification in market participation has produced significant innovation in the design of commodities and payment mechanisms. Expensive and complex project-based deals are giving way to intermediary-based transactions (especially trust funds), pooled investment funds, retail-based transactions and even over-the-counter sales. In their own way, each mechanism seeks to cut market risks, overcome threshold effects and minimise transaction costs. As risks and costs come down, market participation is likely to continue to rise.

Despite significant progress in recent years, for the most part payments for biodiversity services remain nascent and to a large degree experimental. Major constraints to market development remain, not least the significant transaction costs associated with setting up and implementing trades. Constraints tend to be greatest in poor communities of developing countries.

While few assessments of the impacts of these markets on local or global welfare have been undertaken, widespread perceptions of gains need to be balanced with critical evaluations of costs. Particular attention needs to be given to the distribution of benefits and costs, and repercussions for social equity. Early indications suggest a need for caution. Far from gaining from increased income, a more diversified asset base and the development of new skills, markets have the power to threaten poor communities' livelihoods through increased exclusion, lower incomes and a weaker asset base.

4. Markets for carbon offsets

Widely dismissed as far-fetched only a few years ago, today there is a strengthening scientific consensus that global warming is a real and dangerous phenomenon. Global warming results from what scientists refer to as the Greenhouse Effect, which is caused by the build up of greenhouse gases (GHGs) including carbon dioxide, methane, nitrous oxides, chlorofluorocarbons, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride, in the atmosphere. GHGs absorb heat radiated from the Earth's surface and, in the past, have been responsible for maintaining the Earth's temperature at an average 15 degrees Celsius.

Over the twentieth century the Inter-governmental Panel on Climate Change, an international group of leading climate scientists set up to advise the United Nations' Framework Convention on Climate Change (UNFCCC), estimates that a 30% increase in atmospheric GHG levels has caused world temperatures to rise 0.6 degrees Celsius. By far the largest contributor has been fossil fuel burning, which accounts for about 75% of the increase in GHG, followed by forest degradation and deforestation, accounting for an estimated 20%. The Inter-governmental Panel on Climate Change has predicted that at present rates, temperatures will increase by a further 1.4 – 5.8 degrees Celsius over the next 100 years (IPCC, 2001).

The increase in global temperatures will have uncertain implications for humans, but the Inter-governmental Panel on Climate Change posits several potential impacts including rising sea levels, more severe climatic events, coastal erosion, increased salinisation, loss of protective coral reefs, increased desertification, damaged forest ecosystems and increased disease. Poor people are particularly vulnerable to global warming. Not only are they more dependent on the weather for their livelihoods, e.g. through agriculture, but they are concentrated in tropical areas which are likely to suffer most from rising temperatures and sea levels. Moreover, they lack the financial and technical capacity to adjust to the resulting impacts. Fear of these impacts has spurred international action.

The creation of an international regulatory framework to counter global warming lies at the heart of the development of a market for carbon (the major GHG) offsets. Rooted in the establishment of the UNFCCC in 1992, market development was given a boost in 1997 with the signing of the Kyoto Protocol. The Kyoto Protocol established explicit and mandatory limits on industrialised

and transitional nations' emissions (listed in Annex B of the Protocol and Annex 1 of the UNFCCC) known as Qualified Emission Limitation and Reduction Objectives. While individual countries are given specific targets, average required emission reductions for Annex B countries come to 5.2% below 1990 levels by 2008-2012. This is equivalent to a total reduction of 456 million tonnes of carbon dioxide (tCO_2)[22].

For the Protocol to become effective at least 55 countries, representing at least 55% of 1990 carbon emissions must ratify it. Following the finalisation of the Sixth Conference of Parties (COP 6) in Bonn in July 2001, 178 countries had signed the Protocol. However, the USA's (which accounts for about 25% of global emissions) decision to withdraw from the treaty represented a significant blow. Notwithstanding the failure of the USA to come on board, it is expected that the necessary ratifications will be achieved by the end of 2002.

In addition to setting emission reduction targets, the Kyoto Protocol provides a framework for trading emission rights. The idea is simple. Because some countries will find it easier and cheaper to reduce emissions than other countries (e.g. through the introduction of energy efficient technology or carbon sequestration activities such as tree planting), the Protocol allows countries to trade emission rights to reduce overall costs of meeting the global target. For countries wishing to emit more than their limit, they must purchase additional rights from others that find it less costly to reduce their emissions. The Kyoto Protocol sets out three potential "flexibility mechanisms" that would permit emission rights trading:

- International Emission Trading mechanism that allows Annex B countries to trade emission permits, known as Assigned Amount Units (Article 17 of Protocol);
- Joint Implementation (JI) mechanism that allows countries to earn Emission Reduction Units through projects in other Annex B countries (Article 6); and
- Clean Development Mechanism (CDM) allowing for the generation of Certified Emission Reductions from projects in non-Annex B countries (i.e. developing countries that are outside the capping regime) (Article 12).

According to the Protocol, emission reductions may be achieved in one of two ways: (1) by reducing emissions; and (2) by increasing carbon sequestration and storage. The importance of forests as a source (about one-quarter of global emissions come from burning forests, land clearance, and soil erosion) and a store (forests account for two-thirds of terrestrial carbon) of carbon means they can play a key role in generating carbon offsets through four approaches:

- reforestation/ afforestation (including agroforestry) to increase carbon sequestration,
- improved forest management (e.g. reduced impact logging) both to increase sequestration and reduce emissions,

22. The reduction is far greater when compared with likely emission levels in 2008-2012. Estimates vary depending on assumptions about GHG emission increments.

• conservation and protection against deforestation to cut emissions, and
• substitution of sustainably produced biomass for fossil fuels to cut emissions.

However, as part of an effort to achieve a political settlement at COP 6 in July 2001, a number of limits were placed on the use of the flexibility mechanisms. In particular, forestry activities permitted under the CDM are restricted to afforestation and reforestation[23]. Moreover, credits from forestry and other land-based sinks will be capped at 1% of a country's base-year emissions. While forest management may be used in Annex B countries and through JI, country-specific caps have been agreed, e.g. Japan is limited to 4% of its base-year emissions (Pew Centre on Global Climate Change, July 2001). More recently at COP 7, which was held in Marrakech in November 2001, a decision was taken to restrict banking of CDM- and JI-based offsets each to 2.5% of initial emission targets[24].

While a number of decisions were taken in Bonn and Marrakech, previously the Protocol provided few details on how the "flexibility mechanisms" would be implemented. Critically, it was unclear whether a limit would be placed on forest-based offsets or how such offsets would be calculated. Despite these uncertainties, private companies, NGOs and national governments moved ahead with carbon offset transactions. This section focuses on the emergence of a market for forest-based carbon offsets prior to the "Bonn Agreement" and "Marrakech Accord", and attempts to shed light on key features of emerging market form and evolution, drivers and impacts on welfare.

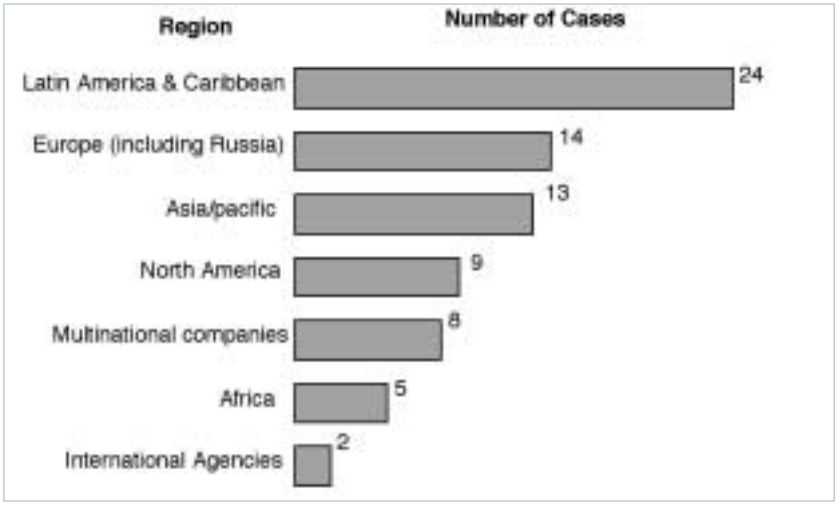
4.1 Carbon offset deals reviewed

A total of 75 payments schemes for forest-based carbon offsets are evaluated in 27 countries, including individual transactions as well as broader national, international and private sector schemes aimed at establishing standardised trading platforms. A summary list of these schemes is provided in Annex 2. Figure 11 below provides a breakdown by region. Where transactions are not easily associated with a particular nation or region, but are carried out by multinational companies or international agencies in many regions, they are categorised separately.

While 20 of the projects reviewed are registered under the Kyoto Protocol's "Activities Implemented Jointly" (AIJ) (a precursor to the adoption of CDM projects) and JI schemes, many are being undertaken independently of officially recognised schemes.

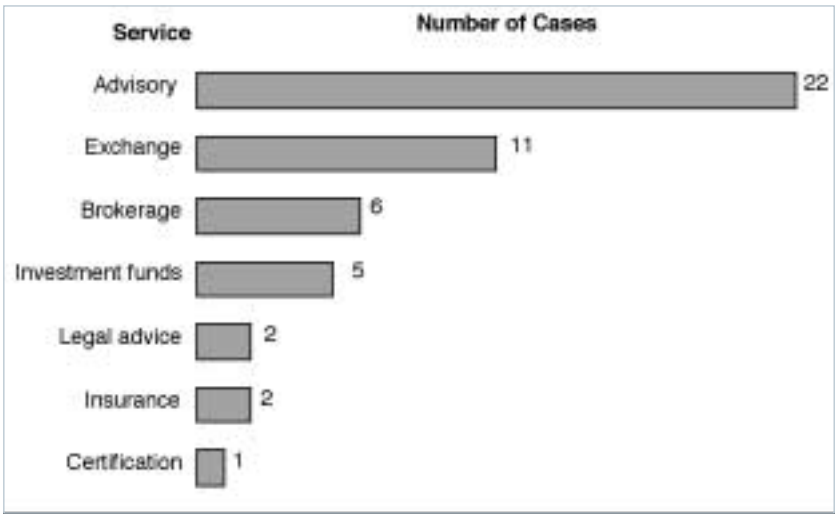
23. See Sections 4.2.1 and 4.6.1 for a discussion of concerns over forest-based carbon offsets.
24. Banking of credits refers to the saving of credits from one compliance period (initially 2008-2012) to the next.

Figure 11: Regional breakdown of carbon trading schemes reviewed



More than in other markets reviewed in this paper, the carbon market is characterised by the rapid emergence of ancillary services such as investment funds, insurance, brokers, legal and advisory services. While not purporting to be comprehensive, Annex 2 outlines those service providers examined in this review. Summary figures of service providers are given in Figure 12.

Figure 12: Ancillary service providers attached to the carbon offset market



4.2 Carbon offset market form

4.2.1 Defining carbon sequestration commodities

As already described, the market for carbon offsets is rooted in international efforts to control GHG emissions and, specifically, in the Kyoto Protocol's country-level emission reduction targets. The Protocol defines four potential carbon commodities, namely:

- Assigned Amount Units achieved through emission reductions in Annex B countries that may be sold to other Annex B countries;
- Emission Reduction Units achieved through emission reduction activities by one Annex B country in another Annex B country;
- Certified Emission Reductions achieved through emission reduction activities by Annex B countries in non-Annex B countries; and
- Removal Units generated through investment in carbon sinks in Annex B countries for use in the existing compliance period.

As a group, Assigned Amount Units, Emission Reduction Units, Certified Emission Reductions and more recently Removal Units are frequently referred to as carbon credits or carbon offsets. The first three commodities may be achieved through reducing emissions at source, or by increasing the rate at which they are absorbed from the atmosphere into carbon sinks, e.g. forests. Removal Units – which was added at COP 7 in November 2001 – are a specific category of credits that can only be generated through carbon sequestration in Annex B countries. All the credits represent carbon that is withdrawn from the atmosphere for at least 100 years, the minimum time defined by the Inter-governmental Panel on Climate Change to compensate for the radioactive forcing of a specified quantity of carbon dioxide or other GHG in the atmosphere.

However, not all carbon credits are equivalent. The Protocol places different restrictions on each. Differences are particularly significant with respect to the eligibility of forestry. For instance, while Certified Emission Reductions cannot be earned from forest management, Assigned Amount Units, Emission Reduction Units and Removal Units can. Moreover, different credits are subject to varying restrictions on their bank-ability. Whereas an unlimited amount of Assigned Amount Units can be saved for use in later commitment periods (i.e. after the first commitment period of 2008-2012), limits are placed on banking Certified Emission Reductions and Emission Reduction Units. A maximum of 2.5% of countries' initial emission targets generated through each of these credits may be banked. No banking of Removal Units is permitted.

The variation in eligibility of forest activities reflects compromises made at COP 6 and 7 to address concerns over the ability of forestry to deliver "additional" and "permanent" carbon offsets[25]. As noted in the introduction, four main forestry activities are known to sequester carbon: reforestation/afforestation, forest management, protection and sustainable biomass production. While all

25. See Section 4.6.1 for a more detailed account of concerns over additionality and permanence.

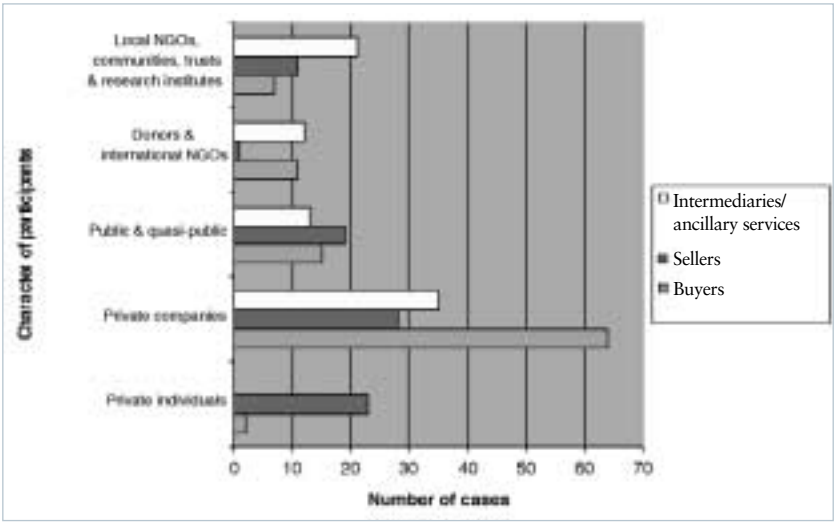
can achieve carbon offsets, practitioners distinguish between activities to reflect risks of "leakage" and future forest conversion[26]. Forest protection and management are viewed to be most risky, and have thus been subject to the greatest restrictions under the Protocol – as noted above, neither is permitted under the CDM. Limits are also placed on the volume of reforestation- and afforestation-based offsets that can be purchased under CDM and JI. For forest activities undertaken in Annex B countries, a specific class of credits – the Removal Unit – has been created which is not bankable, reflecting in part concerns of permanence.

The extent to which different credits are inter-changeable has important implications of competitiveness and attractiveness to private investment (see Section 4.2.3). Despite the restrictions on volume of trading for each commodity, and the extent to which sinks can generate credits, the decision at COP 7 that all credits will be of equal value has removed a significant area of uncertainty over fungibility.

4.2.2 Participants in the carbon offset market

Figure 13 below sets out the relative importance of different stakeholders in markets for carbon offsets. The snapshot suggests a market increasingly dominated by the private sector, with government and NGO participation being gradually sidelined. The private sector is not only the largest player in demanding and supplying carbon offsets, but it is also the most important provider of intermediary and ancillary services[27].

Figure 13: Characteristics of participants in markets for carbon offsets



26. Leakage occurs where forest-based carbon sequestration in one place, leads to forest loss and carbon release elsewhere.
27. Ancillary services included in Figure 13 refer only to those services offered as part of forest-based deals recorded in Annex 2. Ancillary service providers recorded outside of these deals are not counted.

Private corporations are the major buyers of offsets, accounting for 65% of recorded purchasers. On the supply-side, companies remain key accounting for 35% of recorded suppliers, but private individuals are also important accounting for 28%. This is not surprising since land is required for forestry activities and in many countries individuals hold land. For the same reason, governments have maintained a strong foothold as suppliers of carbon offsets.

Growing private provision of intermediary and ancillary services reflects spreading confidence that the carbon market will expand. To date, service providers have focused on selling advice to businesses trying to assess the implications and risks of evolving international and national climate change regulations. However, service providers have also begun to assist in implementing carbon management strategies. Companies are seeking support in achieving in-house carbon savings, purchasing carbon offsets, ensuring these offsets are certified, insured and comply with emerging laws.

4.2.3 Competition for carbon offsets

Assessing the degree of competition in any rapidly evolving market is difficult. Buyers and sellers of carbon offsets are moving in and out of the market quickly making it difficult to discern trends. Obtaining price information for carbon offset purchases is also not easy. Nevertheless, this review finds evidence that competition is rising, and is likely to grow further following ratification of the Kyoto Protocol.

The degree of competition depends critically on the boundaries of the market. As described in Section 4.2.1 carbon offsets may be generated as Assigned Amount Units in Annex B countries, Emission Reduction Units from JI activities, Certified Emission Reductions in non-Annex B countries and Removal Units in Annex B countries. Were a free market to be permitted with no restrictions on trading between different types of carbon offsets, those wishing to purchase carbon offsets would have a wide pool of alternatives from which to choose, and competition amongst suppliers would be more intense.

Pre-Bonn…

Prior to COP 6 and 7, trading suffered from uncertainty over the fungibility of different carbon offsets. Moreover, even within the defined categories (e.g. among Certified Emission Reductions), carbon offsets generated from different activities have been valued differently. Forest-based offsets have tended to be viewed as high-risk given uncertainty in the Kyoto Protocol about the treatment of forest sinks, which forestry activities would be acceptable, and whether this would differ between Annex B and non-Annex B countries. The result has been a segmented market for different types of carbon offsets. The greater the restrictions on trading, the smaller the pool of carbon offsets available for sale and, thus, the level of potential supply-side competition[28].

28. Several authors have estimated impacts of different sets of restrictions on the market for Carbon offsets. See for instance: Zhang (2000), Pearce *et al* (1998), Mann and Richels (1998), Vrolijk (2000).

Given the uncertain backdrop leading up to COP 6, the level of competition in the market for forest-based competition has been muted. Demand has been limited by a lack of imperative and high levels of risks associated with whether forest offsets will be accepted. Supply has been limited by the likely eligibility restrictions limiting forestry activities and areas. Deals that have been struck have been dominated by one-off, individually negotiated projects in developed and developing countries. These have often been attached to larger donor or international NGO supported efforts, as in Belize's Rio Bravo Conservation Project or Burkina Faso's Sustainable Energy Project. For the most part, companies that have been involved, have not sought least cost carbon offsets, but have aimed to gain experience, insure against public criticism and hedge future carbon liabilities. Equally, suppliers of carbon offsets have not sought to push up prices, since the prospect of attracting competing offers have been slim.

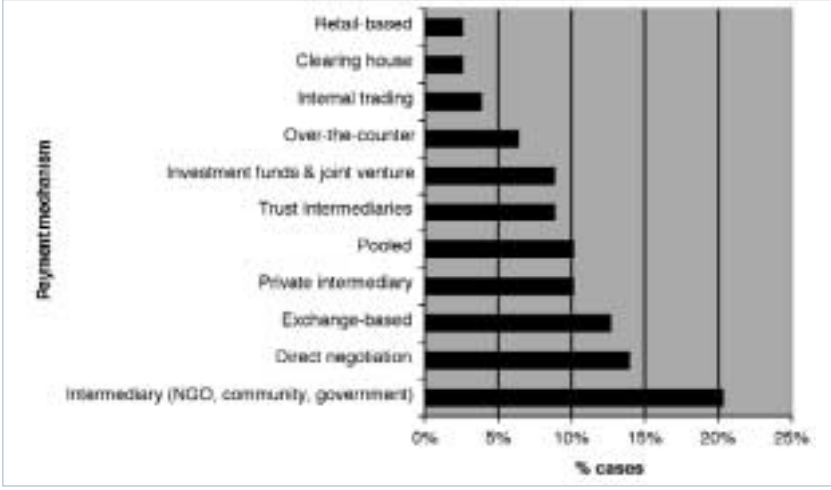
Post Bonn…

Following COP 6 and 7 the market for carbon offsets has shifted into a higher gear and prospects for increased competition brightened. Apart from the finalisation of details surrounding commodity tradability, the emergence of specialised intermediaries, pooling mechanisms and central trading platforms (see Section 4.2.4 on payment mechanisms) has increased competition. These more sophisticated payment mechanisms have stimulated a virtuous cycle of falling transaction costs, increased participation, greater competition and incentives for improved payment mechanisms.

4.2.4 High volume trading set to eclipse *ad hoc* deals

As the market for carbon offsets has matured, there has been a shift from a series of *ad hoc* deals towards the establishment of trading systems that aim to provide a basis for numerous transactions. Figure 14 below provides an overview of payment mechanisms identified in this review.

Figure 14: Payments mechanisms used in transactions for carbon offsets



For the most part one-off trades are channelled through intermediaries, including NGOs, trust funds, private brokers, community-based organisations and government entities. NGOs account for over 40% of the 30 recorded intermediary-based cases. However, private brokers appear to be gaining business in mediating transactions, used for over 20% of the recorded transactions. This picture fits with evidence of a growing private broker sector highlighted in Section 4.2.2.

The most notable development in the carbon offset market has been the shift from individual deals to trading systems that aim to provide a basis for regular and high volume trading. A number of trading systems are emerging, ranging from more sophisticated exchanges to simpler over-the-counter and investment fund mechanisms.

The emergence of exchanges offering trading and clearing functions for carbon offsets is the most visible sign of the growing sophistication of this market. By bringing buyers and sellers together in a central trading platform, exchanges offer a transparent system for price discovery. In addition, by supplying associated services, e.g. insurance, due diligence and strategic planning, exchanges minimise transaction costs associated with searching for trading partners, completing trades and risk management.

Most carbon exchanges are in early stages of establishment and are often emerging alongside government regulatory systems. In the UK, Canada and Europe exchanges are being promoted by governments to minimise costs of implementing planned GHG emissions limits. In other instances, existing exchanges and brokers are setting up carbon platforms so they can gain business once national emission requirements are put in place. This was the strategy of the Sydney Future Exchange in 1998 when it launched its efforts to be the first international exchange to offer carbon trading facilities. The Sydney Futures Exchange's plans, which were reversed in September 2000, are described in Box 11 below. Early action also offers exchanges opportunities to influence national and international legislation. The recently launched Chicago Climate Exchange initiative aims to develop a trading system that is compatible with emerging international rules under Kyoto and that provides a basis for advising the USA government on the development of its own regulations.

Box 11: The Sydney Futures Exchange's flirtation with exchanging carbon offsets

While a number of exchanges are now planning some form of carbon offset trading platform, when the Sydney Futures Exchange first announced its plans for a carbon market in 1999 it was a pioneer. By being ahead of what looked like an inevitable flood of initiatives to cater for a growing carbon offset market, the Sydney Futures Exchange wanted to position itself as the market leader. However, it changed tack in September 2000, abandoning its plans just before the exchange was due to go live. Nonetheless, it is worth highlighting some of the key features of the planned service.

The Sydney Futures Exchange intended to establish an electronic exchange where transactions would occur initially through Sydney, and later also through its subsidiary the New Zealand Futures and Options Exchange. Supply of carbon credits (denominated in terms of metric tCO_2 equivalent) would be channelled through a central carbon pool. These credits would be Kyoto-consistent and independently verified. The verified certificate would then be lodged with the Sydney Futures Exchange registry. Once registered, the carbon credits would be sold electronically. Payments for credits would be made to the Sydney Futures Exchange Clearing-house, which in turn would pass funds on to suppliers.

One of the most complex tasks was developing a standardised, Kyoto-consistent carbon credit. To achieve this goal, the Sydney Futures Exchange aimed to start with a limited category of supply that was in an Annex B country and more easily verified. An agreement was reached with State Forests New South Wales in Australia to supply forest-based carbon offsets generated by tree planting in cleared lands, either for commercial forestry or as environmental plantings. With respect to commercial forestry, it is estimated that over a 30 year growing cycle between 550-1,100 tC/hectare would be sequestered. Based on experience with carbon sequestration credits from Australia, the Sydney Futures Exchange's objective was to offer a trading platform for global carbon credits.

State Forests developed its own system of contracting farmers who would commit to planting and maintaining plantations. Carbon sequestration would be calculated according to a standard carbon accounting procedure being developed jointly by State Forests and the Sydney Futures Exchange. Suppliers would be responsible for guaranteeing continued supply (in perpetuity) and any change in land ownership would require the transfer of the carbon obligations.

Based on this supply, the Sydney Futures Exchange aimed to offer three main commodities, including:

- options for the purchase of carbon dioxide sequestration 2008-2012 at a price agreed today;
- the outright purchase or sale of carbon dioxide sequestered in 2008-2012; and
- the purchase or sale of carbon credits before 2008 for use outside of Kyoto, e.g. for meeting national commitments.

The market was to be a periodic call (auction) market initially, and transformed into a continual market as liquidity increased. By offering clearing-house services, the Sydney Futures Exchange would have ensured sellers were paid for their carbon credits and that buyers received the credits, thereby eliminating counter-party default risk. In addition, the market aimed to lower transaction costs for buyers associated with searching for trades. Other identified benefits for buyers included: the opportunity to manage future liabilities by purchasing forward contracts, price discovery and easy access.

Source: Sydney Futures Exchange (2000); Beil pers. comm. (2000); Beck (February 2000)

Investment funds, such as the World Bank's Prototype Carbon Fund, represent another innovative payment mechanism. Set up as intermediaries, investment funds offer an advanced pooling mechanism allowing numerous investors to

hold stakes in a number of carbon offset deals. Because investment funds involve a greater number of investors, they also permit high levels of risk spreading and allow investors to move in and out of carbon offset projects when they wish.

Over-the-counter trading has become more common with the spread of standardised carbon offsets. In Denmark, the Netherlands, Australia and Costa Rica, over-the-counter systems are being, or have been, developed as precursors to introducing more sophisticated exchange based systems. Costa Rica's system is most advanced having been introduced in 1996 as part of its clearing-house trading system managed by its Office for Joint Implementation in San Jose. In the USA, the Montana Offset Coalition offers an interesting example of a not-for-profit agency setting up its own clearing-house trading mechanism to sell land-based carbon credits from Montana.

Three large multinational energy companies (BP Amoco, Shell, and Suncor Energy) have set up, or are in the process of setting up, their own internal trading systems that aim to achieve a degree of internal price discovery to provide management with improved information on their business units' marginal abatement costs. This is important for companies in devising trading strategies as it enables them to set their maximum willingness to pay for external offsets. In addition, because internal trading schemes are designed to be consistent with Kyoto requirements, they offer lessons for emission trading at both the national and international levels. British Petroleum, now BP Amoco, was the first to launch an internal trading scheme and its experience is outlined in Box 12.

Box 12: BP Amoco pioneers carbon credit trading

British Petroleum piloted an internal carbon dioxide trading scheme in September 1998. The trading scheme, which is a cap and trade scheme, was set up to help the company achieve its target of a 10% reduction in GHG emissions from 1990 levels by 2010. Following its merger with Amoco of the USA in early 1999, it expanded the scheme to all of its 150 business units, thereby raising its targeted emission reductions to 30 million tCO_2. More recently, the scope of trading has been broadened further to include methane allowances (1 tonne of methane is equivalent to 21 tCO_2), and to allow for carbon credit trading where credits are generated by carbon offsets outside the group. Forestry carbon offset schemes are eligible for crediting. Following the completion of the pilot in December 2000, the trading scheme was continued on a permanent basis.

Trading is driven by the allocation of a fixed number of carbon dioxide emission "allowances", with each allowance equivalent to 1 metric tCO_2, to individual business units. Where business units exceed their cap they must purchase additional allowances to offset their excess emissions. Where business units under-emit, they may sell allowances. Business units may also choose to invest in carbon offsets outside their own units in order to sell on the internal trading scheme.

Initially the cap was set at 1998 emission levels and is being gradually reduced to the

final target for 2010. To ensure the 2010 target is met a limit of 5% of initial allowances can be banked for use in later years. In addition, to prevent business units avoiding all emission reduction through the purchase of carbon credits, a limit is placed on the share of emission reductions that can be achieved through credits.

Prices for carbon equivalent allowances are determined through open bidding on BP Amoco's intranet. All trades must go through a central broker, located in Oil Trading International. The broker registers all trades, ensures specific measurement and reporting standards are adhered to, and enforces a penalty system for exceeding permitted cap. All allowances have serial numbers to identify their year, originating business unit and country. Independent verification is required.

The pilot scheme held between September 1998 and December 2000 generated prices of between US$17-20/$tCO_2$ (US$63-70/tC). In 2000, 2.7 million tCO_2 were traded at a significantly lower average price of US$7.60/$tCO_2$, reflecting the broader participation in trading. The company is currently exploring options for futures market to allow business units to plan future allowance purchases and hopes to encourage greater use of external crediting through JI and CDM type projects. To date BP Amoco is involved in just three forest-based offset schemes, including one in Australia by its Kwinana Refinery, one in Bolivia as part of a larger Noel Kempff Climate Action Project supported by The Nature Conservancy and one recently initiated in Scotland.

Source: Grice (October 1999); BP Amoco (2001); PWC (2001)

Photo: Jon Hornbuckle

The Noel Kempff Climate Action Project involved a financial transfer of US$9.6 million from private energy companies, The Nature Conservancy and the local conservation group Fundacion Amigos de la Naturaleza in exchange for carbon credits (14 million metric tC over 30 years) earned through the conservation of 634,286 hectares of forest from logging.

Compared with the market for biodiversity conservation, retail-based sales of carbon offsets have been under-exploited. Two initiatives have been touched on in this review, Greenergy and Climate Care Warranties, both of which are in the UK. Climate Care Warranties represents a flexible retail-based market, offering retailers in an unlimited number of sectors the opportunity to sell "carbon-friendly" products. Greenergy focuses exclusively on the retail electricity market. A more detailed description of Climate Care Warranties is provided in Box 13.

Box 13: Capturing demand for climate regulation through Climate Care Warranties

Climate Care, previously known as the Carbon Storage Trust, was launched in the UK in 1999 to meet public demand for climate change mitigation by offering consumers an option to purchase carbon offsets to counter their daily carbon emissions. Carbon offsets are marketed as Climate Care Warranties attached to particular consumer goods, e.g. cars, airline tickets, or petrol. Climate Care Warranties may be marketed as an optional extra, or integrated into the product. In 2000, prices for Climate Care Warranties ranged from UK£0.014/litre of petrol, £0.0012/kilowatt hour of gas, or £0.0024/ kilowatt hour of electricity (excluding VAT). Retailers that currently sell Climate Care Warranties include: Quest Environment Development Limited, Heuga Carpet Tiles, Amerada, the BioRegional Charcoal Company Ltd. and Discovery Initiatives Ltd.

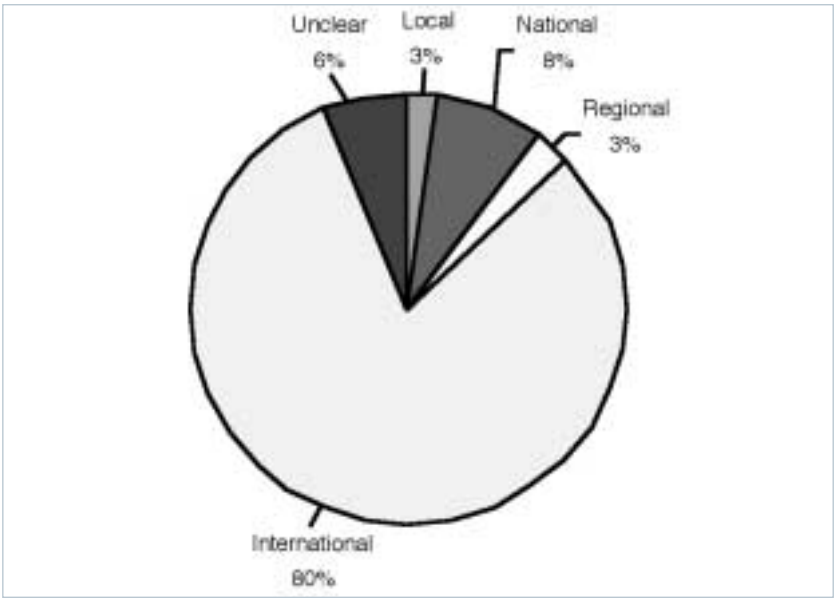
The key attraction to consumers of Climate Care Warranties is that they are simple to understand and, because they are produced and certified independently, they offer a credible source of offsets. From the retailer's perspective, Climate Care Warranties offer simple, low cost carbon offsets and boosts company's green credentials. Moreover, carbon offsets are guaranteed by Climate Care, eliminating any risks.

Climate Care is a UK based group that offers consumers an option to purchase carbon offsets to counter their daily carbon emissions. These warranties are attached to particular consumer goods, such as cars, airline tickets, or petrol. Logo from Climate Care

Carbon offsets are supplied from carbon sequestration and renewable energy projects around the world. While forestry offsets are intended to account for only a small share of investments in the longer-term (10-20%), in 2000 forestry schemes in developing countries accounted for all offsets. By September 1999, Climate Care had offset 4,335 tCO_2 through two investments in Uganda. The most important investment is in a FACE Foundation project on Mount Elgon. Project management and implementation is contracted out to NGOs, the government or donors.

Source: The Carbon Storage Trust (1999); Climate Care (2000); Climate Care (2000b)

Figure 15: Geographical extent of trading in carbon offset markets



4.2.5 Geographical extent of carbon offset trading

Eighty per cent of carbon offset transactions recorded in this review are between participants from different countries (see Figure 15 above). However, international trades that have occurred to date represent a small proportion of the estimated total potential. Schwartze (1999) found that by 1998 the "best guess" value of AIJ projects (forestry and non-forestry) listed on the UNFCCC's website undertaken between 1995-1999, plus seven Japanese projects, came to a total $640 million and 170 million tCO_2. Trexler *et al* (1999) posit that forestry projects (including both AIJ and non-AIJ) may be valued at between US$50 and $130 million. These figures pale in comparison to estimates by the Royal Institute of International Affairs that the potential market for CDM offsets alone could rise to 375 million tC (50% of total required reductions), worth US$10 billion per year, with forestry projects representing the largest contingent.

Prior to the conclusion of COP 7, uncertainties in the Kyoto Protocol relating to property rights, legal liability and eligible activities limited the expansion of international trading (see Section 4.6 on constraints). National governments have moved forward cautiously, concentrating on the promotion of local trading systems. This is true of emerging Danish, UK, Canadian (GHG Emission Reduction Trading scheme, Pilot Emission Reduction Trading scheme and the Thousand (K) Emission Free Index exchange) and USA schemes. The European Union is also planning a regional trading scheme for 2005. Yet, despite their focus on domestic/regional trading, most highlight the intention to broaden their scope when international rules become clearer. The Bonn Agreement in July 2001 and subsequent conclusion of COP 7 should lay the ground for international trading.

As soon as local rules are modified to permit international offsets, potential gains from trading under the CDM or JI programmes are likely to be exploited quickly. Already, the prospect for international trading has stimulated investment by private and public intermediaries and suppliers in improving their systems for bringing CDM and JI offsets to market at competitive rates. State Forest New South Wales of Australia, the Office for Joint Implementation in Costa Rica, Climate Care Warranties in the UK and the World Bank's Prototype Carbon Fund already sell offsets internationally.

A number of other private entities are beefing up their international trading arms with the intention of gaining first mover advantages when the market takes off. The Chicago Climate Exchange, for instance, aims to permit carbon offsets from Brazil when trading is launched in 2002 and to extend trading to other developing countries in the near future. The CDM Alliance was started by Arthur Anderson, Credit Lyonnais, DNV, JLT Risk Solutions and SGS in 2000 to develop a market in CDM offsets. In parallel, Arthur Anderson and Credit Lyonnais have teamed up with Natsource LLC to offer an international trading platform for clients that wish to exchange different forms of carbon credits, i.e. Assigned Amount Units, Emission Reduction Units and Certified Emission Reductions[29].

On the demand-side initiative, the Netherlands' decision to launch its Emission Reduction Unit Permit Tender scheme for CDM and JI projects in April 2001 (even before agreement on the Kyoto Protocol was reached in Bonn) may foreshadow more proactive efforts by buyers to take advantage of international competition. The initial tender for 4 million tCO_2 equivalent offsets, has been followed with an announcement of two more tenders of 3 million and 10 million tCO_2 equivalent from November. While forest-based offsets are not currently eligible under these tenders, it is expected that land-based sinks will be permitted once the Kyoto rules are clarified.

4.2.6 Markets for carbon credits are maturing quickly

In Section 4.2.1 the following checklist was put forward to help guide assessments of market maturity: the time since trades first took place; the degree of price discovery; the level of participation by potential buyers and sellers; and the sophistication of the payment mechanism. Where markets are segmented, as in the case of biodiversity conservation, each market may be at a different stage of development. As described in Section 4.2.5, in the carbon market there are also a number of markets emerging at the international and local levels. While participation is growing rapidly, to date trading has tended to be experimental, aimed at providing lessons for the future or improving investors' public image.

The experimental nature of trading makes interpretation of price information – where it is available – difficult. Pearce and Bello (1998) emphasised this point in their review of USIJI and FACE Foundation AIJ projects. In their study, they found a wide range in implicit prices paid per unit carbon offset (from US$2-3/tC – $400/tC) indicating an extremely thin market and low levels of price

29. The platform is likely to be modified to accommodate newly created Removal Units defined at COP 7.

The FACE (Forest Absorbing Carbon Emissions) Foundation, an NGO established by The Dutch Electricity Generating Board in 1990, carries out forest projects for governments, companies, organisations, and private individuals. Their forests are certified by the Forest Stewardship Council and all carbon emissions are verified. FACE supports projects in the Netherlands, Central Europe, Africa, Latin America and Asia.

Photo: Climate Care

discovery. Both features point to an immature carbon market. However, this is changing as international obligations under the Kyoto Protocol are translated into national trading schemes for carbon offsets. National carbon credit schemes (e.g. in the UK, and Denmark) have already kick-started the development of more sophisticated payment mechanisms and greater price discovery. Rather than continuing to rely on individual offset deals negotiated at length and with little information about alternative options, governments and industry together are investing in the establishment of more efficient payment systems that allow companies to seek out the cheapest emission reduction strategy. As highlighted in Section 4.2.4, the most advanced option being developed is the exchange.

4.2.7 Carbon markets depend on regulation and cooperation

Payments for carbon offsets are closely intertwined with supporting cooperative and hierarchical arrangements. At the highest level, markets for carbon offsets are rooted in the cooperative agreement between nations to cut back GHG emissions i.e. the Kyoto Protocol. Market boundaries and structures are defined by this overarching agreement. Even for companies that have sought to embed markets in their hierarchical structures (e.g. Shell and BP Amoco), markets are designed to fit with Kyoto requirements.

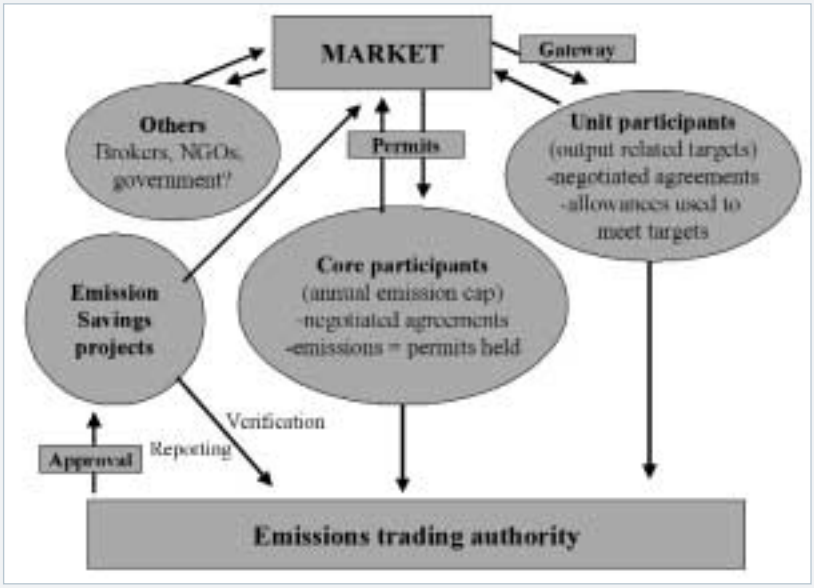
It is also clear that market success depends on support from a range of local hierarchical and cooperative institutions. The establishment of national offices for AIJ and JI, regulatory agencies, trust funds to channel funds for individual deals, trading platforms such as exchanges, and ancillary service providers such as brokers, certifiers and insurers all contribute to market infrastructure. Cooperation between private and non-governmental entities has been critical in spreading risks and transaction costs associated with market development. Example of market supporting alliances include: The Partnership for Climate Action led by seven major carbon emitters, JOINT a consortium of Western European companies exploring JI projects in Central and Eastern Europe, and "Start-up CDM in ACP Countries" launched in May 2000 by a consortium of European and African organisations to promote CDM projects in Africa, the Caribbean and the Pacific.

Box 14: Embedding emission trading in local politics – the UK experience

In 1997, the UK signed up to the Kyoto Protocol and a commitment to reduce GHG emissions by 12.5% below 1990 levels by 2008-2012. More recently, the government announced that it intends to achieve an even stricter target of a 21.5% reduction, irrespective of the ratification of the Protocol.

To help the government think through alternative approaches for achieving its objectives, the Confederation of British Industry and the Advisory Committee on Business and the Environment set up an Emission Trading Group. The Group, comprising 30 companies and institutions, published its proposals for a UK emission trading scheme on October 1999. Despite efforts to ensure the scheme is as simple as possible, existing legal and political commitments have resulted in a complex trading system. Key challenges have involved integrating trading with a planned Climate Change Levy and schemes in the energy sector aimed at protecting a declining coal industry. Trading will be initiated in April 2002.

Figure 14-1: Proposed UK trading Scheme



Source: Varilek and Marenzi (2001)

The trading system is a voluntary cap and trade system that seeks to reduce GHG emissions by 2 million tCO_2 by 2008 (1% of emissions). The scheme (which is depicted pictorially in Figure 14-1) involves two categories of participants:

- "core" participants that agree to binding absolute emission caps; and
- "unit" participants that already participate in the government's Climate Change Levy scheme that sets energy efficiency targets (i.e. energy consumption per unit output).

Because these targets differ, trading between core and unit participants must go through a "gateway" which limits the allowances (each worth 1 tCO_2 equivalent) that unit participants can sell to core participants to maintain the overall target. An exchange rate is also used to convert unit participants' energy consumption into emissions. Allowances will have unique serial number with information attached on year of issue, origin and compliance period for which it has been issued. Banking of credits is permitted until 2007, but limits may be imposed from 2008. Trading will be monitored and rules enforced by an Emission Trading Authority. All six GHGs are included and credits are awarded for past reductions. Measurement, accounting and verification standards for carbon credits are set out in a GHG Protocol. Entities will not receive allowances unless existing emissions are verified. A central Registry must record all trades.

Although the UK system is voluntary, the government is providing attractive incentives for participants. Over the first five years, the government has set aside £30 million (US$45 million) per year. Incentives will be awarded through tenders where participants offer emission reductions for payments. Only those emitters that bid for incentives and adopt legally binding emission targets can participate in trading. In addition to the initial payment by the government for adopting a target, participants may then sell their permits to other emitters.

Source: Cooper (October 1999); Varilek and Marenzi (June 2001); DETR (2001)

The importance of local context means that local trading systems are not identical. This is not only because local hierarchies and cooperative systems differ, but is also due to variations in power relations, politics and history. In the UK, for instance, long-standing government commitments to protect a weak coal industry have meant electricity generators will be exempt from the "cap and trade" scheme for at least five years. To deal with this, the UK trading scheme adopts a complex "gateway" system. This scheme is briefly outlined in Box 14.

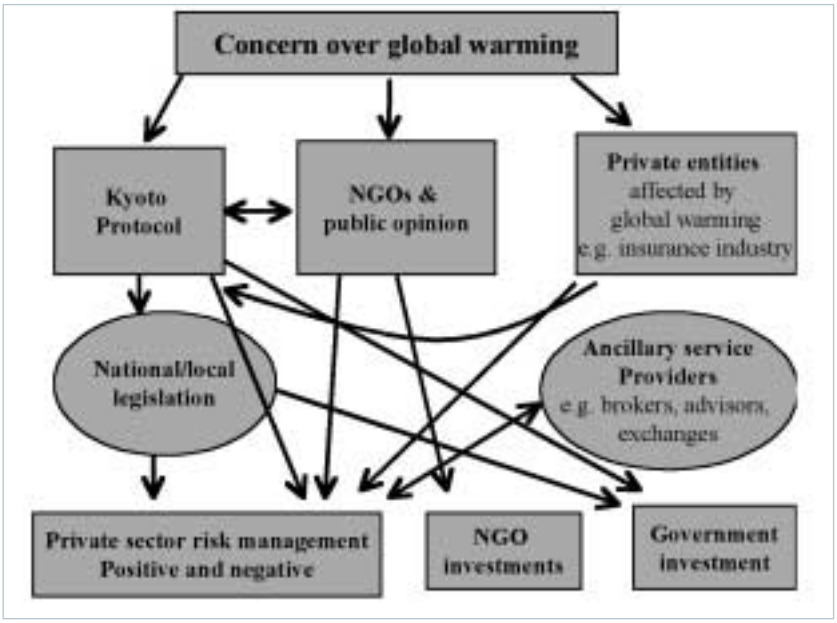
4.3 Drivers for carbon offset markets

The single most important driver for emerging markets for carbon offsets is growing international concern over global warming. However, for many deals more immediate stimulants may be identified, including local requirements for emission reductions, environmental NGO pressure, and insurance company pressure. These factors have increased demand for carbon offsets. Suppliers, e.g. forestry producers, have been slower to respond. Based on those reviewed twice as many deals agreed were driven by buyers as suppliers. Figure 16 draws on the cases reviewed to identify some of the complex web of drivers for market development.

Four main drivers may be identified:

- *Legislative and policy drivers*. At the international level the Kyoto Protocol is the main driver, committing individual nation states to GHG emission targets for 2008-2012, and introducing the prospect of trading to help countries meet

Figure 16: Identifying key drivers for carbon offset markets



targets at least cost. These commitments are being given teeth through the passing of national requirements for emission reductions and the allocation of responsibilities to emitters. Some entities that will be damaged by carbon emission restrictions, e.g. energy and electricity companies, have responded directly to the Kyoto Protocol by curtailing GHG emissions and undertaking JI and AIJ offset projects. Others that have a chance of benefiting from a carbon offset market have sought to promote market development. Australian companies stand out for their proactive approach to finding buyers and a number of deals negotiated to date are outlined in Box 15.

- *NGOs and public opinion.* Companies are increasingly sensitive to public opinion and the risk that negative publicity relating to their environmental credentials will damage their markets. Company wariness is linked to the growing influence of environmental NGOs and their media campaigns. To insure against negative opinion, more and more companies are taking early action to reduce their GHG emissions, irrespective of whether the Kyoto Protocol or national legislation comes into force. At the same time, companies are capitalising on emerging market opportunities by introducing new climate-friendly products, e.g. Greenergy in the UK.
- *Insurance industry pressures*. Certain businesses are directly affected by global warming. The insurance industry, in particular, is threatened by increased natural disasters. Munich Re finds that annual economic losses from natural catastrophes world-wide have risen eight times in the last decade, and insured losses have increased fifteen times. According to some predictions, insurance premiums would have to increase from US$30 billion to $50 billion (at today's prices) to cover annual losses from natural disasters. Given the

financial clout (US$1.4 trillion) of the insurance sector, it represents a critical driver, both as shareholders and as insurers, for forcing private companies to take action. Apart from efforts by individual insurers such as Aon Environmental Solutions and Swiss Re, however, the industry has yet to take decisive action. The United Nation's Environmental Programme's Insurance Industry Initiative, set up in 1997, offers a potential forum for the industry to join forces to think strategically how it might effect change (Dunstan, 2000).

- *Ancillary service providers*. In addition to insurers, pressures from other private sector service providers is rising as they identify increased risks and new opportunities for their clients. The financial sector, for instance, has a clear interest in minimising risks to its investments in carbon-emitting companies by pushing for early action. Likewise, service providers that have invested heavily in positioning themselves to reap rewards from carbon business have an interest in ensuring clients materialise. Natsource LLC, a service provider in the USA, estimates that the carbon trading market will be worth US$60 billion a year in the USA alone, and may reach $1 trillion per year if international trading is permitted (The Economist, October 1999). One example of how service providers are putting pressure on their clients is given by Innovest Strategic Value Advisors' recent effort to offer financial institutions an information database on a range of companies' exposure to carbon liabilities, e.g. future carbon taxes. As investors gain more information on carbon performance they will put pressure on companies to minimise related liabilities. These companies in turn may benefit from hiring Innovest to advise them on how to minimise these risks.

