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FOR SERVICES RENDERED

The current status and future potential of markets for the ecosystem services provided by tropical forests

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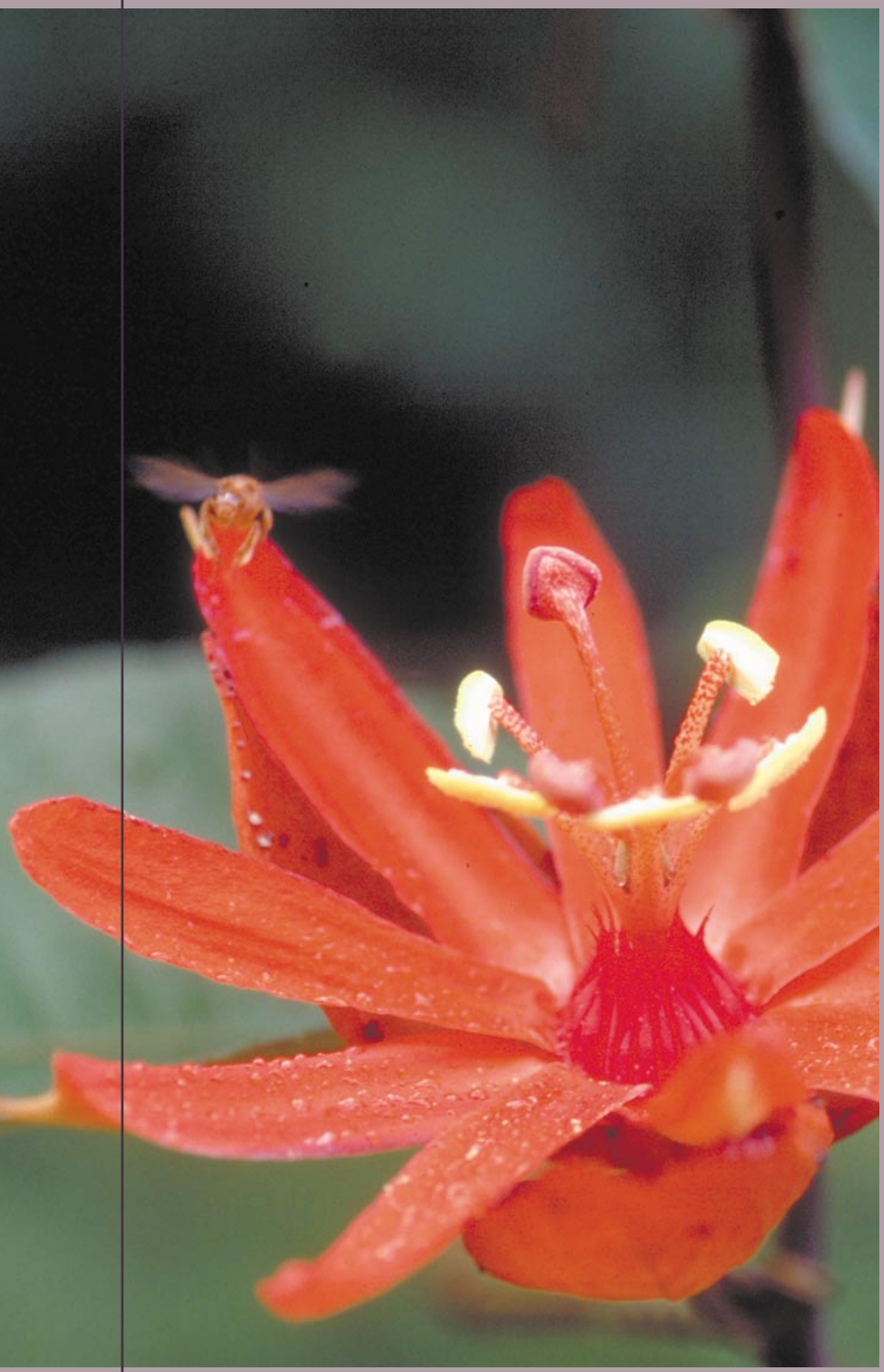

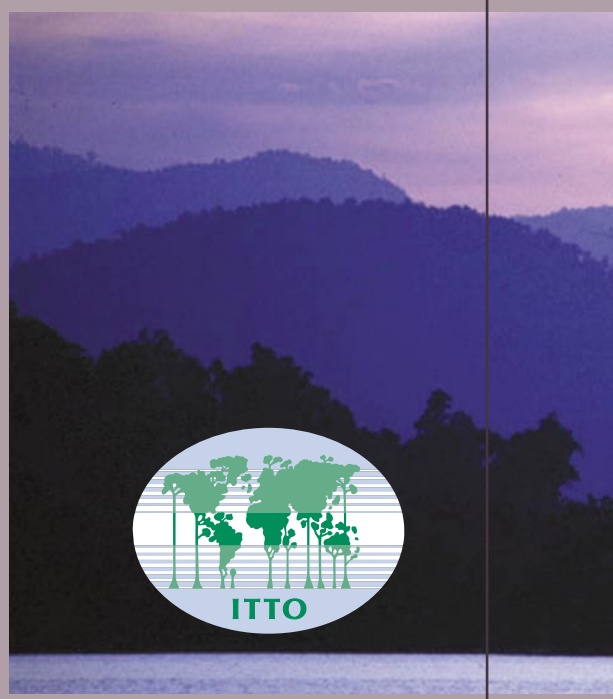

INTERNATIONAL TROPICAL TIMBER ORGANIZATION

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The current status and future potential of markets for the ecosystem services provided by tropical forests

Sara Scherr, Andy White and Arvind Khare, with
contributions from Mira Inbar and Augusta Molar

ITTO Technical Series No 21
International Tropical Timber Organization
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The current status and future potential of markets for the ecosystem services provided by tropical forests

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by Sara Scherr, Andy White and Arvind Khare, with contributions from Mira Inbar and Augusta Molnar

The International Tropical Timber Organization (ITTO) is an intergovernmental organization promoting the conservation and sustainable management, use and trade of tropical forest resources. Its 59 members represent more than 75% of the world's tropical forests and 90% of the global tropical timber trade. ITTO develops internationally agreed policy documents to promote sustainable forest management and forest conservation and assists tropical member countries to adapt such policies to local circumstances and to implement them in the field through projects. In addition, ITTO collects, analyses and disseminates data on the production and trade of tropical timber and funds a range of projects and other action aimed at developing industries at both community and industrial scales. All projects are funded by voluntary contributions, mostly from consuming member countries. Since it became operational in 1987, ITTO has funded more than 700 projects, pre-projects and activities valued at more than US$250 million. The major donors are the governments of Japan, Switzerland and the USA. ITTO contact details can be found on the back cover.

This document is a revised version of International Tropical Timber Council (ITTC) document ITTC (XXXV)/6, which was reviewed by the ITTC in November 2003. It is made available by ITTO as part of its policy of contributing in a timely manner to public debate on issues related to the conservation and sustainable management, use and trade of tropical forest resources. See the ITTO website (www.itto.or.jp) for original translations in French and Spanish, or contact the ITTO office.