Box 15: Australia's forest-based carbon offsets: a successful international marketing campaign

While Australia's federal government continues to explore options for a national GHG emission trading scheme, state agencies and private forest owners have led the way in trading forest-based carbon offsets internationally. A number of deals have already been secured. These are briefly outlined below.

State Forests New South Wales

Faced with declining profits from timber, increasing environmental controls and pressures to provide more amenity services to the general public, State Forests New South Wales has been at the forefront of efforts to market its forests' carbon. Its strategy has been to capitalise on large-scale GHG emitters' interest in hedging future carbon risks by offering immediate sales of, as well as future options to purchase, certified and guaranteed carbon offsets. To make deals more attractive, State Forests offers buyers returns from timber sales from the plantations. To balance the returns to forests and carbon sequestration, forests are gradually built up so they incorporate several age classes. State Forests' only condition is that investors buy at least 1,000 hectares, ensuring transaction costs are covered. To date three trades have been completed:

- In 1998 Pacific Power purchased 250,000 tCO_2 over 10 years from 1,000 hectares of eucalyptus plantations. In 2000 Pacific Power purchased an additional 4,500 tCO_2;
- Delta Energy for CO_2 offsets from 41 hectare pine plantation; and
- Tokyo Electric Power Company invested in afforesting 40,000 hectares over a 10

year period, starting with 1,000 hectares in 2000. The area is expected to sequester 200,000 tC per year.

While all deals have been negotiated directly, State Forests is seeking to streamline the process by using specialised brokers and exchange-based trading. Exchange-based trading possibilities had been drawn up with the Sydney Futures Exchange, but were dropped in September 2000 (see Box 11). Work is ongoing on an alternative.

Queensland's Natural Resource Department
In 1998, a North American – Australian petroleum consortium, including Suncor Energy Inc., Southern Pacific Petroleum, and Central Pacific Minerals, announced plans to invest $3.5 million over 4 years in planting more than 180,000 native eucalyptus trees in four marginal plantation locations covering over 150 hectares. The trees are being planted in cleared lands to ensure they meet Kyoto requirements for "additionality" (see description of Kyoto requirements in Section 4.6.1). The deal is being implemented through Queensland's Natural Resource Department.

Victoria
In 1998, Toyota Motor Corporation, Mitsui and Co. Ltd., and Nippon Paper Industries Co. Ltd entered a joint venture to establish pulp plantations in Victoria. The three investors set up a new company, Australian Afforestation Pty. Ltd., which would be responsible for planting and managing a total of 5,000 hectares of eucalyptus forests. Toyota is the main investor, accounting for 90% of the A$250,000 (about US$126,000) investment. While the wood is sold to Nippon Paper Industries for its pulp mill, Toyota keeps the carbon credits. The three partners share profits from the pulp business. By embedding its carbon purchase in a broader investment, Toyota minimises risks associated with investing in carbon offsets.

Western Australia
In 1998 Western Australia together with local private companies, established a not-for-profit agency called EcoCarbon to develop options for selling carbon offsets. BP Amoco made the first investment, planting 500,000 maritime pine and local native tree species. The project was managed through the Conservation and Land Management Department, which contracted farmers in salt-affected areas to undertake plantings. British Petroleum receives a share of timber and all carbon credits. Estimated sequestration came to about 20 tCO_2/hectare/year.

Australian Plantation Timber
In June 2001 Cosmo, Japan's third largest oil refiner, purchased US$500,000 worth of carbon credits from 10% of Australian Plantation Timber's tree crop, covering 5,092 hectares. Cosmo also bought options on future credits worth $18 million if exercised within the next 11 years. The deal was negotiated and structured by IBJ Australia Bank Ltd., part of the global Mizuho Financial Group. Jaakkopyry, Scandinavian forest consultants, offers measurement and certification services.

Bush for Greenhouse
In 2000, Australia launched a "Bush for Greenhouse" campaign to continue to encourage industry to enter into deals with private landowners. Deals are channelled through a central broker, which involves a consortium of Ernst and Young,

Greening Australia and Landcare Australia. The broker is responsible for securing investment and channelling funds to revegetation projects that maintain a desired carbon pool. Carbon offsets will be recognised by the Australian Greenhouse Office and designed to be consistent with Kyoto and other international legislation. Edison Mission Energy has already contributed A$1 million (US$506,000) for a 5 year Landcare programme.

Source: Beck (2000); Australian Greenhouse Office (2000); Goodman (2000); State Forests New South Wales (2000); Holloway (2001); Suncor (Oct. 1998); PWC (2001)

Pressures on companies to take action to reduce emissions are numerous. Yet, early uncertainties in the Kyoto Protocol as to the extent and coverage of trading have meant that countries have shied away from recognising forest-based carbon offsets. Moral objections to trading as a mechanism to pass on responsibilities for global warming to poorer countries have meant that in some countries, mostly in Europe and the developing world, international trading is fiercely resisted. Despite these uncertainties, two factors that have maintained interest amongst investors in forest-based carbon offsets stand out:

1) *Potential economic gains*. Cost-savings and the wide range of investment opportunities are attractive. Drawing on evidence from the AIJ pilot phase, forest-based carbon offsets in developing countries are often the cheapest option. Work by Brown *et al* (1997) and Dixon *et al* (1993) indicate a range of US$1/tC for curtailing deforestation to $5/tC for establishing plantations on degraded land. While these figures need to be used with caution since they are based on a variety of measurement techniques, often exclude transaction costs and were undertaken at an early stage in market development, they suggest significant savings when compared to alternatives. Costs of non-forestry options range from $400/tC under the CDM, to $20/tC in the USA (Totten, 1999; Pearce and Bello, 1998). Moreover, opportunities for realising these savings are significant. Textler and Haugen (1995) calculate a total 21.6 million to 46.5 million tonnes of carbon credits could be earned from forests in 52 tropical countries.
2) *Public relations benefits*. Public image benefits from forestry tend to be more valuable than for other carbon offset projects because they are associated with positive spin-offs for other environmental services, e.g. biodiversity protection, landscape beauty and watershed services. Indeed, several of the forest-based carbon offset projects to date explicitly highlight these side-benefits to generate favourable publicity, e.g. The Rio Bravo Conservation project in Belize and the Noel Kempff Climate Action project in Bolivia.

4.4 Carbon market evolution

The emergence of a carbon offset market has not been a linear process. Nor has it proceeded at the same rate all over the world. Most advances have been made in Annex B countries that have legislated to set GHG emission caps and amongst large emitters exposed to liabilities associated with Kyoto. Yet there is currently little detailed guidance on how to develop an effective carbon market.

Drawing on experiences from front runners, as well as brokers actively involved in designing and implementing local payments systems (e.g. Sandor of Environmental Financial Products LLC and Stuart Beil of the Sydney Futures Exchange[30]), it is possible to identify broad steps in a process of market development. These are described below.

Define the commodity

As with any market, it is critical to define the product being traded. Key steps include setting out how the commodity is measured, and any restrictions on supply. In the case of carbon offsets, until COP 6 the lack of clarity in the Kyoto Protocol over what counted as a carbon offset made it difficult for market-makers to define acceptable commodities. According to Kyoto, offsets must be "additional" to what would have happened under a business as usual scenario and they must be "permanent". The problems of ensuring additionality and permanence for forestry offsets are discussed in Section 4.6. Prior to the finalisation of COP 6 in July 2001, there was also uncertainty as to whether there would be restrictions on the origin of offsets, e.g. whether they come from Annex B countries or not, and activities that generate offsets, e.g. forest management or reforestation. The vagaries in the Kyoto Protocol have tended to be overcome by making "best-guesses". Recent clarifications made at COP 6 and 7 will provide a critical boost to the market.

Set emission targets and allocate permits

Demand for carbon offsets is created when national emission targets are transformed into mandatory obligations for individual emitters. These obligations have tended to be allocated to emitters either based on past emission performance, through auctions or some hybrid system.

Establish a trading framework with oversight

With emission permits allocated, it is critical to set up a platform for trading and rules that govern transactions. This platform may be new or attached to existing systems, e.g. commodity and equity exchanges. Independent monitoring and enforcement systems must also be established. Buyers must be certain that when they pay for a given commodity, they will receive that commodity. Sellers must be certain they will receive payment if they abide by the rules, and that those who try to cheat will be caught. To maximise participation and trading efficiency and to minimise collusion, trading should be open and transparent and market clearing prices publicly available.

Continual improvement

Once a trading platform has been established, teething problems are inevitable and those overseeing the success of the trading system must be prepared to

30. The SFE has recently dropped its plans for a carbon exchange and Stuart Beil has set up a new brokerage, Universal Carbon Exchange.

monitor and improve the system. Critically, participation in the market needs to be consistently raised to improve efficiency. This may be achieved by harmonising the system with others around the world and, where harmonisation is not possible, developing systems for exchange. For instance carbon offsets generated under Costa Rica's Office for Joint Implementation may differ from those generated in the USA and buyers should have the option of choosing between the two and exchanging one for the other. Exchange rates for trading carbon offsets should account for different levels of risks and values attached to each.

Depending on the context, different trading platforms will tend to evolve. However, because the carbon market is tied into an international agreement, local efforts will tend to converge over time. There is also likely to be a tendency towards exchange-based trading to cope with the high volumes of trade and demand for lower transaction costs and greater price transparency. As markets become more integrated, there will be pressure for local exchanges to form alliances, or even merge.

In terms of a time frame for market development, this will depend on a number of factors. Markets are likely to develop most quickly in countries where there is a strong political commitment to emission reductions and trading, and thus a driver behind enabling legislation. This in turn will depend on the likely distribution of benefits and costs. Where powerful stakeholders expect to lose from the market, they are likely to resist its establishment (as in the case of the Global Climate Coalition of industrialists opposed to Kyoto), and progress will be slow. Where the power balance is in favour of early action, market establishment will depend on the time it takes to pass the requisite legislation and to develop the necessary infrastructure and capacity. Inevitably, this will tend to be faster in industrialised countries with developed market regulatory systems, established trading platforms and skilled service sectors. In New South Wales Australia, for instance, following legislation to establish property rights to forest carbon services in 1998, the Sydney Futures Exchange anticipated that it could establish a futures market in carbon offsets by mid-2000.

4.5 What carbon offset markets mean for welfare and poverty

Grand claims are frequently made about the potential benefits of forest-based carbon offset trading. CDM generated offsets are even required to promote sustainable development in the host country. Yet, in practice there is little hard evidence to show that trades generate significant net economic, social or environmental benefits than costs. This is not to say that there is no potential, but there has been a lack of attention to actual impacts and how trading might be designed to maximise welfare gains. This is particularly critical for developing countries whose gains from trading are less clear than for Annex B countries, for whom trading has been designed to minimise costs. The following provides an overview of the main economic, environmental and social costs and benefits highlighted by the cases.

4.5.1 Economic costs and benefits

The literature that documents economic impacts of specific deals focuses on benefits, both direct and indirect, from a range of stakeholder perspectives. None provides a detailed financial costing and few are comprehensive. Instead authors pick out key expected and actual benefits (though it is not always clear which is being discussed) and it is difficult to determine net benefits. A summary of the costs and benefits associated with forest-based carbon offset trading highlighted in the literature reviewed is provided in Table 6.

Different costs and benefits accrue to different stakeholders. For instance, while Annex B countries benefit from cost-savings associated with trading, non-Annex B and Annex B countries both benefit from financial flows associated with purchases of offsets. An interesting analysis is undertaken by Bosello and Roson (1999) who use an economic model to assess how different carbon trading regimes impact on different countries' per capita income. In addition to highlighting how benefits vary with the degree of freedom in trading, their analysis shows how benefits are distributed and how the distribution alters under different trading scenarios (see Box 16).

Table 6: Economic costs and benefits from markets for carbon offsets

Direct benefits	Indirect benefits	Costs
• Achievement of GHG emission reduction at least cost • Financial flows and carbon credits to host countries for projects • Stable income – regular streams of income for local people reduce vulnerability to seasonal shifts in land-based activities, e.g. agriculture. • New business opportunities for ancillary services, e.g. advice and brokerage • Increased foreign exchange earnings in host country	• Increased forest productivity (e.g. Vietnam forest productivity is expected to rise by 15% during life of project) • Infrastructure development - development of new or existing carbon related institutions (e.g. Costa Rica's Office for Joint Implementation) • Technology transfer – e.g. Reduced Impact Logging • Improved agriculture productivity – positive spin-offs for soil and water quality, e.g. Western Australia • Improved hydropower efficiency due to improved water quality and more regular flows (e.g. Costa Rican National Power and Light company) • Reduced costs of treating drinking water • Positive spin-offs for nature tourism, NTFPs, bioprospecting, organic products and other green business, e.g. Canopy Botanicals in Bolivia	• Actual costs of supply (e.g. project preparation, implementation) • Transaction costs (e.g. searching for deals, negotiating deals, monitoring and enforcement) • Opportunity costs where financing for carbon projects: – replaces aid and other inward flows, – lost agricultural output when forests planted in agricultural land, – lost values associated with local community use, e.g. NTFPs, when protected

Box 16: Identifying the winners and losers from carbon offset trading

Bosello and Roson (1999) use an integrated assessment model to assess the impacts of the Kyoto targets for per capita income in Annex B and non-Annex B countries under five market scenarios. These are: (1) no trading, (2) trading within Annex B countries, (3) trading plus permit banking in Annex B countries, (4) global trading, and (5) global trading and banking. The aim of the research is to examine the international equity impacts of alternative trading mechanisms. The authors use a simple version of the RICE model developed by Nordhaus and Yang (1996) that translates economic activity into carbon emissions, carbon emissions into temperature increases and finally temperature increases into GDP losses. Their model assumes away enforcement and transaction costs. The analysis shows that different options have important impacts on welfare, and that impacts vary significantly between countries.

Since marginal abatement costs are highest where no trading is permitted, the average cost of compliance with emission targets falls with all types of trading. The greatest reductions are for global trading and global trading and banking. For instance the cost for a tonne of carbon under trading within Annex B areas comes to US$32.75 versus $9.2 under global trading regimes. The divergence in costs also increases over time.

Where trading is permitted the model identifies the main exporters and importers of permits. Under Annex B trading, the ex-USSR is initially the only exporter, joined by the USA as the ex-USSR growth picks up (around 2040). Where global trading is permitted non-Annex B countries (most notably China) are the only exporters.

While all countries show a positive welfare gain from global trading, the gain is spread disproportionately with Annex B countries gaining far more than developing countries. The inequality of impacts is greater the more flexible the trading system allowed. Where global trading is compared with no trading the per capita income increments by 2050 are as follows:

- USA: $471.20
- EU: $416.10
- ex-USSR: $118.20
- China: $25.50
- Rest of World: $5.20

The difference is less magnified where global trading and banking is permitted, although China does not gain so much:

- USA: $278.40
- EU: $305.20
- ex-USSR: $138.20
- China: $6.6
- Rest of world: $12.70

The impacts of global trading and banking on income for non-Annex B and the ex-USSR are actually negative in early years, turning positive only around 2040. These figures compare to impacts of trading with the Annex B area of:

- USA: $14
- EU: $21.8
- ex-USSR: $20

• China: $0
• Rest of world: $0

Despite its many assumptions, this analysis highlights that benefits from emission trading are unlikely to be equally spread and suggests that efforts to achieve greater equity in the carbon market may reduce total benefits.

Source: Bosello and Roson (1999)

While models such as that used by Bosello and Roson (1999) are useful, it should be remembered that they depend on accurate data. A key uncertainty with determining the cost savings from trading is that estimated costs vary significantly and are often contradictory (Smith *et al*, 2000; Pearce *et al*, 1998; Schwartze, 1999; IPCC, 2000; Swift and Donnely, 2000; and Trexler *et al*, 1999). For instance, while the conventional view is that forest-based offsets in developing countries will be extremely competitive, others argue that high transaction costs associated with managing risks, finding credible partners, negotiating complex contracts and monitoring implementation will negate any cost savings (Smith *et al*, 2000; and Nicholls, 2002). The constraining role played by transaction costs is picked up in Section 4.6.3.

4.5.2 Social costs and benefits

Table 7 below provides an overview of the social impacts recorded in the cases reviewed.

Table 7: Social costs and benefits from markets for carbon offsets

Benefits	Costs
• Research and training in sustainable forestry, forest-based industries, ecotourism, carbon monitoring, certification, global warming, project management • Secure and long term forest benefits, e.g. NTFPs, timber, recreational benefits • Increased land/resource tenure security where carbon offset deals result in the formalisation of land tenure, e.g. Bolivia's Noel Kempff project and Costa Rica • Social institution building – e.g. the Community silviculture carbon offset project in Mexico aimed to finance the development of local women's groups • Improved health – positive impacts on human health through improved air and water quality, more diverse diet including NTFPs, etc.	• Loss of access to forest resources where carbon offset projects involve forest protection e.g. Tree Farms AS project in Uganda • Reduced tenure security where markets create increased competition for control over forest land • Weakened cooperative arrangements where markets strain traditional relations • Reduced health where projects reduce access to forest based foods that provide key variety in local diets. Also where projects involve fast growing plantations and reductions in water supplies, e.g. Tree Farms AS project in Uganda

There is a clear bias in reporting on social impacts, with little critical analysis of how forest carbon offset projects may negatively affect local communities. The most detailed assessment of the dangers of these projects was undertaken by Norwatch, a Norwegian environmental NGO, for projects in Uganda and Tanzania. Work by Norwatch, which is summarised for Uganda in Box 17 below, highlights the critical need for more thorough investigation of local impacts of carbon offset projects.

Box 17: Social risks of carbon offset projects: a case study in Uganda

In 2000, Norwatch published details of a Norwegian forestry company's, Tree Farms AS (ex-Fjordglott), carbon sequestration project in Uganda. The project was launched in 1996 when Tree Farm AS established a subsidiary in Uganda, Busoga Forestry Company Ltd. to manage a 50-year lease in Bukaleba Reserve covering 5,160 hectares. Over the longer-term, Busoga is hoping to expand the area to 80,000 -100,000 hectares. By 2000 Busoga had spent US$600,000 on planting 600 hectares, mostly of fast growing pines and eucalyptus.

The aim of the project is to generate both sustainable timber and carbon returns. Tree Farms hopes to sell carbon offsets to private emitters in Norway under the CDM. Assuming 500 tCO_2/hectare (based on a Tree Farm plantation in Tanzania), this translates to about 2.13 million tCO_2 for Tree Farms' Uganda plantation at the end of a 25-year rotation. Prior to planting, Tree Farms agreed a forward option with Indistrikraft Midt-Norge, a Norwegian power company, for \$4.4/tCO_2 that could be exercised in 2003. However, in 2000 this contract was cancelled.

While Tree Farms plantation project has been widely applauded as a valuable example of a CDM-based carbon offset project, a number of concerns have been raised by Norwatch relating to negative local social and economic costs. The chief concerns are listed below.

Social concerns

- Threatened eviction of about 8,000 people who depend on the area for farming, collection of timber and NTFPs, cattle grazing and fishing. Apart from the serious livelihood implications, there could be significant repercussions for the project's carbon offsets if evictions result in deforestation in adjacent areas, i.e. "leakage".
- Poor labour relations. Only 43 people were employed by Tree Farms in 2000, with most of the field work undertaken through the taungya system whereby local farmers are contracted to plant and care for seedlings and, in return, are permitted to inter-crop on the forestry company's land. This system allows Tree Farms to access free labour, while farmers get land. However, the farmers are also required to pay rent through the donation of a share of their seasonal crops and/or through cash payments (US$3-53/plot).
- Potential negative impacts on local water supplies as fast-growing plantations absorb increasing amounts of ground water.

Economic concerns

- Low government revenue. The company pays a US$3/hectare/year rental plus a \$312 lump sum on contractual agreement, but rent is only paid on land planted with forests. In 2000 Tree Farms was only paying for 600 hectares. Even when the whole area is planted with trees the total rental payment received from Tree Farm will come to \$319,500, or 3% of Tree Farm's expected carbon profits.

- Forgone revenue from leasing the land out to other users and/or the output generated by local farmers by using land for agriculture.
- Risks of lock-in. Tree Farms is committed to providing carbon offsets in "perpetuity", but its lease only lasts 50 years. It is unclear how this disparity with be reconciled. If the government is locked into maintaining the land under forest, the opportunity costs mount.

Source: Eraker (2000); Stave (2000)

4.5.3 Environmental costs and benefits

Table 8 summarises environmental impacts of forest-based carbon trades highlighted in the literature.

Table 8: Environmental costs and benefits from markets for carbon offsets

Benefits	Costs
• Increased biodiversity – both within the new forest area and/or by relieving pressure on adjacent natural forests • More regular water supplies and higher water quality as a result of the forests impacts on local hydrology and by reducing the area under agriculture subject to fertiliser and pesticide use; • Controlled flooding • Soil fertility improvements due to nutrient and salinity benefits • Reduced wind erosion • Air quality improvements associated with reduced forest fires • Increased scenic beauty • Offshore benefits for coral reefs and fisheries	• Reduced biodiversity where monoculture plantations used • Increased erosion and siltation where plantations are associated with poor land management and road building • Reduced water supplies associated with fast growing trees, e.g. eucalyptus in Uganda • Increased GHG emissions where offsets treated as a "license to pollute"

Forest-based carbon offset proponents have been eager to point to a number of positive environmental spin-offs as reasons for supporting these projects over others such as energy efficiency. Yet, few studies measure these impacts. Only in a few cases have authors pointed to potential negative repercussions, normally associated with planting fast-growing monoculture plantations. In Uganda and Tanzania, Norwatch stands out for its emphasis on the negative impacts of eucalyptus and pine plantations for local water supplies and biodiversity. Climate Care (2000) also points to a concern that by investing in offsets, emitters feel they gain a "license to pollute" and actually increase carbon emissions. While none of the case studies record instances where carbon offset projects have involved clearing natural forest for fast growing plantations, Bonnie and Coda (2001) highlight this as a real concern where Kyoto counts carbon offsets from plantations, but not forest protection (i.e. non-Annex B countries).

Despite these concerns there is clear potential for carbon offset projects to promote a bundle of forest environmental services where they are explicitly

designed to do so. This is true of the two Nature Conservancy projects reviewed in Belize and Bolivia, which aim to preserve biodiversity at the same time as generating carbon offsets. Bundled environmental service markets are discussed in more detail in Section 7.

4.5.4 Impacts for poor people

Box 16 in Section 4.5.1 highlights the potential variations in costs and benefits from carbon offset trading between regions. Bosello and Roson's (1999) analysis suggests that gains from global trading are likely to be captured first and foremost by the industrialised world, and the imbalance in benefit-sharing increases as trading rules become more flexible. The analysis raises serious questions as to whether trading will promote or exacerbate poverty in developing countries. Concerns over equity implications of markets are echoed in work by Bass *et al* (1999) and Scherr and Smith (2000) on emerging carbon markets and rural livelihoods. While none of the cases reviewed in this study systematically evaluated impacts on poor households, in what follows an effort is made to highlight potential opportunities and risks posed by market creation for poor groups.

From the list of economic, social and environmental benefits presented above it is clear that there are a number of ways in which market development can improve livelihoods of poor forest-based communities. As a new source of income, carbon offsets directly raise welfare by increasing purchasing power and reducing vulnerability to shocks by diversifying income streams. Markets also have positive spin-offs for assets on which poor people rely. Investment in forest protection and management is thought to improve the productivity of adjacent agricultural land as well as the forests themselves. Water resources are also thought to benefit – in terms of regulated and augmented flows and improved quality – from improved forest management[31]. Critically, markets may not only increase the quality of natural assets, but they have been know to spur the formalisation of property rights to land and forests, thereby increasing the value of these resources to poor people.

In addition to the positive spin-offs for natural capital, markets may raise human capital through investments in education, training and knock on effects for health. Social institution building is another area that has been highlighted as benefiting from market evolution and one which may particularly benefit marginalised groups who often lack the organisational and management skills needed for cooperative action.

The potential benefits of market development are numerous. However, markets appear to be at risk of becoming a victim of their own success. Rather than generating returns for poor households, markets are increasing competition for

31. Scientific support for positive linkages between forest management and water supplies and quality is, however, unclear – see Box 21 for fuller discussion.

forest resources on which they depend. Increased competition threatens poor peoples' livelihoods as wealthier and more powerful stakeholders seek to control emerging benefits. Hampered by inadequate political representation, informal property rights and weak negotiating skills, poor communities face an uphill struggle in defending their rights. In many cases (e.g. the Tree Farms project in Uganda – see Box 17) these groups are not only excluded from the market, but also lose access to the forests and land.

Even where poor people have formal property rights, access to the carbon market is beyond the capacity and resources of most. Not only do complex rules and eligibility requirements fall hardest on smallholders who do not have the option of spreading costs across large volumes of supply, but they have spurred the emergence of ancillary service providers and intermediaries who have their own sights set on a share of the returns. According to Donnelly, President of the Greenhouse Emissions Management Consortium: "*You need a deal of a couple of million tonnes, at a fairly high price of carbon, before money starts flowing to the landowners. No-one has brought me a proposed CDM transaction that's large enough*" (Nicholls, 2002). For most small suppliers transaction costs associated with market participation outweigh any potential gain. The constraints facing poor suppliers are revisited in Section 4.6.4.

Even where markets are accessible to poor communities, the picture is clouded. Apart from the direct costs of supply (e.g. forest protection and management, measurement of offsets, reporting, certification), in most instances deals require that sellers' commit to delivery of carbon offsets in perpetuity. Locked into long term supply agreements, forest stewards lose flexibility that permits them to respond to changing circumstances and crises. The loss in flexibility hits poor people hardest since they lack alternative buffers to deal with unforeseen shocks. Moreover, where carbon deals require restricted forest use, the loss in flexibility is exacerbated.

In sum, when it comes to evaluating project impacts, the literature describing carbon deals is extremely weak. Unsubstantiated statements and a lack of attention to possible negative impacts, especially for poor groups, undermine the credibility of project assessments. While for many cases it may be too early to measure impacts, there is a real need for more balanced and systematic evaluations. Such analyses are essential for ensuring markets are designed to promote poverty alleviation as well as raise national and global welfare.

4.6 Constraints to carbon market development

Two major sets of constraints to forest-based carbon offset market development can be identified:

- *Policy uncertainty*. The lack of clear international or national policy frameworks for guiding market evolution has hindered market development to date. This failure has left market participants guessing about the rules for future trading systems, raising risks and lowering the number willing to participate.

- *Transaction costs*. Despite the uncertainties surrounding specifics, emerging guidelines for eligible forest-based carbon offsets are already complex and have tended to involve lengthy and detailed negotiations between exchanging parties. For the majority of forestry projects, the transaction costs involved are unsustainable.

While the problem of international policy uncertainty has been alleviated with the finalisation of COP 7 in November 2001, a number of procedural details relating to CDM project eligibility have yet to be finalised. Moreover, the transactions reviewed in this study were undertaken prior to COP 7. In what follows key uncertainties that plagued transactions prior to Marrakech are explored. Constraints posed by costs of implementation are also outlined.

4.6.1 International policy uncertainty

As highlighted in Section 4.3, the Kyoto Protocol represents the foundation on which the market for carbon offsets is based. When the cases in this study were reviewed, the Protocol suffered from a host of unresolved issues that have impacted negatively on trading in forest-based carbon. The most important outstanding issues as they relate to forest-based offsets are summarised in Table 9. Table 9 also points out how, while a number of these issues have been resolved in Bonn and Marrakech, uncertainties remain.

With respect to whether forests are "in" or not, a main sticking point has been over measurement and the determination of "additionality". Critiques of forest sinks point to three main problems. Firstly, there is no standard approach for determining baselines against which carbon offsets are calculated. Depending on how the baseline, or business as usual scenario, is determined, estimates of carbon offsets generated by the project can differ markedly. Secondly, there is a concern that projects may not adequately account for off-site "leakage", i.e. where increased offsets in one location are negated by deforestation and the loss of carbon sinks nearby. This is a particular concern for forestry projects that involve the displacement of local communities to adjacent forest areas. Thirdly, forestry projects are viewed to be vulnerable to reversals and offsets to lack permanence.

While forests pose important measurement challenges, a recent Inter-governmental Panel on Climate Change report on "Land Use, Land Use Change and Forestry" (2000) indicated that most of these difficulties are surmountable. The report points to a number of methods that could be employed to overcome the problems, including careful project design, external insurance, third-party certification and even by discounting the value of forest-based carbon offsets through a technique referred to as the "tonne-year approach" (see Box 18). Moreover, it is argued that, apart from the issue of permanence, the measurement difficulties associated with forests are no greater than those posed by other offset projects (Chomitz, 2000). Rather than being a technical issue, the problem is finding a political agreement on a standard approach to

Table 9: Uncertainties under the Kyoto protocol have been gradually addressed

Pre-COP 6	Post-COP 7	Comments
What share of each country's GHG emission reduction targets can be traded? Will there be requirements for domestic abatement?	No quantitative limits on flexibility mechanisms, but domestic action to constitute "a significant element" of emission reduction strategies.	The EU and several developing countries have argued for the need to cap trading to ensure Annex B countries do not buy their way out of their obligations to cut emissions
Is there a role for forest-based carbon sinks and should there be rules on permitted activities?	Forest-based sinks are limited by category: • only reforestation and afforestation are allowed under the CDM during first target period (2008-2012) and volumes are capped at 1% of country's base-year emissions; • offsets from forest management allowed in Annex B countries and under JI, but country-specific caps imposed	Whether or not to include forestry activities as eligible sources of offset is extremely contentious. Sinks are supported by the Umbrella Group (including the USA, Canada, Australia and Japan) and resisted by the EU. Measurement problems are highlighted as a key problem with sinks, alongside concerns of non-permanence (see below). Detailed rules governing eligibility of CDM sink projects is to be worked out in 2002.
Will there be controls on trading "hot air", i.e. credits generated due to economic contraction rather than efforts to improve energy efficiency or invest in carbon sinks?	To avoid overselling Annex B countries cannot sell more than 10% of their Assigned Amount Units, or five times its most recently reviewed emissions inventory – whichever is lower.	"Hot air", mostly from Russia, could flood the market pushing down carbon offset prices and undercut forest-based offsets.
Who will bear risk for project failure or a country's non-compliance with targets?	Marrakech clarified that compliance is the government's responsibility. Risks associated with the decentralisation of targets to non-governmental entities	This is critical where countries decentralise responsibility for achieving targets to the private sector. If a country fails to achieve its targets, will

Table 9 continued

Pre-COP 6	Post-COP 7	Comments
	must be borne by governments. The precise mechanisms for enforcing compliance have yet to be finalised.	responsibility be passed on to private actors or born by the state?
What standards for certifying emission reductions should apply?	Referred to Inter-governmental Panel on Climate Change for investigation. The CDM Executive Board will be accrediting certifiers before COP 8.	Carbon emission reductions need to be verified and certified by independent third parties.
Are different carbon credit types (i.e. Certified Emission Reductions, Emission Reduction Units and Assigned Amount Units) fungible?	All carbon credits can be traded. Limits apply to trading volumes in certain categories, including forest-based offsets (see above). A new credit was introduced in November 2001 – Removal Units - which is earned through sinks in Annex B countries and cannot be banked.	Unless private investments in CDM or JI projects yield credits that can then be used to offset excess emissions at home, e.g. by exchanging them for Assigned Amount Units, they will hold no value.
Who can own credits? Is the private sector eligible to participate in international trading?	National governments are responsible for meeting their Kyoto targets. It is up to governments how targets are achieved, and they may choose to decentralise responsibilities to private actors.	For the private sector to invest in carbon offset projects, they need to be certain they will gain title to the offsets they generate and be able to trade these rights.

Source: Meyrick (2000); IISD (2001); Pew Centre on Global Climate Change (2001); Nicholls (2002)

measurement. At COP 6, reservations over the use of forest-based sinks led to a compromise to limit the eligibility of forest management based offsets. The delegates also invited the Inter-governmental Panel on Climate Change to develop standardised measurement, monitoring and reporting approaches for permitted forestry activities. Detailed rules governing sinks projects under the CDM are to be worked out by the Subsidiary Body for Scientific and Technical Advice in 2002.

Box 18: Forests' temporary carbon storage: a respite against global warming

The main hurdle that forestry projects face is guaranteeing permanence. Unlike energy efficiency projects that involve a once-and-for-all investment that leads to a permanent reduction in carbon emissions per unit output, forestry projects tend to involve a temporary store of carbon that will be released either when forests are cut down, burnt or get old. Guaranteeing that a certain land area will remain forested forever is extremely risky.

Yet, this does not mean that forests cannot play a role in reducing GHG build-up. By storing carbon temporarily, forests delay its release into the atmosphere and postpone global warming. As long as that delay is valued, perhaps because it provides more time for finding cheaper solutions, then forests offer an important contribution to global warming mitigation.
While forests have a role to play, the challenge is finding a formula which values forest-based carbon offsets appropriately when set against more secure emission reductions. Chomitz (2000) offers two ways forward: (1) discounting forest-based offsets to take account of their non-permanent nature, and (2) devising mechanisms that provide reasonable assurance of indefinite sequestration.

Valuing non-permanent forest-based offsets
If we accept that short term sequestration has value, the main challenge is how to calculate this. One potential solution is the introduction of tonne-year scheme that credits investors for each year carbon is stored. This credit is a fraction of the total for permanent sequestration. This concept is not only attractive for opening the door to forest-based offsets, but it permits the host countries and landowners flexibility in the provision of carbon offsets as there is not requirement for indefinite forest protection.

The difficulty lies in selecting the tonne year to perpetual tonne conversion. Chomitz argues that there are a number of scientifically justifiable approaches and the final choice is a political one. The approach is similar to deriving the conversion between tonnes of different GHG. Ultimately we are interested in their global warming potential, as a proxy for their climate impact. A mathematical formula has been devised to convert reductions in different GHGs into global warming potential equivalents. This formula can be applied to calculating the value of delaying deforestation by one year.

Moura Costa (1999) finds that 60 tonne years equals 1 perpetual tonne. Another approach is to calculate the damage mitigation resulting from postponing emissions by one year. Assuming a linear damage function and a specific discount rate, we can calculate the benefit from postponing damage in today's terms. This approach yields a simple formula: one tonne year equals r perpetual tonnes, where r is the discount rate.

Ensuring indefinite sequestration
Four options are introduced:
(1) *Providing an insurance buffer*. This is the approach adopted in Costa Rica for its Certified Tradable Offsets. Basically, the host supplies additional carbon sequestration as a buffer against unexpected loss. The higher the risk of loss, the larger the buffer. In Costa Rica, the government has allowed for a 50% buffer – i.e. it is only selling 50% of the carbon offsets it has available. This approach

requires careful risk analysis.
(2) *Bundling forestry activities with subsequent emission reductions*. A company can purchase forestry carbon offsets for a period and commit to reducing its emissions by the same amount at the end of the designated period. This capitalises on forests ability to delay requirements for emission reductions until it is cheaper.
(3) *Tax forest-based offsets to fund emission reduction technology research and development*. All buyers of forest-based offset pay a share into a fund for emission reduction research and development.
(4) *Tradable development rights*. Purchase and retirement of tradable development rights offers another mechanism for host countries to finance environmental investments (see Box 1 for description of tradable development rights used in the biodiversity sector).

Source: Chomitz (2000)

In sum, forest-based carbon offset sales prior to COP 6 and 7 have been hindered by numerous uncertainties. Consequently, the market for forest-based carbon offsets has been a fringe affair attracting *ad hoc* participation. The political agreement reached in Marrakech should help to provide much needed impetus to renewed market expansion.

4.6.2 National policy uncertainty

International uncertainty surrounding Kyoto prior to the completion of COP 7 has translated into national level uncertainty. Without clear guidance on which forestry activities would count, what CDM and JI projects would be eligible, or what role the private sector could play, legislators have used their best judgement. In most instances, countries ruled out uncertain activities until final decisions were made. As a result, few of the emerging schemes recognise forest-based offsets (Canada's GERT scheme and the emerging Chicago Climate Exchange are exceptions) and only the Netherlands has allowed for CDM crediting. Instead most schemes planned to phase in international trading and review eligible activities when guidelines were clarified under Kyoto. The cautious approach adopted by nation states undermined incentives for early investment in forest-based offsets. Moreover, because international trading of credits requires that buyers and sellers comply with two sets of national regulations, even where one country accepts forestry, if the other does not the trade will be prevented.

Another barrier to the forest-based carbon offset market is the difficulty of gaining host country approval in developing countries. Many non-Annex B countries view carbon trading as a form of "eco-colonialism", tying countries in to low emission commitments which prohibit growth. Many are particularly opposed to forestry since it locks countries into protecting forests in perpetuity, preventing land conversion for more productive uses, and involves limited technology transfer. Resistance is greatest in Asia. Of all 129 AIJ projects undertaken by 1999, only 7% were in Asia (Nicholls, 2000).

4.6.3 Transaction costs

With the finalisation of COP 7 international policy gaps have been largely filled and guidelines for eligible carbon offset projects clarified. The most significant constraint to market development today is that of high transaction costs. Forestry projects will have to satisfy requirements for "additionality", permanence and, in the case of CDM projects, the promotion of sustainable development in the host country. Experiences under the AIJ scheme and other pilots, suggest that complying with these basic eligibility requirements will be expensive.

Based on the projects reviewed in this study, five major categories of transaction costs may be identified for CDM and JI forestry projects:

- Project identification – searching and selecting projects that will meet Kyoto as well as national crediting requirements.
- Project design and implementation.
- Project monitoring, enforcement and risk management.
- Host country and national project review.
- Marketing – selling carbon credits is time-consuming and expensive.

While transaction costs represent major barriers to market expansion, mechanisms are emerging to overcome these problems. Considering each set of transaction costs in turn, these include:

- *Project identification*. Establishment of central information databases and specialised intermediaries, e.g. carbon brokers, clearing houses, exchanges, that seek to increase price transparency and provide assistance with negotiating matches.
- *Project design and implementation*. Passing of legislation to clarify carbon property rights (e.g. New South Wales, Australia); clarification of forest resource rights (e.g. Bolivia and Costa Rica); local intermediaries to organise implementation (e.g. FUNDECOR, Costa Rica).
- *Project monitoring, enforcement and risk management*. Development of standards for carbon measurement, verification and certification (a proposal for a standardised approach is set out in Box 19); portfolio diversification (e.g. through investment funds); building carbon buffers; development of a sophisticated private insurance and futures market (see Box 20).
- *Host country and national project review*. Clarification and streamlining national and international registration and approval processes.
- *Marketing*. The emergence of specialised entities for raising project finance, e.g. exchanges, clearing houses, specialised brokers, investment funds.

Box 19: Simplified Emission Reduction Credits

A major complaint with the current system for measuring carbon benefits under AIJ and JI projects is that, even when clear rules are established, it will be too costly. Instead of painstakingly calculating carbon offsets generated for each project, it would make more sense, and significantly increase private investment, if Simplified Emission Reduction Credits could be adopted.

Simplified Emission Reduction Credits would be calculated using standardised

reference emission rates for different emission reduction/storage activities. This rules-based approach specifies emission rates for different activities in specific locations, thereby both removing uncertainty in investors' calculations and reducing costs associated with measurement and certification. For instance in the forestry sector, lower bound sequestration rates should be established for different forest activities in different locations. These would be deducted from pre-determined reference emission rates to calculate a Simplified Emission Reduction Credit.

To overcome any uncertainty, an uncertainty discount could be applied, e.g. by counting only 80% of the estimated sequestration. Independent bodies would determine reference sequestration rates and verification would involve third-party confirmation that certain activities had been undertaken. Only where individuals involved in the project wanted actual measurement of sequestration would this be undertaken.

Source: Sandor (October 2000)

Box 20: Minimise carbon risks

In late 2000 the insurer Swiss Re decided to offer a range of services aimed at covering risks associated with the emerging emission reduction market. Swiss Re joined Aon Global Risk Consultants as the leading insurance institutions offering services to the carbon market. The aim is to promote market development by reducing risks for companies. Three business opportunities are being pursued:

- Emission credit trading insurance to cover risks that delivered credits do not meet necessary standards.
- Credit guarantee to protect buyers from risk that sellers will go out of business prior to credit delivery.
- Project insurance to cover risks of project under-performance due to technology failure, natural hazards, financial risks (currency fluctuations), economic risks (e.g. fluctuations in carbon credit values), etc.

Source: Nicholls (2001); www.swissre.co.uk/ (May 2001)

4.6.4 Constraints fall hardest on the poor

Constraints facing market participants are not equally distributed. In each category highlighted above, hurdles tend to be greatest for poor people in developing countries. Even in the case of international policy uncertainty, while rules of the emerging GHG reduction policy framework have been largely clarified at COP 7, those issues which remained unclear for longest, and those details that still require clarification, have impacted on potential CDM participants most.

International uncertainty around the CDM has been compounded by a lack of action in developing countries to invest in the necessary infrastructure for hosting CDM projects. Unclear national standards (including criteria for sustainable development), non-transparent application and approval processes and overlapping authorities all undermine investor interest. The few developing countries that have started to develop a strategy for promoting carbon offset sales have tended to be the most wealthy, e.g. Costa Rica. Until these policies

and institutions are in place, developing countries will be unable to attract business.

With respect to project implementation, there is little question that concluding deals in developing countries under the CDM is more expensive, time consuming and risky than doing business elsewhere (see quote by Donnelly in Section 4.5.4). Apart from the problems introduced by an unclear policy framework noted above, poor information flows, inadequate human resources, lack of experience in negotiating deals, unclear property rights, and weak monitoring and enforcement mechanisms all mean that transaction costs are a major impediment to market expansion. Given this context, the likelihood is that where CDM deals are pursued, they will target well-established and large suppliers to minimise risks and spread costs. Prospects for poor small-holders that lack the skills for implementing carbon projects and suffer from insecure land tenure are dim. It is for this reason that one of the CDM Executive Board's first tasks is to put forward guidelines on mechanisms to bundle small-scale projects, and for fast-tracking smaller projects through the Board's approval process, to minimise transaction costs (Nicholls, 2002).

4.7 Summary

The signing of the Kyoto Protocol in 1997 set the stage for the emergence of a market in carbon offsets. Even before details of the Protocol were finalised in Marrakech and before its ratification by signatories, the carbon offset market had been evolving quickly. Not only are national governments passing laws to ensure emission targets are met, but GHG emitters, brokers, consultants, NGOs, communities, and potential suppliers are responding directly to international policy processes. This chapter has examined key features of the evolving market, with particular attention given to forests-based carbon offsets.

As with other markets for environmental services, the process of market development for carbon offsets has not been smooth, nor is there a single unified trading platform. Rather, transactions have occurred at a number of levels (i.e. local, national, regional and international), through a variety of payment mechanisms (from bilateral to exchange-based) and with varying degrees of government participation.

The most sophisticated trading systems are being set up in Annex B (i.e. industrialised) countries as a result of concerted government efforts to introduce emission caps and establish clear rules and regulations to guide market development. In these situations, voluntary *ad hoc* transactions aimed at gaining experience and generating favourable publicity are being replaced with more systematic trading of a defined carbon commodity – normally 1 tCO_2 equivalent – aimed at minimising costs of compliance. Yet, to date emerging national trading schemes have been isolated efforts and few allow for forestry activities, reflecting recent uncertainties in the Kyoto Protocol. International trade in JI and CDM carbon offsets have been primarily generated through

complex and individually negotiated projects. Investment in the development of an international market architecture remains limited.

However, recent breakthroughs at COP 6 and 7 have boosted prospects for an international market for carbon offsets. In an effort to become market leaders, an increasing pool of organisations (private, public and NGOs) are setting up international brokerage services, investment funds, clearing houses and even exchanges. Insurance companies, consultants and certification suppliers have been quick to offer potential buyers and sellers services to support international trade. A number of these ventures cater for forest-based offsets.

As the market matures, there is an expanding set of experiences from which to learn. This review has struggled to keep up with new information. Descriptions of individual transactions, progress being made in individual trading schemes and new entrants offering more sophisticated services is plentiful. However, there remains a lack of analysis of these experiences. Guidance on the process of market creation and on its impacts is particularly lacking. Critically, it remains unclear whether the carbon market will act as a force in favour of, or against, poverty alleviation. Emerging evidence that poor smallholders in developing countries face serious constraints in accessing market opportunities is cause for concern. While allowing space for learning-by-doing is important, governments have an essential role in acting early to head off emerging problems. As the market for carbon offsets takes off following Marrakech, governments need to put in place those policies and regulations that will ensure efficient and equitable climate change mitigation.

5. Markets for watershed protection

Widespread flooding in China's Yangtze River Basin in the 1998 left over 3,000 people dead, hundreds of thousands homeless and destroyed billions of dollars worth of property. Rapid siltation in hydropower reservoirs in Malawi threatens the future supply of electricity and poor water quality pushes up turbine maintenance costs to unsustainable levels. Rising nutrient pollution in rivers throughout the USA is disrupting delicately balanced aquatic ecosystems and threatening the quality of drinking water. These are just three examples of water resource problems facing policy-makers around the world. Irresponsible land management plays a critical role in undermining water flows and quality. Yet, the question of how to ensure that land managers internalise the negative impacts they have on water has been barely explored. Ambitious plans for integrated catchment management have frequently fallen short of their targets – often due to a lack of tools for encouraging improved land management.

The failure of governments to deliver solutions has prompted local innovation. Payments by water users for watershed protection are growing in popularity as they deliver results. Improved forest management, reforestation and forest protection are prominent activities in evolving deals. In a world where one-fifth of the population lacks access to safe and affordable drinking water and half the population lacks access to sanitation (Cosgrove and Rijsberman, 2000), improving our understanding of how markets for forest watershed protection may improve water quality and augment dry season flows is critical. In this section we explore examples of nascent markets for watershed protection services.

Photo by Ecociencia

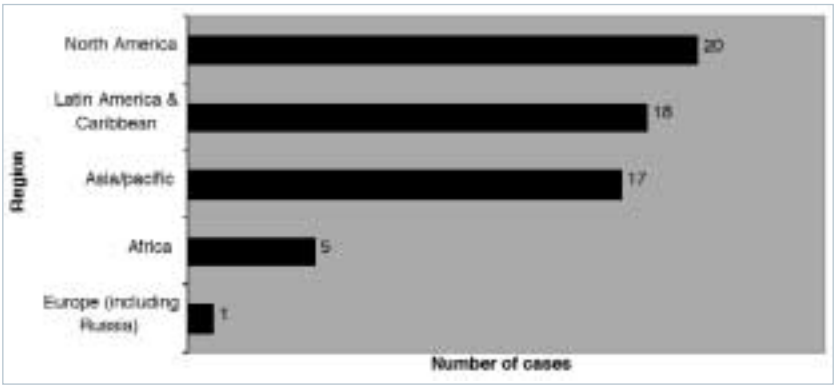
Andean Forests and Páramos (high altitude grasslands) are a vital source of water quantity and quality. The Quito's Water Conservation Fund (FONAG) is a voluntary agreement by which water users in Quito agree to pay a fee or a lump-sum in order to preserve the upper parts of the Cayambe-Coca and Antisana Reserves.

5.1 Watershed protection markets reviewed

Information on markets for forest watershed services is difficult to access, primarily due to the lack of documentation. In many cases, markets are only beginning to evolve and little analysis has been undertaken. In other cases markets are embedded in hierarchical and collective arrangements and relevant examples are easily passed over.

Notwithstanding data constraints, 61 cases of markets have been identified in 22 countries. These cases are listed in Annex 2 and a regional breakdown provided in Figure 17 below.

Figure 17: Regional breakdown on watershed protection markets



In this section preliminary insights into market forms, market drivers, the process of market development and welfare impacts are drawn out.

5.2 Watershed protection market form

5.2.1 Defining watershed commodities

Forests are associated with a range of services delivered at a watershed level. The cases reviewed for this study highlighted five:

- water flow regulation: maintenance of dry season flows and flood control;
- water quality maintenance: sediment load control, nutrient load control (e.g. phosphorous and nitrogen), chemical load control, and salinity control;
- erosion and sedimentation control;
- land salinisation reduction/water table regulation; and
- maintenance of aquatic habitats (e.g. maintaining water temperature, shading rivers/streams, ensuring adequate woody debris in water).

While the perception that forests contribute to the delivery of these services is widespread, there is often little supporting scientific evidence. Box 21 highlights the high level of scientific uncertainty surrounding forest-water linkages.

Box 21: Forest-water linkages – disentangling fact from fiction

Generalisations about forest-water linkages are risky. Complex natural relationships are compounded by poor measurement techniques. The impacts of forests for water flows, quality, erosion, sedimentation, water table levels and aquatic productivity depend on a number of site-specific features, including terrain, soil composition, tree species, vegetation mix, climate and management regimes. Moreover, the extent to which forests offer benefits depends on the alternative land use and management regime employed. Some of the most commonly held myths surrounding forest-water relations are examined below.

Maintenance of dry season flows

The view that forests act as 'sponges' soaking up water and releasing it gradually over dryer periods is widespread. In practice, forests have two opposing impacts on base-level flows: (1) they tend to increase infiltration and soil retention promoting groundwater recharge and reducing runoff; and (2) they use water in evapo-transpiration thereby reducing groundwater recharge. The net effect on flows will vary by location. On balance the evidence points to a stronger link between deforestation, increasing water tables and greater dry season flows. However, instances of deforestation reducing water supplies also exist (Hamilton and King, 1983; Bosch and Hewlett, 1982).

Key factors that appear to influence the outcome are the type of tree species, the form of new land use and its associated management regime. In the case of Cloud Forests, evidence suggests that increased water yields from cloud interception (fog deposition on vegetation) offset higher rates of evapo-transpiration resulting in increased dry season flows (Bruijnzeel, 2000). Where deforestation is associated with high soil compaction (e.g. roads, paths or grazing land), then runoff may rise by more than evapo-transpiration falls, leading to lower water tables.

Flood control

High profile stories blaming flooding on deforestation in upper reaches of catchments have captured the public's attention. In theory, forests may help to reduce flooding by reducing the volume of water flowing overland during high-intensity storms. The evidence supporting these claims, however, suggests that a relationship may only exist in smaller catchments of less than 50,000 hectares. In larger catchments, flooding occurs sequentially in basins as the storm passes over, allowing for averaging out of flood waters. In prolonged and heavy storms even large catchments will flood, but this is likely to occur even where catchments are forested (Bruijnzeel and Bremmer, 1989 cited in Chomitz and Kumari, 1996). Even in smaller catchments, the extent to which forests soak up excess water during rainy periods depends on the forest use and forest type.

Erosion control

Theory tells us that high infiltration rates associated with natural and mixed forests will reduce surface runoff and thus erosion. Moreover, by binding soils, tree roots reduce the susceptibility of soils to erosion, especially on steep slopes. Trees also help to reduce the impact of rain on soils, and thus the level of particle dislodgement.

In practice, establishing clear relationships between forest cover and erosion is extremely difficult. Most scientific evidence exists for the role of forests in reducing

sheet erosion. This suggests that forests are less important than other factors, such as ground cover, soil composition, climate, raindrop size, terrain and slope steepness, in determining erosion rates. Forest use is also critical, with studies showing that different logging regimes and roading systems will produce varying levels of sheet erosion. A review of case studies in Malaysia, for instance, suggests that selective logging may raise erosion vis à vis cocoa and oil palm production (Douglas *et al*, 1992).

Less is known about gully erosion and landslides. In a study of erosion in Chiang Mai Province, Thailand, Forsyth (1996) suggests that gully erosion may be more important that sheet erosion in forested areas due to the way tree trunks and roots shape water flows. Where this is true, deforestation may reduce erosion. Landslides tend to be associated with steep slopes, saturated soils and tectonic movements and are made more likely by human activities, e.g. road building. While shallow landslide may be prevented by deep root systems provided by trees, this is not the case with larger landslides (Bruijnzeel, 1990).

Sedimentation control

Only a portion of eroded soil makes its way downstream. In large watersheds, this may take several years. Sediment delivery ratios depend on a range of site-specific factors, including: the size of catchments – larger basins having lower ratios since they have more obstacles for catching sediment, local geology, topology, stability of river banks, and the state of land use and roading (Chomitz and Kumari, 1996). While changes in land use may have significant impacts on sediment delivery, this needs to be carefully compared to existing levels prior to land use change. Often "background" sedimentation is underestimated due to inadequate sampling data. Very few empirical studies have taken account of all the relevant variables.

Maintenance of aquatic habitats

The link between forests and the health of aquatic populations in rivers, lakes and along coasts is often highlighted (e.g. Hodgson and Dixon, 1988; Hemmingway, 2000). Forests are thought to be important in controlling sedimentation, nutrient loading, water temperature and water turbidity, all of which have direct and indirect negative consequences for fish populations. High sediment and nutrient loads are particularly damaging, causing eutrophication and the development of algae blooms that starve aquatic life of oxygen and sunlight. In the case of riverine aquatic life, forests are thought to provide cover to maintain water temperatures, food and pools for spawning and juvenile development. However, outside mangrove forests, the evidence provided is often superficial and there is a need for site-specific analysis to establish the direct linkages.

Conclusion

Forests do not offer a panacea for the loss of watershed services. Their contribution will depend on a range of site-specific factors, including climate, terrain, soil composition, forest management and roading. In most cases, forests will add most value where they are incorporated into broader watershed protection strategies involving other land uses and physical protection measures such as contour bunding, terracing and check dams.

Photos by Ina T Porras.

Improved water quality from forests around key watercourses is an important benefit that private hydroelectric companies are increasingly willing to recognize through payment mechanisms (Platanar watershed, Costa Rica).

The complexity of forest-water linkages presented in Box 21 has critical implications for the desirability of markets. Market development is premised on the fact that forests provide services that are demanded because they are superior to alternative sources of supply. Understanding forests' added-value to watershed protection is therefore vital. While markets may evolve as long as there is a perception that forests are "good" and people are willing to pay for the services they believe are provided, where forests are not optimal, markets may reduce welfare. Disentangling facts from fiction, and establishing cases where forests play a positive role in the provision of watershed services must be the point of departure for market development. In what follows we focus on market development where forests – on their own or as part of a broader matrix of land uses – are perceived to play a positive role. The aim is not to ignore the issue of forest-water linkages, but to focus on the problem of whether and how to go about establishing a market for watershed services where these are found to be positive.

As a first step in defining a commodity for watershed services, it is essential that we are clear about which service is being demanded. This in turn depends on peoples' needs and values. For instance, where downstream farmers suffer from soil salinisation, they are likely to value the forest for its control of the water table. Where hydropower plant operators are downstream beneficiaries, they will value the provision of clean water and water regulation services. Where there are a number of downstream beneficiaries, forests may meet a variety of demands. A summary of the watershed services being marketed in the cases reviewed in this study is provided in Table 10. Commodities that transform these services into more tangible products are also listed, and defined in Box 22.

Table 10: Summary of watershed services and their commodities

Service	Commodity	Number of cases
Water quality	Watershed protection/ best management practice contracts	6
	Water quality credits	4
	Land acquisitions	4
	Conservation easements	2
Water table regulation	Salinity credits	1
	Transpiration credits	1
	Salinity-friendly products	1
	Stream flow reduction licenses	1
Aquatic habitat protection	Best management practice contracts	3
	Salmon Safe products	1
	Land leases	1
	Salmon habitat restoration contract	1
	Salmon habitat credits	1
	Water rights	1
	Land acquisition	1
Soil contaminant control	Ecolotree plantings	1
Water quality and regulation	Watershed protection contracts	20
	Protected area	10
	Land acquisition	4
	Water rights	2
	Watershed lease	1

Box 22: Commodities used to market watershed service

Key commodities used to market watershed services are listed below in alphabetical order. In some cases, e.g. conservation easements, land leases and land acquisitions, definition can be found in Box 1, Section 3.2.1.

Best management practice contracts – contracts negotiated between watershed landholders and downstream beneficiaries setting out detailed "Best Management Practices" which need to be implemented in return for set payments.

Ecolotree plantings – commercialise trees' soil contaminant removal functions achieved through poplar planting and vegetative systems (legumes and grasses) that filter and absorb contaminated water from the soil. The process is known as "phytoremediation" and is marketed by a USA company, Ecolotree. Major consumers include: wastewater treatment plants, landfill sites and fertiliser manufacturing plants.

Salinity-friendly products – where payments for forests' salinity control function are piggy-backed onto sales of exiting commodities.

Salinity credits – commercialises forests soil and water salinity control function. Tree planting in critical areas reduces water tables and thus salinisation of surface soil and water bodies. The commodity is being developed in Australia as part of regulatory scheme aimed at reducing salinity. Salinity emission limits are issued to point polluters, who can only exceed these limits where they offset

emissions with salinity credits. Land users who invest in activities that reduce soil and water salinity, e.g. tree planting, are issued with credits they can sell to polluters. See also Box 24, Section 5.2.3.

Salmon habitat restoration contract – negotiated contract between landowner and those wishing to protect salmon habitat setting out detailed habitat restoration and maintenance activities in return for set payments.

Salmon habitat credits – commercialise forests role in providing salmon habitat. This proposed commodity would be rooted in a regulatory system that requires landowners in designated salmon habitats to protect forest areas, e.g. riparian buffers. Areas would be zoned according to value as salmon habitats. In less sensitive zones, landowners would be permitted to develop habitat as long as they offset this by purchasing salmon habitat credits in more valuable habitat zones.

Salmon Safe products – where payments for forests salmon habitat protection function are piggy-backed onto sales of agricultural produce. Farmers who invest in salmon-sensitive land management get financially rewarded for their efforts.

Stream flow reduction licenses – permits for land-based activities that reduce water availability for downstream users in South Africa. Exotic tree plantations use significant amounts of water, and must be licensed. In theory, licenses may be tradable, such that land managers who reduce their stream flow reduction can sell excess licenses to others.

Transpiration credits – used in Australia to commercialise forests' role in evapotranspiration and water table regulation. Transpiration credits are supplied through tree planting in critical points of catchments.

Water rights – award property rights for water use. Normally used to regulate demand for water, but may be extended to create incentives for activities that increase water delivery where additional rights can be awarded for sale. Also water rights may offer a vehicle for ensuring water users pay watershed protection fees.

Water quality credits – commercialises forests' water quality maintenance services, e.g. through their role in reducing sediment and nutrient loads in water bodies. The commodity has been developed in the USA as part of regulatory initiatives to maintain water quality. Pollution permits are allocated to point source polluters (e.g. industrial facilities), who are only allowed to exceed their allocation if they invest in non-point source pollution reductions, e.g. through watershed protection. Activities that improve water quality are rewarded with water quality credits that may set against excess pollution.

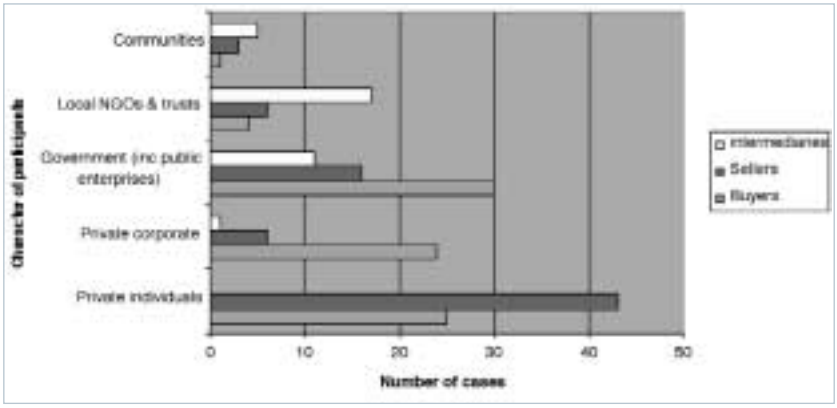
Watershed lease – where land in watersheds is leased by downstream beneficiaries to undertake watershed protection activities.

Watershed protection contract – contract negotiated between watershed landholder and downstream beneficiaries that specifies watershed management activities that will be undertaken in return for set payments.

5.2.2 Characterising participants in watershed service markets

Figure 18 below provides an overview of the types of participants involved in the watershed protection markets reviewed.

Figure 18: Participants in markets for forest watershed services



The market is dominated by the private sector. Taken together, private individuals and corporations account for almost 60% of recorded buyers and over 65% of the recorded sellers. While buyers are evenly split between private corporations and individuals, on the supply-side individual landowners are the main actors. Important corporate investors include companies for whom watershed services are a direct input in their production process, e.g. hydropower entities. Companies that are required to offset water pollution are

Photo: Vu Tan Phuong

Worsening siltation in important reservoirs in Vietnam, such as the Hoa Binh reservoir depicted in the photo below, has spurred the government to excellerate its efforts to reward upland households for watershed protection under its "National Programme to Create and Protect Watershed Protection and Special Use Forests".

also keen buyers since revegetation often offers a cost-effective approach for complying with requirements. Private individuals pay for clean and regular water used for drinking, hygiene, domestic activities and recreation.

While dominating supply and demand, the private sector has failed to carve out an intermediary function. This has been largely left to the government, local NGOs and communities. NGOs have been particularly active in bringing supply and demand together.

Governments also have an important role to play in emerging markets. Taken together public enterprises and government departments are the single most important buyer of watershed services. Government enterprises, e.g. water boards, electricity suppliers and recreation agencies, have a clear interest in maintaining the quality and flow of water. As a major landowner in critical watershed areas, the government also has a role to play in maintaining supplies. The government's role in Vietnam's emerging watershed market is described in Box 23.

Box 23: Government as a buyer and intermediary: the case of Vietnam

Forest land use in upland Vietnam (above 600 metres) has been governed by the government's "people's forestry" initiative since 1994. The initiative involves the transfer of forest management from the state to households and individuals. Forest land may be forested or barren, and different rules apply to land transfer arrangements under each category. Forest land without forest cover may be "allocated", while forest land with forest cover is "contracted".

In parallel with efforts to increase private participation in forestry, the government has implemented a critical shift in its policies towards forests. Whereas before the 1990s forests were thought to offer an abundant source of tangible products, emphasis has shifted to their importance as suppliers of environmental services. Forests' watershed services are singled out for their role in controlling dam sedimentation.

While upland forests are valued for their environmental services, these services have not traditionally generated payments that reward upland communities. The lack of compensation has been compounded by restrictive government land use regulations. A logging ban was introduced in all natural forests in 2000. Moreover, because forest resources are state-owned, local households have not shared in benefits from the revenue earned. State Forestry Enterprises have traditionally been responsible for forest use and have tended to employ lowland people rather than locals. With little incentive to protect forests, natural forest cover is estimated to have declined from 43% in 1943 to 26% in 1993. Protected areas have not been immune. While 6.5 million hectares are classified as protected for watershed management, only 3.1 million hectares are under forest cover.

To tackle this problem, under the new "peoples' forestry" initiative, the state has begun to allocate barren forestland to households through Land Tenure

Certificates and contracts for protection. Financing for household forest protection is provided through a "National Programme to Create and Protect Watershed Protection and Special Use Forests", which has an annual budget of US$60 million. Funds are channelled to State Forest Enterprises, communes and districts to contract households and individuals to undertake protection and regeneration activities. Payments of up to VND 50,000/hectare/year (US$3.34/hectare/year) are made. Payments are channelled to households through "Forest Protection Units" which monitor implementation. By the end of 1996, about 6 million hectares of forestland was allocated for protection (about 5% of total forest land).

Source: Morrison and Dubois (1998), GTZ (1996), Sikor (2000)

5.2.3 Competition or cooperation for watershed protection

Watershed protection markets are characterised by high levels of cooperation rather than competition. This is linked to the fact that watershed protection services cannot be easily parcelled out to buyers. Moreover, in most cases catchments are subdivided amongst several owners making it difficult for individuals to offer to supply watershed protection services. Rather, watershed protection tends to be achieved through cooperation between suppliers and the co-ordination of demand.

In theory, suppliers may also attempt to influence prices where they control a significant portion, or particularly valuable part, of the watershed. However, a lack of scientific information has tended to preclude landowners from marketing unique watershed services. There is little evidence from the studies reviewed of upstream landowners pushing up payments from downstream beneficiaries.

While beneficiaries do not compete with one another for watershed services, as a group they are often in fierce competition with those who want another land use. In fact, one of the major drivers for cooperation amongst downstream beneficiaries is that their watershed services are threatened by changes in land use upstream. Beneficiaries must cover upstream landowners' opportunity costs associated with forgone revenue from alternative land uses, e.g. agriculture, to ensure continued protection.

While the overall picture is one of cooperation, mechanisms are being explored to introduce competition. Where there is limited funding, for instance, efforts may be made to generate competition in supply. New South Wales' proposed Environmental Service Investment Fund will encourage competition in the supply of salinity credits by auctioning payments. In these auctions, landowners will compete in terms of the amount of credits they commit to delivering for the set price. The scheme is described in Box 24.

Box 24: Ensuring competition in supply: New South Wales' Environment Service Investment Fund

In August 2000 New South Wales' Department of Land and Water Conservation published its "Salinity Strategy" for reducing river and land salinity by 2010. The strategy is compatible with a broader Murray-Darling Basin Salinity Strategy. Currently, 40% of private land managers in New South Wales are severely affected by dryland salinity, and irrigation salinity is estimated to affect 15% of irrigated land, with a further 70-80% of irrigated land threatened.

Land and water salinity results where groundwater recharge exceeds outflow and water tables rise to the surface. In New South Wales, increased ground water recharge has resulted from large-scale land clearing and removal of native trees and vegetation. As water tables rise they bring with them natural salts that limit vegetation growth, damage aquatic life and poison drinking water. To counter salinity a number of activities are being encouraged, including the protection and management of native vegetation, increased water use efficiency, and the use of salt-affected lands.

To achieve its objectives, the government is looking to combine regulatory measures with market-based approaches. The system would be based on the introduction of a series of end-of-valley salinity caps and the allocation of salinity permits that award polluters the right to emit salinity. To ease implementation of these requirements, the government will permit trading of permits so emitters with excess permits can sell them to others that exceed their allowances. It would also allow for emitters to purchase salinity offsets, or credits, from landowners who invest in salinity reducing land management activities, such as tree planting. Landowners would effectively be rewarded for the salinity control benefits their forests provide.

Environmental Service Investment Fund – auctioning payments

To manage salinity credit trading, and to ensure salinity control is achieved at least cost, the strategy proposes the creation of a clearing-house in the form of an Environmental Services Investment Fund. This Fund would supply credits to buyers, and purchase credits from landowners. To ensure that payments are channelled to the most effective salinity reduction measures, the Fund would operate an auction system for salinity credit contracts. Auctions would require landowners to compete in terms of the number of credits they would offer for a given price. Moreover, to minimise risks for buyers, the Environmental Service Investment Fund would offer an accreditation service.

Employing exchange rates

A key issue that still requires clarification before an auction system can be implemented is that of exchange rates between different activities and their salinity impacts. Salinity control benefits of tree planting are likely to vary between the land-based activity, soil types, climates and species. Consequently, it is critical that exchange rates are calculated to permit conversion from one to another and calculation of the total salinity impact. CSIRO has made a first step in establishing these exchange rates through its modelling of recharge impacts of different land uses, taking account of climatic and soil features. With this information, salinity credits can be measured in terms of "deep drainage impact" for different land uses. However, due to high levels of uncertainty at this stage, it is proposed that

a 50% safety buffer be employed, such that the loss of 1 unit of salinity control must be compensated by at least 1.5 credits.

Source: New South Wales Department of Land and Water Conservation (2000); Salinity Experts Group (2000)

With respect to developing a competitive system on both the demand and supply side, the USA has probably made the greatest advances through its promotion of watershed pollutant (or effluent) trading. By setting an overall water quality target within designated watersheds and allocating responsibility for achieving these targets to major point source emitters (i.e. direct dischargers such as waste-water treatment plants and industrial emitters), the government has created individual demand for water quality credits. Because water quality credits may be generated through a number of activities, ranging from emissions reduction amongst point-source polluters or land-based activities often including tree planting, there is also competition amongst suppliers. Yet the system is not without risks of anti-competitive behaviour. Box 25 describes the USA trading system and the difficulties of distinguishing anti-competitive behaviour from necessary cooperation in a nascent market.

Box 25: Cooperation or collusion in watershed markets: insights from the USA

The USA market for water quality credits emerged following the Environmental Protection Agency's publication of a draft framework for watershed-based trading in 1996. This framework builds on the Clean Water Act (1972), which introduced the National Pollutant Discharge Elimination System and Total Maximum Daily Load standards for impaired water bodies. The latter establish maximum pollutant loading capacity consistent with federal water quality standards. In determining Total Maximum Daily Loads, states must allocate pollutant loads amongst the main point and non-point source dischargers[32]. The Environmental Protection Agency's guidance document assists states to design trading schemes that help them comply with federal water quality standards in a cost-effective manner. While the Clean Water Act focuses on point source polluters, the Environmental Protection Agency emphasises the opportunities for offsetting point source pollution with non-point source reductions. While most emphasis on non-point source pollution is on agricultural best management practices, trees often have a role to play.

Following a period of inaction, implementation of trading frameworks is taking off. Since the 1980s, 11 effluent trading and offset programmes have been implemented across the USA. Another 5 have been recently approved, 6 planned and 12 proposed (Environomics, 1999). Trading systems fall into two camps:

- *Cap-and-trade systems* where the authority sets a basin-wide cap on pollution and allocates tradable permits up to this limit – usually within the Total Maximum Daily Load programme; and

32. Non-point source pollution refers to land use-based pollution channelled via erosion and runoff. Key sources of non-point source pollution include agriculture, silviculture, urban development, construction, land disposal and the modification of channel flow (Environmental Protection Agency, 1996).

- *Offset systems* where a point source polluter regulated under the National Pollutant Discharge Elimination System must offset excessive pollution through the purchase of point or non-point source credits in the watershed.

In the case of offset systems, the cost of purchasing credits is critical. Markets for credits offer buyers a mechanism for generating competition between suppliers and identifying the cheapest alternative. While markets are still young, early indications suggest that authorities will need to take care to contain anti-competitive behaviour. The risks are highlighted in the case of North Carolina's Tar-Pamlico Basin.

Trading in Tar-Pamlico Basin

The Tar-Pamlico Basin is highly valued for recreational uses, commercial fishing as well as a source of drinking water for 8 cities and towns in central and eastern North Carolina. Over time high levels of nutrient loading, most significantly nitrogen and phosphorus, have resulted in algae blooms which have reduced dissolved oxygen levels with implications for aquatic life. Fish mortality, disease and loss of aquatic vegetation have grown in the basin. The main cause for increased nutrient loading has been non-point pollution, most notably agricultural runoff. The watershed extends over about 11,650 square kilometres and is dominated by forestry and agricultural land uses. Many of the farms use outdated equipment and rely on heavy use of fertilisers. While large areas of forest in the upper reaches of the watershed remain undisturbed, in lowland areas logging occurs.

In 1989 the Basin was designated a Nutrient Sensitive Water. Stricter effluent standards were introduced to limit nitrogen loads to 4 milligrams/litre in the summer, 8 milligrams/litre in the winter and phosphorous loads to 2 milligrams/litre all year round. The standards were to be phased in, with a 28% reduction in nutrient loading – mostly achieved through reductions in nitrogen – required in a first phase (1991-1994).

Trading proposal – cooperation or collusion?

To minimise the costs of meeting these standards, an association of dischargers (the Tar-Pamlico Basin Association) proposed nutrient trading. The idea was to permit dischargers to trade amongst themselves, or to purchase offsets from reductions in non-point source pollution. The latter was to be organised through contributions to the State's Agricultural Best Management Practice Cost Share Programme. The Association initially agreed to pay $56 per kilogram of emission reduction per year. The funds were passed on to District offices to invest in Best Management Practice activities, prioritising those that have most impact on nutrient pollution. Offsets are valid for 10 years.

Since 1991, the Association has provided $150,000/year towards the administration of the offset system, and paid a contribution for credits. Since 1994 offset prices have fallen by almost half to $29/kilogram, permitting the Association to save an estimated $6 million/year as compared with a non-trading approach to meeting water quality targets.

While these savings are impressive, it is unclear whether the gains are being

equitably shared. As the sole buyer of water quality credits, the Association has significant power to push down prices. On the other hand, the Association has played a critical role in establishing a new market and may offer a valuable model for lowering transaction costs. However, as the market matures, the market power of the Association may start to represent a constraint.

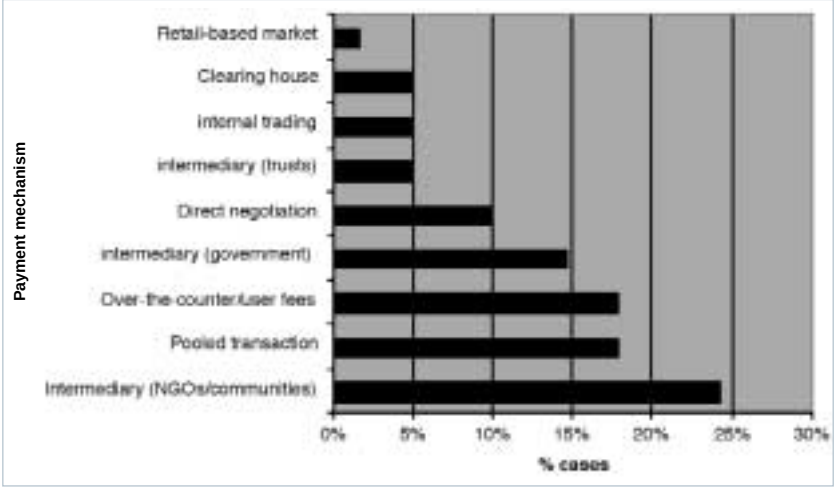
Source: Environmental Protection Agency (1993, 1996); Environomics (1999)

5.2.4 A spectrum of payment mechanisms

Eight categories of payment mechanisms for watershed services were identified in this review. These are described below and their relative importance in the cases reviewed set out in Figure 19.

- *Direct negotiation between buyers and sellers*. These involve either detailed contracts setting out best management practices to be undertaken to achieve improved watershed benefits or land purchase agreements. More recently conservation easements have been negotiated between buyers and sellers.
- *Intermediary-based transactions*. Intermediaries are used to control transaction costs and risks, and are most frequently set up and run by NGOs, community organisations and government agencies. In some cases independent trust funds are created.
- *Pooled transactions*. Pooled transactions control transaction costs by spreading risks amongst several buyers. They are also employed to share the costs of a large transaction as often required in the watershed markets.
- *Internal trading*. Transactions within an organisation, e.g. intra-governmental payments.
- *Over-the-counter trades/user fees*. These occur where the service is pre-packaged for sale, e.g. water quality credits. Watershed services are frequently offered at a standard rate for different beneficiaries through user fees. This rate is normally not negotiable and imposed on all beneficiaries.

Figure 19: Payment mechanisms used in markets for watershed services



The Conservation Fund (Procuencas) is a private initiative involving the collection of an environmental fee from consumers living in Heredia, Central Valley in Costa Rica through their water bills. These funds are then invested in watershed management in strategic catchment areas, both in public (about $30/ha/year) and in private lands (about $60/ha/year).

- *Clearing-house transactions*. A more sophisticated intermediary that offers a central trading platform for buyers and sellers is a clearing-house. This mechanism depends on the existence of a standardised pre-package commodity, e.g. salinity credit, water quality offset.
- *Auctions*. Often associated with clearing-house mechanisms and over-the-counter trading, auctions attempt to move a step closer to a competitive market for watershed services. Auctions are proposed for determining the supply of watershed services as well as for allocating obligations to pay.
- *Retail-based trades*. Where payments for watershed protection are attached to existing consumer purchases, e.g. Salmon Safe agricultural produce. Normally associated with certification and labelling schemes that generate consumer recognition and willingness to pay.

These mechanisms are not mutually exclusive. Rather this review highlights the growing trend in combining a "cocktail" of approaches. In what follows examples are provided to illustrate how these mechanisms are employed.

Intermediary-based transactions are the most commonly employed mechanism, accounting for 44% of the total implemented mechanisms. Of the intermediaries, NGOs and community organisations have been used most frequently. These agencies tend to be either organisations with significant local knowledge and expertise in implementing rural development projects, including watershed protection, or they are set up specifically to manage the transaction process. The Valle del Cauca watershed protection scheme provides a useful example of how a community organisation may be created to facilitate market development (see Box 26).

Box 26: Catalysing payments for watershed services in Colombia through a community-based intermediary

Faced with growing water scarcity and inadequate public finances, farmers in Valle del Cauca have formed water user associations to invest in protecting upstream watershed areas. The first association was the Guabas River Water User Association (Asoguabas). Since then, with support from local sugar cane growers and producers as well as the government's Regional Autonomous Corporation of Rio Cauca, another 11 water user associations, 3 water management foundations and 3 river corporations have been established covering over 1 million hectares and 97,000 families.

These associations represent local communities' demand for watershed protection and are funded by members' contributions through user charges linked to water consumption. Funds for Asoguabas are collected through charges of between US$0.48-$2.81/litre/second, four times a year. In total, in 1998 user fees collected by all water associations amount to well over $600,000 per year.

Watershed protection is achieved through a variety of activities, such as soil stabilisation through re-vegetation and fencing to prevent grazing in vulnerable areas. Emphasis is placed on local community involvement to ensure sustainability. Management plans of the areas abide by regional watershed management plans.

The mechanism through which beneficiaries of watershed services pay suppliers has evolved through time. Initially Asoguabas purchased land in the upper reaches of the watershed in areas identified as vulnerable to erosion. More recently, it has negotiated land management contracts with upstream landowners. Asoguabas, which is a legally registered group with a Board of Directors, is responsible for collecting fees, managing funds and allocating payments to the upstream landowners.

The Asoguabas has been supported by other groups of farmers (Association of Sugarcane Growers and Association of Sugarcane Suppliers). The groups have helped to build organisational capacity and provided administrative support. These groups have also been instrumental in spreading the concept in Colombia. Similar water users associations have been formed in the Amaime, Desbaratado, Bolo, Frayle, Palo, Jamundi, Tulua and Morales River catchments. In other areas the idea has been modified for local context, e.g. Bitacoes Foundation and River Daguas Corporation. More recently there have been moves to form a Colombian Federation of Water Users.

Source: Echavarria and Lochman (1998); Echavarria (2000)

As highlighted in Section 5.2.2, governments also play an important role in markets as intermediaries. They bring potential buyers and sellers together in a wide range of countries, including Australia, the USA, Brazil, China, Colombia, Costa Rica, Guatemala, Malawi and Vietnam (see Box 23).

Intermediary-based transactions are often used as a mechanism for pooling demand. This is critical in markets for watershed protection since threshold effects require minimum areas are protected. Pooling allows sufficient funds to

be raised and permits risk-sharing. Pooling is used in over 17% of the cases reviewed, frequently complemented by user fees. In the case of Valle del Cauca in Colombia (see Box 26 above), community-based intermediaries have been formed by water users to pool their demand through the associations via user charges. In Ecuador two approaches are used. In Quito a trust fund intermediary has been established to pool payments collected through user fees, while in the city of Cuenca a simpler multi-stakeholder grouping has been formed to allocate revenue from a water bill surcharge to watershed protection. The Quito case is outlined in Box 27. A proposal for a similar trust fund based payment system is being considered in the Philippines' Makiling Forest Reserve.

Box 27: Quito's Water Conservation Fund: pooling demand for watershed services through trust funds

Quito's Water Conservation Fund, which was launched in 1998 with support from The Nature Conservancy, USAID and Fundacion Antisana, represents the first attempt to set up a trust fund payment system for watershed protection in Ecuador. Increased competition for water and pressure on land for agriculture, livestock, hydropower and tourism has provided impetus for the fund's establishment.

Finance will be primarily sourced from water users fees levied on domestic, industrial and agricultural users. Users may form associations to contribute to the Fund. The main users include: MBS-Cangahua irrigation project (2.3 m^3/week), private farmers (2.1 m^3/week), the hydropower company HCJB (4.8 m^3/week), Papallacta Hot Springs (0.008 m^3/week), and other hydropower projects, e.g. Electro Quito-Quijos Project, INECEL-Cuyuja Project and INECEL-Coca Codo Sinclair Project (6.5 and 4.3 m^3/week respectively). Water fees will be differentiated between non-extractive users (e.g. hydropower and recreation) and extractive users (e.g. irrigation and drinking). The Metropolitan Enterprise of Water and Sewer Systems in Quito which uses 1.5 m^3 per week for drinking water has already agreed to pay 1% of sales, worth about $12,000/month. In addition to direct payments by beneficiaries, it is possible that funds will be supplemented from national and international sources.

On the supply-side, the improved water supplies are to be achieved through investment in watershed protection, initially in the Cayambe-Coca (400,000 hectares) and Antisana Ecological Reserves (120,000 hectares) surrounding Quito. The area may be extended to incorporate the Condor Bioreserve. Glaciers in these areas store 1,400 m^3 water. The area is inhabited by 27,000 people who use water for agriculture and extensive livestock grazing. Activities that could be financed through this scheme include: land acquisition in critical areas, provision of alternative income for local residents, supervision, implementation of agriculture best management practices, education and training.

The Fund, which became operational in 2000, is managed by a private asset manager (Enlace Fondos) and has a Board of Directors with representatives from local communities, hydropower companies, the national protected area authority, local NGOs and government. The fund is independent from the government, but cooperates with the environmental authority to ensure complementarity with government programmes. Programme will be executed through specialised

entities and will involve local participation. According to the Fund's mandate, administration costs will be limited to 10-20% total expenditure.

Source: Echavarria and Lochman (1998); Johnson (2000); Troya (1998)

Not all user fees are introduced in a consultative manner. They are often imposed by water-based enterprises (e.g. water supply or hydropower entities) to cover costs of watershed protection. This approach has been adopted by New York City, SEMAE in Sao Paulo and Apele Romane of Romania, and is proposed for the Bermejo River project in Bolivia and Argentina as well as for Heredia Public Service Enterprise, Costa Rica.

The use of more sophisticated systems such as clearing-house mechanisms has been limited to developed countries. However, even in the USA where thinking about clearing-house mechanisms is most advanced, implementation is in a nascent phase (see Box 28). New South Wales' proposed Environmental Service Investment Fund, described in Box 24 above, sets out Australia's plan for a clearing-house mechanism.

Box 28: Nascent clearing-house trading in the USA

The US Environmental Protection Agency's "Draft Framework for Watershed-Based Trading" published in 1996 aims to guide states in setting up watershed-based trading regimes. In addition to recognising the potential for point and non-point source pollution trading to contribute to efforts to clean up waterways, the document draws attention to an array of payment systems that can facilitate trading and minimise transaction costs. Watershed banking is perhaps the most sophisticated approach put forward.

Rooted in USA experiences with wetland mitigation banking, watershed banking is a clearing-house system where an intermediary enters into legally binding agreements with suppliers of pollutant reductions in exchange for financial payments. The bank then sells these commitments to polluters that wish to exceed their own limits. The bank thus offers a valuable central trading platform in a complex trading environment. Three states have already started to put in place a clearing-house trading mechanism including: North Carolina's Tar Pamlico Basin trading system, Idaho's Lower Boise River Trading System and Wisconsin's Rock River Basin Phosphorus credit scheme. North Carolina's scheme was outlined in Box 25. The Lower Boise River Trading System is described below.

Lower Boise River Trading System
In September 2000 a set of recommendations to guide watershed trading were put forward in a final report on the Lower Boise River Effluent Trading Demonstration Project launched in January 1998. The main features of the proposed market are outlined below.

The system will involve trading of water quality credits valued in "Parma pounds", i.e. pounds of phosphorus loading reduction calculated for the Boise

River at the river's mouth (Parma). Water quality credits may be generated from point source polluters that reduce emissions by more than they are required, or from non-point source polluters that adopt best management practices from an approved list. The list specifies measured and calculated credits. Measured credits are directly measurable, whereas calculated credits are based on a specified formula. Calculated credits will be subject to "uncertainty discounts" that reduce the value of the credit to account for variability in the effectiveness in particular activities. A provisional list of items includes a range of forestry activities, e.g. buffer strips and filter strips.

Non-point sources are also subject to "Drainage Delivery Ratios". These ratios seek to reflect the complex factors that affect the transmission of pollutant reductions to load reductions at the river mouth (e.g. uptake by vegetation, infiltration into groundwater, etc.). In addition "site-specific factors" are used to modify values to account for the level of diversion and reuse of water below the point of discharge. The aim to provide incentives for the most valuable activities in terms of pollution reduction to be taken up first.

Implementation of best management practices must be additional to any already required under existing regulations and be based on a plan drawn up by a qualified professional. Credits are only valid for sale if they represent measured and verified reductions in pollutant emissions for a specified time period and have been transformed into signed "Reduction Credit Certificates". All credits must be approved and registered.

Point source polluters regulated under the National Pollution Discharge Elimination System are likely to be the main source of demand, though credits can be purchased by anyone. Some permit holders will be permitted to trade with other permit holders or non-point source pollutants.

The proposal suggests that a private not-for-profit multi-stakeholder association, the "Idaho Clean Water Cooperative", oversees trading. The Association will act as a clearing-house and be responsible for:

- receiving and registering non-point source "Reduction Credit Certificates" via Trade Notification Forms signed by both the seller and buyer;
- maintaining a central trade database;
- bringing buyers and sellers together – brokerage function;
- preparing monthly watershed-wide trade summary; and
- providing additional support to traders.

The private buyers and sellers retain significant responsibility for installing and maintaining non-point source reductions, monitoring their impacts and verifying these are correct. All these activities must be achieved prior to submitting a Reduction Credit Certificate to the Cooperative. All trades will be audited by the Environmental Protection Agency and the Idaho Department for Environmental Quality through the regular verification procedures for National Pollution Discharge Elimination System permits. Non-point source credits will be subject to on-site verification by the Soil Conservation Commission. Where credits are found to be false, the point source is liable.

Source: Ross and Associates Environmental Consulting Ltd (2000)

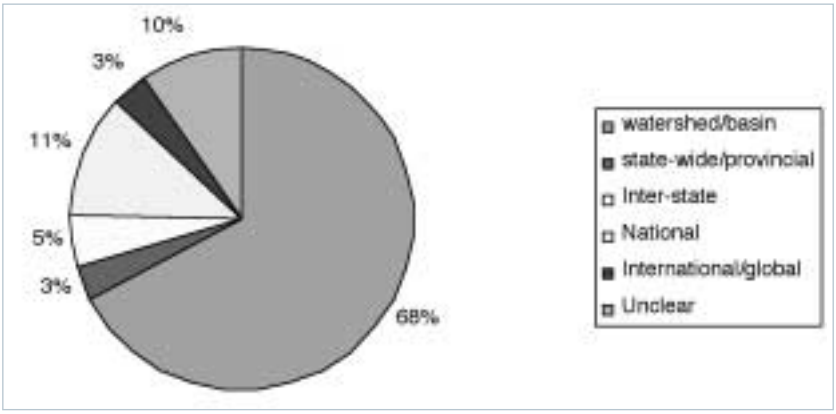
Of the two payment mechanisms not yet touched on, only retail-based trading has been tried in the USA under the Pacific Rivers Council's Salmon Safe scheme. The lack of interest in retail-based markets contrasts with rapid expansion in this mechanism as a way of capturing willingness to pay for biodiversity protection. This may be partly accounted for by the local nature of watershed protection services and the limited market for labelled products. Nonetheless, the Salmon Safe scheme shows how a project may be broadened beyond a single watershed to tackle a regional problem, thereby expanding demand.

With respect to auctions, these are attracting increased interest, but have yet to be implemented. Box 24 above outlined how New South Wales envisages the use of auctions for allocating payments through its Environmental Service Investment Fund.

5.2.5 A preponderance of local markets

Watershed services are supplied at the watershed level. The size and location of a watershed will determine whether the trade is local, state-wide, provincial, national, regional or even international. Based on the cases reviewed, most markets that have emerged are local, often involving watersheds that supply urban or rural settlements (see Figure 20 below).

Figure 20: Geographical extent of markets for watershed protection



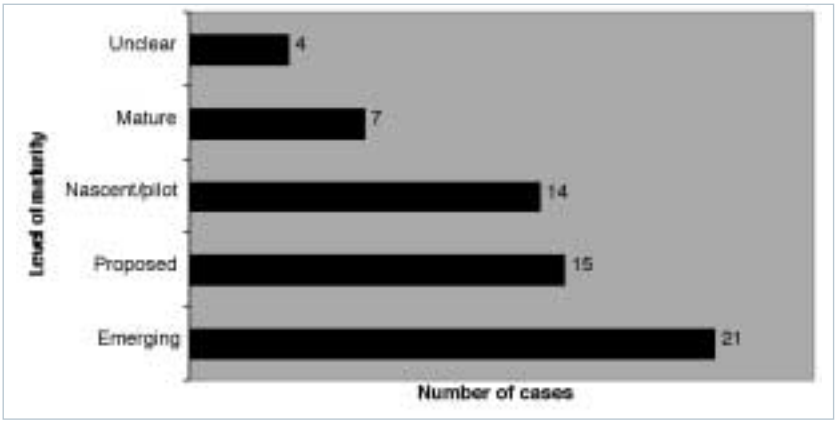
The preponderance of local markets is not surprising given the constraints associated with geographically dispersed markets. In larger catchments not only are hydrological linkages between upstream actions and downstream water impacts increasingly tenuous, but perceived links by beneficiaries and suppliers are less likely. Ultimately, unless downstream communities believe they gain from upstream watershed protection, they will not be willing to pay for supply. Furthermore, even where there exists a willingness to pay, where watersheds span political boundaries (e.g. national or even state borders), the risks involved may prevent payments emerging. Of the cases reviewed, only one proposes an international arrangement between Argentina and Bolivia.

However, not all watershed service markets are tied to specific catchments. South Africa's proposed Stream Flow Reduction Licensing system, for instance, aims to create a regional system for financing catchment management, while Colombia is implementing a national payment scheme. Retail-based markets, e.g. Salmon Safe products in the US Pacific Northwest, raise funds to improve regional watershed services and are not tied to a particular watershed.

5.2.6 Watershed markets are largely immature

Because markets for watershed protection are largely local affairs, numerous markets exist side-by-side. Using criteria set out in Section 2.4.1 (time since initiation, price discovery, market participation and sophistication in payment mechanisms) an attempt was made to classify individual market maturity. Figure 21 provides an overview of this assessment.

Figure 21: Watershed protection market maturity



The majority of markets covered are classified as emerging or nascent, and proposed markets account for a quarter of cases. The most mature markets are concentrated in developed countries, with examples in the USA standing out.

5.2.7 Watershed markets strengthen non-market institutions

Markets for watershed protection services are closely intertwined with other local institutions, often complementing and reinforcing regulatory or cooperative systems for watershed management.

Progress with water quality control initiatives in the USA, for instance, is often associated with the introduction of supporting trading and/or payment schemes (see Box 25 and Box 28). In New South Wales' proposed salinity credit trading scheme (see Box 24), markets will play a key role in strengthening salinity regulations. In the developing world, markets provide essential finance for implementing watershed protection (e.g. China, Brazil, and Costa Rica).

Photo by Ashish Kothari

The success of payment mechanisms often depends on the strength of underlying social institutions. In Sukhomajri, India, over 20 years of experience with cooperation through a Water Users Association and Hill Resources Management Societies has underpinned new systems for sharing benefits from improved watershed protection.

Markets also support cooperative arrangements that have come under strain due to diverging interests. As groups grow and become more heterogeneous, it is increasingly difficult to ensure individuals remain engaged. Cooperative arrangements have employed a range of schemes that permit those who gain most from watershed protection (e.g. irrigators) to compensate those that lose (e.g. landless). India's long history of cooperative watershed management offers interesting examples of how benefit-sharing schemes may promote watershed protection (see Box 29).

Box 29. India: nesting markets in cooperative watershed management

India's experience with participatory watershed management is extensive (Farrington *et al*, 1999; Hinchcliffe *et al*, 1999). Success stories are frequently held up to illustrate the potential for cooperative arrangements to outperform centralised, state-led approaches. Increased local ownership, improved access to local information on problems faced and reduced bureaucratic interference are a few of the benefits associated with a participatory approach.

While participatory watershed schemes are often grouped together, they are not all the same. In many cases cooperation is supported by sophisticated hierarchical systems (e.g. Watershed Development Associations) that distribute responsibilities in an organised way. Market-based approaches also have a potentially valuable role to play in supporting coordination by offering:

- a transparent and efficient way of managing participants' interaction;

• a mechanism for sharing benefits to secure broad participation; and
• a mechanism for self-financing.

An example of how market arrangements have been used within a framework of cooperation is provided in Sukhomajri.

Sukhomajri village, located in Haryana state in the foothills of the Himalayas, was amongst the first in India to test participatory watershed management. The scheme was launched in 1979 in response to growing water scarcity, compounded by reductions in local dams' storage capacity due to high levels of siltation. Residents living downstream of Sukhomajri in Chandigarh were particularly badly affected by siltation of Lake Sukhna, their main source of water. Research by the Water Conservation Research and Training Institute found that 80 to 90% of sediment delivery to Lake Sukhna was coming from only 20% of the catchment. Sukhomajri was blamed for a large share of the sediment load.

To tackle the heavy siltation and low dry season flows, farmers in Sukhomajri were supported by the Research and Training Institute and the Ford Foundation to undertake a programme of check dam construction and watershed management. A Water Users' Association was set up in 1982, charged with implementing watershed management, dam management and the collection of fees from water users. However, the main beneficiaries of watershed protection were residents in Chandigarh. To secure Sukhomajri's participation, resources were provided to the village to construct a reservoir for irrigation.

While the reservoir helped to align farmers' incentives with those downstream, benefits were not evenly spread within Sukhomajri. Whereas landholders below the reservoir benefited from increased water for irrigation, landless individuals who depended on common lands above the reservoir found their access for grazing and the collection of NTFPs restricted. To gain the support of landless households, the Water Users Association introduced a benefit-sharing system. Rather than paying landless households not to use common lands, a tradable water rights scheme was introduced. This scheme awarded every household the same rights to water and permitted those that had no use for water (i.e. landless) to sell their rights to others, thereby gaining a financial compensation for complying with watershed protection. The Water Users' Association was responsible for allocating and keeping records of water rights trades.

More recently the tradable water rights scheme has been abandoned in favour or simpler system of water user fees. Fluctuations in water availability made it difficult to maintain a system of water rights. The new system ensures water users pay a watershed protection charge which is channelled through the Water Users Association to be spent on dam maintenance and watershed protection activities. Hill Resources Management Societies have been established to ensure forest protection. In implementing watershed protection, the Water Users Association makes a point of employing landless people, providing another incentive to gain their support.

Source: Shah (1999), DFID (1999b), Rhoades (1998), Farrington and Lobo (1997), Hinchcliffe *et al* (1999), Fernandez (1999), Patel-Weynand (1997), Kerr (1992); Misra (pers. comm. 1997); Chopra *et al* (1990); Kerr (2002)

In addition to strengthening existing cooperative and hierarchical institutions, markets have frequently spurred the creation of new institutions (e.g. Romania's Water Fund, the Tar-Pamlico Basin Association in North Carolina, Idaho's Clean Water Cooperative, and Ecuador's Water Conservation Fund). Cooperative institutions are often essential for ensuring local support. Brazil's watershed payment scheme in Piracicava builds in cooperative elements through its multi-stakeholder Municipal Environment Council. San Jose's (Costa Rica) watershed fund similarly depends on a multi-stakeholder Board of Directors while Minnesota's (USA) Rahr Malting organises its watershed protection activities with approval from a multi-stakeholder trust fund. New York's Watershed Agreement provides a useful example of how the emergence of a payment scheme may be couched in a complex array of supporting bodies, including a number of multi-stakeholder institutions (see Box 30).

Box 30: From partnerships to payments: New York City's Watershed Forestry Program

Water utilities across the USA are incorporating watershed management and protection as an integral part of their business strategies. Based on a review of 17 water utilities that have adopted watershed approaches to managing their raw water supplies, the Environmental Protection Agency (1999) draws attention to innovative partnerships and transfer mechanisms being adopted by water utilities. These include partnerships between water utilities and landowner representatives, land exchange agreements, conservation easements and land management contracts. The basis for these approaches is a recognition that if water utilities wish to control non-point pollution, they need to consult with landowners. Moreover, where watershed management requires landholders to alter their daily activities, in the absence of regulatory tools the water companies will need to provide incentives for compliance. Within this context a number of water utilities have begun negotiations with households and associations. Perhaps the most well documented case is that of the New York City water authority's partnership with farmers in the Catskill and Croton watersheds to undertake best management practices, including forestry activities. This case is described below, with emphasis placed on the forestry components of the plan.

The New York City watershed covers 1,900 square miles and is split between the Catskill/Delaware catchment, which supplies 90% of the City's drinking water, and the Croton catchment that supplies the remaining 10%. A total of about 1.4 billion gallons are consumed a year by 9 million inhabitants in and around New York City. In 1993 the Environmental Protection Agency threatened to require that the City invest in a $4 to 6 billion filtration system to ensure it met federal water quality standards. Instead the City negotiated to be permitted to pursue a more cost-effective pollution reduction scheme targeting point and non-point source polluters. Following several years of negotiations, the following 3 programmes have been initiated to encourage watershed management:

- A Watershed Agriculture Programme launched in 1994 involves paying farmers to tackle non-point source pollution and the promotion of conservation easements through the federal Conservation Reserve Enhancement Programme. With the latter farmers can choose to enter 10-15 year contracts with the US Department of Agriculture to retire environmentally sensitive lands from production.