The authors of this paper are affiliates of a non-governmental organization, Forest Trends, the mission of which is to maintain and restore forest ecosystems by promoting incentives that diversify trade in the forest sector, moving beyond exclusive focus on lumber and fibre to a broader range of products and services. www.forest-trends.org

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Foreword

Forest ecosystems perform many services on our behalf. They deliver clean water to rivers, lakes and dams, hold soils together, store carbon, and provide habitat for a large part of the planet's terrestrial biodiversity.

Why, then, do we deforest so readily? We have knocked over hundreds of millions of hectares of the world's forests in the last few centuries, and deforestation – particularly in the tropics – continues at a substantial rate today. If forests are so valuable, why do we do this?

The answer is that despite their many acknowledged services, forests are perceived to have less economic value than the land on which they stand; in many places, agriculture simply out-competes forest as a land-use. Such agriculture may not always be sustainable, but immediate economic and financial imperatives commonly override concern for the more distant future.

So it is in the humid tropics. The global community may champion tropical rainforests for their extraordinary biological riches, but people at the forest frontier – small-scale farmers as well as larger agri-industrial enterprises –are clearing those same forests to plant crops and raise animals.

If we want to slow and reverse this process, we need to find ways of making forest a more competitive land-use. At ITTO we believe that the sustainable management of natural tropical forests can make good economic sense – if certain conditions prevail. In particular, the timber and non-timber forest products thus produced must be marketable, and the prices must be the best obtainable on the open market.

In many forests, though, this still won't be enough: additional financial inputs will be needed to make sustainable forest management financially viable and competitive with alternative land-uses.

Where will these inputs come from? The international donor community, of which ITTO is a part, has funded a wide range of forest management projects, with limited success in raising standards to a point where the long-term future of the forests concerned might be secure. But such donor support is diminishing, and export markets for tropical timber products are becoming harder to penetrate.

In recent years people have begun talking about payments for the ecosystem services that forests provide. Clean water, for example, is an increasingly valuable commodity, but the forests have been giving it to us for free for millennia. If forest-clearing leads to a reduction in water quality, will downstream users be prepared to help meet the cost of retaining the forest upstream? A similar question can be posed for carbon: the clearing and burning of forests release potent greenhouse gases into the atmosphere; could polluters in developed countries pay to help stop this? Ditto for biodiversity: will those of us who deplore the loss of biodiversity caused by deforestation be prepared to pay landowners and land-users to keep the forest intact?

This report, which ITTO commissioned from a team at Forest Trends, looks into these questions and other issues surrounding payments for the services rendered by tropical forests. It is the first study of its kind to focus on tropical forests and as such we hope it will make a valuable contribution to debate and policy development in this field.

One of the conclusions reached by the authors is that while international buyers currently dominate markets for ecosystem services in tropical countries (small though they are), in the long run the most important markets will be focused domestically. This may well be true, but it would be unfortunate if we, the international community, were unable to contribute to the growth of markets for services of global importance, such as carbon storage and biodiversity conservation.

Perhaps some tropical countries will continue to give us these services for free. But in the absence of payments, we would have few grounds for complaint if the level of service diminishes.

Manoel Sobral Filho
Executive Director
International Tropical Timber Organization

Acronyms

CER	certified emission reduction
CCX	Chicago Climate Exchange
CDCF	Community Development Carbon Fund
CDM	Clean Development Mechanism
ERT	Environmental Resources Trust
ITTO	International Tropical Timber Organization
NPV	net present value
NGO	non-governmental organization
NTFP	non-timber forest product
PCF	Prototype Carbon Fund
SFM	sustainable forest management

Acknowledgements

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Executive summary

Status of forest ecosystem markets

The past decade has seen the widespread emergence of markets and other payment schemes for forest ecosystem services – such as watershed protection, biodiversity protection and carbon sequestration – around the world. At a global scale, several recent reviews indicate that these activities are nascent and still limited in scope and scale, but that they may have potential to be scaled up to regional, river basin or national levels with further development. Most of the activity to test such schemes to date has been in developed countries, where biophysical science tends to be stronger and legal frameworks and institutions exist that permit the development of more sophisticated markets.

The strong and growing interest in developing these markets is driven by frustrations with traditional government regulatory approaches, growing recognition of the limits of protected area approaches to conservation, societal demands for ecologically sound products, and the forest-based industry's need to find additional revenue sources to remain competitive. Those concerned with conservation and development hope that such markets can contribute to forest protection and restoration and become a sustainable source of new income for the forest-dependent poor who own and administer an increasingly large share of the world's forests. Government officials and industry and community leaders globally are beginning to assess their strategic positions in these markets: identifying their opportunities, the strategic risks of action and inaction, and the implications for their relative competitiveness. Those who have examined these options in depth find there is still a need for policy assessment and pilot experience to test instruments and learn jointly with local participants.

The many different types of market and payment schemes can be organized into four categories: (1) public payment schemes to private forest owners to maintain or enhance ecosystem services; (2) open trading under a regulatory cap or floor; (3) self-organized private deals; and (4) ecolabelling of forest or farm products, an indirect form of payment for ecosystem services. There are numerous examples of each type of market in both developing and developed countries.

Watershed protection services – such as flow regulation, water quality, water supply and habitat protection – are well recognized and indeed are a primary motivation for establishing many national parks and forests. Some 30% of the world's largest cities currently depend on forest areas for their water. Markets for watershed services are site- and user-specific and currently are limited to situations where the downstream beneficiaries – such as hydroelectric power generators, irrigators, municipal water systems and industry – are directly and significantly impacted by upstream land-use.

Public payment schemes predominate in scale (though not in number), and these payments can make a significant contribution to local incomes as well as provide sufficient incentive to maintain forest cover. In Costa Rica, for example, landholders in critical watershed areas are paid between US$30 and US$50 per hectare per year and similar levels of payment are planned in Mexico. In the US, government payments for ecosystem protection range from US$25–US$125 per hectare per year. Self-organized private deals appear to be limited – although information is largely proprietary and there has never been a full assessment of these types of transactions. Open trading schemes – such as wetland mitigation banking – are few, and limited primarily to developed countries.

The many different *biodiversity protection services* – such as habitat and species' conservation, genetic and chemical information, and ecosystem functions such as pollination – are increasingly recognized as critical to many economic sectors, such as commercial fisheries. Market mechanisms include land markets for high-biodiversity-value habitat, payments for private non-consumptive uses such as ecotourism, tradable rights and credits within a regulatory cap on habitat conversion, and ecolabelled products such as shade-grown coffee, herbal medicines and other botanicals from natural forests. The trade in these product markets is booming, with medicinals derived from compounds originally found in forests worth tens of billions of US dollars a year alone, but these benefits are rarely captured by forest peoples. Although the bioprospecting market is still evolving, it has not yet generated significant direct investment or payments to local people. A recent global survey found 72 cases of biodiversity markets in 33 countries, of which 63 were in 28 tropical countries. Over 70%

of these markets were international. Experts estimate that in the US alone over US$2 billion have been invested in easements for habitat conservation over the past several years.

Of all the forest ecosystem services, *carbon sequestration* has arguably drawn the greatest attention and enthusiasm in recent years. There is now scientific consensus that human activities have contributed to global warming and that forests play major roles in both overall global carbon emissions and as a provider of sequestration and storage services. Market segments in which tropical forests can play a role include reforestation and afforestation within the Clean Development Mechanism (CDM) of the Kyoto Protocol (the global cap-and-trade scheme), a range of land-use options that are attractive to investors through non-Kyoto trading, and voluntary payments by emitters to achieve carbon neutrality. Given restrictions on forest carbon offsets and estimating a value of US$10 per ton of carbon, the CDM is expected to raise at most US$300 million per year for afforestation and reforestation in the first commitment period (2008–2012). Estimates of the dollar value of forest carbon trading vary widely and ultimately depend upon the size of the market, which in turn depends upon the final rules adopted under Kyoto, European trading rules, and alternative schemes implemented by the US.

Key findings

Market characteristics

The total value of direct ecosystem service payments in tropical countries is presently modest, but has grown dramatically over the past decade and is significant, particularly to low-income producers: tropical ecosystem services are not yet commodities; rather, they behave as niche markets for products of special value to a narrow range of buyers. Ecosystem service payments will generally cover only a modest share of the costs of sustainable forest management and will be sufficient to finance forests managed for protection alone only where opportunity costs are very low – such as in remote areas where forest production is not economically viable and land-use alternatives are limited.

Very roughly estimated, the annual value of direct payments for forest ecosystem markets in tropical countries is in the order of hundreds of millions of US dollars. Indirect payments, via ecolabelled products such as certified lumber, tropical tree crop products and other non-wood forest products, is much larger, generating approximately as much as several billion dollars per year. Together these are significant but modest relative to the international trade in primary tropical timber products (logs, sawnwood, veneer and plywood), which is now approximately US$8 billion per year, the total trade in all wood products from tropical countries, some US$20 billion per year, and the far larger value of domestic wood and non-timber forest product markets. Direct and indirect payments for ecosystem services combined are approximately the same magnitude as total annual investments in forest conservation by governments, philanthropic organizations and intergovernmental organizations, which is somewhere between US$2 billion and US$2.5 billion per year.

Markets for forest ecosystem services are expected to grow in both developed and developing countries over the next 20 years: the potential for increased demand and increased payment for watershed services is immense. Water demand is projected to double, if not triple, over the next 50 years, and much of this growth will be in developing countries. Downstream users are learning that investments in watershed protection can be far more economical than investments in new treatment facilities. Growth in the carbon market could potentially be large but will depend on still unpredictable rules of international climate-change mitigation. Markets for ecolabelled products for export and for urban consumers in middle-income countries are likely to be the fastest-growing component of biodiversity markets.

Governments play a critical role as the principal direct buyers of many ecosystem services, and as catalysts for many private-sector direct payment schemes: since many ecosystem services are public goods, government intervention is usually required to make a market. This may entail directly paying for a service, establishing property rights, or establishing regulations that set caps and govern trading schemes. Since these markets are characterized by high transaction costs to link buyers and sellers and the lack of specialized market institutions, government intervention is usually required to assist in addressing these two major constraints to market development. Indirect payments, via certification schemes, are dominated by private buyers.

Ecosystem service payments will in most cases cover only a modest – but potentially catalytic – share of the costs of good forest management: prices of ecosystem services are generally not sufficient to justify forest conservation in areas where there are moderate to high opportunity costs for the land. However, evidence suggests that these payments can have a disproportionate catalytic effect on forest establishment and management. Even modest payments, reliably paid over a number of years, can provide the increment to net income that makes forestry enterprises viable, justifying the restoration of degraded lands and enhancing the livelihoods of poor people.

Strategic issues

Policy-makers concerned with tropical forests are beginning to assess their strategic competitive position *vis á vis* the option of markets for ecosystem services. They are keen to understand if and when they should seek to compete in global markets, and what kinds of market approaches make sense in their own domestic contexts. Policy-makers face a set of key issues when trying to adequately assess and develop these options:

1) **property rights and national legal frameworks are necessary for ecosystem service markets to develop, yet these are poorly developed in most producer countries:** recognizing property rights and reforming legal frameworks are often politically contentious and costly, yet are fundamental to establishing payment schemes of any type. Unfortunately, forest areas in developing countries are characterized currently by overlapping and conflicting claims to land and historic tensions over the rights of indigenous and other local communities. In most places it will be necessary to negotiate political support from key stakeholders in order to establish new markets;

2) **these markets are not likely to contribute substantially to poverty alleviation unless proactive efforts are made to recognize rights and shape markets to provide equal access to low-income producers of tropical forest ecosystem services:** as in the development of any new market, rules governing the market tend to be set by the more powerful sectors of society who have the capital and capacity to invest in designing the rules. To some extent, this is already taking place in the global carbon market. The implications of new markets, regulations and ecolabelling standards for low-income producers need to be identified and addressed; and

3) **new market institutions are needed to reduce transaction costs and financial risks:** a major challenge of ecosystem service market development is to ensure that critical institutions are established to reduce transaction costs and to provide intermediation between buyers, sellers, investors, certifiers and other key groups in the value chain. If there is not appropriate action to address this at both national and international levels, many market opportunities will simply fail to materialize, especially in poorer countries and for poorer forest producers.

Knowledge gaps

Information about ecosystem service markets is scarce and the capacity to assess and develop markets is limited. Progress is hampered by a lack of understanding and political support from key stakeholders. Few national, state or local government entities have access to the information needed to shape policy on market design. Most market expertise is available only in the private sector, generally companies and consultants who are motivated by the opportunity to promote business deals. Where site-specific design input is commercially available, pricing of services reflects the fact that most expertise and most commercial demand is presently found in the industrialized countries. While technical expertise for measuring ecosystem services is becoming more available through universities, it is often difficult for governments or non-governmental organizations to access or apply this in a site-specific project.

To realize the potential of ecosystem service markets in tropical countries, leading organizations promoting forest stewardship will need to fill these knowledge gaps. In particular, policy-makers and program leaders require:

- objective technical assistance to identify the opportunities and risks of using different market instruments, and designing them to be effective, efficient and equitable;
- opportunities to exchange experiences, perspectives and lessons with peers in other countries and regions about the most appropriate legal and regulatory frameworks;
- practical data on costs of production, transactions, establishment and management of different market mechanisms; and

- capacity-building to develop sophisticated national expertise in analyzing, designing and implementing ecosystem service markets in the public, private and civic sectors.

Ecosystem service markets could potentially offer a powerful new set of incentives for tropical forest conservation and restoration, and new income opportunities for forest producers. However, it remains unclear which producers, consumers and types of forest resources will be the real beneficiaries of such market development. It is also unclear under what conditions the creation of ecosystem service markets will be the most effective policy instrument for achieving forest policy goals. Most markets are still incipient and their further development will require concerted government action. The decisions being taken over the next few years will shape market effectiveness, efficiency and equity for decades to come.