- A Watershed Agreement reached in 1997 that costs US$1.4 billion over 10 years and involves a land acquisition and conservation easement programme, and a Watershed Protection and Partnership Programme. The latter pays landowners to introduce soil and water conservation practices.
- A Watershed Forestry Programme launched in 1997 promotes improved forest management in catchments that have not already been protected through land acquisition or conservation easements. Forests cover 75% of the watershed land area and are valued for their capacity to filter water and reduce water nutrient content.

With respect to the Watershed Forestry Programme, support is channelled to landowners in the form of cost-sharing for approved practices, logger training and education, Model Forest demonstration projects, free material inputs (e.g. geo-textile fabric for roads), cheap rentals (e.g. portable bridges), and economic development initiatives to take pressure off private forests. To receive payments, foresters must get approval from New York City and, in the case of cost-sharing, must submit plans and employ approved operators. Funds are available for the development of management plans and for the hire of qualified professionals. To be eligible, landowners must have more than 10 acres. Cost-share payments are made following inspection.

In addition, there have been 3 new sets of activities supported under the Forestry Programme:
- Conservation Reserve Enhancement Programme launched in 1998 to provide incentives for landowners to retire streamside buffers from production through cost-sharing agreements. The programme will last for 5 years and aims to establish 165 miles of buffers.
- Whole Farm Easement Pilot Programme launched in 1998 to help landowners finance the implementation of Whole Farm Planning.
- Riparian Forest Buffer Programme launched in 1999 to complement the New York City Conservation Reserve Enhancement Programme by creating a network of professional and financial resources for supporting riparian buffer restoration.

Progress to date has been rapid. By 1999, a total of 81 landowners had submitted forest management plans, covering 24,700 acres of private lands, and an additional 16 landowners had submitted applications for plans. Under the Whole Farm Easement Pilot, 5 out of a planned 10 applications had already been received in late 1999, representing over 1,300 acres of farm woodlots.

While most of the funding for the Forestry Programme comes from the New York City Department of Environmental Protection, additional support is provided by the Department of Agriculture's Forestry Service, the Catskill Forest Association, New York State College of Environmental Science and Forestry, New York State Department of Environmental Conservation, Empire State Forest Products Association and Cornell University. Support is mostly provided in the form of technical assistance and advice.

Source: Watershed Forestry Program (1999); Environmental Protection Agency (1999); Watershed Agricultural Council (2000); Echavarria and Lochman (1998); Dolan (2000)

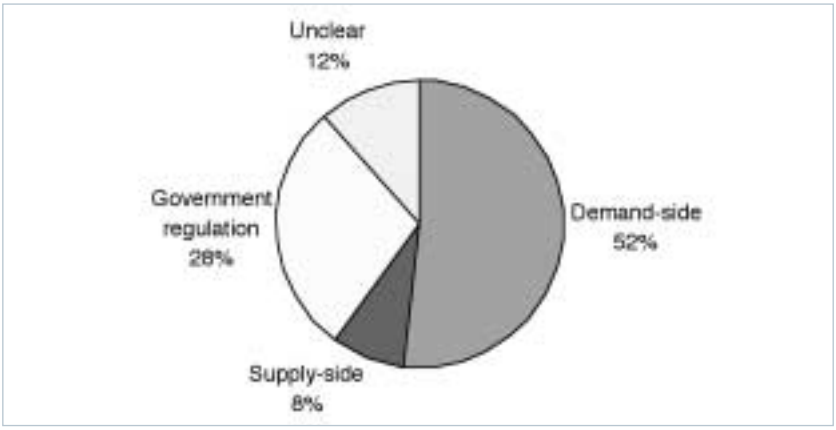
Payments systems for watershed protection may also piggyback on established markets, most notably for land and water rights. Land acquisition is a common approach to realising watershed protection, e.g. the Cannon River Watershed Partnership scheme in Minnesota and Quito's watershed protection scheme in Ecuador. South Africa's proposed water rights and Sukhomajri's original tradable water rights system in India illustrate how payment for water rights offer a basis for collecting payments for watershed protection.

Markets for watershed services that have emerged to date have posed few threats to existing institutional arrangements. Payments have been introduced where they have complemented existing hierarchical and cooperative structures and have served to strengthen these.

5.3 Drivers for watershed market development

Figure 22 presents an overview of the relative importance of demand-side, supply-side and regulatory drivers for market establishment in the cases reviewed.

Figure 22: Drivers for watershed market development



As with markets for biodiversity protection, demand is the main driver behind watershed market establishment, accounting for over 50% of the cases. The perception that forests play a critical role in maintaining water quality and ensuring supplies is the major factor behind growing demand for forest management in key catchments[33]. Willingness to pay is growing amongst government and private entities responsible for providing clean drinking water and managing hydropower plants, downstream farming communities that wish to guarantee continued water for irrigation and broad groups of industrial and domestic users willing to pool payments.

In the case of regulatory drivers, markets are rooted in externally imposed requirements. Apart from examples in Colombia, Jamaica and South Africa,

33. As highlighted in Box 21, perceived forest watershed benefits are not always firmly rooted in scientific data.

government regulation has been most important in developed countries where environmental regulations are stricter. Where governments introduce watershed-based requirements, these are often supplemented by market approaches to increase the effectiveness of requirements, reduce costs of compliance and introduce new sources of finance for watershed protection. The USA stands out for its efforts to use markets to achieve water quality standards. Rooted in its experience with market approaches to achieving air pollution control, trading systems are being pushed as cost-effective tools for reaching water quality targets in a number of states (see Boxes 25 and 28). Regulatory-based markets in developing countries have tended to involve the introduction of mandatory user fees. Colombia's National Watershed Payment Scheme is a good example of such a system and is briefly described in Box 31.

Box 31: Colombia's regulatory-based market for watershed protection services

In 1993 the Government of Colombia introduced a National Environmental System. Under this system forests are given prominence due to their role in protecting watersheds through soil stabilisation, flooding control and water provision in dry periods. In the same year the government set out its intention to decentralise funding for environmental protection. Under its Law 99, Regional Autonomous Corporations – agents responsible for implementing environmental policy – were provided with greater independence. By 1998 Regional Autonomous Corporations accounted for 62% of total public investment in the environment. The remainder came from the central government, a National Royalties Fund and international assistance.

To ensure sustainable financing for implementing environmental policy the government provided the Regional Autonomous Corporations with earmarked revenue streams. Prominent among these are charges for forest watershed services, including:

- Payments by electricity companies with hydropower plants (over 10,000 kilowatt) – 3% of their gross sales revenue must be paid to Regional Autonomous Corporations and 3% to municipalities in catchments where hydropower plants are located. Corporation funds must be allocated to protecting watersheds, while the municipalities can use funds for improving local environment and health.
- Payments by water-based investors – 1% of investments in water-related projects is allocated to protection in the relevant catchment in the form of projects supervised by the Regional Autonomous Corporation.
- Payments by municipalities and provinces – 1% of budgets between 1993-2002 must be allocated to purchasing land to protect watersheds that supply towns.

Source: Rodriguez Becerra *et al* (1999)

Supply-side drivers are less common and of the 5 cases identified in this review, 4 have yet to be implemented. Because watershed services are generally not excludable (i.e. consumption cannot be restricted), it is difficult for suppliers to solicit payments. Nevertheless, the number of proposed schemes reflects a growing conviction amongst suppliers that they may generate payments where

beneficiaries can be convinced of threats to supply. This is the strategy of Malawi's Forestry Department in its efforts to introduce a watershed levy on Water Boards[34].

5.4 Watershed market evolution

Identifying the process through which watershed markets are being formed is difficult. Most literature describing markets focuses on their current structure rather than the process of development. Nonetheless, drawing on the cases reviewed in this study, a broad set of steps in market evolution may be identified. The are outlined below.

Establish that the service is beneficial and determine forestry activities that deliver the service. Significant myths surround the importance of forests to the delivery of watershed services (see Box 21). Scientific evidence needs to be collected for selected catchments to ensure forests are beneficial, and more importantly what species, forest management regime and combination with non-forest land uses are optimal.

Generation of willingness to pay. Awareness that forests play a positive role in water supplies does not always translate into willingness to pay. Beneficiaries must either believe supplies are threatened and that they will have to pay to guarantee their future, or they must be required to pay. Where voluntary payments are sought, entrenched beliefs that watershed protection is the government's responsibility must be challenged. Beneficiaries must also be persuaded that free-riding will not be permitted and that their contributions will not be misused. In the case of regulation, a number of approaches exist from simple mandatory charges, to sophisticated cap and trade systems. Either way, governments must have a basic institutional capacity to enforce rules.

Define a commodity to proxy the service. With demand established, a commodity to proxy watershed services must be defined. The proxy must provide a basis for measuring supply and determining payments. This may be achieved through negotiation or may require a legislative process to establish formal property rights, e.g. water quality credits or salinity credits.

Design and implement a payment mechanism and supporting institutions. With the commodity agreed, a payment mechanism is needed. This may mean building a trading platform such as a clearing-house, setting up brokerage institutions that specialise in organising deals, and investment in supportive agencies, e.g. water user associations, forest management groups, monitoring and enforcement mechanisms, certification systems. The introduction of multi-stakeholder participation is increasingly common in the implementation of

34. It is worth noting that the prospect of watershed payments may create perverse incentives amongst landholders who see an opportunity to extract payments from beneficiaries by damaging watershed services until funds are forthcoming.

payment mechanisms (see Section 5.2.4). Trust funds, in particular, tend to be overseen by multi-stakeholder boards and generate a higher degree of confidence than other payment mechanisms. Increased participation is also being introduced during market design to ensure broad-based support for markets as they evolve. The Philippines' exploration of a Watershed Protection and Conservation Fee provides a valuable example of efforts that may be made to generate support through an intensive consultation exercise (see Box 32).

Box 32: Building support for watershed payment in the Makiling Forest Reserve, the Philippines

The Makiling Forest Reserve is located 100 kilometres south of Manila in Laguna Province. The area is highly valued for its biodiversity, recreational amenities, land fertility and water resources. The reserve provides watershed services to 5 districts, several water cooperatives, households that tap water directly, industrial, institutional and commercial users. However, in recent years, water quality has declined and water supplies have become increasingly scarce due to increasing demand and threatened supplies arising from encroachment and forest conversion in the Reserve. Currently farmers illegally occupy 45% of the Reserve.

The Makiling Forest Reserve was handed to the University of the Philippines Los Banos in 1989 to manage the development of hydro and geothermal (which relies on groundwater supplies) power for the National Power Corporation. In 1996, the university was given a broader mandate with the introduction of the Mt. Makiling Conservation and Development Master Plan. The plan set out a series of targets and activities for increasing forest cover, conserving biodiversity, establishing demonstration areas and strengthening institutional capacity over 25 years.

A key challenge facing the University has been to find finance to implement the Master Plan. Currently it receives regular transfers from the central government, revenue from entrance fees, leases and sales of plants as well as grants. In total these amount to only 10.5% of total requirements for the next 5 years. Given the impending financial crisis, in 1998 the University initiated research into innovative revenue generating mechanisms. Following significant consultation, in 2000 a proposal for a Watershed Protection and Conservation Fee was put forward.

The proposed fee would be added to water bills to capture downstream willingness to pay for watershed protection in the Reserve. While a range of beneficiaries may be ultimately liable, it is recommended that initially the charging scheme focus on the main users, namely Water Districts responsible for supplying potable water, households not serviced by Water Districts, government offices and other institutions, and resorts and private pools. Estimated willingness to pay by these groups came to between US$0.03/cubic metre and $0.04/cubic metre water used for 68% of water users. This is significantly above estimated costs of provision of $0.014/cubic metre.

Funds generated by the fee will be channelled through a new Makiling Forest Reserve Trust Fund. The Trust Fund will be overseen by a multi-stakeholder

Management Board, including representatives from the government research institutes, other large leaseholders, "People's Organisations", local government units (Laguna and Batangas), Laguna Tourism Association, Laguna Chamber of Commerce and Industries, private industries and NGOs. The Board would be responsible for formulating policies, guidelines and criteria for spending and ensuring their implementation.

In developing this proposal significant emphasis was placed on consulting key stakeholders. Not only has this been critical for stimulating demand and a recognition that beneficiaries of watershed services should pay for them, but it has laid the foundations for a solution. Consultation began in May 1998 with a meeting of 40 water users from the government, private sector and civil society (water cooperatives). A subsequent forum was held on water use policies to clarify policies and guidelines concerning water extraction and mechanisms for management. At this gathering a consensus was reached that revenue generated from a fee should be managed by an independent financial organisation and overseen by a multi-stakeholder board. A third meeting was held in 1999 to agree on a final institutional structure for fee collection. The University was charged with drawing up a Memorandum of Understanding on the proposed fee collection scheme.

Source: Francisco *et al* (2000)

Pilot activities and feedback to market design. A pilot phase to test the payments scheme, build skills and generate support is key. It is through pilots that outstanding hurdles will become clearer. For instance, lack of clear resource title may undermine an upstream communities' ability to sign management contracts that deliver watershed protection since they may be vulnerable to eviction from the land or the government may choose to give the forest rights to a timber company. Resistance amongst key stakeholder groups may also hold back markets. Pilots will held to bring out points of resistance and highlight negative impacts for certain groups.

The preceding discussion gives an overview of the kinds of steps that are involved in market creation. Not all the steps will always be followed, nor will they be undertaken in the exact order presented here. The process is iterative and involves continual improvement. The timeframe for market development is, thus, rarely quick, and in some cases development has been stalled while new hurdles are tackled. For instance, resistance from potential payers in the Philippines is holding up implementation, though a pilot payment system has been launched in Mindanao where a power company has agreed to move forward. In Colombia, progress has been held back due to political uncertainty and civil war, while in central America, e.g. El Salvador, recent earthquakes have diverted attention to more pressing needs. Governments may have key functions in catalysing demand and supply, but in some cases the process will evolve on its own.

5.5 What watershed markets mean for welfare and poverty

As with other environmental service markets, the literature on watershed protection fails to produce systematic cost–benefit analyses of emerging payments systems. The implicit assumption is often that markets are "a good thing". The discussion of benefits and costs of watershed protection tends to be broad and little attempt is made to put an economic value on these. Moreover, assessments generally do not examine the costs and benefits *vis à vis* an alternative system for achieving watershed protection, e.g. command and control mechanisms. Instead they focus on assessing impacts of watershed protection. The lack of impact analysis relating to markets is a clear gap in the literature and one that requires urgent attention. More specific comments with regard to economic, social and environmental costs and benefits and what markets mean for poor people are provided below.

5.5.1 Economic costs and benefits

Few of the studies provide a comprehensive list or valuation of the economic costs and benefits resulting from emerging markets for watershed protection services. References tend to be vague, providing little basis for drawing out conclusions as to whether markets generate net benefits. A summary of the available information is presented in Table 11 below.

Table 11: Economic impacts of watershed protection markets

Economic benefits	Economic costs
• Income generation for suppliers • Employment in watershed businesses • Cost savings vis à vis command and control approaches to achieving improved watershed protection • Cost savings vis à vis point source pollution controls • Direct benefits from watershed protection, e.g. more efficient hydropower and water supply systems • Positive spin-offs for forestry, agriculture, fishing, recreational activities	• Costs of providing watershed protection • Transaction costs of introducing and managing payment mechanisms • Opportunity costs associated with forgone land uses.

The main economic benefits highlighted include those that are achieved or expected from watershed protection and those associated with market approaches to promoting watershed protection. In general no figures are provided to indicate the value of these benefits. The study of the Philippines proposed Watershed Conservation and Protection Fee, however, stands out for its efforts to measure consumer surplus (i.e. net benefits for consumers) associated with improved watershed protection. Based on lower average estimated willingness to pay of beneficiaries worth US$0.03/ m^3, given a total annual consumption of 48,607,272 m^3, then willingness to pay comes to US$1.46 million per year. This compares favourably with costs of implementing the watershed management programme worth US$2.591 million over 5 years.

With respect to the cost savings achieved by using market-based approaches, measurements have been made for several of the USA watershed-based trades. For instance in North Carolina, the state is saving US$59 million by adopting a trading scheme versus an emission permit system. New York City is estimated to be saving between US$2.6-4.6 million over 10 years by adopting a land use-based trading scheme instead of building a $4-6 billion filtration system.

The level of actual and expected landowner income is also quoted in descriptions of market systems in Costa Rica, Vietnam and Panama. But, these are one-off figures and are rarely set against costs to landowners, or other benefits.

Costs of watershed protection are provided for 16 of the cases reviewed, but in only 3 cases (Quito's Water Conservation Fund, North Carolina's water quality trading scheme and Minnesota's water quality trading scheme) is reference made to transaction costs. The description of Quito's new Water Conservation Fund highlights how between 10-20% of finance channelled through the Fund will be kept to cover administrative costs. As only one component of transaction costs, this gives an idea of their importance in determining market success.

Transaction costs are also highlighted by Woodward and Kaiser (2000) in their review of USA water quality trading schemes, though they make no attempt to measure them. They emphasise that transaction costs are closely linked to the trading system, rules, reporting requirements, etc. and that different market structures will have different transaction costs. However, they stress that this does not imply that it is possible to simply switch to a system with low transaction costs since high transaction costs might reflect the difficulty of introducing a market in unfavourable conditions, e.g. imprecise measurement techniques. Where these conditions mean that trading is so costly that it is not beneficial, command and control approaches may be preferable.

5.5.2 Social costs and benefits

No social costs were highlighted in the literature. As with economic impacts, social benefits may be split between those arising from watershed protection, and those associated with market-based approaches. The two categories of benefits are listed below.

Benefits associated with watershed protection

- Health benefits result directly from improved drinking water, and indirectly from improved agriculture, fishery productivity and knock on effects for diets.
- Environmental education, which is often promoted alongside watershed protection activities to generate local support.
- Training in improved land use practices that generate watershed benefits.
- Improved recreational opportunities associated with cleaner water, e.g. fishing and water sports.

• Reduced sound and smell pollution, e.g. Ecolotree Ltd. points to improved local odours and reduced sound pollution where it plants its trees.

Benefits associated with markets

• Improved environmental education, which is an essential part of the market development process since it underpins beneficiaries' willingness to pay for watershed protection services.
• Social institution strengthening. Community groups promoted to support markets, offer a basis for cooperation on a range of other livelihood improving activities.
• Improved scientific understanding where market development requires research on land-water linkages.
• Land title clarification where markets require secure property rights.

5.5.3 Environmental costs and benefits

Only environmental benefits are recorded, and for the most part little data is produced to back up the claims. Moreover, they tend to be associated with watershed protection rather than attributed to markets. The main benefits recorded may be split between watershed benefits and other spin-offs. These are listed below:

Watershed benefits

– Improved water quality: controlled sediment and nutrient (e.g. phosphorus, nitrogen) loadings, reduced water salinity
– Flood protection
– Maintained base flows through groundwater recharge
– Soil erosion control
– Soil fertility maintenance (nutrients and salinity)

Positive spin-offs

– Biodiversity protection (both land-based and aquatic)
– Landscape beauty/aesthetic benefits
– Carbon sequestration

The lack of field-based measurements is worrying, especially in light of questions raised in the scientific literature about forest-water linkages (see Box 21).

5.5.4 Watershed market impacts for poor people

The superficial nature of impact analyses extends to evaluations of costs and benefits for poor households. For the most part, little or nothing is said on the topic. Where it is, blanket statements are common. It tends to be assumed that where the benefits listed above accrue to forest-based communities, they will be captured by the poor. However, a broader look at the literature on watershed management warns against simplistic assumptions (see for instance Farrington *et al*, 1999). The benefits and costs listed above are revisited below to consider what they might mean for poor people.

The balance of costs and benefits within a watershed can be looked at by considering upstream and downstream communities, i.e. providers and beneficiaries of watershed protection, separately. If we take upstream landholders first, there are a number of potential benefits for poor communities where they hold land that is targeted under watershed protection payment schemes. Apart from the regular income stream, training in forest management may yield benefits for the natural capital base. This in turn could mean greater income from other forest-based activities, including sustainable timber extraction, NTFPs, eco-tourism, or even the sale of related biodiversity or carbon services. To the extent that these new activities help diversify livelihood portfolios of poorer groups, they may reduce income shocks and increase stability. Moreover, where involvement in watershed service markets leads to investment in cooperative institutions such as watershed committees, there are significant potential spin-offs for poorer groups who gain experience in coordination and may use these new groups as a basis for cooperation in other areas.

But the gains experienced by poor upstream communities depend on their ability to negotiate for payments and their freedom to move in and out of the market. Where poor households lack secure property rights in a watershed and forest protection may be imposed by force, these groups have little leverage for ensuring adequate compensation for the loss of land use rights. In extreme cases, poor households will be evicted from protected areas. Similarly, where disadvantaged groups lack the necessary education and political power to bargain effectively with downstream beneficiaries, they may be coerced into unfavourable deals.

With respect to downstream communities, markets also offer new mechanisms to ensure improved and sustainable water supplies. Yet, the extent to which poor communities gain depends on their access to the improved water, the quantities they use and the extent to which they bear the costs of watershed protection. Where access to water is linked to land rights, landless households may not share in the gains. But, where the costs of watershed protection are shared equally across the community, negative equity impacts may be serious. Even where costs are linked to the level of water use, poor people are likely to be disadvantaged since the total will represent a larger share of their income than wealthier users. Moreover, to the extent that wealthier water users do pay most, funds will be channelled towards watershed protection that benefits their interests. This may or may not benefit poor groups.

A key theme running through the discussion above is that where gains from trade are significant, there will inevitably be competition for a share of the rents – either on the buying or selling end of the market. Poor communities that lack education, managerial skills and political connections will tend to be disadvantaged in such a competition. The risks that poor groups are damaged by markets for watershed protection requires serious consideration. Water is essential to life and risks that markets will reinforce inequities cannot be

ignored by policy-makers. The constraints that poor groups face in benefiting from emerging markets is taken up in Section 5.6.4.

5.6 Constraints to watershed market development

Three broad sets of constraints may be identified: constraints relating to high transaction costs, demand-side constraints and supply-side constraints. These categories are not mutually exclusive, and in many cases constraints may fall into two groups. Factors that push up transaction costs, for instance, may also undermine demand. Each set is examined below.

5.6.1 High transaction costs

Transaction costs can make or break markets. While the costs of identifying potential trading partners, negotiating to implement a trade, monitoring and analysing service delivery, documentation and record keeping and administration of trades exist in all commodity and service markets, they are particularly high in markets for watershed protection. This is partly a reflection of the nature of the product and the large numbers of participants involved, but it is also the result of an underdeveloped market infrastructure. The main reasons for high transaction costs in watershed protection markets are outlined below, and reference made to methods being adopted to reduce them.

Multiple-stakeholder transactions

Deals arranged between upstream and downstream communities in watersheds frequently involve large number of participants. Hydrological threshold effects mean contracts must cover a minimum area of the watershed, often involving large numbers of landowners. Moreover, to avoid "free-riding" in consumption, and to convince beneficiaries to pay, broad participation is often essential. The result is a complex process of negotiation involving a range of upstream and downstream players, often with differing interests. The larger the catchment and the number of communities involved, the greater the chance of conflict. The costs of multi-stakeholder participation are highlighted by Rhoades (1998), Magrath *et al* (1997) and Landell-Mills (1999b). Magrath *et al* (1997) attempt to calculate the costs of participation in Ghana and find that it accounts for 66% of project costs and 80% of the project officials' time. In general, the lower the group homogeneity the higher the costs (Ostrom, 1990; Patel-Weynand, 1997; Fernandez, 1999).

Lack of cost-effective intermediaries

For intermediaries to generate value-added in bringing buyers and sellers together, they require strong managerial, financial and technical skills. One way of proceeding has been to channel payments through existing institutions that have proven skills and experience, e.g. Tar Pamlico's use of North Carolina's Agriculture Best Management Practices Programme. Where intermediaries have been built from scratch or NGOs and community organisations handed the job, heavy investment in capacity strengthening has often been required to allow them to perform their new functions. An interesting evaluation of the

importance of transaction costs associated with building cooperative institutions is provided for Sukhomajri (India) in Box 33 below.

Box 33: Transaction costs and cooperation in Sukhomajri

Chopra *et al*'s (1990) ex-post evaluation of the Sukhomajri watershed protection project extends cost-benefit analysis to incorporate costs associated with establishing a functioning cooperative network, i.e. transaction costs. In addition to the costs of constructing the engineering structures, establishing plantations, purchasing new cattle and equipment and the costs of maintaining the structures, Chopra *et al* add the costs of training the villagers in soil and water conservation techniques, organisational leadership and the cost of "motivational inputs". The training costs were based on labour inputs by the government, the Ford Foundation and India's Central Soil and Water Conservation Research and Training Institute.

The authors investigate the impact of including these transaction costs by calculating the benefit-cost ratio including and excluding these costs. Using a 12% discount rate and shadow prices for labour and capital inputs, the benefit-cost ratio falls from 1.33, when transaction costs are excluded, to 0.73 when they are included. This result highlights the critical role played by transaction costs in determining project viability. Moreover, this example did not include costs of continued negotiation, monitoring, enforcing rules, etc. If these were added, the benefit-cost ratio would be even lower.

This conclusion needs to be qualified for several reasons. Firstly, the creation of enduring institutions is likely to contribute to more than one project and the costs of establishing them should be spread between all the beneficiaries. Secondly, the benefit-cost ratio is calculated using a 12% discount rate, which may be higher than the real opportunity cost of capital, or the true social time preference. A third factor is that environmental benefits, such as improved water quality, are not included. Notwithstanding these qualifications, it is clear that transaction costs make a significant difference to institutional viability.

Source: Landell-Mills (1999b)

Poorly defined property rights

The fact that markets for watershed services are emerging in certain places highlights the far greater number of cases where markets have not taken root. The most commonly sited reason for market failure is the lack of clear property rights for watershed services. This in turn is blamed on the non-excludable and non-rival nature of the services (see Section 2.1). While this review points to a number of innovative approaches to defining property rights (e.g. in the form of transpiration credits, salinity credits, watershed management contracts and conservation easements), in most cases insecure tenure remains the principle constraint to market creation.

Lack of clear and comprehensive regulatory framework

Markets are frequently a product of new regulations (see Section 5.3). Regulatory frameworks also play a critical role in maintaining the conditions for

Photo: Jeffrey Campbell

Transaction costs of participation are often under-estimated. Where large number of people are involved, the costs of negotiation, contracting and monitoring agreements may undermine agreements' viability.

market success. Three aspects of regulations have been blamed in the literature for constraining market progress: the lack of adequate capacity to administer and supervise trading, disjointed regulation, and an adverse legal backdrop.

With respect to inadequate regulatory capacity to implement trading systems, this is particularly crucial where markets have their roots in new regulations. Unless payments systems can be monitored and enforced, there will be an incentive to cheat. The lack of manpower and technical knowledge, for instance, have been blamed for impeding the introduction of Forest Benefit Compensation Funds in China.

The importance of a disjointed regulation in undermining watershed protection markets is evident in Indonesia. Responsibility for watershed management in Indonesia is split between 3 government agencies, undermining efforts to adopt a holistic watershed management approach. The Forestry Department is responsible for forest management in watersheds, the Ministry of Public Works is responsible for surface water management, and the Department of Geology is responsible for ground water management. Decentralisation has compounded confusion by dividing watersheds into even smaller units managed by local authorities (Vermeulen, pers. comm. 2000).

In addition to not clearly defining property rights for watershed services, legislation may actually rule out any form of watershed charges. This is a central

problem facing the Forestry Department in Malawi, for instance, as it negotiates with the Water Boards to introduce watershed fees (Gawamadzi, 1999). In most cases, legislation is simply silent on the question of environmental service payments. However, where government authorities seek to introduce charges, they may risk being taken to court for adopting measures which are beyond their mandate. The threat of court action represents a major concern for the USA Environmental Protection Agency as it seeks to encourage pilots of watershed-based trading. Unlike the US Clean Air Act, which specifically authorised trading in its 1990 Amendments, the Clean Water Act 1972 is non-committal on the issue. Whereas the Clean Air Act has underpinned a vibrant market in sulphur dioxide emissions, the lack of clarity in the Clean Water Act has resulted in a cautious approach to market development (Schary, pers. comm. Feb. 2001).

Transaction costs are partly a function of the level of market maturity and teething problems in nascent markets are to be expected. For the most part, watershed services have not yet been packaged into clearly defined commodities and low levels of experience with trading necessarily raises risks. However, as markets mature, more sophisticated payment mechanism will evolve, risks will be better managed and transaction costs should fall. There are already early signs of progress. Buyer and seller cooperation (e.g. through the formation of associations or users groups), standardised contracts, more sophisticated intermediaries and new risk management tools, e.g. uncertainty discounts used in water quality trading, all suggest progress.

5.6.2 Factors that undermine demand

Lack of scientific information establishing benefits provided by forests

The key determinant of willingness to pay for forest watershed services is a perception that forests benefit welfare. A range of services has been highlighted in the literature from water quality improvements, soil salinity control, groundwater recharge, temperature control through to peak flow regulation. Yet, little tends to be said about the scientific evidence linking forests to the production of these services (see Box 21). For instance, how badly are water supplies affected by the conversion of a hectare of forest to agriculture in this watershed? What thresholds exist in forest watershed service markets? Does the species or soil type matter? Are forest plantations as effective as natural forests? Lack of scientific evidence on these issues represents a critical limitation to market development. Equally, where markets evolve in spite of inadequate scientific proof, this can store up problems for the future.

Inadequate resources have been allocated to filling the gap in scientific understanding. The Australian government's investment in research on forest-salinity linkages and increasing efforts to improve scientific understanding of non-point source pollution in the USA stand out. Research in developing countries is particularly limited, and where is does occur it tends to be disconnected from market development initiatives.

Lack of participation of key stakeholders

Lack of participation of stakeholders in market design and implementation constrains market development. Where beneficiaries are not involved in designing the payment system and ensuring against free-riding, they may be unsupportive. Equally where landholders are not consulted, the payment system may not meet their needs and, thus, fail to deliver watershed protection. The importance of stakeholder participation to market success has been explicitly acknowledged by the USA Environmental Protection Agency, which has issued specific guidelines on this aspect of market development in its 1996 Draft Framework for Watershed-Based Trading.

Lack of willingness to pay

Willingness to pay is a prerequisite for demand. Two key reasons for a lack of willingness to pay are highlighted in the literature:

(1) Resistance of stakeholders that are used to receiving watershed protection services for free. This is particularly damaging where more powerful entities are determined to face down efforts to force them to pay the full costs of water provision.

(2) Lack of finance, especially where the government is the buyer. In Vietnam, for instance, government payments for watershed protection are too low to attract the necessary landowner participation (Sikor, 2000).

5.6.3 Factors that undermine supply

Low awareness of market opportunities and capacity to exploit these

A crucial constraint on the supply side is a widespread lack of awareness that there is a potential market to exploit. Even where landowners believe they supply valuable watershed services, they have rarely thought to demand payment. This is not surprising since willingness to pay is only likely to be forthcoming where downstream beneficiaries feel their water supplies are threatened. Where watersheds are in good health, downstream communities continue to benefit irrespective of whether they pay or not. However, there is room for upstream landowners to be more proactive in bargaining for payments. Landowners who are aware of the potential market may take this into their calculations in deciding whether or not to convert their forest to another land use. In so doing they can determine the minimum payment they are willing to accept to abandon their plans. With this information they are in a position to initiate a bargaining process.

Lack of credibility in service delivery

The weakest link in an effort to persuade downstream communities to pay for upstream forestry is the lack of reliable, site-specific hydrological data illustrating clear forest-water linkages. Without this data it is difficult for suppliers to specify how they will alter service delivery. To get around this problem, upstream landowners will have to offer some form of insurance scheme to minimise risks to downstream buyers. For instance, they could commit to paying for additional damage caused by their failure to deliver. Alternatively they may set aside a share of profits to invest in mechanical solutions to water problems if land-based options fail. Another option would be to adopt the insurance method used for

guaranteeing water quality credits in Idaho, USA. Essentially, the upstream landowners would invest in a far larger area of watershed than they believe is necessary to provide an uncertainty buffer.

Cultural resistance

A third constraint to supply of watershed protection services relates to cultural resistance to the idea that downstream communities should determine what land use upstream people adopt. This is evident in the USA, where landowners are very protective over their rights (Schary, pers. comm. 2000). Where members in a community refuse to participate, this can undermine entire agreements.

5.6.4 Constraints fall hardest on the poor

While the constraints discussed above were drawn out of a global review of markets, most will tend to be more severe in developing countries, and poor groups in these countries will be most constrained. The primary constraints affecting poor households are listed in Table 12.

Table 12: Constraints to pro-poor watershed markets

Constraint	Comment
Costs of organising multiple-stakeholder transactions	Poor people will tend to hold smaller plots, so the co-ordination of supply will be more complex and costly. Poor beneficiaries will also be more numerous and in many cases water use will be informal and unregulated, making it more costly to incorporate them into payment schemes. While costs will tend to be higher for poorer groups, it is often these groups which lack the necessary management, leadership and conflict resolution skills to guide a transaction process.
Lack of cost-effective intermediaries	Capacity constraints are likely to be greatest in developing countries where the service sector is under-developed, and the environment less conducive to efficient deal-making, e.g. due to poor information flows.
Poorly defined and insecure property rights	The lack of secure property rights is a major problem in developing countries. Poorer groups tend to be the worst effected as they lack the contacts, power and know-how to formalise their claims. Prospects for developing more sophisticated watershed-based rights are slim where land rights remain unclear.
Lack of clear and comprehensive regulatory framework	The lack of adequate capacity to administer and supervise markets, disjointed regulation and overlapping mandates, and a contradictory legislative framework are frequent problems in developing countries.
Lack of scientific information on forest-water linkages	While the paucity of scientific information is a global problem, information tends to be particularly inadequate in developing countries that lack the technical and financial resources to devote to long term data collection and analysis.
Lack of stakeholder participation	In negotiations around market design and payments, poorer individuals and groups are often most vulnerable to exclusion. Not only do these groups often lack the skills to ensure their voice is heard, but they also tend to lack political representation. Involving smaller participants is costly.

Table 12: continued

Constraint	Comment
Lack ability to pay	Where poor people lack the financial resources to pay for improved watershed protection, they have no influence over the allocation of resources to watershed protection. Markets will allocate resources to meet needs of those that can pay, e.g. dam owners, hydropower companies[35].
Low awareness of market opportunities and capacity to exploit these	Poor people will tend to be least well-educated about market opportunities for watershed protection services, and least able to initiate bargaining with major downstream beneficiaries. Not only may they be less powerful, but poor individuals lack essential marketing, negotiation and coordination skills.
Lack of credibility in service delivery	Where landowners' property rights are insecure, they are in a weak position to promise delivery of watershed services. Moreover, where beneficiaries are poor it is more difficult for them to guarantee forest protection since they will need to maintain flexibility so they can respond to unexpected shocks.

While constraints to pro-poor watershed markets are significant, the intention is not to suggest that markets are inherently inequitable. Rather, because markets evolve within an unequal world and are driven by specific groups, there are risks that they will be designed to benefit more powerful groups. The role of government is to prevent markets that reinforce entrenched inequities, and to promote markets that can offer weaker groups opportunities. A good illustration of how markets may represent a positive force in sharing benefits from watershed protection is provided by Sukhomajri (India – see Box 29). Here markets were designed with a view to ensuring support of marginalised and landless members of the community. Equity was to be insured through the allocation of water rights to all households.

5.7 Summary

Forests – either on their own or as part of broader multiple-use landscapes – produce a number of watershed services valued by society. While services vary between sites, forests are credited with, amongst other things, protecting water quality, regulating water flows, preventing floods, controlling soil salinisation and maintaining aquatic habitats. Whereas historically the protection of critical watersheds has been the preserve of government, the review highlights the growing role of private companies, individual landholders, NGOs and communities in delivering and financing for watershed services. This section has reviewed 61 efforts to broaden participation through the establishment of markets for watershed services.

The emergence of a market for watershed services has not been associated with significant competition in supply or demand. Because watershed services benefit

35. Based on an investigation of five NGOs, Shah (1999) finds that poor people are in fact willing and able to pay for watershed protection as long as they are educated about the value of watershed protection, and where locally acceptable payment mechanisms are used.

groups of individuals and are characterised by threshold effects, cooperation in demand and supply is key. Market development depends on strengthening cooperative and hierarchical arrangements to allow beneficiaries and providers to come together to formulate group payment strategies and tackle free riding. At the same time where cooperative or hierarchical arrangements exist, but have come under strain due to inequitable benefit-sharing and high costs, markets are being introduced to ease tensions and facilitate financial and in-kind transfers.

Given the large number of stakeholders involved in watershed protection, payments tends to be channelled through intermediaries, allowing buyers and sellers to contract out the negotiation and conclusion of deals, overseeing implementation and enforcing contracts. Intermediaries are also valuable mechanisms for pooling funds from a group of beneficiaries and/or collecting user fees. In more advanced countries, over-the-counter trading using pre-packaged commodities is being promoted, in some cases alongside clearing-house systems.

For the most part, markets have emerged as a result of growing willingness to pay amongst beneficiaries, most often related to improved understanding of the benefits provided by watershed and growing threats to these. In more developed countries, new government regulations for improved water quality has been the major force behind investment. Due to the difficulties of excluding non-payers from watershed services, suppliers have generally lacked leverage for demanding payments. Yet, as commodities and payment mechanisms become increasingly sophisticated, supply-driven markets are no longer unthinkable.

Amidst the flurry of activity to promote payments for watershed protection, little attention has been given to impacts. Questions need to be asked as to whether markets provide a preferable mechanism for delivering watershed services to tried and tested regulatory systems. The literature provides little insight on this issue. For the most part, studies offer superficial reviews of economic, social and environmental benefits with virtually no assessment of costs. Moreover, the literature fails to convince us that markets offer the optimal way of achieving improved watersheds. The lack of attention to equity impacts of emerging payment schemes raises a number of concerns.

Concerns over equity impacts are reinforced by the analysis of constraints to market development. Even where the gains from trade are significant, the significant transaction costs involved introduce serious barriers to entry for anyone lacking financial resources, managerial and coordination skills, technical knowledge and political connections. Moreover, the costs of participating in emerging markets rise the greater the number of individuals living in a watershed, the weaker the government's regulatory capacity, the less reliable hydrological data, and the less secure property rights. While developing countries face severe hurdles in establishing markets for watershed protection, it is the poorest groups in these countries that risk marginalisation. Governments have a critical role to play in ensuring markets work for the benefit of all sections of society, not just the most powerful.

6. Markets for landscape beauty

Of the forest environmental services reviewed in this report, markets for landscape beauty have the longest history. Providers of access to landscape beauty (i.e. land stewards) have been charging "consumers" (i.e. tourists and tour agencies) for decades. Today, forest-based tourism is a key category of ecotourism, one of the fastest growing sectors in the world.

There is no universally accepted definition of ecotourism. For some it is synonymous with nature-based tourism. For others it is viewed as a more focused subset, which places special emphasis on promoting local community welfare. The International Ecotourism Society (2001) uses the following definition: "*responsible travel to natural areas that conserves the environment and sustains the well-being of local people*". In this review, the focus is on finding cases that fit the International Ecotourism Society's narrower definition of ecotourism.

According to the World Tourism Organisation (2000), in 1999 total international tourism exceeded 663 million people, was worth over $455 billion and employed (directly and indirectly) almost 200 million people, about 10% of

Photo: Ina Porras

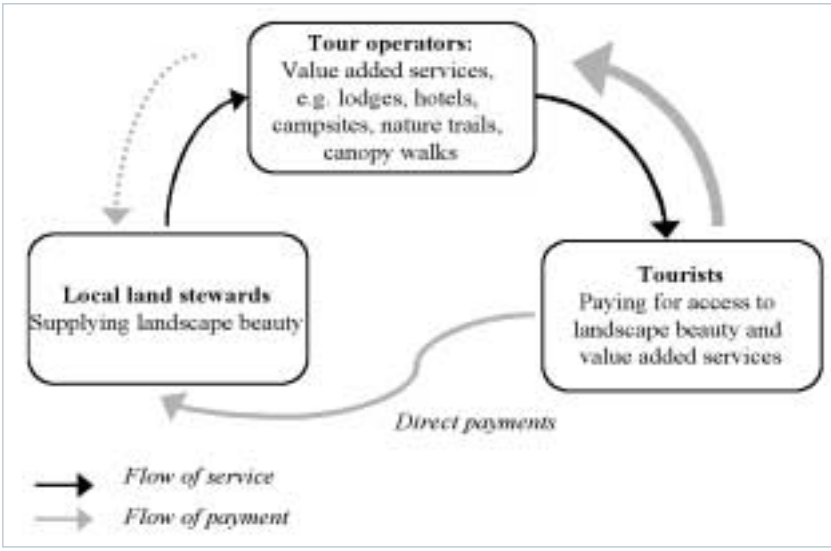
Forests and the wildlife they contain represent powerful magnets, drawing tourists from around the world to national parks, protected areas and private reserves.

the global workforce. International tourist arrivals have grown by 7% a year since 1950 and nature-based tourism has increased even more quickly. Over a decade ago the World Resources Institute estimated that nature tourism was growing between 10-30% a year. Today, it is likely that growth is even higher. In 1998, The International Ecotourism Society estimated that of the 528.4 million tourists in 1994, between 40-60% were nature-based.

Whereas in the past ecotourism has been considered a niche market, today it is mainstream. Yet, the rapid rise of ecotourism has occurred at a time when investment in the protection of natural habitats is shrinking around the world. Since governments have traditionally been the main caretakers of scenic landscapes, often through the creation of protected areas, the decline in funds allocated to protection is a reflection of broader efforts to tackle burgeoning public deficits and improve efficiency (Landell-Mills and Ford, 1999; Brown, 2001).

However, the fact that spending on the upkeep of scenic natural destinations has continued to decline despite rapid growth in ecotourism also points to a fundamental problem with the market for landscape beauty: a gap between payments for tourism products and payments for landscape beauty. Figure 23 provides a schematic of the supply chain for nature-based tourism, and the central role played by tour agencies. While consumers will pay for nature-based services, intermediary tour operators that provide access to these services have frequently been unwilling to pass increased returns on to local land stewards. Despite the rapid expansion of tourism to developing countries – tourism grew by at least 50% between 1990-1997 in almost half of the 48 poorest countries – leakage from the host country is thought to average 55%. Moreover, costs of ecotourism are often born locally (Ashley *et al*, 2000). Understanding why the

Figure 23: Ecotourism supply chain



market for landscape beauty has widely failed to materialise requires a critical assessment of power relations along the ecotourism supply chain.

Ironically, tour operators' tendencies to take landscape beauty for granted is often rooted in the fact that governments have historically provided it virtually free of charge. Not only has this meant few tourism companies pay for landscape beauty, but it has undermined potential competition from private providers (Lindberg, 2001). However, as governments' ability to subsidise the ecotourism business declines, new pressures for payment by tour operators have emerged.

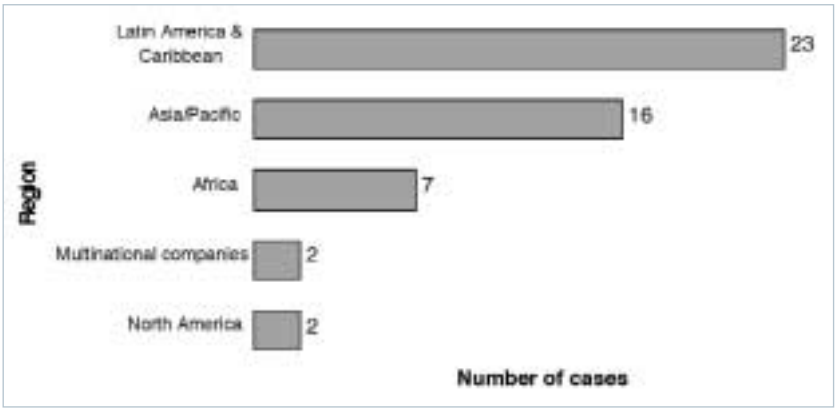
Thus, while one of the oldest markets for forest environmental services, the market for landscape beauty is far from the most advanced. However, this chapter will highlight signs of change, particularly where growing pressure on natural resources is beginning to threaten lucrative businesses. Not only are tour operators waking up to the fact that landscape beauty will not be delivered for free forever, but also land stewards are seeking to capture their fair share of business by reaching out to consumers directly.

6.1 Landscape beauty markets reviewed

This review has considered 51 payments for landscape beauty. Figure 24 highlights how most of the cases come from Latin America and the Caribbean, followed by Asia/Pacific.

Most of the examples involve site-specific transactions negotiated by independent agencies, e.g. through short and long-term access agreements, entrance permits, forest management contracts. In addition, a number deal with government efforts to establish payment systems at the national level, e.g. a new visitor user fee system in Canada's national parks, or the Nepal government's protected areas revenue sharing scheme with local communities. Examples of two multinational companies – Abercrombie and Kent and CCAfrica – which

Figure 24: Regional breakdown of payments schemes reviewed



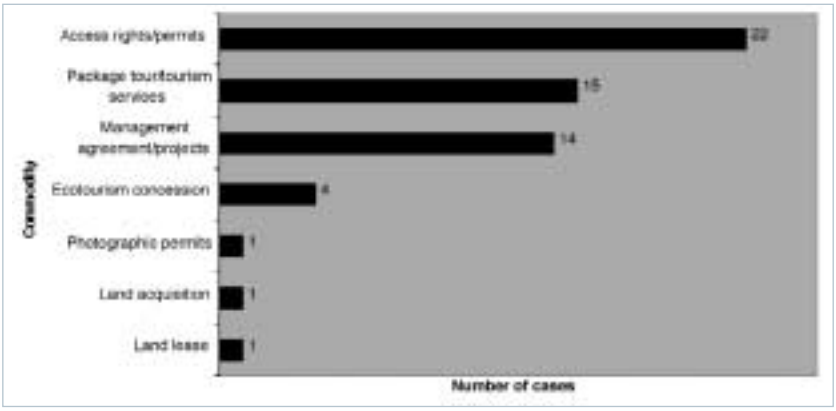
have introduced payment schemes are also highlighted. A list of the cases reviewed is provided in Annex 2.

6.2 Market form

6.2.1 Defining landscape beauty commodities

This review identified seven commodities that are being used to market landscape beauty. The relative importance of these commodities is highlighted in Figure 25. Access rights and entrance permits are the most commonly employed method for capturing beneficiaries' willingness to pay for scenic beauty. They are also the most direct. In contrast package tours seek to capture payments for landscape beauty as part of a broader payment for recreational activities. In other words landscape beauty is embedded in a larger commodity that includes value-added features, e.g. tourist lodges or recreation facilities. In the case of natural resource management agreements, ecotourism concessions, land lease and land acquisition an effort is being made to tap into tour agencies' willingness to pay.

Figure 25: Commodities used to market landscape beauty



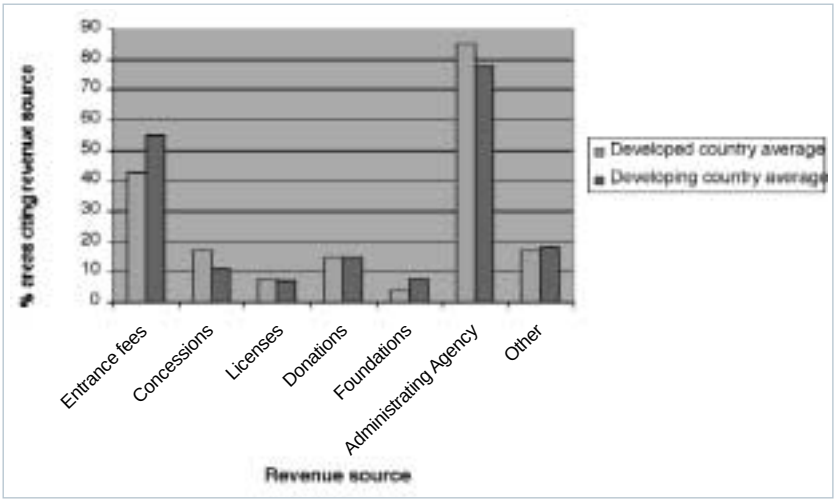
Although this chapter focuses on payments for landscape beauty, in a number of cases ecotourism operations have been established as a mechanism for protecting forest biodiversity. Since areas with high levels of species endemism and diverse flora and fauna are thought to also have significant tourism potential, ecotourism has been viewed as a way to commercialise biodiversity. However, recognising the positive spin-offs of markets for landscape beauty for biodiversity protection does not change the fundamental character of the market. The commodity being purchased by tourists is an access right to scenic beauty, not biodiversity. This distinction is important since biodiversity and scenic beauty are not necessarily perfectly correlated. Increasing the supply of biodiversity protection does not always raise scenic beauty. Equally, the sale of scenic beauty may not encourage an increased supply of biodiversity.