Résumé analytique

Situation des marchés des écosystèmes forestiers

La décennie écoulée a vu l'apparition généralisée de marchés et d'autres dispositifs de rémunération des services assurés par les écosystèmes forestiers dans l'ensemble du monde : protection des bassins versants, protection de la biodiversité et piégeage du carbone. À l'échelle planétaire, plusieurs études récentes indiquent que ces activités sont encore en herbe et qu'elles restent d'extension et d'échelle limitées; elles n'en recèlent pas moins la possibilité de s'accroître pour atteindre le niveau régional, celui d'un bassin hydrographique ou le niveau national avec de plus amples développements. La majeure partie des activités visant à mettre à l'essai ces dispositifs ont eu lieu pour l'heure dans des pays développés où la science biophysique est souvent plus fortement développée et où l'existence de cadres juridiques et d'institutions permet le développement de marchés plus élaborés.

L'intérêt croissant pour ces marchés s'explique par les frustrations que créent les approches régulatrices traditionnellement suivies par les pouvoirs publics, la reconnaissance croissante des limites de la formule des aires protégées pour la protection de la nature, les exigences de produits écologiquement rationnels qui s'expriment dans la société, et la nécessité pour les entreprises de la filière forêt-bois de trouver des sources de revenu supplémentaires afin de rester compétitives. Ceux qui ont le souci de la conservation et du développement espèrent que ces marchés pourront contribuer à la protection et à la restauration des forêts pour devenir une source durable de nouveaux revenus chez les populations pauvres tributaires des forêts, ces dernières étant propriétaires et administratrices d'une part de plus en plus importante des forêts du monde. Les responsables des administrations centrales, les chefs de file de l'industrie et les leaders d'opinion commencent dans leur ensemble à prendre la mesure de leur position stratégique dans ces marchés: cerner les créneaux, les risques stratégiques que comporte toute action ou inaction, et les implications qui en résultent pour leur compétititivé. Ceux qui ont procédé à un examen approfondi de ces options constatent que sont encore nécessaires une évaluation des lignes de conduite et une mise à l'essai pilote des instruments, en tirant les enseignements de cette expérience avec les participants locaux.

Les nombreux types de marchés et de dispositifs de règlement peuvent être regroupés en quatre catégories: 1) les systèmes de rémunération publique des propriétaires forestiers privés destinés à assurer le maintien ou à permettre l'amélioration des fonctionnalités des écosystèmes; 2) un commerce ouvert encadré par une réglementation qui fixe seuils et plafonds; 3) les marchés de gré à gré auto-organisés; et 4) l'écolabélisation des produits fermiers ou forestiers, forme indirecte de rémunération des fonctionnalités et services qu'assure l'écosystème. De chacun de ces types de marché, les exemples abondent, dans les pays en développement comme dans les pays développés.

Les services de protection des bassins versants: la régulation des eaux, la qualité de l'eau, l'alimentation en eau et la protection des habitats sont bien reconnues et constituent une motivation première à créer de nombreux parcs nationaux et forêts domaniales. La consommation en eau de quelque 30% des plus grandes villes du monde dépend aujourd'hui de massifs forestiers. Les marchés des services que procurent les bassins versants sont spécifiques aux sites et aux usagers concernés; ils se limitent pour l'heure aux situations où les éléments bénéficiaires en aval que sont par exemple les générateurs de stations hydroélectriques, les dispositifs d'irrigation, les réseaux municipaux d'alimentation en eau courante et l'industrie, ressentent directement et de manière sensible les effets du mode d'occupation des sols en amont.

Les systèmes de règlement public prédominent par leur échelle (mais ne sont pas les plus nombreux), et ces paiements peuvent constituer une contribution significative aux revenus locaux et fournir ainsi une incitation suffisante au maintien du couvert forestier. Au Costa Rica par exemple, on verse des rémunérations allant de 30 à 50 dollars E-U par hectare et par an aux propriétaires fonciers des terrains situés dans des bassins versants assurant des fonctions indispensables et l'on prévoit d'octroyer des rémunérations du même ordre au Mexique. Aux Etats-Unis, les paiements acquittés par les pouvoirs publics pour la protection des écosystèmes varient entre 25 et 125 dollars E-U par hectare et par an. Les marchés passés de gré à gré paraissent plus limités, bien que les informations dans ce domaine demeurent largement sous le sceau du secret professionnel et que ce type de transaction n'ait pas fait l'objet d'un recensement exhaustif.

Les dispositifs de commercialisation ouverte – tel le *mitigation banking*[1] sur zones humides – sont rares et se limitent principalement aux pays développés.

Les nombreux différents *services de protection de la biodiversité* que sont la conservation des espèces, l'information génétique et chimique et les fonctionnalités de l'écosystème dont la pollinisation se voient de plus en plus reconnus comme indispensables à de nombreux secteurs de l'économie, notamment la pêche commerciale. Les mécanismes de marché englobent les marchés fonciers des habitats à forte valeur de biodiversité, les paiements des usages privés non consomptibles tels l'écotourisme, les droits et crédits cessibles dans un cadre réglementaire régissant les conversions d'habitats, et les produits porteurs de labels écologiques que sont le café cultivé sous ombrière, les médicaments naturels et d'autres produits botaniques tirés des forêts naturelles. Le commerce sur ces marchés connaît un essor sans précédent, les médicaments produits à partir de molécules originellement issues de la forêt représentent une valeur qui se chiffre en dizaines de milliards de dollars par an mais ces avantages ne profitent que rarement aux populations forestières. Bien que le marché de la bioprospection soit encore en évolution, il n'a pas encore engendré d'investissements ou de paiements directs au profit des populations riveraines. Une enquête mondiale a récemment recensé 72 marchés de la biodiversité dans 33 pays, dont 63 se trouvaient répartis dans 28 pays tropicaux. Plus de 70% de ces marchés sont internationaux. Les experts estiment que dans les seuls Etats-Unis, plus de deux milliards de dollars E-U ont été investis dans des servitudes foncières aménagées pour la conservation d'habitats au cours des dernières années.

De tous les services ou fonctionnalités de l'écosystème forestier, le *piégeage du carbone* est sous doute celui qui a suscité le plus d'attention et d'enthousiasme chez les acteurs ces dernières années. Les scientifiques s'accordent aujourd'hui à reconnaître que les activités anthropiques ont contribué au réchauffement climatique et que les forêts jouent un rôle majeur dans le bilan global du carbone à l'échelle planétaire de par les fonctions de piégeage et de fixation de ce gaz qu'elles assurent. Les segments de marché dans lesquels les forêts tropicales peuvent jouer un rôle comprennent les reboisements et les boisements pris en compte dans le Mécanisme du développement propre (MDP) du Protocole de Kyoto (dispositif mondial de compensation), et un éventail d'options d'utilisation des terres susceptibles d'attirer les investisseurs par le biais de transactions commerciales dites « non-Kyoto », ainsi que des versements volontaires opérés par des émetteurs de gaz à effet de serre dans le but d'équilibrer leur bilan du carbone. En tenant compte des restrictions imposées aux crédits d'émission de carbone liés aux forêts, et en retenant une valeur estimée de 10 dollars E-U par tonne, le MDP devrait rapporter au moins 300 millions de dollars E-U par an pour les boisements et reboisements au cours de la première tranche d'engagement (2008-2012). Les estimations de la valeur numéraire en dollars du commerce du carbone forestier varient considérablement et cette valeur dépendra en dernier ressort de la taille du marché, laquelle sera fonction des règles finales adoptées dans le cadre du Protocole de Kyoto, des règles européennes de commerce, et des autres systèmes mis en place par les Etats-Unis.

[1] Le *mitigation banking* est un instrument de régulation et de coordination visant à assurer des substitutions entre fonctionnalités non-marchandes de la nature en assurant un système d'évaluation des substitutions (c.a.d. déplacement des fonctionnalités dans l'espace) et de financement. Son objectif est de conserver un nombre stable de fonctionnalités écologiques sur une zone donnée, comme par exemple la biodiversité, la rétention des nutriments, les espaces récréatifs, le paysage, la régulation des inondations, etc.. Le dispositif implique que les actions de développement (économique, résidentiel, agricole) ayant des impacts jugés négatifs sur un ensemble de fonctionnalités, soient compensés, lorsque c'est possible et écologiquement justifié, par l'achat de crédits de fonctionnalités. Ces crédits correspondent à des financements d'actions de conservation, de restauration ou de création de fonctionnalités écologiques (préalables et dans la même zone de fonctionnement écologique) par des entités publiques ou privées. C'est un instrument d'évaluation, de mise en œuvre et de financement des déplacements de fonctionnalité dans l'espace. D'après G. Geniaux - INRA Ecodéveloppement, 2001.

Principales conclusions

Les caractéristiques du marché

La valeur totale des paiements directs auxquels donnent lieu les fonctionnalités des écosystèmes dans les pays tropicaux est aujourd'hui modeste, mais elle a progressé de façon spectaculaire au cours de la décennie écoulée et a atteint un niveau significatif, particulièrement pour les producteurs à faible revenu: les fonctionnalités (ou « services ») des écosystèmes tropicaux ne sont pas encore des marchandises ; elles constituent plutôt des créneaux de marché pour des produits présentant une valeur particulière auprès d'un spectre limité d'acheteurs. La rétribution des fonctionnalités des écosystèmes ne couvrira qu'une part modeste des coûts de la gestion forestière durable et suffira à financer la seule gestion des forêts aménagées à des fins de protection là où les coûts de renoncement sont très faibles – tel est le cas des zones éloignées des centres

où la production forestière n'est pas économiquement viable et où les usages fonciers concurrents sont limités.

Très grossièrement estimée, la valeur annuelle des paiements directs sur les marchés des fonctionnalités forestières dans les pays tropicaux est de l'ordre de quelques centaines de millions de dollars E-U. Les paiements indirects, par l'entremise des produits écolabélisés tel le bois certifié, sont beaucoup plus importants et représentent approximativement plusieurs milliards de dollars par an. Ensemble, ces paiements pèsent un certain poids, mais ils restent modestes au regard du commerce international des produits ligneux tropicaux primaires (grumes, sciages, placages et contreplaqués, qui se chiffre aujourd'hui approximativement à 8 milliards de dollars E-U par an, ou au regard du commerce total des produits dérivés des bois tropicaux représentant 20 milliards de dollars E-U par an, et à la valeur beaucoup plus importante des marchés nationaux du bois et des produits forestiers non ligneux. Le total des paiements directs et indirects des fonctionnalités des écosystèmes sont approximativement du même ordre de grandeur que le total des investissements annuels effectués dans la conservation forestière par les gouvernements, les organisations philanthropiques, les organisations intergouvernementales, soit entre 2 et 2,5 milliards de dollars E-U par an.

Les marchés des fonctionnalités des écosystèmes forestiers sont appelés à croître dans les pays développés comme dans les pays en développement au cours des 20 prochaines années. Les possibilités d'augmentation de la demande portant sur les fonctionnalités des bassins versants, et celles d'une progression de leur rémunération, sont immenses. On projette un doublement, voire un triplement, de la demande d'eau au cours des 50 prochaines années et une part notable de cette progression s'effectuera dans les pays en développement. Les utilisateurs en aval apprennent que les investissements dans la protection des bassins versants peuvent avoir une valeur économique bien supérieure aux investissements dans de nouveaux équipements de retraitement des eaux. La croissance du marché du carbone peut être riche de promesses, elle n'en dépendra pas moins des règles pour lors impondérables des dispositifs internationaux d'atténuation du changement climatique. Il est vraisemblable que les marchés des produits écolabélisés destinés à l'exportation et aux consommateurs des zones urbaines des pays à revenu moyen soient parmi tous les marchés de la biodiversité ceux dont la croissance sera la plus forte.

Les gouvernements jouent un rôle déterminant en tant que premiers acheteurs directs de nombreux services des écosystèmes et comme éléments catalyseurs de nombreux dispositifs de rémunération directe adoptés par le secteur privé. Sachant que de nombreux services des écosystèmes sont des biens publics, l'intervention des pouvoirs publics est généralement requise pour instituer un marché. Cela peut prendre la forme d'un paiement direct de services, de l'instauration de droits de propriété ou de réglementations qui fixent un cadre et régissent les dispositifs de négociation des effets de commerce. Sachant que ces marchés se caractérisent par des coûts de transaction élevés liant acheteurs et vendeurs, et par l'absence d'institutions de marché spécialisées, l'intervention des pouvoirs publics est généralement requise pour aider à traiter ces deux contraintes majeures du développement du marché. Quant aux régimes de rétribution indirecte, qui fonctionnent par l'entremise de systèmes d'écocertification, ils sont dominés par les acheteurs privés.

Le paiement des fonctionnalités des écosystèmes ne couvrira dans la plupart des cas qu'une part modeste, mais potentiellement catalysatrice, des coûts de la bonne gestion forestière. Les prix des services d'écosystème ne sont généralement pas suffisants pour justifier la conservation forestière dans des zones où les coûts de renoncement à la terre sont modérés à élevés. Toutefois, des preuves existent que ces paiements peuvent avoir sur l'aménagement forestier et la gestion forestière un effet catalyseur disproportionné. C'est ainsi que des paiements, même modestes, effectués à échéances régulières pendant un certain nombre d'années peuvent réaliser un incrément de revenu net qui rende les entreprises forestières viables tout en justifiant la restauration des terres dégradées et en rehaussant le niveau de vie des populations pauvres.

Les questions stratégiques

Les responsables chargés des politiques forestières dans le monde tropical commencent à prendre conscience de leur position stratégique compétitive dans la perspective des marchés des services d'écosystèmes. Ils se montrent désireux de savoir si et quand ils devront chercher à entrer en concurrence sur les marchés mondiaux, et quel type d'approche de

marché est le mieux indiqué dans leur sphère nationale. Les responsables sont ainsi confrontés à un ensemble de questions incontournables lorsqu'il s'agit de peser ces options en vue d'en tirer parti.

1) **Droits de propriété et ossatures juridiques nationales sont nécessaires au développement des marchés des services des écosystèmes, or ces cadres sont mal développés dans la plupart des pays producteurs**. La reconnaissance des droits de propriété et la réforme des cadres juridiques sont souvent politiquement sensibles et coûteuses, elles n'en sont pas moins fondamentales pour instaurer des dispositifs de rétribution quel qu'en soit le type. Malheureusement, les massifs forestiers des pays en développement se caractérisent aujourd'hui par des revendications foncières concurrentielles ou contradictoires qui s'accompagnent de tensions persistantes touchant aux droits des collectivités autochtones et riveraines. Dans la plupart des cas, il sera nécessaire de négocier l'adhésion politique des acteurs principaux pour pouvoir instaurer de nouveaux marchés.