6.2.2 Broadening participation in markets for landscape beauty

Figure 27 sets out the characteristics of participants in the cases reviewed. Private individuals and companies are by far the most important buyers, and communities are the largest sellers, followed by governments. This snapshot shows that the market for landscape beauty is no longer dominated by private individuals paying entrance fees for access to government-owned protected areas. On the demand-side, while individual tourists remain critical, tour companies are starting to acknowledge their debt to land stewards. On the supply-side there is an effort to compensate communities living in and adjacent to scenic attractions. Even government protected areas are being forced to compensate local people that control the continued supply of landscape beauty.

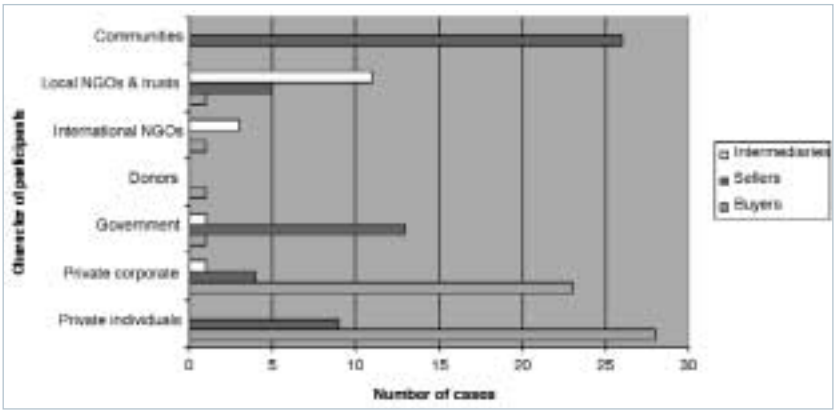
While governments continue to be major suppliers of landscape beauty, moves towards charging market rates for access have been gradual. This picture

Figure 26: Protected area revenue sources



Source: Lindberg and Enriquez (1994)

Figure 27: Participants in markets for landscape beauty



reinforces that painted by Lindberg and Enriquez's (1994) review of funding sources for protected areas in developed and developing countries (see Figure 26). In about 80% of the cases evaluated, funds came from central government. Even though around half of the cases considered imposed entrance fees, very few covered their management costs. As authorities come under budgetary pressure, they are beginning to tap visitors' willingness to pay for their services.

While the private sector is not yet a major supplier, participation is increasing, e.g. in Costa Rica and South Africa. This is not only a result of expanding demand, but also a consequence of increasing charges in government protected areas which allow the private sector to compete.

Photo: Ina Porras

Boating and rafting companies operating in Costa Rica depend heavily on the maintenance of landscape beauty alongside the rivers. Recognising this FONAFIFO, the National Forest Fund, initiated a process of negotiation with leading rafting companies in 2000 to explore payments for forest protection to local landowners.

6.2.3 Level of competition

Figure 23 in the introduction of this chapter highlights how the market for forest landscape beauty is embedded in a supply chain for nature-based tourism. As well as distinguishing between demand-side and supply-side competition, it is important to consider competitiveness at different stages in the supply chain.

For the most part, the ecotourism sector is highly competitive, with a growing number of tour operators competing for expanding business. Many tour operators complain that tourists are extremely price sensitive (Adshead, pers. comm. June 2001). However, the degree to which customers will switch suppliers depends, in part, on the uniqueness of the product on offer (i.e.

whether it has close substitutes) (Lindberg, 2001). The more unique the site, the higher the price an operator may charge. Tour operators have been better at marketing "unique" products to final customers than land stewards have been in marketing to the tour operators. Moreover, because landscape beauty is often provided by governments free of charge, or at prices well below costs of provision, there is little chance for alternative suppliers to enter the market. The result is that willingness to pay by customers for landscape beauty is primarily captured by tour operators, while land stewards gain little.

However, the picture is changing. Not only are governments raising access fees, but providers of landscape beauty are becoming more market savvy. The Government of Rwanda realised its opportunity early, introducing charges of US$250/tourists for entry into its Parc National des Volcans in the 1980s. Home to Africa's last remaining mountain gorillas, the Government was quick to recognise its monopoly position and the potential for introducing high fees.

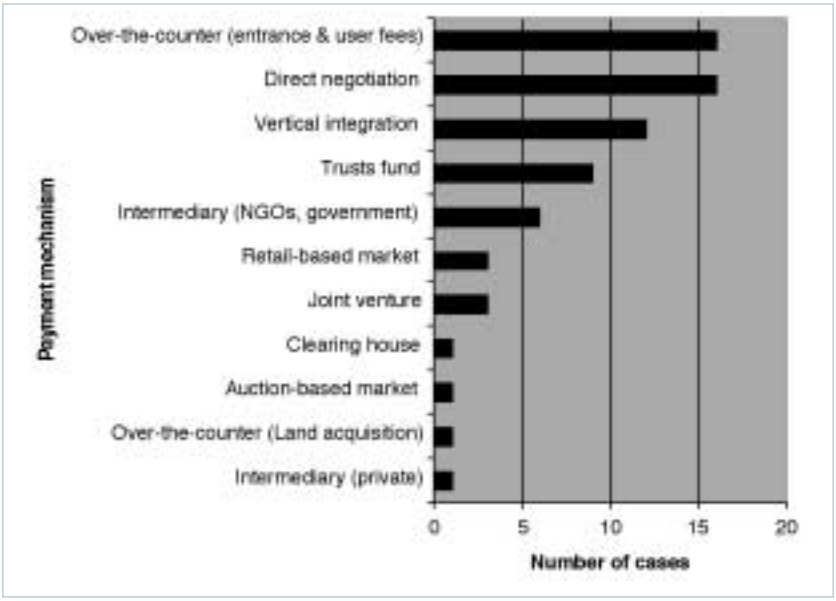
Creative marketing by community groups, often with support of international NGOs and donors, has begun to create a niche market for community-based nature tourism. Rather than selling access to landscape beauty *via* tour operators, communities are setting up their own businesses. Examples of such ventures are found in Belize, Costa Rica, Fiji, Guatemala, Indonesia, Kenya, Mexico, Nepal, Thailand, and Uganda. Tour operators that see a future in community-based ecotourism are seeking to form joint ventures with land stewards. This is the case in Ecuador and Peru. Gradually, the market for landscape beauty is evolving from one dominated by government provision and characterised by below-cost pricing, to a more competitive situation involving a wider range of suppliers, the development of niche products and increased consumer choice.

6.2.4 Payment mechanisms for landscape beauty

Figure 28 presents an overview of the payment mechanisms employed to capture willingness to pay for landscape beauty. In theory, entrance fees offer the most efficient mechanism for channelling payments from beneficiaries of landscape beauty to providers. This is because they charge people for access to landscape beauty, rather than the provision of associated services, e.g. tour guides or accommodation. However, historically entrance fees have rarely been used by protected areas to capture beneficiaries' willingness to pay. Instead, where fees are imposed they are set low to encourage visitation and minimise illegal entry. Protected areas are often viewed as part of a nation's heritage, which should be accessible to all. Consequently, entrance fees do not far outstrip other payment mechanisms in the cases reviewed.

However, entrance fees appear to be experiencing a revival. Not only are the benefits for financing national protected areas being re-emphasised, but the positive spin-offs for private sector investment in the protection of scenic spots are receiving attention. An interesting illustration of how governments are beginning to revisit entrance fees is provided by Makiling Forest Reserve in the Philippines (see Box 34).

Figure 28: Payment mechanisms for landscape beauty



Box 34: Reviving entrance fees in the Philippines – efforts in Makiling Forest Reserve

The Makiling Forest Reserve is located 100 kilometres south of Manila and is highly valued for its biodiversity, landscape beauty, land fertility and water resources. In 1998 a task force was set under a United Nations Environmental Programme project to consider the potential for generating revenue from recreation and ecotourism. Currently, landscape beauty is provided by the government through a subsidy channelled through the University of the Philippines Los Bãnos. Income is collected from entrance fees, but this amounts to a mere 12% of the subsidy and does not cover costs of provision.

To deal with the revenue shortfall, the task force proposed increases in entrance fees to Makiling Botanical Gardens, a 300 hectare area of forestland. The fee increases were based on studies of tourists' willingness to pay and an analysis of competition from a nearby private resort, Hillspa Resort in Lalakay. It is assumed that because proposed rates of P6/head (about US$0.11/head) for students and P10/head (US$0.19/head) for non-students are well below that of the main competition's rates of P50/head during the day and P80/head at night, demand would not fall.

The increased fees were proposed alongside investments aimed at raising the value of the recreational experience for visitors under the Makiling Rainforest Ecotourism and Park Development Project. The project was put forward in 1999 by the Makiling Centre for Mountain Ecosystems. Activities will include extended nature trails, mapping, signs and an information centre in the Makiling Botanical Gardens as well as investment in new ecotourism activities, e.g. rock climbing, cave exploration, butterfly house, peak tours and bird watching outside the Gardens. Landscape beauty is a critical component of most activities. The project is estimated to cost US$168,649 over 2 years.

While the task force's recommendations have not been fully implemented, their main points have been addressed. Most importantly, entrance fees to the Makiling Botanical Gardens have been doubled to P10/head (US$0.19/head) for normal visitors non-swimmers, and P50/head (US$0.98/head) for swimmers. University residents get discounts. Revenues from the entrance fees are channelled to park management and the maintenance of landscape beauty, through a new Makiling Forest Reserve Trust Fund set up to allocate revenues from a range of new financing instruments being introduced (see Box 32, Section 5.4 for a description of watershed fees)

Source: Calderon *et al* (2000)

While entrance fees are experiencing renewed interest, an increasingly common mechanism for agreeing payments for landscape beauty is the simplest: direct negotiation. Direct negotiation allows for site-specific agreements between tour operators and local land stewards (local communities or the government agency responsible for protected areas). Payments involve in-kind transfers alongside financial payments, and may be either direct or nested in projects aimed at local development and/or conservation. Box 35 illustrates how one tour operator in the Cuyabeno Wildlife Reserve in Ecuador has negotiated payments for community support for the preservation of local landscape values.

Box 35: Rewarding land stewards for landscape beauty in the Cuyabeno Wildlife Reserve

In 1979, the Cuyabeno Wildlife Reserve was established in Ecuador's Amazonian region to protect an area rich in diverse flora and fauna. As the Reserve became a successful ecotourism destination and local tour operators more powerful, the government yielded to demands for an extension of the Reserve in 1991 to 800,000 hectares to protect it from threats from oil exploration, cattle ranching and loggers.

However, the area is not totally free of human interference. A number of indigenous and migrant communities, including the Sionas, Secoyas, Quichuas, Cofans and Shuar, reside within its boundaries. The location of these communities within the Reserve has made them the focus of a number of ecotourism operations seeking access to community lands.

The Quichuas migrated to the Reserve in the 1980s and formed two main settlements: one in the Playas de Cuyabeno and one at Zancudo near the Peruvian border. Zancudo is the more remote and includes 10 families that subsist on slash and burn agriculture, hunting and fishing. Playas is located near market centres, so villagers survive through ranching, selling cash crops and working in local oil and tourism industries. People from both settlements are involved in an ecotourism operation, the Flotel, operated by Transturi, a major tour operator in the area. Due to its location, Zancudo has benefited most from efforts by Transturi to provide incentives for the protection of landscape beauty.

In 1994 a Letter of Agreement was signed by Transturi and the Zancudo. The agreement sets out what Transturi will "pay" the Zancudo people and commitments by the Zancudo in return for these payments. On the Zancudo side, they

are committed to providing exclusive access to Transturi, refraining from hunting around the Flotel and protecting the area from encroachment. In return, Transturi offers employment, delivers food items (including one cattle per month), supplies medical services, river and air transport, and a range of education services (e.g. school uniforms, paying teachers salaries and for local courses).

However in 1995, a collapse in tourism to the region due to hostilities between Ecuador and Peru, put serious strain on the agreement. To stave off bankruptcy, Transturi was forced to scale back its employment of the Zancudo (from 22 to 7) as well as other benefits. In response, the Zancudo continued to hunt in areas designated for tourism.

Despite these problems, it is estimated that the Zancudo gain significant benefits from the relationship. Financial income from salaries and tips make up 75% of these benefits, coming to over US$2,000 a month, or $24,000 a year. Adding food and other services gained, the total annual benefit comes to over $32,000, or about $400/head/year, by far the largest source of cash income for this forest-based community.

Source: Wunder (1999)

Photo: Sven Wunder

Indigenous communities living within Ecuador's Cuyabeno Wildlife Reserve are increasingly joining forces with ecotourism operators to market the natural beauty of their forests.

The third most commonly employed payment mechanism is that of vertical integration. By developing their own tourism operations, local land stewards seek to bypass tour operators to capture willingness to pay for landscape beauty. Vertical integration allows for the creation of an internal market for landscape beauty. To compete with other tourist destinations, land stewards

offer value-added products, e.g. tour guides, accommodation and food. Donor and NGO support for community-based ecotourism enterprises (often due to its perceived positive spin-offs for the rural poor and conservation) has helped promote this mechanism in the developing world. In this review examples are found in Belize, Costa Rica, Fiji, Guatemala, Indonesia, Kenya, Mexico, Nepal, Thailand, and Uganda. A number of different enterprise structures have been developed, ranging from shareholding businesses to simpler membership schemes. Box 36 outlines a sample of interesting approaches.

Box 36: Adding value to landscape beauty – capturing willingness to pay through vertical integration

Thailand

In 1995 Kanchanaburi Province launched a new initiative to develop an ecotourism cooperative, the Kanchanaburi Ecotourism Cooperative Company, which seeks to promote local peoples' involvement in a rapidly expanding ecotourism market. Located 125 kilometres west of Bangkok, Kanchanaburi Province has immediate access to a significant market and is characterised by wide ranging natural beauty. The Province contains 6 National Parks, 2 Wildlife Preserves and 1 Wildlife Hunting Prohibited Preserve, together covering about 1 million hectares, much of which is forested.

The Cooperative works through a membership system, whereby communities and private companies involved in ecotourism purchase shares in the Company. Funds raised from shareholders, as well as private donations and borrowing, are used to offer members free services, e.g. training and advice, information exchange and monitoring environmental impacts. Marketing services are provided through a sister organisation, the Ecotourism and Adventure Company. In addition, the company invests in its own ecotourism services, e.g. nature trails, handicrafts and botanical gardens. The company earns profits through a system of commissions and royalties from service providers that market under its name, e.g. handicraft suppliers, ecotourism lodges and guesthouses. These businesses must pay between 20-35% of their revenues to the Kanchanaburi Ecotourism Cooperative Company. Shareholders receive regular dividend payments based on Company profits.

Belize

Launched in 1990, the Toledo Ecotourism Association represented 10 local Mopan, Kekchi Maya and Garifuna rainforest settlements. The communities, which contain about 6,000 people, became interested in ecotourism in the late 1980s as a mechanism for generating revenue through activities that are compatible with their traditional lifestyles. In addition to protecting the forest landscape, the Association offers a number of value added services, including guided walks, stays in community guesthouses, handicrafts, musical performances, crafts lessons and forest canopy walks.

The Association is run as a membership, and currently involves 210 community members who commit to offering specific services. Direct payments are made to service providers, e.g. for meals and guided tours. An additional 20% is kept by the Association as profit and channelled into a central Fund to be allocated to managing the scheme (55%), marketing (15%), community conservation (10%)

and development (10%) activities. Each village has an elected executive that oversees ecotourism activities.

Fiji

Located on Fiji's largest island, Viti Levu, Koyoyanitu contains the largest remaining un-logged tropical montane forest in on the island. The forests also house economically valuable tree species. With average incomes in the area well below the national poverty line, there is increasing pressure on locals to give logging companies access to the forests. With support from a local plantation company, international NGOs and donors, the community decided to explore ecotourism as an alternative to logging, which rewards communities for their land stewardship. In 1991, one village (Acabe) terminated its logging operations in favour of investing in the development of an ecotourism lodge. By 1993, a lodge for 12 guests had been built, along with nature trails and picnic sites. Other villages had also invested in ecotourism facilities.

To help promote ecotourism in the area, each village formed an Ecotourism Cooperative Society Ltd. that brought together all those that had contributed to ecotourism ventures (including landowners and those contributing labour and capital) as shareholders. The Cooperative established a Koroyanitu Development Trust to manage the newly created National Park, promoting ecotourism, awarding contracts, and approving participation. The Trust would also hold shares in a new private entity – Fijian Vanau Tours Inc. This new company would seek to secure funding for ecotourism facilities, provide training, management and technical assistance to the village Cooperatives. It would itself hold shares in a limited liability company: Fijian Vanua Tours Company Ltd., which would seek external capital for the community enterprise. A total US$14,200 was raised in 1994, equal to the village's total annual income for 1993. Some funds were channelled to a new school fund, training for managers and environmental protection, e.g. enrichment plantings and the establishment of a tree nursery. The community retained about $8,600.

Source: Pitamahaket (1997); Toledo Ecotourism Association (2001); Baba (1997)

A number of intermediary-based payment mechanisms are also being used to channel returns from ecotourism to providers of landscape beauty. Where negotiations between land stewards are complex and prolonged, many private companies seek support of NGOs or the government. In some cases, it is the NGO or government agency that initiates deals. FONAFIFO, Costa Rica's National Forestry Fund is, for instance, playing a catalytic role in an emerging deal between rafting companies and riparian landholders for landscape beauty maintenance.

Trust funds are also used as intermediaries. They are favoured for offering an independent agency with a legally binding mandate to oversee payments to local land stewards according to predetermined criteria. Fund intermediaries were used in 9 of the cases reviewed, including examples in Costa Rica, Ecuador, Indonesia, Mexico, Nepal and the Philippines. CCAfrica's efforts to establish a Foundation to manage its payments to local communities are described in Box 37.

Box 37: Paying for landscape beauty through an independent foundation – CCAfrica's model

CCAfrica (also known as Conservation Corporation Africa) was established in the 1990s to develop an ecotourism enterprise that generates revenue for conservation and local livelihood improvement. The enterprise aims to help poor communities in Africa benefit from their role in maintaining beautiful landscapes, natural resources and the associated wildlife, thereby generating incentives for continued resource management. Today, CCAfrica operates in 6 countries (South Africa, Botswana, Namibia, Zimbabwe, Kenya and Tanzania) and employs 3,000 people, making it the largest ecotourism group in Africa.

Apart from involving local people in the company through direct employment, CCAfrica has a history of channelling a share of its profits back to local communities. Initially it channelled funds through a Community Development Trust established when its first private game reserve, Phinda Private Game Reserve, was set up in KwaZulu Natal, South Africa in 1991. At the time Phinda represented the largest private game relocation ever undertaken, involving the restoration of 17,000 hectares of degraded farmland.

The Phinda Community Development Trust formed the basis for the establishment of a broader Rural Investment Fund Trust in 1994 that worked across all regions in which CCAfrica operated and attracted international support. In 1998, a donation by the Swiss Trust enabled the creation of an offshore Rural Investment Fund that sought to invest internationally to ensure future financing for rural development. In 1999, all three trusts were merged as the CCAfrica Foundation, registered as an NGO in South Africa and the USA. In July 2001, the Africa Foundation became an autonomous organisation still working closely with CCAfrica, but also embarking on new partnerships across Southern and East Africa.

Today, CCAfrica donates South African R1.2 million (US$103,448) a year to this Foundation to invest in local economic development and conservation activities. A range of projects cover five main areas:

1) Basic needs and regional infrastructure: education (classrooms, libraries, equipment), health care (aids awareness, etc.), water supply;
2) Capacity building and small business development: micro-lending, community forums, skills training;
3) Environmental awareness;
4) Sports and cultural development; and
5) Community equity in ecotourism: resource exchanges, community land lease agreements (e.g. the cooperative management of the Klein's concession in Tanzania by CCAfrica and the Ololosokwan community).

Local communities select and implement all projects.

Source: CCAfrica (2001)

While less common, joint ventures between tour operators and land stewards offer a new form of payment mechanism that has gained ground in recent years. By allowing local people to buy into tourist operations, it offers a variation on

the vertical integration model. However, whereas community enterprises seek to develop their own value added services, joint ventures permit communities and tour operators to combine forces. Three examples of joint ventures were identified in this review, one in Ecuador and two in Peru. Box 38 describes one of the Peruvian examples.

Box 38: Joining forces through joint ventures to provide ecotourism in Peru

In south-eastern Peru's Madre de Dios Department of the Amazon, a joint venture has been struck up between the Infierno community of the Bahuaja-Sonene buffer zone and Rainforest Expeditions, a private company committed to ecotourism. The joint venture involves the construction and management of a "luxury" lodge, Posada Amazonas, on the Tambopata River. Tourists are attracted to the area for its beautiful forest landscapes and diverse widlife, e.g. Harpy Eagles, Macaws and Giant River Otters. The new Posada Amazonas lodge is located metres from a famous macaw salt lick.

The joint venture, which was signed in 1996 and lasts for 20 years, brings together the Infierno community's land use rights, cultural heritage and local knowledge with Rainforest Expeditions' tourism expertise and marketing infra-structure. Critically, the Infierno were awarded legal title as a "native community" to about 9,600 hectares on both sides of the Tanbopata river in 1976.

In return for agreeing to allow the construction of a tourist lodge in community lands and exclusive access to Rainforest Expeditions tourists, the parties agreed to the following conditions:

- Lodge management would be split equally between the two partners.
- Profits would be split 60:40 (Infierno : Rainforest Expeditions) to reflect relative inputs in labour, materials and capital.
- Rainforest Expeditions agreed to hand over control and assets to the community by 2014. With a grant worth US$150,000 from the Peru-Canada Fund, Infierno was able to purchase all the assets in 1999.

Source: Stronza (2000)

Another less frequently employed payment mechanism, but one that offers significant potential, is what this report refers to as retail-based payments. These are payments for landscape beauty that piggy-back on existing markets for ecotourism. In Costa Rica, for instance, rather than paying for conservation out of tourism profits, the Meliá Hotel chain offers its customers the options of making a voluntary contribution in their hotel bills to the National Parks Foundation, an NGO which supports local environmental protection programmes.

Finally, it is worth touching on an example of the introduction of a simple clearing-house mechanism for allocating payments for landscape beauty. Concerned by the threats of conventional tourist development to Talamanca, Costa Rica, local residents decided to set up the Talamancan Association of

Ecotourism and Conservation in 1990. Rather than acting as a community based enterprise, the Talamancan Association serves as a communication centre which connects visitors with local tourist services offered by community members. By centralising sales of community-based ecotourism packages in one place, the Talamancan Association reduces search costs for both buyers and sellers. Also, because tours are pre-packaged, deals are simple over-the-counter transactions.

These payment mechanisms are not mutually exclusive and in many cases are combined. A common combination is that of entrance fees with an intermediary arrangement whereby revenue from entrance fees is pooled in a central fund for allocation to predetermined projects or to local land stewards.

Overall, the market for landscape beauty continues to be dominated by relatively unsophisticated payment mechanisms. There are, however, a number of emerging trends. The revival of market-based entrance fees offers potential for the emergence of a more efficient and transparent market. At the same time, the expansion of community-based enterprises and joint ventures indicates growing efforts by land stewards to bypass tour agencies and tap directly into consumer demand. However, rather than making the market for landscape beauty more transparent, vertical integration internalises the market within the new enterprise. Which trend will eventually predominate, and whether new more sophisticated payment mechanisms drawing on specialised intermediaries will gain ground remains unclear.

6.2.5 Geographical extent of trading

The market for ecotourism may be local, domestic or international (see Figure 29). Visitors to scenic spots come from near and far; there is no inherent boundary to the customer base. The determining factor of the geographical extent of the market is the character of the buyer.

Figure 29: Geographical extent of market for landscape beauty

Where tourists are paying for landscape beauty directly, e.g. where community-based ecotourism operations have been formed or in the case of entrance fees, the market is generally international. This is particularly true where scenic spots are located in developing countries, since a large proportion of visitors tend to come from wealthier industrialised nations.

When tour operators are paying land stewards for access to and the protection of landscape beauty, in many cases the market involves domestic players. In 7 of the cases considered, approximately 14% of the total, transactions are between domestic entities. An example of a domestic transaction between Transturi, an Ecuadorian tour operator, and local communities in the Cuyabeno Wildlife Reserve was provided in Box 35 above.

6.2.6 Long market history, but lack of maturity

In the introduction of this chapter, the market for landscape beauty was described as having the longest history of the four environmental services considered in this report. It was also characterised as being, in many ways, the least advanced. This apparent contradiction is explained by the fact that while the recreational values of landscape beauty have long been recognised, and simple payment systems have existed in some countries for hundreds of years, the evolution of more sophisticated payment mechanisms has been slow. As was highlighted in Section 6.2.4, a predominant payment mechanism in the market is the least sophisticated: direct negotiation.

The reasons for the lack of progress in establishing more sophisticated systems lie, in part, with the inequitable distribution of power along the ecotourism supply chain (see Figure 23). To date, tour operators have established themselves as the "suppliers" of landscape beauty, even though they rarely own the land on which they market their services. Land owners and managers are often not paid for their contribution. Moreover, local communities are frequently viewed to be detracting value from nature-based holidays. Even where government owns the land in which tour agencies operate, charges may be low in an effort to promote private investment. In other instances, where the tourist industry has become an important income generating activity, lobbying against the application of higher fees and charges is a powerful force against change.

Ironically, while low prices for access to landscape beauty have helped to fuel a boom in nature-based tourism, excessive visitation and under-investment in resource management is beginning to take its toll. In extreme cases, degradation of natural environment undermines the landscape beauty on which tourist agencies depend.

Yet, the situation is changing. Not only are entrance fees making a come-back (see Section 6.2.4), but increasingly sophisticated payment mechanisms are being introduced. Independent trust funds, NGOs and even government agencies are getting involved to establish more equitable payment systems. In some cases, companies are forming joint ventures with local land stewards,

recognising that their input of land and natural resources is of equal or even greater value than tour operators' contribution. Where land stewards see little value in negotiating with existing tourist companies, they are taking their products directly to customers.

As payments systems become more closely linked to market demand and supply, willingness to pay for landscape beauty should become clearer. So far, however, evidence from recent deals between tour operators and land stewards suggests that rent-sharing is still skewed towards tourist agencies. An exception to this pattern is provided by the joint venture between Rainforest Expeditions and Infierno of Peru, which involves a profit sharing formula that favours the local community (see Box 38).

Thus, taking the criteria for assessing market maturity outlined in Section 2.4.1, Table 13 below provides a preliminary assessment for the market for landscape beauty based on the evidence collected in this review.

Table 13: Assessing market maturity for landscape beauty

Criteria	Performance (high, medium, low)	Comment
Time period since trading first took place	High	Entrance fees collected for over a hundred years in some protected areas. Dominated by government supply.
Degree of price discovery	Low	Few efforts to set prices for landscape beauty according to demand and supply conditions. Recently, prices have been rising for land stewards.
Level of participation	Medium	Participation of private and community land stewards rising as prospects for profits increase.
Degree of sophistication of the payment mechanism	Medium	Gradual shift towards more sophisticated deals, e.g. intermediary-based transactions, joint ventures, vertical integration, but these are far from widespread.

6.2.7 Markets for landscape beauty are embedded in strong cooperative and hierarchical structures

Payments for landscape beauty tend to be embedded within payments to tour operators. The emergence of a market for landscape beauty is focused on ensuring that payments are passed along the supply chain to land stewards. Where this is occurring, the transferral of payments has tended to involve the creation of new cooperative and hierarchical structures.

In the case of directly negotiated deals between tour operators and local communities, for local communities to negotiate effectively with companies they tend to form cooperative or hierarchical institutions to represent the broader

group. Where there is no clear grouping, tour operators often choose to deal through intermediaries. Equally, in some instances communities seek outside help to negotiate on their behalf. While these intermediaries may be existing bodies, e.g. FONAFIFO in Costa Rica, the King Mahendra Trust for Nature Conservation in Nepal or the Organisation of Ecuadorian Achuar Nationalities, new agencies are often created to ensure effectiveness and independence. Examples include: ASCOMOTI and ATEC (Costa Rica), Acción Amazon (Ecuador), Lodge Management Committee (Langtang National Park, Nepal), Abercrombie and Kent Global Foundation and CCAfrica's Foundation.

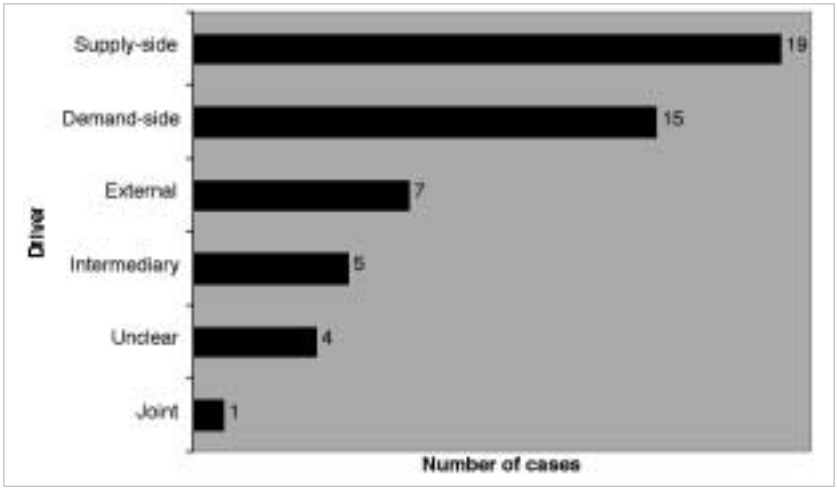
In the case of land stewards developing tourism enterprises (see Section 6.2.4), either on their own or through joint ventures with companies, they are effectively internalising the market for landscape beauty within a new hierarchical structure. In the case of government efforts to capture landscape beauty values through higher entrance fees, in addition to new legal frameworks for imposing fees, there is often a need for supporting infrastructure to enforce new laws.

As with other markets for environmental services, that for landscape beauty depends on the development of supporting cooperative and hierarchical institutions. It should be stressed that how these supporting structures evolve depends on a number of factors, including existing power relations between stakeholders.

6.3 Drivers for market development

Figure 30 illustrates how drivers for payments for landscape beauty are dominated by supply-side factors. This contrasts with experiences in other environmental service markets where demand-side and regulatory drivers have

Figure 30: Drivers for landscape beauty payments



tended to dominate. The importance of supply-side drivers reflects the higher degree of excludability in the landscape beauty market, which allows land stewards to prevent non-payers from gaining access to the resource and thus take the initiative in setting access charges. The opposite is true for watershed and biodiversity services where the difficulty of excluding non-payers mean markets have arisen as voluntary initiatives on the part of consumers.

There are a number of reasons why land stewards are gaining confidence in their negotiations with tourists and tour operators. In the case of governments, the main driver behind the introduction of entrance fees is declining central finance, exacerbated by increasing visitor numbers. This is true in both developed and developing countries. Box 39 examines how the Canadian Government's decision to reduce support for protected areas has led to renewed efforts for higher entrance fees.

Box 39: Seeking self-sufficiency in protected area management – raising entrance fees to Canada's protected areas

Parks Canada is responsible for managing the 38 national parks and reserves, covering 22.2 million hectares, with an additional 7.4 million hectares withdrawn for future park establishment. Nine national parks are World Heritage Sites.

In 1994 a new visitor user fee system was introduced and Parks Canada was permitted to keep revenues from the national parks system. The idea is that the federal government pays for park creation and protection, while Parks Canada covers operational and maintenance costs. In 1999/2000, Government appropriations came to about C$389 million (US$245 million) and the parks generated C$74 million (US$47 million), 45% from entrance fees, 24% recreation fees, and 20% from rentals and concessions. In a critical break with the past, fees are set to reflect demand and supply conditions. In total, 16.3 million visitors entered the parks, up from 15.7 the previous year.

At the provincial level, central funding has also gradually declined over time and the 12 provincial park agencies have devised a number of techniques to increase revenue. In 1994/5 6 park agencies had become financially independent. Since then Quebec and Ontario have followed suit.

Source: Brown (2001)

Where communities are land managers, different drivers are at play. The spread of information about land stewards negotiating favourable benefit-sharing arrangements with tour agencies, or setting up community-based tourist enterprises has been critical. As more communities negotiate deals, the more rapidly experience spreads. This local "multiplier effect" helps to explain emerging clusters of good practice, e.g. in Ecuador.

In addition to viewing ecotourism as an additional source or revenue, for many communities it is attractive because it is consistent with existing land management and community activities. The Cofan ecotourism project in

Ecuador, for instance, was initiated by a community that saw ecotourism as a way to supplement its meagre cash income without compromising its traditional way of life. In Talamanca, Costa Rica, community-based ecotourism was viewed by locals as a mechanism for supplanting unsustainable tourism emerging in the area.

On the demand-side, the key drivers have been tour agencies. The greater the investment made by the tour operator in a particular location, e.g. in terms of the construction of lodges, training local labour, marketing, the more inclined they are to maintain the natural resource on which their operation depends. In addition, for those companies that seek to carve out a niche market in community-based ecotourism, or "Fair Trade" tourism, investment in local conservation and land stewards is a necessary input. Some operators' willingness to pay for landscape beauty reflects their ethical concerns.

In certain cases, drivers have come from external agents, many of whom become intermediaries in emerging markets. Donor and NGOs have been particularly attracted by the potential for community-based ecotourism both to raise local living standards and to encourage conservation.

6.4 Landscape beauty market evolution

The evolution of markets for landscape beauty reflects a shift in the distribution of power in the tourism market towards land stewards. As already highlighted in Section 6.3, the major drivers for market development are land stewards who are demonstrating a greater willingness to impose charges on consumers, be they tourists or tour operators. While the process through which markets are established varies in terms of the length of time taken, a common set of steps appears to be emerging:

- *Estimate market demand* – willingness to pay for access to landscape beauty.
- *Define the commodity sold* – access rights, use rights associated with value added activities, or a package tour combining logistical arrangements, access to landscape beauty and supplementary activities.
- *Define and establish a payment mechanism* – linked to the type of commodity being marketed, land stewards need to decide whether payments for landscape beauty will be based on direct negotiation, be channelled through an intermediary, involve establishing a community-based enterprise or joint venture, etc.
- *Pilot the payment system.*
- *Revise system based on experience.*

Where the market is demand-driven, similar steps apply. However, rather than estimating willingness to pay, tour agencies will be interested in local land stewards' willingness to accept. In many cases this will fall below what tour operators would be willing to pay. This distinction is critical and the outcome will depend on the balance of power between the two parties. The greater the tour agency's existing investment in a location and the more unique a site, the

less able it will be to hold down prices. Similarly, the more dependent a local community on tourist revenue and the fewer alternative income sources (e.g. other interested tour operators), the less able it will be to threaten removal of access rights to push up prices. The final outcome will also depend on relative negotiation skills and access to information on available alternatives. Less well-educated and poorly informed participants will be at a serious disadvantage in negotiations. We return to the issue of equity in Section 6.6.

6.5 What markets mean for welfare and poverty

Few of the sources examined in this review offer a thorough assessment of economic, social and environmental impacts. Most impacts that are recorded are done so in an *ad hoc* manner and focus on benefits, rather than costs. Those impacts that are recorded are summarised below. In addition, an effort is made to draw out impacts for poor households. Box 40 and Box 41 offer descriptions of two comprehensive assessments of impacts for local communities from emerging markets.

6.5.1 Economic costs and benefits

As already highlighted, tourism is the world's largest employer, generating (directly and indirectly) almost 200 million jobs, equivalent to about 10% of global employment. In 1999 alone, tourism returned US$453 billion (World Tourism Organisation, 2000). As the most rapidly growing market segment, ecotourism has the potential to generate significant economic benefits at both the local and national levels. This review highlights how at the local level ecotourism ventures are already having an impact, in some cases supplanting traditional businesses as the largest source of income. Below, the most important impacts are listed:

- Income from entrance fees and direct payments for access rights
- Income from associated value added services, e.g. salaries and wages of employees of ecotourism operations; sales of handicrafts and food; sales of services (e.g. guided tours, transport)
- Development of related economic sectors, e.g. sustainable forestry and agriculture
- Increased local land values
- Increased foreign exchange where ecotourism is dominated by foreign nationals

In addition to the financial value of these benefits, they are important for permitting rural communities to diversify their livelihood strategies and provide an alternative source of cash income.

The literature provides little comparison of these benefits with costs of providing landscape beauty. Brief reference is made in more thorough assessments, e.g. Stronza (2000) and Wunder (1999), to lost revenue from logging, hunting and other exploitative activities. However, because landscape beauty is often in joint production with other benefits, e.g. NTFPs and other

environmental services, it is difficult to isolate the costs of providing landscape beauty. Instead, the costs of provision need to be set against a bundle of benefits. Bundled sales of environmental services are considered in Section 7.

6.5.2 Social costs and benefits

As with economic impacts, the literature reviewed focuses on social benefits. Five categories of social benefits may be identified:

- *Training and skills development*. This is the most frequently sited benefit and includes training in ecotourism service provision, e.g. as cooks, guides and managers, as well as training in related enterprises, e.g. organic agriculture, handicrafts, NTFP processing.
- *Education*. Several ecotourism operations offer environmental education in local communities. In addition, many contribute to basic education for local children, e.g. through school building and provision of supplies and teachers.
- *Healthcare*. A number of the tour operators offer staff and local communities healthcare services, either by funding regular visits by nurses and doctors (e.g. Lianshulu Lodge in Namibia), or by investing in local health clinic (e.g. FUNDESIN in Ecuador). Investments are also made in raising nutrition through more varied diets and improved water supplies.
- *Improved local infrastructure*. Another positive spin-off for locals is associated with improved transport and communication links to market centres.

Ecotourism is a relatively recent commercial activity in China. The rapid growth of foreign and domestic visitors to scenic forest spots has highlighted the value attached to landscape beauty services. In 1999 China's 1,002 forest parks attracted over 58.6 million visitors. 98 per cent of these visitors were domestic.

Photo: Natasha Landell-Mills

- *Increased social capital*. Investment in building local organisational capacity is stressed more the greater the community role on ecotourism (e.g. Cofans in Ecuador – see Box 40, Annapurna Conservation Area in Nepal, Budongo Forest Ecotourism Project in Uganda).

On the cost side, the main point repeated in the wider literature relates to negative impacts for local cultures due to a sudden influx of foreign tourists. In the cases considered, this point is noted with respect to Jade Peak Gorge in Sichuan Province, China. However, in most cases no mention is made of cultural impacts, and some even point to the benefits of ecotourism in providing a boost to a "dying" culture, e.g. the Cofans in Ecuador view ecotourism as an economic activity that allows the community to maintain its traditional way of life.

Other negative impacts of ecotourism are highlighted in a study of Posadas Amazonas in Peru (see Box 41) and include increased inequity between those involved in a local ecotourism venture and those left out, and longer working hours.

6.5.3 Environmental costs and benefits

In a number of cases ecotourism operations are promoted as a mechanism for generating finance for conservation of local environments. In particular, ecotourism has become a favoured conservation tool amongst environmental NGOs, e.g. The Nature Conservancy and Conservation International of the USA, and is promoted most vigorously in those areas with high levels of biodiversity. Not surprisingly, biodiversity protection is a frequently sited positive spin-off from the sale of landscape beauty.

Another commonly identified benefit is improved local water quality arising from reduced erosion and sedimentation. In locations where organic agriculture has been promoted reduced use of chemical inputs is also claimed to benefit local water supplies.

These benefits have been achieved in a variety of ways from forest protection, to more active sustainable forestry, enrichment plantings and agroforestry. Hunting bans are another common feature of ecotourism operations.

6.5.4 Impacts for poor people

As repeatedly emphasised in this section, most revenue from ecotourism has traditionally gone to the tour operators who deliver a range of services from accommodation to food to forest-based activities. Poor people who benefit from ecotourism activities have tended to do so through wage labour. Yet, as land stewards in many tourist destinations, poor communities contribute much more than just labour to these operations. The emergence of markets for landscape beauty reflects a recognition of the natural resource input into ecotourism. The extent to which poor communities are benefiting from this gradual shift is, however, unclear.

Two of the most comprehensive studies of impacts of ecotourism operations for local livelihoods were undertaken by Wunder (1999) and Stronza (2000). The results from their evaluations are presented in Box 40 and Box 41. In brief terms, there is significant potential for gains through:

- Income flows from entrance fees, wages, salaries, sales of tourism products and services; and
- Asset building:
  - Human capital is built through training, education and health care
  - Physical capital is strengthened through investments in local infrastructure
  - Social capital increases with improved community organisation and management
  - Natural capital is improved with investments in forest protection, e.g. raised soil fertility, improved water supplies, increased biodiversity

While the potential benefits are significant, as with other emerging markets for environmental services, the realisation of this potential is less evident. Local communities compete for rents with large companies who are at a significant advantage in setting the terms of any deal. Moreover, even where rents are being shared, it may not always be the poorest who gain. Income flows will gravitate to those offering necessary skills and services. Improved infrastructure may be targeted at maximising flows of tourists rather than improving links of remote communities to market centres. Similarly, improved education and training in environmental management may not be of great value to poor communities. Investments in the natural environment may increase the value of the site to tourists and raise revenue, but the opportunity costs for locals – in terms of forgone agriculture, hunting or timber – may also be significant.

The point is not to argue that the emerging markets for landscape beauty necessarily hurt poor people, but that their impacts on vulnerable groups need to be given greater attention. There is significant potential in these new markets to allow forest stewards to increase the value of their asset base, but there are also numerous barriers.

Box 40: Assessing impacts of landscape beauty markets in Ecuador

In 1999 Wunder attempted to compare the benefits of three emerging deals between tour operators and local communities in the Ecuadorian Amazon region of the Cuyabeno Wildlife Reserve. The aim was to assess how community benefits differ under different types of arrangements, from the simple salary-based relationship to more inclusive joint ventures. The three case studies are outlined below, followed by an overview of their economic, social and environmental impacts.

Quichuas – salary model

The experience of the Quichuas in Zancudo is described in Box 35 above. Based on Wunder's economic analysis the Zancudo gain significant benefits from the relationship. Financial income from salaries and tips make up 75% of these benefits, coming to over US$2,000 a month, or $24,000 a year. When we add food and

other service benefits gained, the total annual benefit comes to over $32,000, or $400/head/year.

Cofans of Zabalo – joint venture
The Cofans originated near Dureno, but in 1984 a small group moved deeper into the Reserve to escape growing threats to their culture and to specialise in ecotourism. The group consists of approximately 17 families, or 100 people. Ten of the families joined together to set up a joint venture with Transturi Tours: "Aguarico Trekking". The new company offers 9-10 day treks in the jungle organised by the Cofans, with marketing, transport arrangements and other logistical functions left to Transturi. Transturi invested $15,000 up front to establish a basic infrastructure in the forest, e.g. 1 guest house and 3 jungle camps. The Cofans constructed 60 kilometres of jungle trails and a museum near their village. In addition to their group tours, Transturi tourists from its Flotel operation visited the museum twice a week. For access to the museum, Transturi paid $2/tourist and the villagers all gain from sales of handicrafts.

Specialisation in ecotourism has paid off financially. In total, the Cofans earn about $49,400/year, equivalent to $494/head. While shareholders in Aguarico get a sizeable chunk of the revenue from profits (approximately $15,300/year), the entire village benefits from the museum, handicrafts and food sales as well as salaries and tips. In fact handicraft sales from the museum trips alone come to more than profits from Aquarico.

Siona-Secoyas – a semi-autonomous model
The Sionas and Secoyas are two ethnic groups living in the western area of the Reserve. While from different areas (Colombia and Peru respectively), over the years the groups have intermarried. Today they inhabitant several settlements, one of which is actively involved in forest-based ecotourism: Puerto Bolivar. Puerto Bolivar's strategic location near the Cuyabeno lakes, the area with the highest tourism density in the Reserve (between 14-20 agencies operate in the area), allows it excellent access to tourism opportunities.

A significant portion of local community revenue is from motorised canoe transport. In addition, the Sionas act as guides, cooks and provide staff to various operators on the lakes. Based on evidence from two lake operators, Nuevo Mundo and Neotropic, the Puerto Bolivars earn 36% of their income from river transport and 31% from guide services. In total, these operators generated about $19,500/year, or $31.50/tourist. Extrapolating for the other operations, in total the group is probably pulling in about $35,000/year.

Economic benefits
The economic benefits are significant, with the highest income achieved by the Cofans ($494/head) who specialise in tourism. Benefits include profits (in the case of Zabalo), salaries, tips, sales of food and handicrafts, access/entrance fees, compensation payments and a range of medical, transport and education services offered by tour operators.

Social benefits
Social benefits are notable, with tour operators often paying for land and air transport, health care, schooling as well as food imports to provide a more

balanced local diet. Local communities may also gain from on-the-job training as guides, cooks and, occasionally, managers.

Environmental benefits
Two major impacts are highlighted, both of which promote the protection of forests and their associated environmental services. Firstly, the greater the time spent working in tourism, the less time available for traditional activities such as agriculture and hunting. Secondly, increased dependence on tourism begins to affect values attached to protecting specific tourist attractions, e.g. threatened animals. However, Wunder stresses, that tourism is only one of a number of factors to consider, including: population pressure, distance from an urban market, ethnic, cultural and historical influences and local community organisational capacity.

In all of the cases assessed, the Cofans invested most in forest conservation. The group adopted a zoned land use plan that prohibited hunting in high tourist value areas. Total protection was awarded to those species valued by tourists and the group abandoned dynamite fishing. Finally, a quota system was adopted which set monthly caps on hunting per family. While hunting restrictions were also agreed in Zancudo and Puerto Bolivar, restrictions were imposed by tour operators not villagers, and were often abused.

Source: Wunder (1999)

Box 41: Assessing impacts of landscape beauty markets in Peru – the case of Posada Amazonas

As described in Box 38 above, in May 1996 the Infierno community of south-eastern Peru entered into a joint venture with Rainforest Expeditions to build and co-manage a new lodge in their lands. The joint venture involves the construction and management of a "luxury" lodge, Posada Amazonas, on the Tambopata River. In 2001, Stronza completed a three year evaluation of the joint venture, including an assessment of its emerging economic, social and environmental impacts for the community.

Economic impacts
A number of benefits were identified, including:
- Wages/salaries. Average annual income in first 2 years of operation (1998-9) was $2,206. This accounted for about 10% of community income and permitted diversification in livelihood. Twelve community members who were employed full time, earned over half of their annual income from ecotourism. In 2001/2 the community expects to earn about $100,000, equivalent of 21% annual income. Workers at Posada Amazonas earn $65/month more than at nearby lodges, and according to Rainforest Expeditions website, income is 38% above what would earn from traditional activities, e.g. agriculture and hunting.
- Sales of handicrafts, food, wood and other products.
- More steady and reliable income.
- Diversified livelihood strategies.

On the cost side, the author points to forgone income from agriculture, hunting and forestry due to reallocation of efforts to ecotourism. She also highlights

increased exposure to downturns in the ecotourism sector amongst those that give up subsistence activities.

Social impacts
A number of social benefits are highlighted:
- Social safety net provided by company, e.g. emergency hospital treatment.
- Improved nutrition for staff eating at lodge.
- New skills and training – in English and ecotourism management through workshops and apprenticeship schemes.
- Social institution building. An Ecotourism Committee was set up on a voluntary basis to oversee the communities relationships with Rainforest Expeditions and to manage profits that are returned to the community. A key concern of the group has been raising local participation to spread the gains. Based on this experience additional committees have been established, e.g. education, handicraft and agriculture.

Social problems relate to increased internal community conflicts between those involved in ecotourism and those left out. Educated males tended to gain most. The author also points to long hours worked by staff and separation from families.

Environmental impacts
The author considers the hypothesis that ecotourism will provide communities with new incentives for conservation as they attach greater value to forests and wildlife. In practice, increased work in ecotourism has reduced time spent in agriculture and hunting and has had positive spin-offs for the local environment. A preliminary survey also suggested that those individuals working in tourism had changed their views on the values of wildlife. This view is reinforced by the Rainforest Expedition's website, which indicates that the Infierno community is setting up wildlife conservation schemes. For instance, Harpy Eagle nests have been assigned guardians who get paid for each tourist that visits the nests.

Source: Stronza (2000); Rainforest Expeditions (2001)

6.6 Inequity as the most important constraint to market development

The most important constraint to market creation is an imbalance in power relations along the supply chain, which has permitted intermediary tour operators to capture payments for landscape beauty without passing on revenue to land stewards. While land stewards are supplying the key ingredient into ecotourism operations, i.e. beautiful landscapes, they are restricted in their ability to claim returns by a number of factors. The most important are listed below:

- *Tenure insecurity*. In a number of the cases examined, local communities did not have clear legal title over their land. In Tanzania, Uganda and Kenya, for instance, modern property rights legislation conflicts with customary laws. The lack of secure title reduces land stewards' ability to negotiate with tour operators.

- *Unclear regulatory environment*. Even where the government has legal title of an area, there is often confusion over which government agency has authority to grant access. Tour operators are less likely to enter into deals with any one agency where there exists a risk that it will be annulled by another.
- *Resistance from Park managers*. Two main reasons for inertia in creating markets for government-owned protected areas are evident. Firstly, it is frequently felt that protected areas are part of a nation's heritage and should be available to all for free. Secondly, because these agencies often lack financial independence, they have little incentive to introduce market-based mechanisms which will increase their revenue.
- *Resistance from community members*. As noted in Section 6.5, not everyone within a community gains from the emergence of a market for landscape beauty. Those who are not actively involved in an ecotourism enterprise do not gain financially, and may even lose where limitations are imposed on natural resource utilisation. Losers may be in a strong position to resist the establishment of an ecotourism market.
- *Lack of skills and capacity*. Communities lack skills in a number of key areas. Leadership, negotiation, organisational and management skills are essential for bargaining with tour operators and effectively managing an ecotourism operation. Additional skills that are frequently in short supply are associated with running an ecotourism business, e.g. cooking, provision of appropriate accommodation and tour guiding.
- *Lack of capital*. In addition to a lack of human capital (i.e. necessary skills), communities often lack financial capital necessary for setting up an operation. In the case of the Cofans in Ecuador and the Koyoyanitu ecotourism initiative in Fiji, this problem was overcome through joint venture with capital rich tour operators. NGOs and donors have also helped to provide sufficient start-up funds for nascent initiatives.
- *Coordination costs*. The costs of dealing with communities often outweigh benefits for tour operators. Costs of negotiation, concluding and enforcing contracts rise the larger the group and the fewer its skills. Moreover, negotiations may be further burdened by complex government regulations relating to use rights in community lands.

The above factors are not just constraints to market development, but they are also major barriers to the emergence of equitable markets for landscape beauty. Market development effectively depends on the emergence of a more equitable relationship between poorer land managers and more powerful tour operators.

6.7 Summary

This chapter has reviewed evidence from 51 cases of emerging markets for landscape beauty. While the provision of landscape beauty represents a critical ingredient into the market for ecotourism, payments for this input have been slow to develop. Not only have tour operators taken landscape beauty as a free input, but also protected area managers have rarely sought to capture consumers' willingness to pay. This situation is unsustainable, and in many

locations supplies are threatened. Efforts to establish a market for landscape beauty are long overdue.

It is clear from the literature that market evolution is not a simple process. The introduction of payment mechanisms where none existed before involves the creation of new institutional arrangements and the involvement of new stakeholders. As tour operators begin to establish themselves as paying customers, communities and private landowners are seeking to compete with publicly owned protected areas. At the same time, intermediary organisations are responding to demand for support in searching for, negotiating and implementing deals.

Despite the broadening of stakeholder participation, little progress has been made in developing sophisticated payment mechanisms such as auctions or clearing-house mechanisms. For the most part payments are based on site-specific negotiations or reformed entrance fees. More recently, the establishment of community-based ecotourism operations and joint ventures has allowed land stewards to directly tap tourists' demand. However, far from creating a more transparent and efficient market for landscape beauty, vertical integration internalises the market for landscape beauty within a new enterprise.

Thus, despite its claim to being the oldest market of the four forest environmental services considered in this review, the market for landscape beauty remains relatively immature. Constraints to market development are well established and shifts in power balances difficult to make. As long as tour agencies resist paying for landscape beauty, land stewards' opportunities for being rewarded for the services they provide lie in establishing themselves as marketing enterprises. Yet, without the skills to administer and manage complex international business, this route is fraught with difficulties – particularly for poor households. Some more forward-looking agencies and communities believe that ecotourism must ultimately involve a joint effort and the pooling of skills and resources. Whatever the model, for landscape beauty to be protected into the future, it is clear that providers must receive fair compensation for their inputs.

7. Bundling forest environmental services

This report has looked in detail at emerging markets for four forest environmental services: biodiversity protection, carbon sequestration, watershed protection and landscape beauty. Each environmental service has been looked at in isolation. Yet, a number of emerging markets do not fit neatly under any single environmental service category. Rather, they represent efforts to sell a bundle of services. These efforts reflect the fact that environmental services are frequently in joint production, such that investment in the production of one service results in the simultaneous production of other services.

In this section we explore key features of markets for bundled environmental services, and attempt to draw out preliminary insights into the benefits they offer as well as potential pitfalls. The section starts by briefly considering theoretical issues relating to bundling, before moving on to consider evidence from case studies. A list of the case studies reviewed is provided in Annex 2.

7.1 Insights from theory

In Section 2 a strong theoretical case for market creation was put forward. Where conditions are right, markets help to ensure resources are allocated to their most valuable use, and thus help to maximise social welfare. Missing markets create distortions in resource allocation. Traditionally, countries have dealt with market failure through regulations and systems for minimising undesirable impacts. This review has focused on efforts aimed at countering market failure through market creation.

Yet, the creation of markets for individual environmental services often deals with only part of the problem and may, in certain circumstances, create new distortions. Where markets for a service are missing, little investment will be channelled towards the production of this service. Instead funds will flow towards sectors where investments yield competitive returns. At the same time, damage inflicted on the non-marketed service will not be internalised by those responsible since there are no financial consequences. By creating a market for an environmental service, this service will tend to benefit from new investment flows and reduced negligence. But, those services that remain outside the market system do not necessarily benefit and may even be negatively affected by investment channelled towards the newly marketed service.

To illustrate this point it is worth considering a hypothetical example. Imagine that landscape beauty and biodiversity protection services provided by forests fall outside the market economy, and that these services have been traditionally maintained through a system of land development regulations. Now, imagine that infringements of these regulations and growing demand for access to landscape beauty have led to consumer willingness to pay for increased supplies of this service. As a result, investments in the provision of landscape beauty begin to generate attractive returns and private landowners invest in its supply. However, scenic views favoured by the public, e.g. managed countryside scenes, are not particularly rich in biodiversity. While increased supplies of landscape beauty have little initial impact on biodiversity, and may even have positive spin-offs, as supply increases a negative relationship emerges.

While it is hypothetical, the example above has many real-life parallels. The critical point is that environmental services are often inter-related and linkages are not always positive. However, in much of the literature on forest environmental services, there is a presumption that services are complementary and increased investment in one service will have positive spin-offs for others. In practice relationships between service supply is not always well understood, especially since these relationships are often dynamic – switching between positive, negative and neutral at different levels of service supply – and site specific. The most diverse forests are not necessarily optimal for landscape beauty or carbon sequestration, nor do they necessarily provide the highest level of watershed protection.

Theory suggests that a degree of caution is necessary when we are dealing with market creation in a world of incomplete markets. While focusing on isolated services represents a practical way forward in the near term, ultimately we should be attempting to create markets wherever they are missing. Markets for bundled environmental services appear to offer a step in the right direction.

7.2 Examining the evidence

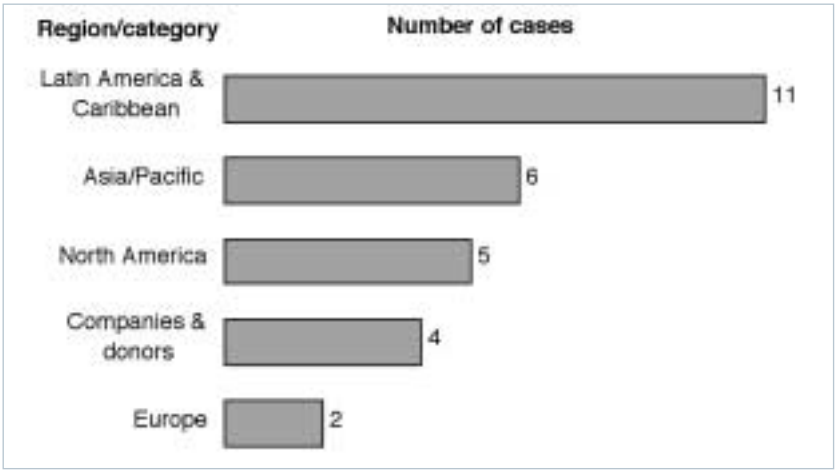
In this review 28 cases of bundled service sales were recorded. Figure 31 provides a regional breakdown of these cases. The cases varied in terms of which and how many services were bundled together. Over 50% of the cases involved only 2 services, 18% involved 3 and 29% involved 4. The most common combination of services was carbon sequestration and biodiversity protection, followed by landscape beauty combined with biodiversity protection. In what follows we draw out distinguishing features of markets for bundled services.

7.2.1 Merged bundles or shopping baskets

Based on the cases reviewed, there appears to be two main categories of bundled service sales:

- merged bundles – where environmental services are sold together and cannot be subdivided for sales to separate purchasers; and

Figure 31: Regional breakdown of bundled service cases reviewed



- shopping basket bundles – where purchasers can acquire specific services on their own or as part of a package and land stewards can sell different services to different buyers.

The cases are reasonably evenly split between the two categories, though the shopping basket approach is slightly more common. The key attraction of merged bundles is transaction cost savings. With the shopping basket approach, services are subdivided, commodities defined and efforts made to find buyers for each service. Where services are sold as a non-separable unit, the commodity definition and sales procedure are greatly simplified.

On the other hand, where merged bundles save on cost, they lose in efficiency and in market breadth. By merging all services together, the seller cannot sell individual services to separate clients, and thus reduces total earnings potential. Also, by not selling individual services to individual customers, allocative efficiency gains are restricted since individual services do not have their own prices to send out signals about relative value.

The shopping basket approach has tended to be driven by stakeholders focused on maximising returns. At the margin where forest protection for environmental services is in direct competition with alternative land uses such as ranching or agriculture, the little bit extra earned from selling biodiversity access rights on top of the sale of carbon sequestration rights can make all the difference. This model has worked effectively for The Nature Conservancy in Belize, Bolivia, Costa Rica and Paraguay, where it has sought to leverage more funds for biodiversity protection by promoting the sale of carbon offsets in biodiversity-rich locations. The idea of joining forces to generate adequate finance for mutually beneficial forest land management has also been behind Costa Rica's National Power and Light Company's link-up with a Norwegian consortium to purchase watershed protection and carbon sequestration services

respectively. Equally in Sikkim, India, agencies wishing to invest in biodiversity protection have seen the attractions of working with local beneficiaries of landscape beauty (i.e. tour operators) to finance conservation efforts in the area.

While buyers have certainly contributed to the emergence of a shopping basket approach, the greatest advances have tended to come from intermediary and supplier-driven initiatives. Costa Rica has made the greatest strides in developing a sophisticated market infrastructure for selling different services to different buyers, while bundling payments to land stewards. Costa Rica's experience has been touched on under each of the service chapters in this report and is brought together in Box 42 below. Australia's proposal for an Environmental Service Investment Fund follows the same lines, aiming to offer a clearing-house for the sale of a number of environmental service property rights, from carbon offsets to salinity and, potentially, biodiversity credits. The Fund's role in acting as a clearing-house for salinity credit trading was described in Box 24, Section 5.2.3. The idea would be for biodiversity and carbon trading to be channelled through a linked Conservation Trust, which would top up salinity payments. The Fund would receive support from an Environmental Service Investment Team to draw up contracts (Agreements) with providers. The Philippines, under its Integrated Protected Areas Fund, is also seeking to generate payments from a range of service beneficiaries.

Outside the public sector, Hancock New Forests Australia Pty, Ltd. and Sustainable Forest Management Ltd. are the only suppliers this review found developing a sophisticated shopping basket approach. Hancock New Forests Australia Pty. Was set up in July 2001 as an unlisted private investment company, and is seeking to attract companies and institutional investors interested in a mix of financial and environmental service returns. Initially it is focusing on carbon credit yields, but it is investing significant effort in exploring prospects for selling its salinity and biodiversity benefits. Given New South Wales efforts to commercialise salinity credits (see Box 24, Section 5.2.3), the outlook is positive. Sustainable Forest Management Ltd. hopes to set itself up as a market leader in the management of international long-term investments in a range of forest environmental services. Like Hancock New Forests Australia, it is prioritising carbon credit investments. In May 2001, it kicked things off with a deal worth 48,000 tCO_2 purchased from native American Confederated Salish and Kootenai tribes who replanted 100 hectares of their Montana reservation. The trade was organised through the Montana Offset Coalition and Environmental Financial Products Ltd (Bernstein, pers comm. 2001; Robson, 2001).

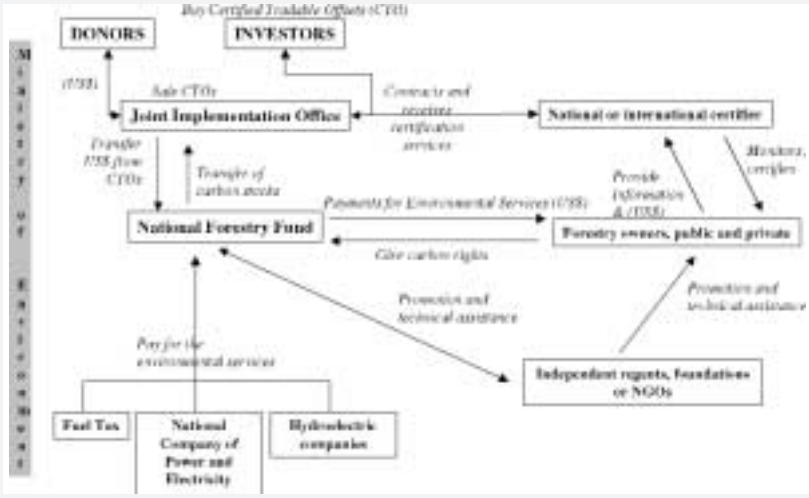
Box 42: Shopping basket and merged bundles of environmental services in Costa Rica

When Costa Rica set up its Payments for Environmental Services programme in 1995, it was widely praised for pioneering global efforts to introduce compensation systems for environmental services. The programme seeks to encourage forest protection and management by paying forest owners for the services their

trees provide. The programme recognises four services provided by forests: carbon, biodiversity, watershed management and landscape beauty.

An overview of how the programme works is represented pictorially below. Briefly, the Ministry of Environment, through the National Forestry Fund (FONAFIFO), is charged with channelling government payments to private forestry owners and protected areas. Payments vary according to the activity undertaken: reforestation (US$450/hectare), sustainable management of forest ($320/hectare) and forest preservation ($200/hectare). Payments are made over a five-year period. In return landholders cede their environmental service rights to FONAFIFO for this period. When the contracts expire, landowners are free to renegotiate prices, or sell the rights to other parties. They are, however, committed to managing or protecting their contracted forest for 20 years (or 15 in the case of reforestation). Their obligation is recorded in the public land register and applies to future purchasers of the land.

The Costa Rican Payments for Environmental Services Programme



Having purchased rights to clearly identified environmental services, FONAFIFO can then sell them to buyers at local, national and international levels. Local level buyers to date include hydroelectricity companies (e.g. the Costa Rica National Power and Light Company, La Manguera, Energía Global) who are interested in watershed services, and tourism agencies (e.g. Hotel Melia, rafting companies) interested in landscape beauty. At the international level, FONAFIFO has developed a system to transfer carbon sequestration rights as Certified Tradable Offsets to buyers via a newly created Costa Rican Office for Joint Implementation. The Office for Joint Implementation negotiates with international investors and donors. These Certified Tradable Offsets could be purchased attached to a particular project, or as a standardised credit which is drawn from a pool of investments. In addition to income from sales of particular environmental service rights, FONAFIFO receives regular income from a share of fuel tax revenues.

Source: Espinoza, Gatica and Smyle (1999), Chomitz (1999)

Where the objective is not so much to maximise revenue as to ensure land stewards are rewarded for the suite of services they provide, the merged bundle approach may make more sense. Land stewards that are paid for their services internalise the values provided by conservation, without having to invest in individual service commercialisation. This approach is adopted not only in Costa Rica with respect to paying landowners for adopting approved forest management plans (see Box 42 above), but is used in the UK and USA. The USA's Conservation Reserve Programme is well known and offers a number of lessons associated with awarding contracts for bundled services through auctions. The USA has also gone furthest in developing conservation easements and tradable development rights as mechanisms for marketing bundled environmental services. These instruments were defined in Box 1 with respect to their use in the biodiversity protection market. Three examples provided in this review – in Virgina, New Jersey and Vermont – illustrate how they have been used to market a bundle of services. Box 43 provides a brief description of New Jersey's Tradable Pinelands Development Credits.

Box 43: New Jersey's Tradable Pinelands Development Credits

In 1980 a newly created New Jersey Pineland Commission imposed a Management Plan within the Pinelands National Preserve. The plan classified all land and water resources in the Preserve into 10 categories of environmental sensitivity using a number of criteria. The aim was to introduce land development restrictions in the most sensitive areas, while providing for a system of financial compensation to those who lose building rights. The system also seeks to provide payments to landowners who protect the bundle of designated environmental services. Financial compensation is achieved through a system of Tradable Pinelands Development Credits.

Essentially the system works as follows. Landowners living within and outside environmentally sensitive areas are issued with Tradable Pinelands Development Credits. Any development must be matched by development credits, up to a cap of 46,200 homes. Landowners outside restricted zones can develop more than their allocated credits as long as they purchase additional credits. Each credit allows for 4 building units. While landowners in restricted zones are not permitted to use their credits for development (although certain activities, e.g. forestry, fishing and wildlife management, recreation and agriculture are permitted), they can sell their credits to landowners in unrestricted areas. Approximately 1 credit is issued for 39 acres of agricultural land. By 1995, 12,538 acres of land had been preserved, following the sale of 1,424 building units.

For the most part trades occur through bilateral negotiation. However, to ensure smooth market functioning the State Government set up the Pinelands Development Credit Bank. The Bank is authorised to buy and sell credits, but only when the private market dries up. Even then prices cannot exceed 80% of the private market rate. In 1990 the Bank undertook an auction of credits to generate interest. In 1995, prices per quarter credit were between US$3,500-4,500. This compares to prices of $10,000/credit in 1990. By 1995, almost 80% of trades had happened through the private market. All sales of credits are recorded in property deeds.

Source: IIED (2001); Johnston and Madison (1997)

Bundled environmental services have also been sold through retail-based markets. The Forest Stewardship Council, for instance, seeks to capture the public's willingness to pay for the protection of a range of forest environmental services through the sale of certified timber. Certification aims to signal that timber that has been produced alongside a number of environmental services. Where consumers pay more for, or buy greater volumes of, these products, the producer effectively captures the value they attach to these bundled services. Box 44 below provides a brief description of the market for Forest Stewardship Council forest products.

Box 44: Forest Stewardship Council certification and bundled environmental service sales

Forest Stewardship Council certification emerged in the early 1990s from an alliance of NGOs and large retailers wishing to develop a positive market-based approach to promote sustainable forestry. Essentially, the idea was that forest managers that invest in sustainable practices should be rewarded for the range of positive environmental services they produce along-side timber. (To be certified producers must abide by 10 Principles and a number of Criteria. These specifically highlight the importance of conserving forests' biodiversity, watershed protection and landscape beauty). This reward would come through the creation of a market niche which delivered price premia and/or market share.

Demand for certification

The main driver behind Forest Stewardship Council certification has been the World Wildlife Fund. Direct lobbying and publicity campaigns have led to the establishment of a market for certified timber. Not only have a number of retailers in Europe and the USA adopted explicit procurement policies that favour certified wood products, but the World Wildlife Fund formed an Alliance with the World Bank in 1997 setting a goal of achieving 200 million hectares of certified forest by 2005. Amongst retailers, UK companies (dominated by the large "do-it-yourself" chains including B&Q and Homebase) have been the most proactive. In 1995 a UK World Wildlife Fund 1995+ Buyers Group was established as a focal point for market pressure for certified wood supplies. In 2000, this group claimed to represent 20% of UK wood imports. In Western Europe as a whole about 5% of the wood market is certified, and in the USA the share is closer to 1%, equivalent to about US$500 million/year. These shares are growing rapidly, with estimates by PriceWaterhouseCoopers for the USA ranging between 100-150% per annum.

More recently demand has been expanding through the creation of Global Forest and Trade Networks, established in 14 countries throughout the world. These Networks include buyers and other stakeholders interested in promoting certification. In addition to those located in Europe and North America, Networks have been set up in Russia, Australia and Brazil and work is in progress in Bolivia, East Asia, South-east Asia, and West Africa.

Supply

By April 2001, over 22 million hectares of forests had received Forest Stewardship Council certification. To date, supply of certified products has been dominated by

European producers, accounting for over 70% of certified area in August 2000. In terms of forest type, natural forests dominate, accounting for 81% of the certified area.

Measuring payments for environmental services
While the concept of paying for environmental services as a part of final wood product prices is straightforward, measuring the payment is often complicated. This is because variations in price are not only a reflection of certification, but may also indicate product differentiation, e.g. different styles of garden furniture. Moreover, because the supply of certified products involves a long supply chain (retailers, traders/importers, processors/ manufacturers, producers), price premia paid in one part of the chain may not be passed on. Therefore, even where final consumers or retailers pay premium, manufacturers may not pass this on to the forest manager who is ultimately the one investing in the provision of environmental services. Alternatively, even where final consumers are not paying premia, manufacturers may be. While it is difficult to collect information on price premium paid by retailers, circumstantial evidence suggests the latter scenario may be occurring as manufacturers are being required by retailers to guarantee certified supplies.

Source: Bass et al (2001)

7.2.2 Moving towards bundling

As highlighted above, there appears to be two main approaches to bundling. Figure 32 below illustrates these. The most direct route – depicted on the left side of the figure – is adopted by the merged service approach in which no effort is made to break down components for sale to separate purchasers. In contrast, to arrive at the shopping basket approach – depicted on the right side of the figure – suppliers have tended to go through an intermediary stage of marketing individual services and adding more services to their sales as experience is gained and new opportunities arise.

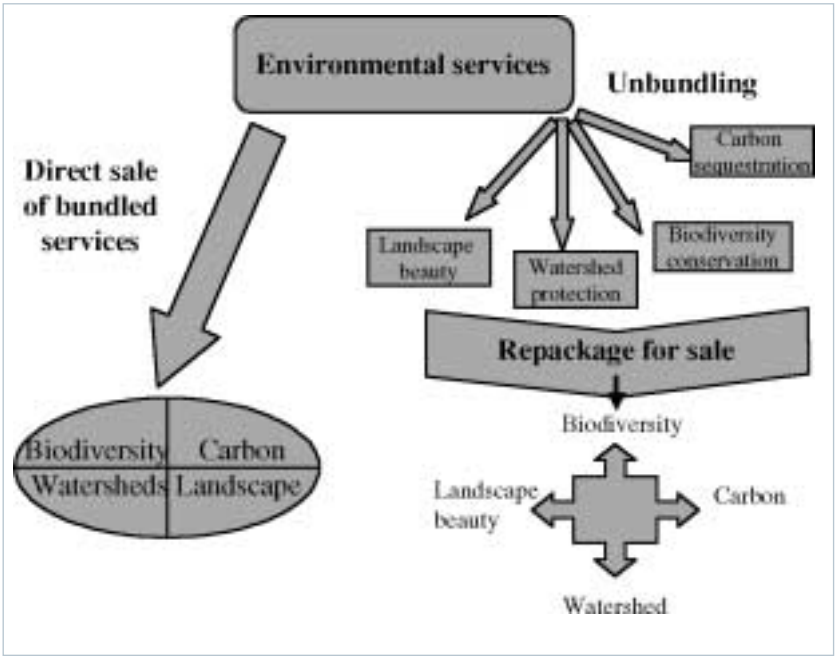
Given the additional steps required in the shopping basket approach, transaction costs will tend to be higher. Market evolution is also likely to be more long-winded, with the development of the necessary infrastructure and technology for parcelling out services taking several years.

While the diagram suggests that the two approaches are alternatives, in practice a combination of approaches may be adopted. In addition, the pursuit of one approach does not preclude switching to another in the future. For instance, while a country might start by selling a fixed bundle of services, improvements in technology and measurement techniques over time may permit sales of individual services.

7.2.3 Constraints to bundling

The two approaches to bundling described above face different constraints. With respect to the shopping basket approach, the constraints will be the same

Figure 32: Two approaches to bundling



as those identified for marketing individual services, but magnified by the number of services being sold. Difficulties with defining property rights, measuring service provision, tenure insecurity, political resistance, and policy uncertainty are just a few of the constraints highlighted in Sections 3-6.

Efforts to market services as a pre-packaged bundle face new difficulties. By far the most important is the lack of information on trade-offs and complementarities between services in specific locations. Where a forest's carbon sequestration services are being sold alongside watershed services, for instance, forest owners need a full understanding of the forest management routine which optimises the delivery of both. Such information is seriously lacking.

7.3 Summary

This section has attempted to draw attention to an area of market development that has received minimal attention in the literature: environmental service bundling. However, practical experience is expanding as those demanding and supplying services seek to capitalise on complementarities between services. Based on the 28 examples reviewed here, two approaches to developing markets for a suite of services are emerging: (1) merged bundles and (2) shopping basket bundles. While merged bundles do not permit services to be sub-divided and sold individually, they offer a useful control on transaction costs. The shopping basket approach is more sophisticated, permitting the sale of individual services to different purchasers. The result is likely to be a more efficient allocation of

resources and higher returns to sellers. Yet, given the technical, data and institutional requirements for successfully marketing a suite of services to separate buyers, for most forest managers the shopping basket model is a distant goal.

8. Overview and some recommendations

Since 1994, Malawi's national electricity supplier has been paying local NGOs to protect watersheds surrounding key hydroelectricity plants, thereby insuring against sedimentation. In 1995, one of Ecuador's first joint ecotourism ventures was established between the Cofan people and the Transturi Tourist Company in the Cuyabeno Wildlife Reserve. The venture, "Aguarico Trekking", promised to reward the Cofans for their careful maintenance of the area's famous scenic beauty that draws tourists from around the world. In 2000, Earthcall Telecommunications Ltd. in the UK was putting into practice its plan to capture public willingness to pay for biodiversity protection through biodiversity-friendly telephone calls.

There is little doubt that markets for forest environmental services are being established with tremendous speed and ingenuity. This report has brought together experiences of market creation for four sets of forest environmental services: carbon sequestration, biodiversity protection, watershed protection and landscape beauty as well as for 'bundles' of services. Over 280 cases were reviewed. The message conveyed by this wide-ranging overview of market emergence is clear:

Markets for forest environmental services are developing at an increasing rate all over the world and their emergence has critical implications for welfare.

There is an urgent need for policy-makers to respond to this development. Lessons need to be learnt from experiences on the ground and guidance compiled on how to create an environment in which markets evolve for the benefit of all, and in particular poor people.

For each environmental service examined, the paper considered six central questions:

- *What form do markets take?* Markets vary tremendously between locations and services sold. This review considered 7 key features to help describe market form: the commodities, the character of participants, the level of competition, payment mechanisms, the geographical extent of trading, the level of maturity and the degree to which markets are nested in broader institutional contexts.

- *Why do markets evolve?* Markets evolve in response to changing demand and supply conditions. Understanding what is driving changes in these is a critical first step in developing strategies in market creation.

- *How do markets evolve?* Institutional development tends to be slow, iterative and path dependent. It is closely intertwined with shifting power relations and changing incentive structures. Understanding the complex processes through which change occurs is essential for those wishing to foster market development.

- *What does market development mean for human welfare?* With market development driven by certain individuals and/or groups, there can be no presumption that markets will improve social welfare. Economic, social and environmental impacts need to be measured. Transaction costs associated with establishing and running market mechanisms must also be considered.

- *What do markets mean for poor people?* Impacts on poor households are of particular interest, not just for equity reasons, but for ensuring markets are sustainable. To help guide this assessment the review considered how markets are impacting on benefit flows and livelihood assets (including financial, human, social, physical, natural and political) held by vulnerable groups.

- *What are the key constraints to market development?* Lessons on constraints to market development need to be drawn out from answers to the above questions. Understanding constraints is critical as a basis for identifying prerequisites for welfare-enhancing markets.

Without claiming to offer final answers to the above questions, the following discussion draws on Sections 3-7 to:
(1) distil broad lessons relating to market form, drivers and the process of market development; and
(2) develop preliminary insights on the impacts of markets for poor people and potential ways forward for promoting pro-poor markets.

8.1 Overview – distilling broad lessons

8.1.1 Different commodities work in different contexts – the key is balancing precision and costs

A critical feature of any market is how the commodity being offered for sale is defined. While commodities in existing markets are easily identified, this is often one of the most challenging aspects of market creation. It is also one of the most important steps for determining whether or not the market will take off and be sustained.

Individual services do not necessarily translate into single commodities. Rather, numerous commodities are used to market the same service. Table 14 below summarises the commodities identified in the cases reviewed[36].

36. Definitions for these commodities may be found in sections on individual services.

Table 14: Commercialising forest environmental services

Environmental service	Commodity
Watershed protection (e.g. reduced flooding; increased dry season flows; improved water quality; maintained aquatic habitat; soil contaminant control; reduced downstream sedimentation)	Watershed management contracts; water quality credits; water rights; land acquisition/lease; salinity credits; transpiration credits; conservation easements; certified watershed-friendly products; stream flow reduction licenses; salmon habitat credits; reforestation contracts; protected areas
Landscape beauty (i.e. protection of scenic "viewscapes" for recreation or local residents)	Entrance rights; long-term access permits; package tourism services; natural resource management agreements; ecotourism concessions; photographic permits; land acquisition; land lease
Biodiversity conservation (e.g. role in maintaining ecosystem functioning, maintaining options for future use, insurance against shocks, improved choice, existence values)	Protected areas; bio-prospecting rights; biodiversity-friendly products; biodiversity company shares; Debt-for-nature swaps; biodiversity credits; conservation concession; land acquisition; biodiversity management contracts; logging rights acquisition; tradable development rights; conservation easements
Carbon sequestration (i.e. absorption and storage of carbon in forest vegetation and soils)	Assigned Amount Units, Certified Emission Reductions, Emission Reduction Units, Removal Units; carbon offsets/credits, tradable development rights, conservation easements

The number of commodities used to commercialise these four environmental services reflect two features of these markets:
(1) the difficulty of finding effective proxies for services; and
(2) the fact that services are themselves often composite products, providing different benefits to different consumers.

With respect to (1), it is rare for the commercialised product to reflect perfectly the desired environmental service. This is because proxies need to overcome problems of non-rivalry and non-excludability in order to provide a basis for packaging and sale (see Section 2.1). Therefore, in the case of watershed services, beneficiaries purchase more tangible inputs in the form of watershed management contracts, rather than the end-product. Often these proxies are nested in a new regulatory framework that gives them their value. Carbon offsets, salinity credits and water rights, for instance, are given their value by emerging national and international legislation. To overcome the lack of precision in defining commodities, in certain cases more than one commodity may be used to capture willingness to pay for the same service.

The second reason we find several commodities emerging to market "individual" services is that environmental services are often themselves compilations of more specific services. Biodiversity conservation offered by

forests, for instance, may be broken down into more specific services such as the maintenance of ecosystem functioning, maintenance of options for future use, insurance against future shocks, improved choice-sets, or the preservation of existence values. Watershed protection services include flood control, maintenance of dry season flows, water quality protection, maintenance of aquatic productivity, or reduced sedimentation. Different commodities reflect different service attributes. For instance, in the case of bio-prospecting rights, the emphasis is on the diversity of genetic information of value to pharmaceutical, biotechnology, or other companies. Salinisation credits are designed to capture forests' role in reducing downstream soil and water salinisation. In the case of watershed management contracts used by hydropower plants in Malawi, the focus is on forests' role in minimising sedimentation in dams and lowering the turbidity of water channelled through the hydropower plant turbines.

While different beneficiaries are interested in different services, services may not always be dis-aggregated since they are often in joint supply. To the extent that only one service is commercialised, beneficiaries of associated non-marketed services become free-riders. By commercialising a bundle of environmental services, land stewards are better able to maximise the return to forest investment. Examples of service bundling were provided in Section 7.

Bundling, however, requires a clear understanding of relationships between services and trade-offs that emerge. The combinations of services are likely to vary significantly between forest types. For instance, fast-growing plantations may have a detrimental impact on local water supplies (in terms of both quantity and quality), while being valuable in terms of carbon sequestration. The lack of knowledge of technical relationships between services constrains the development of markets for bundled products.

In the same way that forests provide a number of environmental services, these services may be produced by a number of land uses. Forests are not the only provider. Many of the cases reviewed have considered services provided by trees within more complex landscapes. For instance, in several of the watershed cases forestry is one of a number of land management techniques used to improve downstream hydrology and conserve soil. When considering forests' role, it is important to consider how forests fit into a broader land use context.

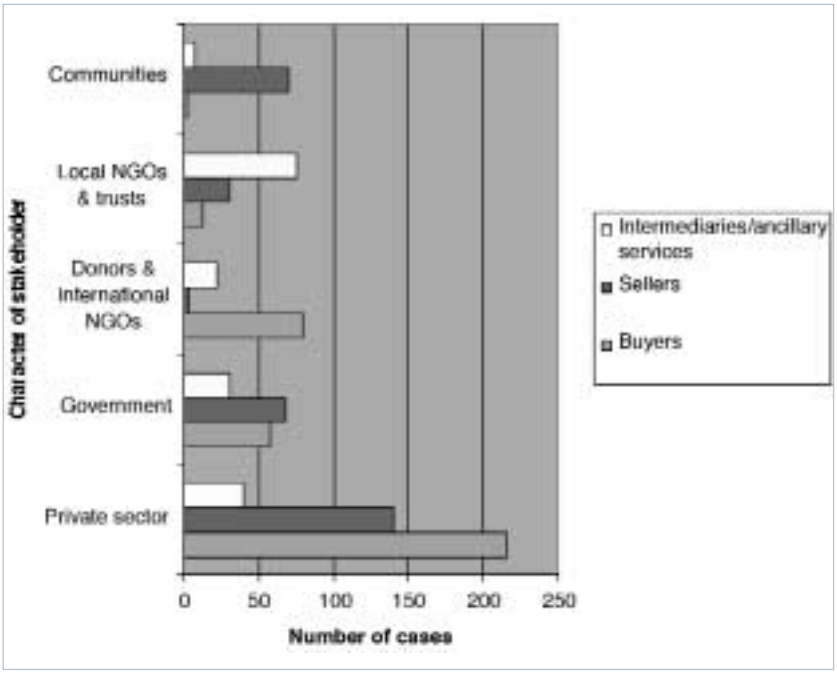
For policy-makers seeking the most appropriate commodity for marketing environmental services, there are no simple guidelines. Different commodities may work in different contexts. The central challenge is finding an effective balance between commodity-precision and implementation costs. In general, the cruder the commodity, the less well-targeted and cheaper it will be. The simplest commodities are grafted onto existing land or forest management markets. For instance, payments for biodiversity protection are often made in the form of payments for land ownership rights. In this case, implementation costs are low since no new legislation or government intervention is required, and buyers and sellers are familiar with the commodity being used.

More sophisticated commodities may involve the creation of new property rights and a new regulatory framework. In the market for carbon sequestration in developing countries, Certified Emission Reductions have been defined through detailed international negotiations, scientific reviews and national legislative action. Not only is the promulgation of supporting legislation and regulations often time-consuming, but implementation will require investment in market infrastructure (e.g. payment mechanisms, monitoring and enforcement agencies, ancillary service providers), as well as a costly process of familiarisation amongst market participants. While the new commodity may be better targeted, these advantages need to be weighed against implementation costs. In countries that lack implementation capacity, costs involved in achieving high levels of precision may be prohibitive.

8.1.2 Markets are multi-stakeholder affairs

The private sector, government, local and international NGOs, community groups and donors are all participants in markets for forest environmental services as buyers, sellers, intermediaries, brokers and providers of support services. Figure 33 draws together information for carbon, biodiversity, watersheds and landscape beauty markets to provide an overview of the relative importance of different stakeholders.

Figure 33: Overview of stakeholder participation in markets for forest environmental services



The following observations may be made regarding stakeholder roles in market functioning.

Private sector. Buying and selling of forest environmental services is dominated by the private sector. Private participants range from individuals and households (e.g. landowners, forest managers, farmers/irrigators, domestic users) through to companies (e.g. forestry, hydropower, water supply, tourism/recreation, fishing, water-using, carbon-emitting companies). Companies account for over twice as many purchases as individuals, while individual landowners dominate sales. The private sector is also active in the provision of intermediary services, though it ranks second after local NGOs and trust funds. The extent of private involvement varies between services. With respect to buying, the private sector is most prevalent in the market for landscape beauty, accounting for 94% of purchases, followed by 70% for carbon. Private sales are most dominant in the carbon and watershed markets and private intermediaries are most active in the carbon market.

Public sector. Theory tells us that a government's role in existing markets should be restricted to establishing a conducive policy framework, introducing supporting laws and managing the regulatory environment. When it comes to market creation, however, governments have played a more active role. As well as designing policy and regulatory frameworks, governments are also important buyers and sellers of services and are frequently active intermediaries. In this review governments account for an average 16% of buyers, 23% of sellers and 17% of intermediaries. While in some instances these interventions are temporary and aimed at catalysing non-governmental participation (e.g. through the provision of advisory services, training and information), in others governments' participation reflects their roles as providers and beneficiaries of services. Quasi-governmental agencies have been particularly keen market participants, reflecting their financial independence and ability to pursue innovative responses to growing environmental service scarcity (e.g. State Forests New South Wales efforts to sell a range of environmental services in Australia; Escom's decision to pay for watershed protection for improved hydropower provision in Malawi).

Communities. Community groups have been active sellers of environmental services, most notably biodiversity services and landscape beauty, accounting for 40 and 50% of sales in these markets respectively. In watershed markets, communities have made inroads as intermediaries, accounting for 15% of intermediary providers. In the case of watershed and biodiversity protection, communities come together as purchasers.

Local NGOs and trusts. Local NGOs and trust funds pay critical roles as intermediaries, accounting for 43% of intermediaries recorded in all markets. Their involvement is often targeted at supporting local people and community involvement. Trusts have been most commonly employed in the market for biodiversity protection (accounting for 62% of intermediaries), followed by

carbon and landscape beauty. Local NGOs have contributed most as intermediaries in the watershed market, accounting for 44% of intermediary providers recorded. They have also been instrumental in transactions for landscape beauty. Local NGOs also act as sellers and buyers of environmental services, though it is only in the market for biodiversity protection that they play a significant role, representing 17% of sellers.

Donors and international NGOs. Donors and international NGOs are most involved in the purchase of global environmental services, accounting for 23 and 28% of recorded buyers for biodiversity protection respectively. Both are known to purchase carbon sequestration and landscape beauty. While donors do not get involved in the provision of intermediary services, international NGOs do offer assistance in carbon, biodiversity and landscape beauty markets. Both are involved in the provision of ancillary services to the carbon market.

Market creation and management are not just private affairs, but benefit from the skills and experience brought by a range of bodies. Efforts to limit participation and exclude certain groups are not only likely to reduce the pool of expertise available for market development, but they may sow seeds of future discontent and resistance. Market success depends heavily on capitalising on stakeholders' enthusiasm for the process and avoiding 'closed shop' arrangements.

Notwithstanding the importance of broad participation, policy-makers may catalyse market development by targeting individuals or groups early in the process. Identifying whom to target will be context specific. Whereas in some cases private companies may offer valuable ancillary services, in others community groups will be better placed. A clear first step for policy-makers is to identify environmental service beneficiaries and providers. Where the aim is to achieve early success, as a basis for spurring broader participation, it may be appropriate to target larger participants amongst these groups – companies, landowners, international NGOs, donors or even government agencies. The transaction costs of piloting payments between larger players – and thus smaller numbers of players – are likely to be lower and enable early lessons to be learned.

On the other hand, where policy-makers are concerned with ensuring equitable participation, pushing for early deals between larger players involves risks. Those excluded from early pilots are more likely to be increasingly marginalised as the market evolves since they will lack the skills and experience to participate. Where equity is considered to be important, capacity building amongst poorer groups will be key. Particular support could be given to community-based organisations and NGOs who offer an effective service to smaller groups. The question of promoting pro-poor markets is returned to in Section 8.2.

8.1.3 Competitiveness is difficult to establish in nascent markets

The level of competition in a sector has critical implications for the distribution of benefits between producers and consumers and productive efficiency. The lower the level of producer competition, generally the lower the productive efficiency (i.e. the higher the costs of production) and the lower the benefits experienced by consumers. The lower the level of competition among consumers, the lower their willingness to pay and the lower the returns to producers.

One approach to measuring competitiveness is to evaluate market concentration. Another is to assess the ease with which individual buyers or sellers can push prices up or down. In emerging environmental service markets, however, the following factors have meant that conventional rules of thumb in assessing competitiveness may be misleading:

- *Price discovery and price volatility*. Emerging markets involve a process of uncovering participants' costs and benefits. Price fluctuations do not necessarily reflect market power, but efforts by buyers and sellers to reach mutually beneficial deals. Also, negotiations in the early stages of market development are often oriented towards gaining experience in transactions, rather than competing on price. This is particularly evident in the market for carbon offsets.
- *Shifting market boundaries*. Markets are not only characterised by a period of price discovery, but participation may expand or shrink as markets evolve and change shape, e.g. through the creation of niche markets. In these circumstances, assessing market power based on the extent of participation may be misleading.
- *Threshold effects and cooperation*. In the case of watershed and biodiversity services, a minimum area needs to be involved to produce valued services. As a result demand and/or supply may need to be coordinated. Cooperation between suppliers may not, therefore, be a sign of collusion.
- *Non-excludability and cooperation*. In the case of watersheds, beneficiary cooperation is one mechanism for overcoming free-riding. Beneficiary collaboration is not seeking to build market power, but represents an efficient method for pooling demand.
- *Transaction costs and cooperation*. In several of the evolving markets, transaction costs are an important constraint. The pooling of demand and supply represents a strategy for overcoming these costs and minimising risks taken on by any market participant to promote market development. In the carbon market for instance, pooling of demand through investment funds has encouraged greater participation and promoted competition between funds.
- *Heavy government intervention*. While government intervention is often thought to stifle competition, in the early stages of market creation governments play critical roles in stimulating demand, supply and providing the necessary market infrastructure to support transactions. Higher levels of government involvement do not necessarily equal less competition.

Given the early stage of market development, it is thus difficult to disentangle un-competitive behaviour from the natural features of an emerging market. It

is, therefore, important that policy-makers show restraint in efforts to curb anti-competitive behaviour in nascent markets. Rather, investment should be made in increasing market information and promoting transparent payment mechanisms (see Section 8.1.4). As markets mature, and participants become better informed of their costs and benefits, prices are likely to be more reliable guides to the level of competition. Already, there are indications of increased competition associated with the establishment of central trading platforms, e.g. exchanges for carbon sequestration, and the emergence of intermediaries and ancillary service providers that are accumulating increased market information.

8.1.4 Market immaturity predominates, but momentum is growing

In Section 2.4 four criteria were proposed to guide evaluations of market maturity: (1) the time period since the trading system was initiated, (2) the degree of price discovery, (3) the level of market participation and liquidity, and (4) payment mechanism sophistication. While a lack of information has prevented an assessment of markets against all these criteria, a review of the payment mechanisms employed provides an indication of market evolution.

Eleven types of payment mechanisms are listed in Box 45, roughly in order of sophistication. Figure 34 provides a picture of the relative importance of these mechanisms in the cases reviewed. The Figure amalgamates information from individual deals and trading systems, and excludes proposed mechanisms. Where transactions use more than one payment mechanism, each mechanism is recorded. The aim is to provide a broad impression of the relative frequency with which payment mechanisms are used.

Box 45: Payment mechanisms to market forest environmental services

Eleven types of payment mechanisms were identified in this review:

- *Direct negotiation between buyer(s) and seller(s).* Deals are often project-based and frequently involve a lengthy process of bargaining to agree details of payments, activities and contingency plans for various risks. While costly, direct negotiations remain popular for offering a flexible approach for customising deals.
- *Intermediary-based transaction.* This is increasingly common as a mechanism to reduce transaction costs associated with searching, negotiating and completing deals. In addition the intermediary may help to lower trading risks associated with project failure or non-delivery by building up skills to identify better transactions and vetting participants. Local and international NGOs and multi-stakeholder Trust Funds are the most common form of intermediary, with the former used most in markets for watershed protection and the latter in biodiversity markets. Private intermediaries are increasingly employed for carbon transactions.
- *Pooled transactions.* This approach aims to control trading risks by sharing the investment among several buyers. In addition, the pooled fund may be large enough to diversify investments. In certain cases pooled transactions are neces-

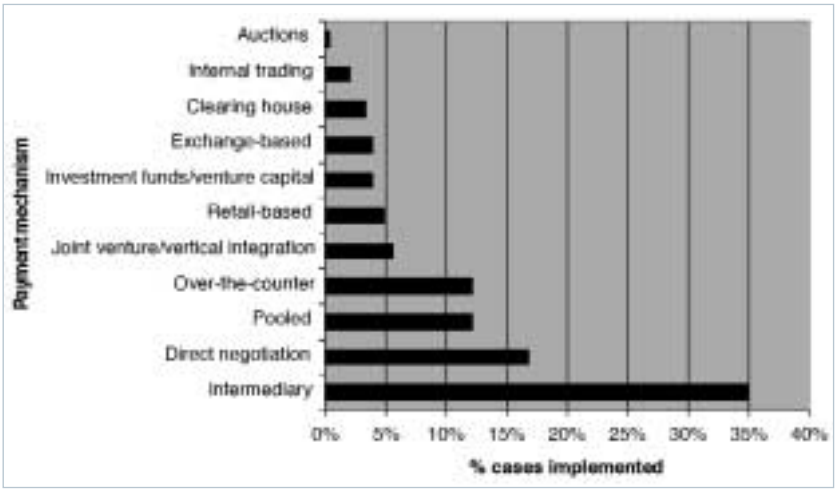
sitated by the existence of threshold effects which mean that a minimum forest area must be protected to generate supply. In the case of watershed protection, for instance, downstream beneficiaries must normally ensure a minimum share of the catchment landowners/managers participate in a payments scheme. Similarly, biodiversity protection often requires investment in contiguous land areas rather than small parcels. Investment funds offer a specific category of pooled transactions. Pooled transactions often go hand-in-hand with intermediary-based trading. Once funds have been pooled, investors/buyers need to have someone to manage them and organise the transaction.

- *Investment fund/venture capital.* This is a more sophisticated form of pooling where external investors put money into a fund that invests in environmental service-based businesses. In some cases, investors expect to receive payments in environmental service products, e.g. carbon offsets.
- *Internal trading.* Trading within an organisation involving payments between agents within broader hierarchies or cooperative arrangements.
- *Joint venture and vertical integration.* Joint ventures permit providers of environmental services to gain an equity stake in value-added businesses. Payments for environmental services are made in the form of a share of business profits to the environmental service provider. In certain cases, service providers have established their own companies to add value and to retail the service provided. In these cases payments are essentially internalised within a new company hierarchy.
- *Over-the-counter trades.* Over-the-counter trades seek to shift the market towards a standardised trading system by pre-packaging environmental commodities. Critically, over-the-counter trading tends to be driven by sellers who have recognised the potential of their market and wish to expand beyond *ad hoc* deals to mass marketing, e.g. Costa Rica's Certified Tradable Offsets market or Australia's salinity credits. Yet, over-the-counter trading may also be arranged from the buyer's side by offering pre-packaged deals for purchase, e.g. Austria's 25-year biodiversity management contracts. A key limitation to over-the-counter markets is the threshold effect, which makes defining the unit of supply difficult. You either have to purchase a large area that produces the required services, or a unit of a larger package.
- *Clearing-house transactions.* The clearing-house approach aims to lower transaction costs associated with over-the-counter trading. Rather than trading standardised products through a series of independent bilateral transactions, a clearing-house offers a "one-stop shop" with a central stock of commodities for sale and a pool of buyers looking for suitable purchases. Moreover, their specialised nature permits them to build up associated services, such as insurance or technical advice.
- *Auction-based trades.* A more advanced form of over-the-counter trading where a pre-package good is bought or sold through an open or closed bidding process conducted at discrete points in time. The approach aims to maximise competition and move away from individually negotiated deals. The only case of auctions being used is that of New Zealand's system of auctioning ecotourism concessions. However, auctions have been proposed for allocating salinity credit contracts in Australia and for distributing Stream Flow Reduction Permits in South Africa.
- *Retail-based trades.* By packaging forest services onto existing retail goods and

services, it is possible to capture public willingness to pay, without building a separate market. From the retailer's perspective, packaging the service into an existing product allows it to differentiate itself from its competitors and obtain a competitive advantage. This approach has been employed for marketing all four forest environmental services investigated. Examples include: biodiversity-friendly coffee, Salmon Safe agricultural produce, ecotourism, Climate Care warranties and Forest Stewardship Council certified timber.