2) **Il est peu vraisemblable que ces marchés contribuent de manière sensible à atténuer la pauvreté si ne sont pas déployés des efforts de nature volontariste conduisant à une reconnaissance des droits et à donner consistance à des marchés qui offrent aux producteurs à faibles revenus un accès équitable aux services des écosystèmes des forêts tropicales.** Comme dans le développement de tout nouveau marché, les règles qui régissent le marché sont trop souvent arrêtées par les secteurs les plus puissants de la société qui disposent à la fois du capital et de la capacité de s'investir dans l'élaboration de règles nouvelles. Dans une certaine mesure, c'est ce à quoi l'on assiste dans le marché mondial des crédits d'émission de carbone. Les implications que comportent pour les producteurs à faibles revenus les nouveaux marchés, leurs réglementations et les normes d'écolabélisation doivent être reconnues et traitées.

3) **De nouvelles institutions de marché sont nécessaires pour réduire les coûts des transactions et les risques financiers**. Un des enjeux majeurs du développement du marché des services des écosystèmes consiste à faire en sorte que soient en place les institutions indispensables pour réduire les coûts des transactions, et qu'intervienne un courtage entre acheteurs, vendeurs, investisseurs, certificateurs et autres catégories maîtresses dans la chaîne de la valeur. Si rien d'utile n'est fait en ce sens, au niveau national comme au niveau international, de nombreux créneaux de marché ne seront tout simplement pas présents au rendez-vous, et ce particulièrement dans les pays pauvres et pour les producteurs forestiers désavantagés.

Des connaissances lacunaires

L'information sur les marchés des services des écosystèmes est parcellaire et la capacité de jauger les marchés et de les développer est limitée. Les progrès sont freinés par le défaut de compréhension chez les acteurs clés et leur absence d'adhésion au concept. Rares en effet sont les entités nationales, étatiques ou les collectivités territoriales qui disposent des informations nécessaires pour se déterminer sur la forme que doivent prendre ces marchés. Le savoir-faire et la maîtrise de ces marchés restent entre les mains du secteur privé, à savoir des sociétés et des consultants motivés par des perspectives de conclure des transactions. Là où des apports conceptuels spécifiques aux sites sont disponibles, les prix pratiqués pour les services visés traduisent le fait que la majeure partie des connaissances spécialisées et de la demande commerciale se trouve aujourd'hui dans les pays industrialisés. Alors que la maîtrise technique permettant de mesurer les fonctionnalités et services des écosystèmes est diffusée par les universités, il est souvent difficile aux administrations nationales et aux ONG de l'appliquer dans un projet spécifique à un site donné.

La réalisation des potentialités des marchés des services des écosystèmes dans les pays tropicaux passe par l'élimination de ces lacunes dans les connaissances et par l'information que doivent assurer les grandes organisations oeuvrant en faveur d'une gestion raisonnée des forêts. C'est ainsi que les responsables politiques et les chefs de programmes devront :

- se doter d'une assistance technique objective qui leur permette de déterminer les perspectives et les risques qui s'attachent à l'utilisation d'instruments de marché différents, et d'élaborer ces instruments dans un souci d'efficacité, d'efficience et d'équité ;
- avoir la possibilité d'échanger des expériences, des points de vue et des enseignements avec leurs homologues dans d'autres pays et régions sur les cadres juridiques réglementaires les mieux adaptés ;

- disposer de données concrètes sur les coûts de production, ceux des transactions et sur l'instauration et la gestion des différents mécanismes de marché ;
- renforcer les capacités et se doter des moyens de développer une maîtrise nationale sophistiquée qui permette l'analyse, la conception et la mise en oeuvre de marchés des services des écosystèmes dans les secteurs public, privé et la société civile.

Les marchés des services des écosystèmes recèlent la possibilité d'un ensemble d'incitations fortes à la conservation et à la restauration des forêts tropicales, et sont porteurs de nouvelles perspectives de revenus pour les producteurs forestiers. Toutefois, on ne voit pas nettement quels producteurs, consommateurs, et types de ressources forestières seront les vrais bénéficiaires du développement de ces marchés. On ne voit pas non plus clairement dans quelles conditions les marchés des services des écosystèmes à créer seront les instruments politiques les plus efficaces pour la réalisation des objectifs forestiers. La plupart des marchés en sont encore à leur début et leur futur développement nécessitera une action concertée des gouvernements. Les mesures que l'on prendra dans les prochaines années décideront de l'efficacité, de l'efficience et de l'équité de ces marchés pour les décennies à venir.

Resumen analítico

Situación de los mercados de servicios de ecosistemas forestales

En los últimos diez años, se ha registrado por todo el mundo un gran surgimiento de mercados y otros sistemas de pago de servicios ecosistémicos tales como la protección de cuencas hidrográficas, la protección de la biodiversidad y el secuestro de carbono. En el ámbito mundial, varios estudios realizados recientemente indican que dichas actividades se encuentran en la etapa inicial y que todavía son de envergadura y escala limitadas, pero que pueden tener el potencial de extenderse a nivel regional, de cuenca o nacional con un mayor desarrollo. A la fecha, la mayor parte de la actividad realizada para probar dichos sistemas ha tenido lugar en países desarrollados, donde los conocimientos científicos biofísicos suelen ser mayores y existen los marcos jurídicos e institucionales que permiten el desarrollo de mercados más sofisticados.

El enorme y creciente interés observado para desarrollar dichos mercados está impulsado por la frustración causada por los enfoques reguladores gubernamentales tradicionales, el reconocimiento cada vez mayor de las limitaciones de los sistemas de áreas protegidas con respecto a la conservación, la demanda de productos ecológicamente racionales por parte de la sociedad, y la necesidad que tienen las industrias forestales de encontrar fuentes suplementarias de ingresos para poder mantener su competitividad. Todos aquéllos dedicados a la conservación y al desarrollo esperan que dichos mercados puedan contribuir a la protección y restauración forestal y convertirse en una fuente sostenible de nuevos ingresos para las poblaciones pobres que dependen de los bosques y que son propietarias de una porción cada vez mayor de los bosques del mundo y se encargan de su administración. Los funcionarios gubernamentales y los líderes industriales y comunitarios están comenzando a evaluar su posición estratégica en estos mercados: identificando sus oportunidades, los riesgos estratégicos de la acción o inacción, y las repercusiones de su relativa competitividad. Quienes han examinado estas opciones en detalle consideran que sigue existiendo la necesidad de una evaluación de las políticas y de experiencias piloto para probar instrumentos y aprender junto con los participantes locales.

Los numerosos tipos de mercados y sistemas de pago diferentes pueden clasificarse en cuatro categorías: (1) sistemas públicos de pago a los propietarios forestales privados para mantener o aumentar los servicios ecosistémicos; (2) comercio libre conforme a un límite reglamentario superior o inferior; (3) transacciones privadas organizadas independientemente; y (4) etiquetado ecológico de los productos forestales o agrarios, una forma indirecta de pago por los servicios ecosistémicos. Existen numerosos ejemplos de cada tipo de mercado en los países en desarrollo y desarrollados.