- *Exchange-based trades.* Exchange-based trades make use of national and international exchanges to extend the market to new buyers and sellers and introduce prospects for secondary market trading and derivatives, e.g. options and futures. Only a small percentage of the world commodities are sold through such exchanges (The Economist, October 21, 2000) and it is not necessary that forest environmental services would ever be suited to this form of trading. However, there are attractions for the global environmental services such as carbon and biodiversity that need to find international custom. Interest in exchange-based trading has been greatest in the evolving carbon market, largely as a result of the heightened estimates of trading volumes.

Figure 34: Payment mechanisms used in markets for forest environmental services



From Figure 34 it is clear that markets for environmental services remain largely unsophisticated affairs, dominated by intermediary-based payments schemes and direct negotiation. Yet, the picture is changing. Growth in pooled transactions has given the market a boost as more buyers come together to spread risks, and the emergence of over-the-counter trades reflects a growing confidence amongst suppliers who are beginning to set the terms of deals. Gradually, case-specific negotiations are being replaced by trading systems that seek to promote a greater volume of payments at lower costs. Retail-based trading, clearing-house mechanisms, investment funds and exchange-based platforms are all testimony to this trend.

Understanding the evolution of payments mechanisms is not only useful for assessing the status of market maturity, but it holds lessons for policy-makers that wish to promote market development. Three important insights are already discernible:

(1) While more sophisticated payment mechanisms may lower transaction costs and risks for traders, the costs of establishing payment mechanisms rise as they become more complex. The lower the government and non-governmental capacity, the higher the costs of setting up sophisticated payment systems. Poor countries may often do best to promote simpler payment mechanisms, such as bilateral deals or intermediary-based transactions.

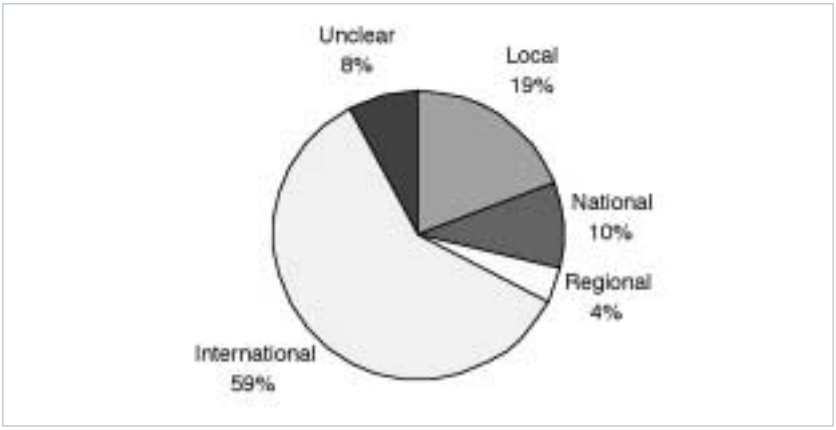
(2) The evolution of payment mechanisms is not a linear process, and is closely intertwined with broader institutional development (see Section 8.1.6). Some advances may be cheap and easy to implement, even in under-developed sites. Examples include shifts from bilateral exchanges to intermediary-based transaction to pooled transactions. Others, such as over-the-counter trading, clearing-house transactions or exchange-based trades may require revamping of the government regulatory framework, an efficient financial sector, the development of a specialised service support sector, and/or improved communication infrastructure.

(3) Different payment systems can, and often do, co-exist. In many cases, they are complementary, for instance where a pooled investment fund searchers for deals through a local-level intermediary. In others, they offer market participants a choice so they can decide which mechanism best suits their needs. Rather than promoting a single approach to environmental service deals, policy-makers may do better to encourage discussion of a menu of options.

8.1.5 Clear governance is critical for emerging markets

Figure 35 illustrates the geographical breakdown in trading for the four environmental services examined in this review.

Figure 35: Geographical extent of trading for forest environmental services



The extent of trading depends partly on the nature of the service. Global services such as carbon and biodiversity tend to be sold internationally (mostly to beneficiaries in the West), while localised services such as watershed protection target local beneficiaries. International tourists dominate landscape beauty markets, though local tour agencies are increasingly paying to maintain forest landscapes.

Market infrastructure and design are also critical determinants of the extent of trading. In the case of global environmental services, most international trading to date has involved one-off directly negotiated deals, often rooted in a national legal system. The lack of global systems of governance inhibits the expansion in deals by raising transaction risks. Just as the expansion in international trade in goods and services provoked the signing of a General Agreement of Tariffs and Trade in 1948 and, more recently, the establishment of the World Trade Organisation, growth in international environmental service payments will depend partly on efforts to introduce a clear trading framework. Recent advances with the Kyoto Protocol (most notably in Marrakech in November 2001) for reducing GHG emissions indicate how a global system of standards and rules can emerge. Similar international agreements may offer a key to unlocking broad-based financing for global environmental service investment.

While governance issues are important for expanding payments for global environmental services, progress in setting up markets for these services can also be made at the national level. The importance of national initiatives to trading in global services is illustrated by emerging carbon markets. Notwithstanding recent advances with the Kyoto Protocol noted above, to date the market has been segmented. National authorities have been setting up their own trading systems, each with its own procedures (e.g. measurement, verification and monitoring systems). As the Kyoto Protocol comes into force we are likely to see increasing links between national schemes. With biodiversity protection – another global environmental service – national and local payments systems have emerged as a result of regulatory systems that promote domestic willingness to pay.

Markets for watershed protection services are also heavily influenced by governance systems. Watershed service payments tend to develop for smaller catchments or basins located within national boundaries. This is not only because hydrological linkages between upstream land use and downstream populations are more clearly perceived in smaller catchments, but also because cross-boundary deals pose larger risks since they fall under separate jurisdictions. Increased coordination in watershed management between adjacent states would provide a valuable boost to international deals.

Policy-makers play key roles in determining the scope of markets. Just as the creation of a clear and stable regulatory environment at the national level is essential to promoting domestic investment, flexible and low-cost international payments systems depend on the development of an effective system of global governance.

8.1.6 Markets are not the only show in town

Markets evolve within existing institutional frameworks, composed of a variety of formal and informal rules and codes of conduct. In many cases, markets complement and reinforce these institutions, while in others they may replace arrangements that are not functioning effectively. Payments systems have played a key role, for instance, in shoring up cooperative arrangements for watershed protection in India by offering a new tool for sharing benefits with disadvantaged groups (see Box 29). Strict regulatory systems aimed at achieving carbon emission or water quality targets have also been strengthened through the introduction of market mechanisms that permit greater flexibility in achieving individual entities' requirements.

Markets also stimulate change. Transactions tend to depend on the creation of new regulatory and other third-party agencies (e.g. intermediaries, brokers, consultants, regulatory agencies, certification bodies), or cooperative arrangements (e.g. water users associations, buying coalitions, multi-stakeholder supervisory bodies). Often, the establishment of payment systems challenges embedded power relations. In extreme cases, the resulting resistance of threatened stakeholders may lead to market failure.

Thus, institutional frameworks in which markets evolve are dynamic and inter-dependent. This fact has critical implications for the potential for market-based solutions to tackle shortages in forest environmental services. Rather than focusing on promoting markets as alternatives to non-market arrangements, efforts should be directed towards identifying the optimal package of market, cooperative and regulatory arrangements. Inevitably the appropriate package will depend on the local context, including existing institutions, power relations, history, and culture.

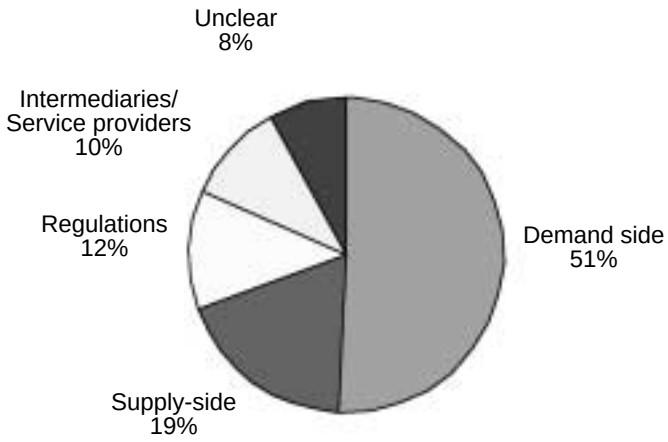
The following five steps can help policy-makers evaluate the optimal way forward:

(1) Map the current situation, including existing policies and laws that determine the regulatory context, key stakeholders involved in environmental service provision and use, cooperative arrangements for maintaining environmental services.
(2) Assess the effectiveness of existing arrangements. Are sufficient environmental services delivered? If so, what costs are involved? What problems exist?
(3) Evaluate options for market mechanisms to improve welfare – either by complementing or replacing existing arrangements.
(4) Identify requirements for supporting hierarchical and/or cooperative arrangements.
(5) Undertake a social cost-benefit analysis, including an assessment of transaction costs and equity impacts.

8.1.7 Drivers for market development are inter-linked and dynamic

The review points to an array of drivers of market development. These emanate from the demand-side, the supply-side, regulations and intermediaries or ancillary service providers. While the relative importance of each set of drivers varies between services, a summary picture is provided in Figure 36.

Figure 36: Relative importance of drivers for market development



Demand-side drivers are predominant, reflecting the non-excludable nature of most environmental services and, thus, the reliance on beneficiaries volunteering to pay. Four major factors lie behind a growing willingness to pay:

- A growing appreciation of the benefits provided by services, together with a heightened awareness of threats to supplies.
- Companies' efforts to improve their public image and head off criticism from NGOs.
- Identification of niche market opportunities associated with "environmentally-friendly" products, e.g. biodiversity-friendly cocoa.
- Ethical concerns and desire of beneficiaries to contribute to nature conservation.

As willingness to pay for environmental services picks up, suppliers of services are becoming more forthright in demanding compensation. Suppliers have tended to be most proactive where they are able to exclude non-payers. For instance, providers of landscape beauty who are able to prevent non-payers from experiencing scenic landscapes are well placed to collect entrance fees. But even where environmental services are non-excludable, suppliers are seeking payment. Their pitch is simple. Unless beneficiaries finance service provision, future supplies for all beneficiaries will be at risk. The threat is often enough to spur collective action on the part of beneficiaries. As more land stewards gain compensation for their environmental services, new suppliers will be tempted to

demand payment. At the same time, improved measurement techniques, systems for pooling supplies and the emergence of innovative insurance strategies are boosting suppliers by lowering transaction costs.

Of course, the ability of service suppliers to demand payment is dependent on them being able to offer credible commitments to future supplies. This in turn depends on them holding secure property rights over the land from which the service is delivered. Government action to allocate property rights over environmental services is thus an essential first step in promoting supply-side market development.

Government regulation is a third driver for market development. The importance of the Kyoto Protocol and national GHG emission regulations were emphasised as critical drivers of markets for carbon offsets. Watershed protection payments, especially in developed countries, are frequently the result of government water supply and quality requirements. Even payments for biodiversity are being generated by government conservation targets. For the most part government regulations do not involve involuntary charges on beneficiaries, but set quantitative environmental targets and allow regulated entities to achieve targets through market means. Market mechanisms increase the cost effectiveness of reaching specified targets and reduce resistance to standards.

Intermediaries and ancillary service providers have been important drivers in markets for carbon and landscape beauty. In the former, the growth of the ancillary sector has taken on a catalytic role as companies that have established themselves as market leaders, e.g. as providers of strategic planning services or insurance, seek to ensure their expectations are realised. In the market for landscape beauty, local NGOs have played a key role in helping communities to reap returns to their land stewardship.

Drivers of markets for environmental services are dynamic and inter-linked. One driver may kick-start events and processes that generate new drivers. For instance, in the carbon market, while the over-arching driver is the Kyoto Protocol, national legislation, company initiatives and public opinion have placed more immediate pressure on buyers and sellers to act. Similarly, government action to define new property rights provides a basis for suppliers to take a more aggressive approach to selling services.

The effectiveness of different drivers will inevitably vary between contexts. In general, market development will move forward most quickly where powerful stakeholders are supportive. For policy-makers interested in promoting markets for environmental services, the question of which path to take will require careful consideration of which stakeholders to involve and how different groups will be impacted and likely to respond.

With these considerations in mind, there would appear to be four main approaches for kick-starting market development:

- *Awareness-raising*. General education should be supported by targeted information campaigns aimed at potential market participants. Suppliers of an environmental service need to learn about the value of their service and potential willingness to pay for its delivery, while beneficiaries need to learn about the value of the service and threats to its continued provision. Broader education helps to ignite public demand for action.
- *Reducing transaction costs and trading risks*. Governments play an important role in ensuring a conducive environment for market development. Investment in market infrastructure, efficient communication systems, research on service delivery and measurement, training and investment in supporting regulations and standards all contribute to lowering transaction costs and risks for potential market participants.
- *Providing secure property rights*. Tenure security is essential to the emergence of a market for environmental service. Without clear and defendable rights to land, forests or the environmental service itself, suppliers cannot make a credible commitment to supply an environmental service. Important actions that can improve tenure security include: formalisation and registration of rights, maintenance of a central and public registry, coordination of government departments involved in allocating rights, and the strengthening of the dispute resolution mechanisms. Monitoring and enforcement systems will also need improving to ensure that rights can be defended where challenged.
- *Introducing stricter environmental standards*. Stricter environmental standards – where they are effectively enforced – often stimulates demand for market mechanisms to ease implementation.

8.1.8 Market evolution takes time and effort

Market development is not straightforward, nor is it uniform. Markets evolve to suit their broader institutional framework (see Section 8.1.6). While some markets mature quickly, others become 'stuck' or even fail (e.g. market creation for watershed protection in Colombia has stalled due to increasing political uncertainty and civil war). The process is heavily influenced by the existing power structure, with market structures often reflecting the interests of those that have a hand in their construction. Markets may be influenced at any stage, from the initial data collection on the benefit of forest environmental services, to the establishment of a legal and regulatory framework, to the design of payment mechanisms[37]. Of particular concern is that poor groups may be excluded from the market development process and consequently have little influence over its final structure (the constraints facing poor groups from benefiting from markets is discussed in Section 8.2).

37. A number of scientists claim, for instance, that support for forests' watershed services is rooted in the interests of politicians and conservationists, rather than scientific evidence (Forsyth, 1996).

While the process of market creation is case-specific, broad lessons may and should be learned. In particular, policy-makers have clear potential roles in fostering market establishment and shaping market form. As already highlighted in Section 8.1.7, policy-makers may play a crucial role in kick-starting market development through awareness-raising, reducing transaction costs and providing secure property rights. In addition, governments are best placed to invest in market infrastructure, notably regulations and legislation that will provide a foundation for markets to grow. Governments also have a role in overseeing market implementation, preventing anti-competitive behaviour and promoting international cooperation in the development of global systems of governance. Above all, governments must act as referee, ensuring a level playing field for all – especially poorer groups.

Based on the above, a preliminary attempt to identify key steps in a process of market development – where markets are not evolving of their own accord – is set out below:

- *Identification of benefits provided by specific service and determination of (forestry) activities that deliver this service*. Uncertainties over service benefits and linkages between forests and these services are often significant. In the case of watershed protection, scientific evidence highlights the complexity of forest-water relationships and the need to look more broadly at land management activities which deliver watershed benefits (see Box 21). There is also disagreement over the role of forests and forest activities that provide biodiversity and carbon sequestration benefits. A first step for policy-makers must be to invest in clarifying the science that will underpin market design.

- *Undertake a feasibility study*. Once the science is clear, it is important to undertake a transparent evaluation of market feasibility. Feasibility assessments should involve cost-benefit analyses, with an explicit calculation of implementation and transaction costs. The distribution of impacts and the potential for resistance to markets should also be examined.

- *Establish willingness to pay*. Two principal methods for stimulating demand include:
  - provision of information on benefits of, and threats to, environmental services; and
  - the introduction of strict environmental standards with built in market mechanisms.

- *Formalise property rights*. For beneficiaries of an environmental service to pay for a given service, suppliers must show that they can ensure service delivery. In most cases this requires that suppliers have clear property rights over forest resources.

- *Establishment of commodity, payment mechanism and supporting institutions*.

– Define commodity. Commodities may be defined through new legislation (e.g. salinity credits, carbon offsets), or through negotiation (e.g. forest management contract).
– Establish a payment mechanism and trading platform: bilateral, Intermediary/broker-based, clearing-house, retail-based, auctions, exchanges, etc.
– Put in place a regulatory environment for trading, including monitoring and enforcement mechanisms.
– Define verification and certification systems.
– Invest in human capital for smooth functioning of the new institutional environment.

- *Pilot activities and feedback to market design*. Pilots are essential for testing market mechanisms, building skills, identifying impacts and pin-pointing constraints, such as unclear property rights, resistance from key stakeholders, and negative impacts on disadvantaged communities. Pilots provide a basis for modifying market design.

The above list is not a blueprint, but the beginnings of a "How to" manual for policy-makers. These steps will not always be relevant, nor must they be undertaken in this order. By setting out a potential set of steps, however, the authors hope to spur discussion. In what follows, we take a more detailed look at how markets impact on human welfare and what measures governments can take to ensure equitable outcomes.

8.2 Markets and the poor – pitfalls and opportunities

Very few thorough assessments of the impacts of emerging markets are found in this review. For the most part, market descriptions are general, *ad hoc* and vague. Virtually none focus in on impacts for poor households. Moreover, because literature tends to be written by proponents of markets, there is a heavy emphasis on benefits, and little critical analysis of costs. In some cases benefits are not even measured, but assumed to result to reflect project intentions. Even where evaluations are more detailed, they rarely provide information on the costs and benefits of market-based solutions versus alternatives, e.g. 'command and control' approaches. Rather they tend to identify costs and benefits associated with service provision.

The paucity of analytical information on emerging markets may be partly explained by the immature nature of markets, and the difficulty of making meaningful assessments at this early stage. However, understanding the impacts of markets as they develop is of significant interest. Moreover, there are a number of cases that have been running for several years.

To provide a platform for more serious analysis, in what follows we bring together the main costs and benefits identified for the cases reviewed. The aim is

not to present a comprehensive list of impacts, but to highlight emerging insights as well as inadequacies in our understanding. Particular emphasis is placed on the distributional implications of markets. The discussion provides a basis for the subsequent assessment of constraints facing poor groups in accessing market benefits and preliminary thoughts on actions for promoting pro-poor markets.

8.2.1 Markets and poor people – evidence from the review

Table 15 below paints a hazy picture of the economic, social and environmental impacts of markets. By transforming environmental externalities into private commodities, markets generate new sources of income for sellers, improve service delivery for buyers, raise the efficiency with which resources are being used and allocated and promote new investments in a range of related assets. Markets clearly offer significant potential for promoting global, national as well as local welfare.

However, the few references to negative impacts in the literature raise important concerns – particularly with respect to what they imply for equity. Market access is essential if people are to benefit. Yet, there is little evidence to suggest that everyone has equal access. In fact, by spurring competition, markets may lead to the further marginalisation of weaker groups as they are evicted from forest lands. Moreover, because markets introduce a money-based system for allocating resources, those with less money have reduced influence over service delivery. Apart from the moral issues raised, the inequitable distribution of benefits poses hurdles for market expansion. In an effort to focus on market impacts for poor individuals, Table 16 draws on discussions in Sections 3-7 to highlight impacts for six livelihood assets as defined in Section 2.4.5: natural, physical, human, social, financial and political capital.

Table 16 highlights potential opportunities and risks offered by markets. Whether poor people realise the potential, or fall victim to the risks is an empirical question. There are, however, a number of reasons for pessimism. In what follows we consider why the constraints to market development are likely to be most difficult to overcome in poor areas, and access to market opportunities lowest for poor people.

Table 15: Impacts of markets for environmental services

Economic benefits	Economic costs
• Income/profits from sale of environmental service • Diversified production base – lower risks of shocks • Employment gains – new jobs associated with emerging markets • Efficiency gains associated with removal of market failure • Improved infrastructure associated with market development, e.g. research facilities, transport, communications • Technological transfer • Achievement of environmental target at least cost - cost savings vis a vis command and control approaches	• Costs of supply - forest protection, certification • Transaction costs - searching for buyers, negotiations, contracting, establishing new intermediaries, monitoring and enforcement • Opportunity costs – e.g. markets replace existing payments, lost agricultural output when forests planted in agricultural land, lost values when protected, e.g. timber and NTFPs
Social benefits	**Social costs**
• Increased land/resource tenure security – where deals result in the formalisation of land tenure to minimise risks to buyers • Improved health - investments in medical facilities, environmental improvements (e.g. reduced water and air pollution), more diverse diets, etc. • Social institution strengthening - e.g. local cooperative arrangements to support to evolving markets may provide a basis for cooperation in other areas • Knowledge and research - environmental research and education through support to local schools, universities and research bodies; • Skill development – in related fields, e.g. sustainable forestry, forest-based industries, ecotourism, carbon monitoring, certification, global warming, project management • Improved recreational and cultural opportunities –more pleasant environment for recreational activities and protection of cultural heritage and religious sites	• Loss of rights to forest resources, especially for poor people – where projects involve forest protection or lead to privatisation of rights to common lands • Reduced health – where loss of access to forest based foods that provide variety in local diets. Also where projects involve fast growing plantations and reductions in water supplies • Risks of domination by the wealthy since they have highest weight in a system based on ability to pay. • Land acquisition schemes may push up local land prices and undermine local communities • Negative cultural impacts associated with monetising environmental services
Environmental benefits	**Environmental costs**
• Improved supply of marketed services: biodiversity conservation, carbon sequestration, watershed protection services and landscape beauty • Positive spin-offs for the non-marketed services	• Negative spin-offs for non-marketed services: e.g. reduced biodiversity or water supplies where monoculture plantations for carbon sequestration

Table 16: Impacts of markets for key assets held by poor households

Potential benefits	Potential risks
Natural assets	***Natural assets***
• Increase forest values due to improved management and new market opportunities • Where markets lead to regularisation of land tenure, this raises value of natural assets • Positive spin-offs for other natural assets, e.g. soil fertility and agriculture, water flows and quality, air quality due to reduced forest fires	• Lost access and use rights due to increased competition for resources • Lost use values (e.g. timber and NTFP) where new harvesting restrictions imposed • Negative spin-offs for other natural assets, e.g. worsened water quality due to replacement of natural forests with fast-growing plantations for carbon sequestration
Physical assets	***Physical assets***
• Infrastructure development – transport, market infrastructure, research, health care	• Dismantling of local infrastructure, e.g. roads, to ensure sustained supply of environmental services • Increased inequality with investment in physical infrastructure targeted at certain market participants
Human assets	***Human assets***
• Education and training - environmental management, enterprise development, project management, marketing, negotiations, etc. • Improved health - more varied diets, improved water supply (quantity and quality), improved air quality, investment in health clinics, improved disposable income for medical treatment	• Inappropriate education diverts spending away from broader skill development • Poor capture few educational and skill development opportunities since offered only menial jobs • Reduced health where poor are excluded from collecting NTFPs for domestic consumption and lost disposable income
Social assets	***Social assets***
• Increased tenure security where markets spur rights formalisation • Increased managerial and organisational capacity of community-based organisations to tackle common problems • Protection of forest-based cultural heritage	• Reduced tenure security where markets lead to displacement of poor who lack formal property rights • Erosion of cooperative arrangements due to increased divisions between those that gain and lose. • Threats to cultural heritage where markets and commercialisation undermine local value system
Political assets	***Political assets***
• Increased political representation and voice due to improved organisational capacity (see social assets above) and contacts in private and public sector.	• Loss of political representation where markets lead to increased competition for resources and exclusion of poor from forest areas.
Financial assets	***Financial assets***
• Income from sales of environmental services • Income from related employment (e.g. NTFPs, fuelwood, timber, ecotourism, transport) • Improved security and stability of income due to diversification	• High costs of bringing services to market (transaction costs and opportunity costs) means many poor suppliers excluded • Income associated with forest exploitation may fall due to new restrictions. • Poor excluded from new markets since lack necessary skills and assets • Reduced security where contract design is inflexible (e.g. long-term contracts do not allow suppliers to respond to short-term shocks)

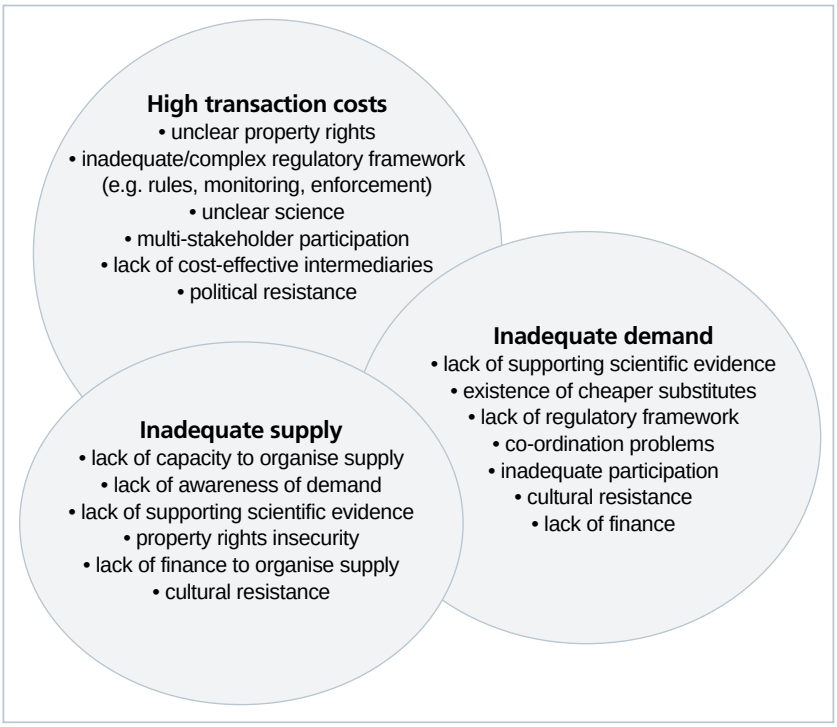
8.2.2 Constraints to pro-poor market development

The evolution of markets for forest environmental services has generally been a slow and iterative process. Sections 3-7 touched on numerous constraints to market development. Three broad groupings may be identified: (1) factors that raise transaction costs, (2) factors that undermine willingness to pay, and (3) factors that undermine willingness to supply. Drawing on experiences from individual service markets, Figure 37 sets out key constraints associated with each category. The Figure is presented in the form of overlapping circles to emphasise the fact that constraints are inter-linked and may be categorised in more than one grouping.

The importance of the constraints varies by environmental service and between countries. Poor people in developing countries often face the greatest hurdles. Ten reasons for inequity in market opportunities stand out:

- *Insecure tenure*. Insecure property rights are a common feature of environmental services throughout the world. Not only are rights over services rarely defined, but commodities often lack supporting legislation. Insecurity of tenure tends to be most acute for poor communities in developing countries. This is true even where the commodity is well established, e.g. land[38]. Without clearly defined and enforceable property rights, deals between buyers and sellers are risky and difficult to conclude.

Figure 37: Three sets of constraints to market development



38. See discussion on commodities as proxies for environmental services in Section 8.1.1.

Moreover, where poor people lack secure tenure, markets for environmental services may increase inequality by increasing competition for control over resources and the eviction of weaker groups by more powerful entities.

- *Inadequate regulatory framework*. Regulations often provide the basis for defining new environmental commodities. They also define systems for monitoring and enforcement that are essential ingredients in well-functioning markets. Unless regulations are put into practice, payments for environmental services may not be forthcoming. For regulatory systems to be enforceable it is important that they are not overly complex, that oversight capacity exists and is transparently applied, and they are consistent with existing laws. Developing countries frequently lack the capacity to achieve the necessary regulatory standards.
- *Inadequate skills and education*. Where individuals have clear property rights, the extent to which they benefit from market opportunities depends on their ability to participate and compete for business. This in turn requires, amongst other things, managerial skills for organising supply – especially when large number of landholders are involved, negotiation and contracting skills for structuring deals, scientific understanding of environmental services and technical skills to deliver the services. Low levels of education and inadequate skills place a serious handicap on participation.
- *Inadequate finance*. Participation in emerging markets requires up-front investment. With respect to supply, service providers will need to invest in searching for clients, acquiring skills (see above), bringing the service to market, insurance, etc. On the demand-side, buyers need finance to conclude a deal. While up-front investments will tend to be highest for poorer groups for reasons noted in other bullets, it is this group that tends to lack access to affordable finance.
- *Poor market information*. Access to information on potential buyers and current prices being paid for environmental services is key for sellers to be in a position to negotiate a fair deal.
- *Lack of market contacts*. At present environmental service markets tend to be segmented, largely unregulated and highly dependent on directly negotiated deals. Knowing where to go to initiate trade and where to find support and advice is critical. Finding an intermediary that can be trusted is essential. Market contacts take time to develop and are most easily made and solidified through regular communication. This may prove difficult to achieve for poor rural communities.
- *Insufficient communication infrastructure*. Linked to the above, an important determinant of the costs of negotiating and concluding deals will relate to how accessible sellers are to buyers. Transportation and communication infrastructure is important in bringing parties together.
- *Inappropriate commodity design*. In general the provision of environmental services is a long-term commitment (e.g. carbon offset deals tend to span decades rather than months or years). However, poor communities rely on livelihood strategies that are flexible and able to cope with unexpected shocks. Thus, even where new markets offer opportunities for increasing income, where they require extended commitments they are unlikely to attract

participation of vulnerable groups. Where poor people accept long-term contracts, there are serious risks that these contracts will decrease poor people's ability to respond to shocks and damage welfare.

- *High co-ordination costs.* Participating in markets for forest environmental services is expensive. Searching for, negotiating, agreeing, implementing, monitoring and certifying deals are all costly. These transaction costs will be higher the greater the number of buyers and sellers involved. Poor households with small plots will tend to face high co-ordination costs as part of any deal[39].
- *Weak power.* Even when poor communities can participate in markets, they tend to be the weakest party. Whether they are negotiating with ecotourism companies for a share of rents, or being asked to pay for watershed protection by electricity suppliers, they will be pushed towards their reservation price. Where power balances are unequal, achieving a level playing field is extremely difficult.

The above factors are inter-linked and mutually reinforcing. The risk is that new markets for environmental services will reinforce the existing power balance, thereby restricting the ability of poor communities to tap into increasing forest-based wealth. The opportunity is that markets will provide a mechanism for poor communities to overcome historical marginalisation and improve their welfare. The challenge is identifying how to ensure that markets provide a force for poverty alleviation.

The constraints to pro-poor market development are formidable. However, the appropriate response is not to reject market development, but to find ways of harnessing its power to act as a force for equitable welfare growth. This review has highlighted how markets are extremely adaptable and constantly changing shape to overcome impediments. New techniques to overcome high transaction costs, promote willingness to pay and generate supply are regularly emerging. Mechanisms for pooling demand, the emergence of specialised intermediaries, new products for insuring supply and systems for verification and certification are just a few of the innovations picked up by this review. The key challenge is to ensure a share of the energy being devoted to expanding markets is channelled to promoting more equitable market structures. In what follows, ideas for moving forward are proposed.

8.2.3 Potential ways forward – developing pro-poor markets

The literature on forest environmental services provides little guidance on the development of "pro-poor" markets. Given the role of governments in establishing the legal underpinnings and regulatory framework for markets, they must play a central part in ensuring equity. Building on insights offered by this review and the discussion above on constraints to pro-poor markets, seven possible steps for promoting pro-poor markets include:

39. Threshold effects associated with the delivery of certain environmental services (e.g. biodiversity or watershed protection) often require that a minimum area is protected.

- *Formalise forest service property rights held by the poor*. Formalisation of natural resource property rights is essential for giving poor households control over, and rights to, returns from sales. To attract business, land managers must be able to offer credible commitments for supply. In most poor countries environmental service rights will be embedded in land or resource tenure rights. In these cases formalisation requires clarifying poor individual's tenure rights over forestland and standing trees. From the cases reviewed, there are already signs that market development has spurred forest land tenure formalisation in disadvantaged communities in Bolivia, Costa Rica, Peru, Ecuador and India. In more sophisticated economies property rights for environmental services may be separated from rights to timber and NTFPs. In these cases, it will also be important to ensure poorer land managers are able compete for control over their service rights.

- *Define appropriate commodities*. Different commodities are appropriate in different contexts. In poor countries with weak regulatory capacity, simpler commodities that can be self-enforced and that fit into existing legislative systems are preferable. In addition, commodities need to be flexible enough to allow for individuals to respond to unexpected shocks. Shorter duration contracts and systems of insuring service delivery may help reduce risks for buyers and sellers, and broaden prospects for poor groups to participate.

- *Devise cost-effective payment mechanisms*. Just as commodities need to be carefully selected to fit given institutional contexts and requirements, payment mechanisms need to be chosen with an eye on local capacities and likely implementation costs. In areas where regulatory capacity is weak, trading skills in short-supply and market infrastructure under-developed (e.g. communication, information systems, transport, monitoring), simpler payment mechanisms are likely to be most effective. Innovative techniques to lower transaction costs such as systems for pooling demand and supply and intermediary-based transaction should be actively encouraged.

- *Strengthen cooperative institutions*. The importance of cooperation in the delivery of, and payment for, environmental services has been repeatedly highlighted through this report. Cooperation is particularly important in allowing poor landowners and service beneficiaries to share the costs associated with market participation. Moreover, while landowners with small plots are unlikely to find a market for their carbon offsets, biodiversity conservation, watershed protection or landscape beauty, a group of landowners may attract interest. However, cooperation is itself costly. Official recognition of cooperative institutions, as well as training in project management, conflict resolution and participatory processes would strengthen poor communities' ability to cooperate and, thus, participate in markets.

- *Invest in training and education*. While requirements will vary depending on the context, training in marketing, negotiation, management, financial accounting, contract formulation, and conflict resolution will all tend to be

important. Technical skills relating to the delivery of forest environmental services will also be needed. In some instances it may be most cost-effective for government to support the emergence of specialised ancillary service providers and intermediaries who can offer necessary services to poor communities. A key consideration will be how to ensure service providers do not exploit their position, and retain the trust of poor communities.

- *Establish a market support centre*. Information is power. To improve poor people's ability to participate in emerging markets, a central market support centre could offer a number of services:
  - Free access to information on recent prices and transactions.
  - A contact point for potential buyers, sellers and intermediaries.
  - An advice bureau to support the design and implementation of contracts.
  - Research which draws together emerging best-practice with respect to contract design and implementation and feeds this back through its advice bureau. This could be particularly important in the development of flexible contracts that are suitable to poor communities' needs.

- *Improve access to finance*. Where finance is needed to negotiate and conclude environmental service deals, the government may have a role to play in supporting access to funds. This is especially true where banks and other formal lending institutions are failing to provide loan facilities due to their lack expertise in emerging markets, inflexible collateral laws and/or the non-existence of reliable credit registries. The government has a role to play in providing supportive legislation and stimulating competition amongst financial intermediaries to increase lending to disadvantaged groups. To the extent that markets for forest environmental services increase the value of poor people's asset base, financial institutions should be encouraged to take account of these assets in determining loan conditions.

Poor people face a number of hurdles in accessing the full benefits that markets for environmental services have to offer. Governments have a responsibility to level the playing field and ensure equitable access to market opportunities. The actions listed above represent preliminary ideas for a broader strategy of promoting pro-poor markets. The list is not comprehensive. The identification of specific actions and the prioritisation of these actions need to be undertaken at the local level, with the participation of affected parties. It is hoped that what is presented here stimulates thought and more detailed local initiatives.

Annex 1: Glossary

Bundled services – where more than one environmental service is provided simultaneously.

Clearing-house – an intermediary that offers a trading platform for buyers and sellers of standardised products. Clearing-houses seek to lower transaction costs associated with over-the-counter trading by offering a "one-stop-shop" for buyers and sellers, often including the provision of ancillary services such as insurance and technical advice.

Commodity – tangible product bought and sold in a market transaction.

Competitiveness – the level of competition between buyers or sellers of a good or service. Highly competitive markets tend to include several buyers and sellers, none of whom (when acting alone) can influence prices. However, it is important to distinguish between *actual* competition – measured in terms of the number of buyers or sellers already in a market – and *effective* competition which takes account of potential buyers and sellers who may enter the market where prices move too high or low. The threat of market entry controls the market power held by existing participants.

Direct negotiation – where payments for environmental services are agreed directly by buyers and sellers. Payments are often embedded within larger projects that set out detailed conservation activities and which involve a lengthy process of bargaining (e.g. integrated conservation and development projects).

Exchange-based trades – where a commodity has been standardised and can be resold in secondary and, in some cases, derivative markets such as futures or options markets.

Excludability – refers to the ability of supplier to exclude non-payers from consumption. Public goods are defined as non-excludable since a supplier cannot exclude anyone from consumption (see also rivalry).

Free-rider – an individual or group who benefits from the supply of a good or service which is paid for by others.

Institutions – a set of working rules that guide decision-making and resource allocation. Institutions may be formal (e.g. statue law, common law and property rights) or informal rules (e.g. codes of conduct, norms of behaviour or social conventions) that govern behaviour and their associated enforcement mechanisms. Three types of institutions can be identified:

- Markets – decentralised forms of co-ordination where exchange of goods and services between individuals determines resource allocation. The central mechanism guiding decision-making is the price system.

- Hierarchies – mechanisms for co-ordinating activities that rely on planning, rules and the stratification of authority in a group. Hierarchies are most commonly associated with bureaucracies and may be found in the state and private sector firms.
- Cooperative arrangements – fall outside the market and hierarchical arrangements and refer to voluntary and often informal forms of co-ordination. A critical feature of such arrangements is the role played by trust and personal relationships.

Institutional nesting – refers to the fact that institutions tend to be interlinked and embedded in broader frameworks of market, hierarchical and cooperative institutions.

Intermediary-based transactions – occur where funds are channelled *via* intermediaries, e.g. Trust Funds, local and international NGOs. Intermediaries help to reduce transaction costs associated with searching, negotiating and completing deals. In addition, they lower trading risks by building skills for efficient transactions.

Investment fund – where investors pool funds in an intermediary, which then invests in targeted enterprises. In environmental service markets, investment funds may target service providers, e.g. biodiversity businesses.

Joint venture – where two or more investors join forces to start up an enterprise. Each investor gets an equity stake in the new enterprise to reflect their input, be it financial capital, land, labour or physical capital.

Market power – the extent to which individual entities can influence market prices. The greater an individual's market power, the more influence over prices (s)he has (see also competitiveness).

Non-excludability – see excludability

Non-rival – see rivalry

Over-the-counter trades – where a commodity is pre-packaged for sale.

Path dependency – refers to the dependency of current reality on the past. Understanding institutional frameworks today requires an appreciation of historical situation and the path of change.

Payment mechanism – mechanism through which payments for a service or commodity are made. Numerous payment mechanisms exist, ranging from simple direct payments to more complex payments that are channelled via a third party.

Pooled transactions – involve the pooling of funds by buyers, or pooling of service supplies. Pooling controls trading risks for buyers by sharing the investment among several buyers and, in some cases, by permitting diversified investments. For suppliers, pooling helps share transaction costs and overcome requirements for minimum levels of service supplies, e.g. minimum forest protection to conserve biodiversity.

Price discovery – process through which buyers and sellers find a market-clearing price for a new product. Initially buyers and sellers will come together and experiment with different prices. As information about different deals spreads, prices will tend to converge.

Reservation price – minimum price acceptable to suppliers of a good or service. Reservation prices must cover costs of production, including opportunity costs of employing land, labour and capital.

Retail-based markets – where payments for a particular environmental service is attached to, or "piggy-backs" on, existing markets for another good or service. Carbon-neutral cars, for instance, permit customers to purchase carbon sequestration along with their car.

Rivalry – refers to the degree of competitiveness in consumption of a good or service. Where a good is rival, consumption by one individual reduces supplies available to another. Public goods are defined as being non-rival such that consumption by one individual does not reduce the availability of the item to others.

Thin trading – "low volume" trading where transactions are infrequent.

Transaction costs – costs (monetary and in-kind) associated with setting up and participating in market exchange, excluding the actual payments made to suppliers for the commodity. Market creation imposes a range of costs, e.g. establishment and management of a property rights system, a system of exchange, a monitoring and enforcement system, supporting legislation, etc. Participation in markets is also costly, as buyers and sellers must spend money and time collecting information, negotiating, drawing up contracts and monitoring adherence to contracts.

Venture capital – where investors offer equity input into a start-up company. Such investments tend to be more risky than investments in established businesses, and are, thus, often associated with higher returns.

Annex 2: List of case studies reviewed

Case studies of biodiversity conservation markets	
Country	**Project/commodity**
Australia	Biodiversity credits
Australia	Shares in Earth Sanctuaries Ltd.
Australia (Western Australia)	Exclusive access rights to Smokebush
Australia (Tasmania)	Tasmania Private Reserve Programme – conservation covenants & land acquisition
Austria	Lower Austria Landscape Fund – biodiversity management contracts
Belize	The Belize Protected Areas Conservation Trust – protected areas
Belize	Rio Bravo Conservation and Management Area – land acquisition & private protected area
Bhutan	Bhutan Trust Fund for Environmental Conservation – protected areas
Bolivia	Logging rights purchase
Bolivia	Debt for nature swap
Brazil	CONAMA – park mitigation requirement
Brazil (Amazon)	Reserve requirement offsets
Brazil	National Environmental Fund – protected areas
Cameroon	Access rights for bioprospecting
Chile	Private protected areas
China	Pippa Horticulture Company Ltd – access rights
China	Shares in National Scenic Reserves/ Forest Parks
China (Guizhou Province)	Protected wetland for endangered cranes
Colombia	ECOFUNDO – protected areas
Colombia	Conservation coffee
Costa Rica	INBio's bioprospecting permits
Costa Rica	Del Oro – payments for forest pest and disease control services through a land lease
Costa Rica	Children's Rainforest, Monteverde – protected areas
Costa Rica	Debt-for-Nature Swaps
Costa Rica	Biodiversity-friendly cocoa
Costa Rica	Monteverde Coffee – biodiversity friendly coffee
Ecuador	Ethno-bioprospecting – access rights
Ecuador	Debt for nature swap
Ecuador	The Tagua Initiative – biodiversity friendly accessories.
El Salvador	Biodiversity-friendly coffee
Fiji	Strathclyde Institute access rights
Fiji	Trust Fund for biodiversity conservation
Ghana	Time-Debt Swaps

Guyana	Conservation Concession
India	Paying for ethno-biological knowledge and access rights in Kerala
India	Harda (Madhya Pradesh) – protected areas
Indonesia	Wasur Project – protected areas
Jamaica	Debt-for-nature swap
Malawi	Malawi Environmental Endowment Trust (MEET) – biodiversity company shares
Malawi	Mulanje Mountain Conservation Trust (MMCT) – protected area
Mexico	El Triunfo Biosphere Reserve – Biodiversity-friendly coffee
Mexico	Northern Chihuahua – biodiversity management contract
Mexico	Biodiversity-friendly cocoa
Netherlands	Biodiversity offsets
Nigeria & Cameroon	The African International Cooperative Biodiversity Group (ICBG) – biodiversity access rights
Pakistan	Northern Pakistan – protected areas
Peru	Biodiversity-friendly coffee
Peru	Rainforest Cookies
Philippines	Debt for Nature Swap
Philippines	Foundation for the Philippine Environment – Debt-for-nature swap
Philippines	World Land Trust – land acquisition
Russia	Talan – payments by an ecotourism company for biodiversity protection
Suriname	International Cooperative Biodiversity Group project – Biodiversity access rights
Switzerland	Ecological compensation programme – biodiversity management contracts
Uganda	Mgahinga-Bwindi Impenatrable Forest Conservation Trust – protected area
USA	Yellowstone National Park – Research Specimen Collection Permit
Vietnam & Laos	International Cooperative Biodiversity Group-biodiversity access rights
West Africa (Ghana, Cote d'Ivoire)	Shade cocoa in the Upper Guinean forest

Private sector and international agency initiatives
Earthcall Telecommunications Ltd.
Critical Ecosystems Partnership – payments for hotspot protection
Global Environment Emerging Markets Fund – biodiversity business shares
Small and Medium Enterprise Programme – biodiversity business shares
Kijani Initiative – biodiversity business shares
Botanical Garden Trading Company Ltd – access rights and Hotspot conservation
GEF – biodiversity protection
American Cocoa Research Institute Shade Cocoa Programme
Community Products Inc payments for forest conservation
Debt for nature swap – the Enterprise for the Americas Initiative
Terra Capital Investors Ltd – purchase of biodiversity business equity
Eco-Enterprises Fund – biodiversity business shares
The Environmental Enterprise Assistance Fund's Corporacion Financiera Ambiental – business shares
Café Ibbis – biodiversity-friendly coffee

Case studies for carbon sequestration markets	
Country	**Project/commodity**
Argentina	La Plata/Fontana, Patagonia
Australia	National credit scheme
Australia	Bush for Greenhouse programme
Australia	Australian Plantation Timber sale of carbon credits
Australia (New South Wales)	Sales of CO_2 tradable rights by New South Wales State Forests
Australia (Queensland)	North American purchasing consortium
Australia (Victoria)	Landcare forestry investment & Bush for Greenhouse
Australia (Victoria)	Australian Afforestation Pty. Ltd. – afforestation for timber and carbon
Australia (Western Australia)	Western Australia EcoCarbon Initiative
Belize	Rio Bravo Conservation project
Bolivia	Noel Kempff Climate Action Project
Brazil (Mato Grosso)	Peugeot investment in carbon offsets
Brazil (Parana)	Atlantic Forest protection for carbon
Burkina Faso	Sustainable Energy Project
Canada (Alberta,	KEFI-exchange – carbon credit trading
British Columbia and	
Saskatchewan)	
Canada	GHG Emission Reduction Trading (GERT) scheme
Canada	Pilot Emission Reduction Trading (PERT) scheme – trading air pollutants, e.g. NO_x, volatile organic compounds, SO_2, CO_2
China	Forest-based carbon sequestration
Costa Rica	Certified Tradable Offset (CTOs)
Costa Rica	Norway purchase of CTOs – AIJ project
Costa Rica	Biodiversifix (AIJ project)
Costa Rica	CARFIX (AIJ approved 1994)
Costa Rica	ECOLAND (AIJ approved 1994)
Costa Rica	Klinki Forestry Project (AIJ project approved 1995)
Costa Rica	Protoype Carbon Fund – Fund for Renewable Energy

Czech Republic	Krkonose (Giant Mountains) National Park – a FACE project
Czech Republic	Sumava National Park – a FACE project
Denmark	Emission trading scheme for electricity plants
Ecuador	Programme FACE de Forestacion (PROFAFOR) – a FACE project
Ecuador	Bilsa Biological Reserve
Guatemala	Reforestation and carbon sequestration
Honduras	Biomass power generation (USIJI project)
Indonesia (Borneo)	Reduced Impact Logging in East Kalimantan (USIJI)
Malaysia	Infapro – a FACE project
Malaysia	Reduced impact logging in Sabah
Mexico	Agroforestry in Scolel Te (AIJ) – protocarbon credits
Mexico	Community silviculture in Sierra Norte, Oaxaca (AIJ)
Mexico	Chiapas carbon offsets
Mexico	Halophyte Cultivation in Sonoro (registered USIJI project)
Netherlands	Air pollutant trading – includes carbon credits
Netherlands	Emission Reduction Units (EMUs) Permit Trading (ERUPT)
Panama	Reforestation in Chiriqui Province (USIJI)
Panama	Reforestation bonds in Darien
Paraguay	Mbaracayu initiative
Peru, Bolivia, Ecuador	Applied Energy Services, Inc Shady Point
Poland	Wroclaw – a FACE project
Russia	RUSAFOR Saratov Afforestation Project – USIJI
Russia	Vologda reforestation project – USIJI
Russia	Energy Carbon Fund
Tanzania	Tree Farms AS carbon plantation
Uganda	Uganda Wildlife Society – a FACE project
Uganda	Norwegian Tree Farms AS selling carbon offsets to a power company – carbon forward option
United Kingdom	Emission Trading Group
United Kingdom	North Sea gas flare emission "consent" trading
United Kingdom	Greenergy – carbon certified electricity
United Kingdom	Climate Care Warranties
USA	The Sky Trust – carbon emission permits
USA	Environmental Synergies, Inc. – carbon offsets through reforestation
USA	Forest Forever Fund – conservation easements and carbon credits
USA (Oregon)	Carbon offset projects
USA (Montana)	Montana Offset Coalition
Vietnam	Plantations in central and southern Vietnam – AIJ

Multinational enterprise initiatives
Shell's Tradable emission permit system (STEPS) – carbon and methane offsets
Carbon allowances within BP Amoco
Suncor Energy – GHG credits
The Greenhouse Emission Management Consortium (GEMCo)
Ontario Power Generation
Civil Aviation Organisation – carbon emission controls
Partnership for Climate Action – a consortium approach
JOINT
Regional initiatives
Start-up CDM in Africa
EU emission trading scheme – carbon credits
International Agency schemes
World Bank Prototype Carbon Fund
IFC's Renewable Energy and Energy Efficiency Fund (REEF) – carbon credits