Los servicios de protección de cuencas hidrográficas – tales como la regulación de caudales, calidad del agua, suministro de agua y protección de hábitats – están ampliamente reconocidos y, por cierto, representan una motivación primaria para establecer muchos parques y bosques nacionales. Aproximadamente el 30 por ciento de las ciudades más grandes del mundo dependen actualmente de los bosques para su suministro de agua. Los mercados de servicios de cuencas hidrográficas son específicos para el sitio y el usuario, y actualmente están limitados a las situaciones en que los beneficiarios "corriente abajo", tales como los generadores de energía hidroeléctrica, irrigadores, sistemas municipales de suministro de agua y la industria, reciben el impacto directo e importante del uso de las tierras "corriente arriba".

Los sistemas públicos de pago predominan por su escala (pero no por su cantidad), y dichos pagos pueden efectuar una contribución importante a los ingresos locales y ofrecer también un incentivo suficiente para mantener la cobertura boscosa. En Costa Rica, por ejemplo, los terratenientes en zonas de cuencas hidrográficas de importancia crítica reciben entre US$ 30 y US$ 50 por hectárea por año y en México se están planeando pagos de escala similar. En los Estados Unidos, los pagos del gobierno por la protección de ecosistemas oscilan entre US$ 25 y US$ 125 dólares por hectárea por año. Los tratos privados organizados independientemente parecen ser limitados, aunque la información es en su mayor parte de dominio privado y nunca se ha efectuado una evaluación completa de este tipo de transacciones. Los sistemas de comercio libre, tales como los bancos de mitigación para humedales, son poco numerosos y están limitados principalmente a los países desarrollados.

Los muchos y diversos servicios de protección de la biodiversidad – tales como la conservación de hábitats y especies, información genética y química, y funciones ecosistémicas como la polinización – están cobrando un creciente reconocimiento por su importancia crítica para muchos sectores de la economía, tales como las pesquerías comerciales. Los mecanismos de mercado incluyen mercados de tierras para hábitats de gran valor de biodiversidad, pagos para usos no consumistas tales como el ecoturismo, derechos y créditos comerciables dentro de un máximo reglamentario por conversión de hábitat, y productos con etiquetado ecológico tales como el café cultivado bajo sombra, plantas medicinales y otros productos botánicos provenientes de bosques naturales. El comercio en estos mercados de productos está prosperando; por ejemplo, los fármacos derivados de compuestos encontrados originalmente en los bosques tienen un valor de miles de millones de dólares estadounidenses por año, pero estos beneficios rara vez llegan a los pueblos de los bosques. Pese a la evolución del mercado de bioprospección, todavía no ha generado cantidades importantes de inversiones directas o de pagos para las poblaciones locales. Una encuesta mundial realizada recientemente reveló 72 casos de mercados de biodiversidad en 33 países, 63 de los cuales se encontraban en 28 países tropicales. Más del 70 por ciento de estos mercados eran internacionales. Los expertos estiman que en EE.UU. solamente, en los últimos años, se han invertido más de 2.000 millones de dólares en servidumbres para la conservación de hábitats.

De todos los servicios del ecosistema forestal, el secuestro de carbono es el que ha despertado el mayor entusiasmo e interés en los últimos años. El consenso científico actual es que la actividad humana ha contribuido al calentamiento del planeta y que los bosques tienen una función primordial tanto en las emisiones mundiales de carbono como en la prestación de servicios de secuestro y almacenamiento del mismo. Los segmentos del mercado en que los bosques tropicales pueden tener una función incluyen la forestación y reforestación conforme al Mecanismo de Desarrollo Limpio (MDL) del Protocolo de Kyoto (el sistema mundial de límite máximo y comercio), y una diversidad de opciones de uso de la tierra que son de interés para los inversores por medio del comercio no sujeto al Protocolo y los pagos voluntarios por los responsables de las emisiones para lograr la neutralidad con respecto al carbono. Dadas las restricciones impuestas en las compensaciones forestales de las emisiones de carbono y la estimación de un valor de US$ 10 por tonelada, se anticipa que el MDL generará un máximo de 300 millones de dólares por año para actividades de forestación y reforestación en el primer período de compromiso (2008-2012). Las estimaciones del valor dólar que representa el comercio de carbono forestal son muy diversas y, en definitiva, dependen de la magnitud del mercado, la cual a su vez depende de las normas finales aprobadas con arreglo al Protocolo de Kyoto, las reglamentaciones comerciales europeas y los sistemas alternativos aplicados por EE.UU.

Conclusiones principales

Características del mercado

Actualmente, el valor total de los pagos directos por servicios ecosistémicos en los países tropicales es limitado, pero ha aumentado drásticamente en el último decenio y es importante especialmente para los productores de bajos ingresos: los servicios de los ecosistemas tropicales todavía no son productos básicos; más bien se comportan como mercados especializados de productos de valor especial para un grupo limitado de compradores. Los pagos por servicios ecosistémicos, en general, cubrirán sólo una pequeña parte de los costos de la ordenación forestal sostenible y serán suficientes para financiar bosques manejados únicamente con fines de protección, donde los costos de oportunidad son muy bajos, por ejemplo, en zonas remotas en las que la producción forestal no es económicamente viable y las alternativas de uso de la tierra son limitadas.

En términos muy generales, el valor anual de los pagos directos a los mercados de servicios de ecosistemas forestales en los países tropicales es del orden de los cientos de millones de dólares estadounidenses. Los pagos indirectos por medio de productos con etiquetado ecológico, tales como la madera certificada, los productos de cultivos forestales tropicales y otros productos forestales no maderables, son mucho mayores y generan aproximadamente varios miles de millones de dólares cada año. En conjunto representan cifras importantes, pero son modestas en comparación con el comercio internacional de productos primarios de maderas tropicales (trozas, madera aserrada, chapas y madera contrachapada), que representan actualmente unos 8.000 millones de dólares estadounidenses por año, el comercio total de productos de madera de los países tropicales, de un valor de 20.000 millones de dólares al año,

y el valor mucho más elevado de los mercados nacionales de madera y productos forestales no maderables. Los pagos directos e indirectos por la totalidad de servicios ecosistémicos son de aproximadamente la misma magnitud que las inversiones anuales totales en la conservación forestal efectuadas por gobiernos, organizaciones filantrópicas y organizaciones intergubernamentales, que oscilan entre 2.000 y 2.500 millones de dólares estadounidenses por año.

Se anticipa que en los próximos veinte años, los mercados de servicios de ecosistemas forestales aumentarán tanto en los países en desarrollo como en los países desarrollados: existe un enorme potencial para aumentar la demanda y los pagos por servicios de las cuencas hidrográficas. Se prevé que la demanda de agua se duplicará, o incluso triplicará, en los próximos 50 años y buena parte de dicho aumento se producirá en los países en desarrollo. Los usuarios de los sectores de la producción y la industria están aprendiendo que las inversiones hechas en la protección de cuencas hidrográficas pueden resultar mucho más económicas que las inversiones en nuevas instalaciones de tratamiento. El desarrollo del mercado de carbono tiene un gran potencial, pero dependerá de normas aún imprevisibles de mitigación del cambio climático a nivel internacional. Es probable que los mercados de productos con etiquetado ecológico para exportación y para consumidores urbanos de países de ingresos medios constituyan el componente de crecimiento más acelerado de los mercados de biodiversidad.