Carbon market ancillary service providers	
Service	**Company/Entity**
Brokerage	Cantor Fitzgerald Environmental Brokerage Services (US)
Brokerage	Environmental Financial Products (Chicago)
Brokerage	Mitsubishi Corporation
Brokerage	CDM Alliance
Brokerage	Start-up CDM in ACP Countries (SUSAC)
Brokerage/ exchange	Emission Market Development Group
Exchange	CO2e.com – internet based trading of CO_2 equivalent
Futures exchange	Sydney Futures Exchange (abandonned 2001)
Exchange	International Petroleum Exchange, London
Exchange	SBF Paris Bouse
Exchange	Chicago Climate Exchange – cap and trade pilot for GHG emissions
Exchange (UK)	Emission Trading Group – GHG emission trading
Exchange (UK)	North Sea gas flare emission "consent" trading
Exchange (Ontario, Canada)	Pilot Emission Reduction Trading (PERT) exchange – trading air pollutants, e.g. NOx, volatile organic compounds, SO_2, CO_2
Exchange (British Columbia, Canada)	GHG Emission Reduction Trading (GERT) exchange
Exchange (Alberta, BC and Saskatchewan in Canada)	KEFI-exchange – carbon credit trading
Insurance	Aon Environmental Solutions
Insurance & investment advice	Swiss Re
Investment fund	World Bank Prototype Carbon Fund
Investment fund	IFC's Renewable Energy and Energy Efficiency Fund (REEF)
Investment fund	UBS (Switzerland)- Alternative Climate Fund
Investment fund	Dexia-FondElec Energy Efficiency and Emission Reduction Fund

Investment fund	DB Capital Clean Energy Fund
Investment Fund	Sustainable Forestry Management Ltd.
Certification and verification (forestry)	SGS Ltd
Legal Advice	Baker and McKenzie Solicitors and Attorneys
Legal Advice	Van Ness Feldman's Global Climate Change Practice
Advise and consultancy	Alternative Energy Development, Inc.
Advise and consultancy	BC Hydro International
Advise and consultancy	BCC Economic Consultants
Advise and consultancy	CarbonBank
Advise and consultancy	CJ Aron Associates
Advise and consultancy	COGEN-Asian Institute of Technology
Advise and consultancy	Det Norske Veritas
Advise and consultancy	DIN CERTOCO Gesellschaft fur Konformitatsbewertung mbH
Advise and consultancy	Eco-Carbone
Advise and consultancy	Ecofys BV
Advise and consultancy	Econergy International Corporation
Advise and consultancy	EcoSecurities
Advise and consultancy	Energy for Sustainable Development
Advise and consultancy	Environmental Resources Management
Advise and consultancy	Environmental Synergies Inc. (USA)
Advise and consultancy	Evolution Markets LLC
Advise and consultancy	ICF Consulting
Advise and consultancy	Innovest Strategic Value Investors
Advise and consultancy	Idufor Oy
Advise and consultancy	Natsource LLC
Advise and consultancy	PriceWaterhouseCoopers Climate Change Services
Advise and consultancy	URS Corporation

Case studies for watershed protection markets	
Country	**Project/ commodity**
Australia (New South Wales)	Macquarie River Basin – transpiration credits
Australia (New South Wales)	Salinity credit trading
Australia (New South Wales)	Salinity-friendly products
Bolivia, Argentina	Bermejo River – watershed protection contracts
Brazil (Sao Paulo)	SEMAE – watershed restoration contract
Chile	Water share trading and payments for watershed protection
China (Guangdong Province)	Watershed protection contracts
China (Hebei Province)	Miyun Reservoir restoration and maintenance scheme
China (Jiangxi Province)	Xingguo County – watershed protection contracts
China (Northwest)	Mini-watershed restoration schemes
China (Shiangxi Province)	Yao County watershed protection contracts
Colombia	Valle del Cauca – land acquisition and land management contracts
Colombia	National watershed management contracts
Colombia	Compoalegre Users Association – land acquisition
Costa Rica	Heredia Public Service Enterprise – national park protection

Costa Rica	Energia Global payments, Central Plateau
Costa Rica	River Platanar, San Carlos
Costa Rica	Monte Verde Cloud Forests
Costa Rica	San Jose watershed fund
Ecuador	Water Conservation Fund in Quito
Ecuador	Cuenca City – Land acquisition & watershed protection
El Salvador	El Imposible National Park – protected area contract
Guatemala	Montagua River, Sierras las Minas
India (Gulbarga, Karnataka)	MYRADA – land management contracts
India (Himachel Pradesh)	Inter-state watershed protection contract
India (Rajasthan)	Water harvesting in the Arvari catchment – reduce siltation and water table regulation
India (Sukhomajri)	Tradable water rights system and user fees
Indonesia	Sumber Jaya Lampung – land management contracts
Indonesia (West Lombok)	Payments for improved water quality
Jamaica	Watershed protection contracts & fees
Malawi	Escom – watershed protection contracts
Malawi	Water Boards – watershed protection contracts
Malawi	Water Boards – protected area contracts
Pakistan	Mangla Dam – watershed protection contracts
Panama	Darien: Committee for saving the Filo del Tallo hills
Panama	Chagres watershed payments scheme
Philippines	Makiling Forest Reserve – protected area contracts
Philippines	National Power Corporation Watershed rehabilitation fee
Romania	Paying for improved water quality
South Africa	Stream flow reduction licenses (SFRL)
USA	Ecolotree – soil contaminant removal
USA (Colorado)	Boulder Creek Riparian Enhancement Project
USA (Connecticut)	Long Island Sound sediment compensation fund
USA (Idaho)	Lower Boise River Effluent Trading System – Reduction Credit Certificates
USA (Maine)	Portland Water District water quality scheme – land acquisition and planting contracts
USA (Minnesota)	Rahr Malting Company – pollution reduction credits worth 1 lb CBOD/day equivalent.
USA (Minnesota)	Cannon River Watershed Partnership – land management contracts
USA (mostly in Maine)	Leases for forested aquatic environments
USA (New York)	NYC Watershed Programme – land acquisition, conservation easements, forest and land management contracts
USA (North Carolina)	Tar-Pamlico Basin – nutrient pollution credits
USA (Oregon)	Salem Public Works Department – land management contract
USA (Oregon)	Model watersheds programme – land management contracts
USA (Oregon)	Little Butte Creek – salmon habitat restoration contract
USA (Oregon)	The Deschutes Basin Land Trust – land and water rights acquisition
USA (Pacific Northwest)	Salmon Safe certified agricultural produce

USA (Pacific Northwest)	Salmon habitat credits
USA (Pennsylvania)	Chester Water Authority – Land management contracts
USA (Utah)	Salt Lake City Corporation – land acquisition & conservation easements
USA (Washington)	Seattle Public Utilities water quality improvement scheme – land acquisition
USA (Wisconsin)	Rock River Basin – Phosphorus credits
Vietnam	Government watershed management contracts
Zimbabwe	Integrated Catchment Management in Dryland Areas – watershed protection contracts

Case studies for landscape beauty markets	
Country	**Project/commodity**
Australia	Photographic permits in Queensland
Belize	Toledo Ecotourism Association – package holiday
Belize	Belize Audubon Society – protected area ecotourism & entrance permits
Canada	Parks Canada increasing self-financing – access rights
China	Jade Peak Gorge – private park & access permits
Costa Rica	National protected areas – access rights
Costa Rica	Hotel contributions to National Parks System – management contracts
Costa Rica	Rafting companies payment for river bank conservation – management contracts
Costa Rica	Biological corridors for Titi Monkeys – management contracts
Costa Rica	Monteverde Cloud Forest Reserve – access rights
Costa Rica	Talamanca – package holiday
Ecuador	Tropic Ecological Adventures – access rights and management agreements
Ecuador	Cofan Ecotourism project – access rights and package holiday
Ecuador	Transturi's Flotel in Cuyabeno Wildlife Reserve – access rights
Ecuador	Sionas, Cuyabeno Wildlife Reserve – tourism services
Ecuador	Maquipucuna Reserve ecotourism – access rights
Ecuador	FUNEDESIN – land purchase & management agreements
Ecuador	Kapawi Ecolodge and Reserve – leasing forest land & management agreement
Fiji	Koyoyanitu ecotourism initiative – package holiday
Guatemala	Community tourism in Alta Verapaz Cloud Forest – package holiday
Guatemala	Bird watching – access rights in private lands
India	Ecotourism Sikkim – access rights
India	Paying for landscape beauty in Sikkim – management agreements
Indonesia	Tourism licenses/concessions in protected areas
Indonesia	Gunung Halimun National Park (Java) – ecotourism package

Kenya	Mwaluganje Community Wildlife Reserve Ltd. – access to landscape beauty & wildlife
Kenya	Illngwesi Co. Ltd. – access to landscape beauty and wildlife
Mexico	Community recreational park near Mexico City – package tours
Mexico	Community ecotourism in Oaxaca – package tours
Namibia	Lianshulu Lodge, Mudumu National Park, Caprivi Region – access rights & management agreements
Nepal	Annapurna Conservation Area – access rights & management agreements
Nepal	Ghalekharka-Sikles Area, southern Annapurna ecotourism – package of services
Nepal	Royal Chitwan National Park – buffer zone ecotourism services
Nepal	Lodge tax in Langtang National Park – management projects
Nepal	Muir's Tours – natural resource management projects
Nepal	National Park payments for landscape beauty – access rights
New Zealand	Ecotourism concessions
Peru	Private ecotourism concessions
Peru	Posada Amazonas – joint ecotourism venture in the Amazon – tour package
Peru	Peru Verde's joint ecotourism ventures – package tour
Philippines	Protected areas access rights
Philippines	Makiling Forest Reserve – access rights
Rwanda	National Park – access rights
South Africa	Access rights and ecotourism activities in Kwa-Zulu Natal
Thailand	Kanchanaburi Ecotourism Cooperative Company – ecotourism services
Uganda	Budongo Forest Ecotourism Project – package tourism & access rights
Uganda	Kyambura Game Reserve – conservation agreements
USA	Recreational Fee Demonstration Program – access rights and concessions
Private sector initiatives	
Abercrombie & Kent – landscape beauty conservation agreements	
Conservation Corporation Africa – Rural development and conservation projects	

Case studies for bundled environmental services		
Country	**Environmental service**	**Project/commodity**
Australia (New South Wales)	Water table regulation, biodiversity conservation, carbon sequestration	Environmental service trading in New South Wales: salinity credits, biodiversity credits and carbon offsets
Australia (New South Wales)	Carbon sequestration, water table regulation, biodiversity conservation	Hancock New Forests Australia - carbon, biodiversity, and salinity credits
Belize	Landscape beauty and biodiversity	Belize Audubon Society - protected area ecotourism & entrance fees
Belize	Carbon sequestration and biodiversity protection	Rio Bravo Conservation project
Bolivia	Biodiversity protection, carbon sequestration	Noel Kempff Climate Action Project
Brazil	Watershed, biodiversity, landscape beauty protection	ICMS Ecologico
China	All	National Ecological Benefits Compensation Fund – payments for environmental services
Costa Rica	All	Government Payments for Environmental Services scheme – contracts for forest protection, sustainable management and reforestation
Costa Rica	Carbon and watershed protection services	Norway purchase of Certified Tradable Offsets & Costa Rican National Power and Light Company purchase of improved water quality
Costa Rica	Carbon sequestration and biodiversity protection	Biodiversifix (AIJ project)
Costa Rica	All	BOLPRO (Agricultural stock market) sales of trees' environmental services
Ecuador	Biodiversity protection and carbon sequestration	Bilsa Biological Reserve
India	Biodiversity conservation and landscape beauty	Ecotourism & conservation in Sikkim
Indonesia	Biodiversity protection and landscape beauty	Gunung Halimun National Park (Java)
Panama	Carbon sequestration, watershed protection, biodiversity conservation, landscape beauty	Sale of environmental services in Darien

Paraguay	Carbon sequestration and biodiversity protection	Mbaracayu initiative
Philippines	Watershed protection, biodiversity conservation, landscape beauty	Integrated Protected Areas Fund – payments for environmental services
Philippines	Watershed protection and landscape beauty	Makiling Forest Reserve – ecotourism access rights & watershed protection charge
Poland	Watershed protection, biodiversity conservation	National Fund for Environmental Protection and Water Management
United Kingdom	Biodiversity protection and landscape beauty	Environmentally sensitive area agreements
USA (Virginia)	All	Tree rights deposits and The Forest Bank
USA	All	Payments for environmental services – Department of Agriculture's Conservation Reserve Program
USA (Virginia)	All	Tradable development rights
USA (New Jersey)	Biodiversity protection, landscape beauty	Tradable Pinelands Development Credits
USA (Vermont)	All	Conservation easements
Company initiatives		
Forest Stewardship Council	All	Independently certified timber
Environmental Synergy, Inc.	Carbon sequestration and biodiversity protection	Sale of carbon offsets & biodiversity benefits
Sustainable Forestry Management Ltd.	Carbon sequestration, biodiversity protection, landscape beauty	Private investment fund
Donor initiatives		
GEF	Biodiversity protection and carbon sequestration	Small and Medium Enterprise Programme

References

American Cocoa Research Institute (ACRI). 1999. *Concept Paper on Sustainable Cocoa Program*. Unpublished paper. McLean, VA: ACRI.

Adshead, M. 2001. Personal communication.

Australian Greenhouse Office. 2000. "Bush for Greenhouse – Linking industry and landholders". *Greenhouse Notes*. Australia: AGO.

Anuradha, R. V. 1998. *Sharing With the Kanis: A Case Study from Kerala, India*. Montreal: Secretariat of the Convention on Biological Diversity.

Arnold, J. E. M. 1998. "Forestry and Sustainable Rural Livelihoods" in Carney, D. (ed.) *Sustainable Rural Livelihoods: What contribution Can We Make?* London: Department for International Development.

Asad, M. 1997. "I*nnovative Financial Instruments for Global Environmental Management*". Draft. GEF Co-ordinating Unit. Environment Department. Washington: World Bank.

Ashley, C., C. Boyd and H. Goodwin. 2000. *Pro-poor Tourism: Putting Poverty at the Heart of the Tourism Agenda*. Natural Resource Perspectives Report no. 51. London: Overseas Development Institute.

Asquith, N. 2000. *How Should the World Bank Encourage Private Sector Investment in Biodiversity Conservation?* Washington DC: The World Bank.

Aylward, B. 1991. *The Economic Value of Ecosystems: 3 – Biological Diversity*. No. LEEC GK 91-03. London: IIED.

Aylward, B. and A. Fernandez Gonzalez. 1998. *Institutional Arrangements for Watershed Management: A Case Study of Arenal, Costa Rica*. CREED Working Paper no. 21. London: International Institute for Environment and Development / Institute for Environmental Studies, Amsterdam.

Baba, J. O. 1997. "Towards Sustainable Livelihoods: The Koroyanitu Development program" in J. Bornemeier, M. Victor and P. Durst (eds). *Ecotourism for Forest Conservation and Community Development: Proceedings from an International Seminar 28-31 January, 1997*. Bangkok: RECOFTC and FAO.

Barbier, E. 1991. "The Economic Value of Ecosystems: 2 – Tropical Forests." London Environmental Economics Centre Gatekeeper Series No 91-01. London: IIED.

Barbier, E. and B. Aylward. 1996. "Capturing the Pharmaceutical Value of Biodiversity in a Developing Country". *Environmental and Resource Economics* 8 (2): 157-181.

Bass, S., O. Dubois, P. Moura-Costa, M. Pinard, R. Tipper and C. Wilson. 1999. *Rural Livelihoods and Carbon Management: Natural Resources Issues Paper*. London: International Institute for Environment and Development.

Bass, S., C. Hughes and W. Hawthorne. 2001. "Forests, biodiversity and livelihoods: linking policy and practice" in I. Koziell, and J. Saunders (eds) *Living Off Biodiversity: Exploring Livelihoods and Biodiversity Issues in Natural Resources Management*. London: International Institute for Environment and Development.

Bass, S., K. Thornber, M. Markopoulos, S. Roberts and M. Grieg-Gran. 2001. *Certification's impacts on forests, stakeholders and supply chains*. London: IIED.

Baumann, P. 2000. *Sustainable Livelihoods and Political Capital: Arguments and Evidence from Decentralisation and Natural Resource management in India*. Sustainable Livelihoods Working Paper no. 136. London: Overseas Development Institute.

Bayon, R. 2001. Personal communication.

Bayon, R., C. Deere, R. Norris and S. Smith. 2000. *Environmental Funds: Lessons Learned and Future Prospects*. Gland, Switzerland: World Conservation Union (IUCN).

Bayon, R., J. S. Lovink and W. J. Veening. 2000. *Financing Biodiversity Conservation*. IADB Sustainable Development Dept. Technical papers series ENV-134. Washington DC: Inter-American Development Bank.

Bebbington, A. 1999. *Capitals and capabilities: A framework for analysing peasant viability, rural livelihoods, and poverty in the Andes*. Background paper for policies that work for sustainable agriculture and regenerating rural economies. London: IIED.

Beck, T. 2000. "Australia shows the way". *Environmental Finance* 1 (4): 19-21.

Beil, S. 2000. Personal communication.

Bernstein, A. 2001. Personal communication.

Bishop, J. (ed.). Forthcoming. *Valuing Forests. A Review of Methods and Applications in Developing Countries*. London: IIED.

Bonnie, R. and M. Coda. 2001. "Saving forests, earning credits". *Environmental Finance* 2 (7): 25.

Bosch, J. and J. Hewlett. 1982. "A review of catchment experiments to determine the effects of vegetation changes on water yield and evapo-transpiration". *Journal of Hydrology* 55: 3-23.

Bosello, F. and R. Roson. 1999. "Carbon Emissions Trading and Equity in International Agreements". FEEM Working Paper 57.99. Milan: Fondazione Eni Enrico Mattei.

BP Amoco. 2001. "Greenhouse Gas Emission Trading". BP Amoco unpublished report. Website: www.bp.com/downloads/.

Bradach, J. and R. Eccles. 1991. "Price, authority and trust: from ideal types to plural forms" in G. Thompson, J. Frances, R. Levaŭíć, and J. Mitchell (eds) *Markets, Hierarchies and Networks: The Coordination of Social Life*. London: Sage Publications Ltd.

Brock, K. 1999. *Implementing a Sustainable Livelihood Framework for Policy-Directed Research: Reflections from Practice in Mali*. Working Paper no.90. Brighton: Institute for Development Studies.

Brown, P., B. Cabarle and R. Livernash. 1997. *Carbon Counts: Estimating Climate Change Mitigation in Forestry Projects*. Washington D.C.: World Resources Institute.

Brown, C. 2001. *Visitor Use Fees in Protected Areas: Synthesis of the North Amercian, Costa Rican and Belizean Experience*. Arlington VA: The Nature Conservancy.
Bruijnzeel, L.A. 1990. *Hydrology of Moist Tropical Forest and Effects of Conversion: a State of Knowledge Review*. Paris: UNESCO / Amsterdam: Vrije Universiteit.
Bruijnzeel, L. A. 2000. *Hydrology of Tropical Montane Cloud forests: A Reassessment*. Amsterdam: Tropical Environmental Hydrology Programme.
Byron, N. and J. E. M. Arnold. 1997. *What Futures for the People of the Tropical Forests?* CIFOR Working Paper no. 19. Bogor Barat, Indonesia: Centre for International Forestry Reseach.
Calderon, M., C.Cruz, R. Cereno and F. Cruz. 2000. "Market-based instruments for forest Recreation and Eco-tourism in the Makiling Forest Reserve" in H. Francisco, J. Dizon and C. Torres (eds) *Economic Instruments for the Makiling Forest Reserve*. Laguna: University of the Philippines Los Banos.
Carbon Storage Trust. 1999. *The Carbon Storage Trust and Climate Care Warranties – a detailed analysis*. UK: The Carbon Storage Trust.
Carney, D., M. Drinkwater, T. Rusinow, K. Neefjes, S. Wanmali and N. Singh. 1999. *Livelihoods Approaches Compared. A Brief Comparison of the Livelihoods Approaches of the UK Department for International Development (DFID), CARE, Oxfam and the United Nations Development Programme (UNDP)*. London: Department for International Development.
CCAfrica. 2001. Conservation Corporation Africa. Website: www.ccafrica/com/.
Chambers, R. and G. Conway. 1992. *Sustainable Rural Livelihoods: Practical Concepts for the 21st Century*. IDS Discussion Paper no. 296. Brighton: Institute of Development Studies.
Chomitz, K. 1999. *Transferable Development Rights and Forest Protection: An Exploratory Analysis*. Report prepared for Workshop on Market-based Instruments for Environmental Protection, July 18-20, 1999. Washington DC: World Bank.
Chomitz, K. 2000. *Evaluating carbon offsets from forestry and energy projects: how do they compare?* Washington DC: World Bank.
Chomitz, K. and K. Kumari. 1996. *The Domestic Benefits of Tropical Forests: A Critical Review Emphasising Hydrological Functions*. Policy Research Working Paper 1601. Washington DC: World Bank.
Chopra, K., G. Kadekodi and M.N. Murty. 1990. *Participatory Development, People and Common Property Resources*. New Delhi: Sage Publications.
Climate Care. 2000. *Climate Care News*. May. Email circular. Oxford: Climate Care.
Climate Care. 2000b. *Carbon offsets in forestry: policy review for the Climate Care scheme*. Oxford: Climate Care.
Coase, R. 1937. "The Nature of the Firm". *Economica* 4: 386.
Coase, R. 1960. "The Problem of social cost." *Journal of Law and Economics* 3: 1-44.
Commons, John R. 1934. I*nstitutional Economics*. New York: MacMillan.

Conservation International. 1999. *Conserving Biodiversity in West Africa Through Cocoa: A concept paper*. Unpublished paper.
Conservation International. 1999. *Biodiversity Conservation Through Shade Coffee*. Unpublished paper. Washington DC: Conservation International.
Conservation International. 2001. *Critical Ecosystem Partnership Launches $150 million Fund to Better Protect Biodiversity Hotspots*. Website: www.cepf.net.
Convention on Biological Diversity (Article 2). Montreal: Secretariat of the Convention on Biological Diversity. Website: http://www.biodiv.org/convention/articles.asp?lg=0&a=cbd-02
Cooper, G. 1999. "UK unveils hybrid GHG trading scheme". *Environmental Finance* 1 (2): 4.
Cooper, G. 1999. "US Shuns World Bank's carbon fund". *Environmental Finance* 1 (1): 14-16 .
Cornes, R. and T. Sandler. 1996. T*he Theory of Externalities, Public Goods and Club Goods* (Second Edition). Cambridge: Cambridge University Press. 590 pp.
Cosgrove and Rijsberman. 2000. *World Water Vision: Making Water Everybody's Business*. Paper prepared for the World Water Council. London: Earthscan Publications Ltd.
Dagnino-Pastore, J. M. and P.E. Farina. 1999. *Transaction costs in Argentina*. Paper submitted to 3rd Annual Conference of the International Society of New Institutional Economists. September 16-18. Washington, D.C.
de Beer, J. and M. McDermott. 1989. *The Economic Value of Non-Timber Forest Products in Southeast Asia*. Amsterdam: Netherlands Committee for IUCN.
de Soto, H. 2000. *The Mystery of Capital*. New York: Basic Books.
DETR. 2001. *Draft Framework Document for the UK Emissions Trading Scheme*. London: Department of the Environment, Transport and the Regions.
DFID. 2001. *Sustainable livelihoods guidance sheets*. London: Department for International Development.
DFID. 1999. *International Development Target Strategy: Water Resources and Environmental Sanitation (Preliminary draft)*. London: Department for International Development.
DFID. 1999b. *Willing To Pay But Unwilling to Charge: Do 'Willingness To Pay' Studies Make a Difference*. Media Workshop, India. London: Department for International Development.
Dixon, R. K. Andrasko, F. Sussman, M. Lavinson, M. Texler, and T. Vinson. 1993. "Forest Sector Carbon Offset Projects: Near-Term Opportunities to Mitigate Greenhouse Gas Emissions". *Water, Air and Soil Pollution*. 70: 561-577.
Dolan, D. 2000. *Conservation Easements in the Catskill Region*. New York: The Watershed Forestry Program.
Douglas, I., T. Greer, K. Bidin and M. Spilsbury. 1992. *Impacts of Rainforest Logging on River Systems and Communities in Malaysia and Kalimantan*. London: School of Oriental and African Studies.

Dunstan, S. 2000. "Insurers can kick-start Kyoto". *Environmental Finance* 1 (7): 27-29.
Dyer, G. and V. Griffith. 2001. "Growing together – As the science and management of biotechnology converge with those of pharmaceuticals, the larger companies are starting to consolidate". *Financial Times*, Wednesday, 19 December.
Echavarria, M. 2000. V*aluation of Water-Related Services to Downstream Users in Rural Watersheds: Determining Values for the use and Protection of Water Resouces*. Background paper no. 4 of the Land-Water Linkages in Rural Watersheds Electronic Workshop. Rome: Food and Agriculture Organization of the United Nations.
Echavarria, M. and L. Lochman. 1998. *Policy Mechanisms for Watershed Conservation: Case Studies*. Washington, D.C.: The Nature Conservancy.
Economist. 2000. "B2B exchanges: The container case". *The Economist*, 21 October.
Environmental Policy Studies Workshop. 1999. *Access to Genetic Resources: An Evaluation of the Development and Implementation of Recent Regulation and Access Agreements*. Environmental Policy Studies Working Paper no. 4. Washington DC: The Tides Centre – Biodiversity Action Network.
Environmental Protection Agency. 1996. *Draft Trading Update – December 96: Tar-Pamlico River, North Carolina*. www.epa.gov/OWOW/watershed/trading/tarpam.htm.
Environomics. 1999. *A Summary of US Effluent Trading and Offsets Projects*. USA: United States Environmental Protection Agency.
Eraker, H. 2000. *CO2lonialism: Norwegian Tree Plantations, Carbon Credits and Land Conflicts in Uganda*. Oslo: Norwatch. www.fivh.no/norwatch/
Espinoza, N., J. Gatica and J. Smyle. 1999. *El Pago de Servicios Ambientales y el Desarrollo Sostenible en el Medio Rural*. San José: RUTA, IICA.
Falconer, J. 1990. *The Major Significance of "Minor" Forest Products: The Local Use and Value of Forests in the West African Humid Forest Zone*. Community Forestry Note 6. Rome: FAO.
Falconer, J. and J. Arnold. 1989. *Household Food Security and Forestry: An Analysis of Socioeconomic Issues*. Community Forestry Note 1. Rome: FAO.
Farnsworth, N., O. Akerele, A. Bingel, D. Soejarto, and Z. Guo. 1985. "Medicinal Plants in Therapy". *Bulletin of the World Health Organisation* 63: 965-81.
FAO. 1995. *Non-wood forest products for rural income and sustainable forestry*. Non-wood Forest Products Series no.7. Rome: Food and Agriculture Organization of the United Nations.
FAO. 2001. *State of the World's Forests*. Rome: Food and Agriculture Organization of the United Nations.
Farrington, J. C. Turton and A.J. James (eds.). *Participatory Watershed Development: Challenges for the Twenty-first Century*. New Delhi: Oxford University Press.

Farrington, J. and C. Lobo. 1997. *Scaling Up Participatory Watershed Development in India: Lessons from the Indo-German Watershed Development Programme*. Natural Resource Perspectives Report no. 17. London: Overseas Development Institute.

Fernandez. 1999. "The Impact of Technology Adaptation on Productivity and Sustainability: MYRADA's Experiences in Southern India" in F. Hinchcliffe, J. Thompson, J. Pretty, I. Guijt and P. Shah (eds) *Fertile Ground: The impacts of participatory watershed management*. London: IT Publications.

Fleck, R. 1999. *When Should Market-Supporting Institutions Be Established?* Montana: Montana State University.

Forsyth, T. 1996. "Science, myth, and knowledge: testing Himalayan environmental degradation in Thailand". *Geoforum* 27 (3): 375-392.

Francisco, H., J. Dizon and C. Torres (eds). 2000. *Economic Instruments for the Makiling Forest Reserve*. Quezon City: University of the Philippines Los Banos.

Gawamadzi. 1999. *Proposed Levy on Commercial Water Consumption Sales for Forestry Conservation and Development*. Unpublished Work.

Goodman, A. 2000. "Australia's Greenhouse Gambit". *Tomorrow* 10 (1), January/February.

Grice, M. 1999. "BP Amoco goes global with emission trading". *Environmental Finance* 1 (1): 5.

Grifo, F., D. Newman, A. Fairhfield, B. Bhattacharya and J. Grupenhoff. 1997. "The Origins of Prescription Drugs", in F. Grifo and J. Rosenthal (eds) *Biodiversity and Human Health*. Washington, D.C.: Island Press.

GTZ. 1996. *Process Monitoring – Work Document for Project Staff*. Doc. no. 402/96 22e NARMS, Department 402. Eschborn, Germany: Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ).

Guerin-McManus, M., L. Famolare, I. Bowles, S. Malone, R. Mittermeier and A. Rosenfeld. 1998. *Bioprospecting in Practice: A Case Study of the Suriname ICBG Project and Benefit Sharing under the Convention on Biological Diversity*. Report submitted to the Secretariat of the CBD. Montreal: Secretariat of the Convention on Biological Diversity.

Hamilton, L. and P. King. 1983. *Tropical Forested Watersheds: Hydrologic and Soils Response to Major Uses or Conversions*. Boulder: Westview Press.

Hawthorne, W. 1996. *Holes and sums of parts in Ghanaian forests: regeneration, scale and sustainable use*. Proceedings of the Royal Society of Edinburgh, 104B:75-176.

Hemmingway, 2000. "Salmon and the Northwest". *Open Spaces Quarterly*. 1 (1).

Hinchcliffe, F., J. Thompson, J. Pretty, I. Guijt and P. Shah (eds.) 1999. *Fertile Ground: The impacts of participatory watershed management*. London: IT Publications.

Hodgson, G. and J. Dixon. 1988. *Logging versus fisheries and Tourism in Palawan*. East-West Environment and Policy Institute Occasional Paper 7. USA: East-West Center.

Holloway, G. 2001. *Oil giant buys environmental insurance*. Cable News Network (CNN) www.cnn.com.

Hussein, K. and J. Nelson. 1999. *Sustainable Livelihoods and Livelihood Diversification*. IDS Working Paper 69. Brighton: Institute for Development Studies.

IIED. 2001. *Annex 1: Notes on four possible country action-learning programmes (Draft)*. Unpublished Work. London: International Institute for Environment and Development.

International Institute for Sustainable Development. 2001. "Summary of the Resumed Sixth Session of the Conference of the Parties to the UN Framework Convention on Climate Change: 16-27 July 2001". *Earth Negotiations Bulletin*. Website: www.iisd.ca/climate/cop6bis/.

International Ecotourism Society. 2000. *Ecotourism Statistical Fact Sheet*. Burlington VT: The International Ecotourism Society.

International Trade Centre. 1999. *Organic Food and Beverages: World Supply and Major European Markets*. Geneva: ITC UNCTAD/WTO.

IPCC. 2000. *Summary for Policy Makers: Land Use, Land-Use Change and Forestry*. Geneva: Intergovernmental Panel on Climate Change.

IPCC. 2001. *Climate Change 2001: The Scientific Basis*. Geneva: Intergovernmental Panel on Climate Change.

Jodha, N. 1991. *Rural Common Property Resources: A Growing Crisis*. IIED Gatekeeper Series no. 24. London: IIED.

Johnson, N. 2000. *Market Strategies to Build Sustainable Links Between Forests, Water and People*. Discussion Draft presented at Forest Trends Environmental Markets and Forests Workshop, Sydney, Australia, April 10-12, 2000. Washington DC: World Resources Institute.

Johnston, R. and M. Madison. 1997. "From Landmarks to Landscapes: A Review of Current Practices in the Transfer of Development Right". J*ournal of the American Planning Association* 63 (3).

Joshi. 1999. Personal communication.

Kerr, J. 1992. "Watershed Management: From Technology Intervention to Social Organisation" in Agarwal, A. (ed.) *Proceedings from a Seminar on the Economics of the Sustainable Use of Forest Resources*. Delhi.

Kerr, J. 2002. "Sharing the Benefits of Watershed Management in Sukhomajri, India" in Pagiola, S., J. Bishop and N. Landell-Mills (eds.). "*Selling Forest Environmental Services: Market-based Mechanisms for Conservation and Development*". London: Earthscan London.

Kumari, K. 2001. *The Global Environment Facility: Experiences and Trends – Lessons from SFM Financing (GEF)*. Report no. OSLO/IV.4/FF. Paper presented at the Workshop on Financing of Sustainable Forest Management, Oslo, Norway, 22-25 January 2001. Bogor Barat, Indonesia: Centre for International Forestry Reseach.

Landell-Mills. 1999. *Country Profile for Brazil*. Unpublished report. London: IIED.

Landell-Mills. 1999b. *Defining a strategy for financing sustainable forestry in Malawi*. UNDP Working Group on Financial Flows and Mechanisms in Support of Malawi's National Forestry Programme. New York: United Nations Development Programme.

Landell-Mills, N. and J. Ford. 1999. *Privatising sustainable forestry. A global review of trends and challenges*. London: IIED.
Leach, M., R. Mearns and I. Scoones. 1997. *Environmental Entitlements: A Framework for Understanding the Institutional Dynamics of Environmental Change*. IDS Discussion Paper 359. Brighton: Institute for Development Studies.
Lindberg, K. 2001. *Tourist "Consumption" of Biodiversity: Market Charactersitics and Effect on Conservation and Local Development*. Paper presented at the OECD Workshop on Market Creation for Biodiversity Products and Services, Paris, January 2001. Paris: Organisation for Economic Co-operation and Development.
Lindberg, K. and J. Enriquez. 1994. *An Analysis of Ecotourism's Economic Contribution to Conservation and Development in Belize*. Vol 2. Washington, D.C.: World Wildlife Fund.
Magrath, P., J. Compton, A. Ofosu and F. Motte. 1997. *Cost-Benefit Analysis of Client Participation in Agricultural Research: A Case Study from Ghana*. AgREN Network Paper No. 74b. London: Overseas Development Institute.
Mann, A. and R. Richels. 1998. *The Kyoto Protocol: A Cost-effective Strategy for Meeting Environmental Objectives?* Palo Alto, California: Electric Power Research Institute.
McNeely, J., K. Miller, W. Reid, R. Mittermeier and T. Werner. 1990. *Conserving the World's Biological Diversity*. Gland: The World Conservation Union (IUCN).

Merlo, M., E. Milocco, R. Panting and P. Virgilietti. 2000. "Transformation of environmental recreational goods and services provided by forestry into recreational environmental products". *Forest Policy and Economics* 1.
Meyrick, G. 2000. "Coping with Kyoto – the legal perspective". *Environmental Finance* 2 (1): XXIV.
Mikitin, K. 1995. "*Issues and Options in the Design of GEF Supported Trust Funds for Biodiversity Conservation*". Global Environment Division, World Bank. Washington DC: World Bank.
Misra. Personal communication. 1997.
Morrison, E. and O. Dubois. 1998. S*ustainable livelihoods in upland Vietnam: land allocation and beyond*. Forestry and Land Use Series no. 14. London: International Institute for Environment and Development.
Moura-Costa, P. and C. Wilson. 2000. "An equivalence factor between CO2 avoided emissions and sequestration – description and applications in forestry". *Mitigation and Adaptation Strategies for Global Change* 5: 51-60.
Munasinghe, M. (ed.). 1993. *Environmental Economics and Natural Resource Management in Developing Countries*. Washington: World Bank.
Myers, N., R. Mittermeier, C. Mittermeier, G. da Fonseca and J. Kent. 2000. "Biodiversity hotspots for conservation priorities". *Nature* 6772 (February 24): 853-858.
Nee, V. 1999. "The Role of the State in Making Markets". *Journal of Institutional and Theoretical Economics* 156: 64-88.
Nicholls, M. 2000. "Asia cautious on carbon trades". *Environmental Finance* 2 (5): 26.

Nicholls, M. 2001. "Summer season hots up". *Environmental Finance* 2 (5): 13-14.
Nicholls, M. 2002. "CDM fears cloud Marrakech success". *Environmental Finance* 3 (3): 24-26.
Nordhaus, W. and Z. Yang. 1996. "A Regional Dynamic Equilibrium Model of Alternative Climate Change Strategies". *The American Economic Review*. Vol. 86, no. 4, pp. 741-765.
North, D. 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press.
North, D. 1995. "The New Institutional Economics and Third World Development" in J. Harriss, J. Hunter and C. Lewis (eds.) T*he New Institutional Economics and Third World Development*. London: Routledge.
NSW Department of Land and Water Conservation 2000. T*aking on the challenge: NSW Salinity Strategy*. Sydney: New South Wales Department of Land and Water Conservation.
OECD. 1996. S*aving Biological Diversity: Economic Incentives*. Paris: Organisation for Economic Co-operation and Development.
Ostrom, E. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge, UK: Cambridge University Press.
Ostrom, E., L. Schroeder and S. Wynne. 1993. *Institutional Incentives and Sustainable Development: Infrastructure Policies in Perspective*. Boulder: Westview Press.
Ostrom, E., R. Gardner, and J. Walker. 1994. *Rules, Games and Common Pool Resources*. University of Michigan Press.
Patel-Weynand, T. 1997. "Sukhomajri and Nada: Managing Common Property resources in Two Villages" in J. Kerr, D. Marothia, K. Singh, C. Ramasamy and W. Bentley (eds) *Natural Resource Economics: Theory and Application in India*. New Delhi and Calcutta: Oxford and IBH Publishing Co. Pvt. Ltd.
Pearce, D. And K. Turner. 1990. *Economics of Natural Resources and the Environment*. John Hopkins University Press, Baltimore.
Pearce, D. and T. Bello. 1998. *Selling Carbon Storage: Background Paper for the Guyana Forest Partnership Initiative*. CSERGE and University of East Anglia.
Pearce, D. D. Moran and W. Krug. 1999. *The Global Value of Biological Diversity* (Draft). London: Centre for Social and Economic Research on the Global Environment (CSERGE).
Pearce, D., B. Day, J. Newcombe, T. Brunello and T. Bello. 1998. *The Clean Development Mechanism: Benefits of the CDM for Developing Countries*. London: CSERGE.
Perelet, R. A. 2000. Personal Communication.
Pew Centre on Global Climate Change. July 2001. *Climate Talks in Bonn: News and Information: Summary of the Climate Change Agreement in Bonn*. www.pewclimate.org/bonn/daily.cfm?m.
Pitamahaket, P. 1997. "The Development of Kanchanaburi Ecotourism Cooperative: The First Ecotourism Cooperative in Thailand" in J. Bornemeier, M. Victor, P. Durst (eds) *Ecotourism for Forest Conservation and Community Development: Proceedings from an International Seminar 28-31 January, 1997*. Bangkok: RECOFTC and FAO.

PriceWaterhouseCoopers. 2001. *Credit based emissions reduction projects – learning through practical engagement*. Report, February.
Rainforest Expeditions. 2001. *Rainforest Expeditions*. www.perunature.com/
Rausser, G. and A. Small. 2001. "Valuing Research Leads: Bioprospecting and the Conservation of Genetic Resources". *Journal of Political Economy* 108 (1): 173-206.
Reid, W. and K. Miller. 1989. *Keeping Options Alive: The Scientific Basis for Conserving Biodiversity*. Washington DC: World Resources Institute.
Rhoades, R. 1998. *Participatory Watershed Research and Management: Where the Shadow Falls*. SARLs Gatekeeper Series no. 81. London: International Institute for Environment and Development.
Robson. 2001. "Native Americans sell carbon credits from forestry project". *Environmental Finance* 2 (7): 9.
Rodriguez Becerra, M. and E. Ponce De Leon. 1999. *Financing The Green Plan ('Plan Verde') in Colombia: Challenges and Opportunities*. Paper prepared for the PROFOR (UNDP) Workshop on Financing Sustainable Forest Management, London. October 11-13.
Rosenthal, J. 1997. "Integrating Drug Discovery, Biodiversity Conservation, and Economic Development: Early Lessons from the International Cooperative Biodiversity Groups" in F. Grifo and J. Rosenthal (eds) *Biodiversity and Human Health*. Washington DC: Island Press.
Rosenthal, J. 2000. *International Cooperative Biodiversity Groups*. Bethesda: Fogerty International Center. www.nih.gov/fic/programs/icbg.html.
Ross & Associates Environmental Consulting, Ltd. 2000. *Lower Boise River Effluent Trading Demonstration Project: Summary of Participant Recommendations For a Trading Framework*. Idaho: Idaho Division of Environmental Quality.
Salinity Experts Group. 2000. *Report to the NSW Government on Market-Based Instruments*. Australia: Treasury Office of Financial Management.
Salloum. 1999. Personal communication July 1999.
Sandor, R. 2000. "CDM – simplicity is key". *Environmental Finance* 1 (2): 11.
Schary, Claire. 2001. Personal communication.
Scherr, S. and J. Smith. 2000. *Capturing the Value of Forest Carbon For Local Livelihoods: Opportunities Under the Clean Development Mechanism: Notes from CIFOR Bellagio Meeting Feb. 2000*. Unpublished Work.
Schmidt, R., J. Berry, J. Gordon. 1999. *Forests to fight poverty: creating national strategies*. New Haven and London: Yale University Press.
Schwarze, R. 1999. "Activities implemented jointly: another look at the facts". *Ecological Economics* 32 (2): 255-267.
Scoones, I. 1998. *Sustainable Rural Livelihoods: A Framework for Analysis*. IDS Working Paper 72. Brighton: Institute for Development Studies.
Shah, A. 1999. "The Acid test: Will Beneficiaries Contribute?" in Farrington, J., C. Turton and A. J. James (eds) *Participatory Watershed Development: Challenges for the Twenty-First Century*. Oxford: Oxford University Press.

Shepherd, G., M. Arnold and S. Bass. 1999. *Forests and Sustainable Livelihoods: Current understandings, emerging issues and their implications for World Bank Forest Policy and funding priorities*. Draft Issues Paper. A contribution to the World Bank Forest Policy Review Process. Washington DC: World Bank.

Sikor, T. 2000. *The allocation of forestry land in Vietnam: did it cause the expansion of the forests in the northwest*. Draft. Vietnam: Hanoi National University.

Simon, H. 1957. *Administrative Behaviour*. 2nd ed. New York: Macmillan.

Simon, H. 1982. *Models of Bounded Rationality*. Vol. 2. Cambridge, MA: the MIT Press, Cambridge.

Simpson, R. D and R. A. Sedjo. 1996. *Incentives in Biodiversity Prospecting and Incentives for Conservation*. Discussion Paper 96-14. Washington DC: Resources for the Future.

Smith, J., K. Mulongoy, R. Persson and J. Sayer. 2000. *Harnessing Carbon Markets for Tropical Forest Conservation: Towards a More Realistic Assessment. Environmental Conservation* 27 (3): 300-311.

State Forests of New South Wales. 2000. *Investing in the Environmental Services of Forests*. Sydney: State Forests of New South Wales.

Stave, A. J. 2000. *Carbon Upsets – Norwegian Carbon Plantations in Tanzania*. July. Oslo: Norwatch. www.fivh.no/norwatch/

Stavins, R. 2000. "Experience with Market-Based Environmental Policy Instruments" in K. Maler and J. Vincent (eds.) *The Handbook of Environmental Economics*. Amsterdam: North-Holland/Elsevier Science.

Stiglitz, J.1986. "The New Development Economics". *World Development* 14 (2): 257-65.

Stronza, A. 2000. *"Because it is Ours": Community-based Ecotourism in the Peruvian Amazon*. Unpublished Dissertation. Gainesville: University of Florida.

Suncor. 1998. *SPP/CPM and Suncor Energy Launch Australia's Largest CO2 Capture Trial*. www.suncor.com/newsrelease/Environment/Environment-ClimateChange/8-78.html.

Swanson, T. and T. Goschl. 2000. "Property rights issues involving plant genetic resources: implications of ownership for economic efficiency". *Ecological Economics* 32 (1): 75-92.

Swift, B. and A. Donnelly. 2000. "Why US carbon prices will be low". *Environmental Finance* 1 (6): 21.

Swiss Re. 2001. www.swissre.co.uk/ (May 2001). Zurich: Swiss Re.

Tansley, A. 1935. "The Use and Abuse of Vegetational Concepts and Terms". *Ecology* 16: 284-307.

ten Kate, K. 1999. "The Diversa/INBio agreement" in K. ten Kate and S. Laird (eds) *The commercial use of biodiversity: Access to genetic resources and benefit-sharing*. London: Earthscan Publications Ltd.

ten Kate, K. and S. Laird. 1999. *The commercial use of biodiversity: Access to genetic resources and benefit-sharing*. London: Earthscan Publications Ltd.

Textler, M. and C. Haugen. 1995. *Keeping it Green: Tropical Forestry Opportunities for Mitigating Climate Change*. Washington, D.C.: World Resource Institute.

Thompson, G., J. Frances, R. Levavšić and J. Mitchell (eds.). 1991. *Markets, Hierarchies and Networks: The Coordination of Social Life*. London: Sage Publications.
Toledo Ecotourism Association. 2001. *The Toledo Ecotourism Association*. www.belizehome.com/toledomaya/.
Totten, M. 1999. *Getting it Right: Emerging Markets for Storing Carbon in Forests*. Washington DC: World Resources Institute.
Townson, I. 1995. "Forest Products and Household Incomes: A Review and Annotated Bibliography". *Tropical Forestry Papers* 31. Oxford: Centre for International Forestry Research and Oxford Forestry Institute.
Trexler, M., L. Kosloff and R. Gibbons. 1999. "Forestry and Land-Use Change in the AIJ Pilot Phase" in R. Dixon (ed.) *The UN Framework Convention on Climate Change Activities Implemented Jointly (AIJ) Pilot: Experiences and Lessons Learned*. The Netherlands: Kluwer Academic Publishers.
Troya 1998. Is it Troya & Curtis 98? Troya, R. and R. Curtis. 1998. *Water: Together We can Care for It!. Case Study of a Watershed Conservation Fund for Quito, Ecuador*. Arlington VA: The Nature Conservancy. www.mtnforum.org/resources/library/tncla98a.htm.
United Nations. 1997. *List of Protected Areas*. New York: United Nations.
USEPA. 1993. TMDL *Case Study: Tar-Pamlico Basin, North Carolina*. www.epa.gov/owow/watershed/trading/cs10.htm. Washington DC: United States Environmental Protection Agency.
USEPA. 1996. *Draft Framework for Watershed-Based Trading*. EPA 800-R-96-001. Washington DC: United States Environmental Protection Agency, Office of Water.
USEPA. 1999. *Protecting Sources of Drinking Water: Selected Case Studies in Watershed Management*. Report no. EPA 816-R-98-019. Washington DC: United States Environmental Protection Agency, Office of Water.
Vane-Wright, R. 1996. "Identifying priorities for the conservation of biodiversity: systematic biological criteria within a socio-political framework" in K. Gaston (ed.) *Biodiversity: a Biology of Numbers and Difference*. Oxford: Blackwell Science.
Varilek, M. and N. Marenzi. 2001. "The opportunity is in the details". *Environmental Finance* 2 (8): 21.
Vermeulen, S. 2000. Personal communication.
Vorhies. 2001. Personal communication.
Vrolijk, C. 2000. "Adding up Kyoto". *Environmental Finance*. 1 (8): 27-29.
Wallis, J. and D. North. 1986. "Measuring the Transaction Sector in the American Economy, 1870-1970" in S. Engerman and R. Gallman (eds.) *Long-Term Factors in American Economic Growth*. Chicago: University of Chicago Press.
Watershed Forestry Program. 1999. *Watershed Forestry Program*. New York: Watershed Agricultural Council. Website: www.nycwatershed.org/forest.htm
Watershed Agricultural Council. 2000. *Watershed Riparian Forest Buffer Programme*. New York: Watershed Agricultural Council.
Williams, P., C. Humphries, R. Vane-Wright. 1991. "Measuring biodiversity: taxonomic relatedness for conservation priorities". *Australian Systematic Botany*, 4: 665-679.

Williamson, O.1985. *The Economic Institutions of Capitalism*. New York: Free Press.
Woodward, R. and R. Kaiser. 2000. "Market Structures for US Water Quality Trading". *Review of Agricultural Economics*. Draft
World Tourism Organisation. 2000. *WTO News*. (2). Madrid: WTO.
Wunder, S. 1999. *Promoting Forest Conservation through Ecotourism Income? A case study from the Ecuadorian Amazon region*. CIFOR Occasional paper no. 21. Bogor Barat, Indonesia: Centre for International Forestry Reseach.
Wunder, S. 2001. "Poverty Alleviation and Tropical Forests – What Scope for Synergies". *World Development*. 29 (11).
Zhang, Z. 2000. "Estimating the Size of the Potential Market for the Kyoto Flexibility Mechanisms". *Review of World Economics*. 136 (3): 491-521.