Los gobiernos cumplen una función de importancia crítica como principales compradores directos de muchos servicios ecosistémicos y como catalizadores para muchos sistemas de pago directo del sector privado: dado que muchos servicios ecosistémicos son bienes públicos, en general se necesita la intervención del gobierno para constituir un mercado. Ello puede implicar el pago directo de un servicio, el establecimiento de derechos de propiedad o la instauración de reglamentos que fijen topes máximos y rijan los sistemas de comercialización. Puesto que estos mercados están caracterizados por elevados costos de transacción para vincular a compradores y vendedores y por la falta de instituciones de mercado especializadas, normalmente requieren la intervención del gobierno para ayudar a superar estas dos limitaciones importantes del desarrollo del mercado. Los pagos indirectos, por medio de sistemas de certificación, están principalmente en manos de compradores privados.

En la mayoría de los casos, los pagos de servicios ecosistémicos cubren sólo una parte reducida de los costos de la ordenación forestal racional, pero dicha parte tiene potencial para actuar de catalizador: en general, los precios de los servicios ecosistémicos no son suficientes para justificar la conservación forestal en zonas en que los costos de oportunidad de la tierra son moderados o elevados. No obstante, todo parece indicar que dichos pagos pueden ejercer un efecto catalizador desproporcionadamente elevado en el establecimiento y la ordenación de los bosques. Incluso pagos modestos, efectuados de forma fiable durante varios años, pueden llevar a un aumento de los ingresos netos que permita la viabilidad de las empresas forestales, justificando así la restauración de las tierras degradadas y mejorando los medios de sustento de la población pobre.

Cuestiones estratégicas

Los responsables de la formulación de políticas relativas a los bosques tropicales están comenzando a evaluar su posición competitiva estratégica con respecto a la opción de mercados de servicios ecosistémicos. Les interesa enormemente saber si deben procurar competir en los mercados mundiales, y cuándo hacerlo, así como qué tipo de enfoques comerciales son razonables dentro de su propio contexto nacional. Se enfrentan así a una serie de cuestiones fundamentales en sus esfuerzos por evaluar correctamente y promover estas opciones:

1) **los derechos de propiedad y los marcos jurídicos nacionales son necesarios para permitir el desarrollo de los mercados de servicios ecosistémicos, pero en la mayoría de los países productores no están correctamente establecidos:** con frecuencia, el reconocimiento de los derechos de propiedad y la reforma de los marcos jurídicos son actividades costosas y muy discutidas a nivel político, pero son fundamentales para el establecimiento de los sistemas de pago de todo tipo. Lamentablemente, las zonas forestales de los países en desarrollo, en la actualidad, están caracterizadas por reivindicaciones de tierras superpuestas y conflictivas y por tensiones históricas con respecto a los derechos de los pueblos indígenas y otras comunidades. En la

mayoría de los lugares, será necesario negociar el apoyo político de los interesados clave para poder establecer nuevos mercados;

2) **es poco probable que estos mercados efectúen una contribución sumamente importante a la reducción de la pobreza, a menos que exista un gran empeño por reconocer los derechos y formar mercados con miras a brindar un acceso equitativo a los productores de servicios de ecosistemas forestales tropicales de menores ingresos:** como suele suceder con el desarrollo de todo mercado nuevo, las reglas que rigen el mercado suelen estar determinadas por los sectores más poderosos de la sociedad, que tienen el capital y la capacidad para invertir en la formulación de las reglas. En cierta medida, esto ya está sucediendo con el mercado mundial del carbono. Es preciso identificar y examinar las repercusiones que tienen los nuevos mercados, las reglamentaciones y las normas del etiquetado ecológico para los productores de bajos ingresos; y

3) **se necesitan nuevas instituciones comerciales para reducir los costos de transacción y los riesgos financieros:** uno de los principales desafíos del desarrollo del mercado de servicios ecosistémicos es garantizar el establecimiento de instituciones cruciales a fin de reducir los costos de transacción y brindar una intermediación entre compradores, vendedores, inversores, certificadores y otros grupos de importancia clave en la cadena de valor. Si no se toman medidas apropiadas para ello a nivel nacional e internacional, muchas oportunidades de mercado simplemente no se concretarán, especialmente en los países más pobres y para los productores forestales de menores ingresos.

Brechas de conocimientos

Es poca la información existente sobre los mercados de servicios ecosistémicos, y la capacidad de evaluación y desarrollo de mercados es limitada. El progreso se ve impedido por la falta de comprensión y apoyo político de los principales interesados. Pocas entidades nacionales, estatales o municipales tienen acceso a la información necesaria para dar forma a la normativa en materia de diseño de mercados. La mayoría de los conocimientos expertos sobre el mercado existen solamente en el sector privado, generalmente en compañías y consultores motivados por la oportunidad de promover negocios comerciales. En los casos en que se comercializan diseños para sitios específicos, el precio de los servicios refleja el hecho de que la mayoría de los conocimientos y de la demanda comercial se encuentran actualmente en los países industrializados. Si bien se observa un aumento en la disponibilidad de conocimientos técnicos para la medición de servicios ecosistémicos por medio de las universidades, el acceso o aplicación en un proyecto específico suele ser difícil para los gobiernos u organizaciones no gubernamentales.

A fin de concretar el potencial de los mercados de servicios ecosistémicos en los países tropicales, será preciso que las organizaciones líderes que promueven la gestión forestal cubran dicha brecha de conocimientos. En particular, los responsables de la formulación de políticas y los coordinadores de programas necesitan:

- asesoramiento técnico objetivo para identificar las oportunidades y los riesgos del uso de diferentes instrumentos de mercado, y formularlos de modo que sean eficaces, eficientes y equitativos;
- oportunidades para intercambiar experiencias, perspectivas y lecciones con sus pares de otros países y regiones sobre los marcos jurídicos y normativos más apropiados;
- datos prácticos sobre los costos de producción, transacciones, establecimiento y administración de diferentes mecanismos de mercado; y
- aumento de capacidades con el objeto de desarrollar sofisticados conocimientos nacionales en materia de análisis, diseño y aplicación de mercados de servicios ecosistémicos en los sectores público, privado y civil.

Los mercados de servicios ecosistémicos ofrecen la posibilidad de toda una nueva gama de poderosos incentivos para la conservación y restauración de los bosques tropicales y nuevas oportunidades de ingresos para los productores forestales. No obstante, aún no está claro qué productores, consumidores y tipos de recursos forestales serán los verdaderos beneficiarios del desarrollo de tales mercados. Tampoco está claro en qué condiciones será más efectiva la creación de los mercados de servicios ecosistémicos como instrumento normativo para el logro de las metas de la política forestal. La mayoría de los mercados aún son incipientes y su desarrollo ulterior exigirá la acción concertada de los gobiernos. Las decisiones que se tomen en los próximos años determinarán la eficacia, eficiencia y equidad de los mercados por décadas.

1 Introduction

The many ecosystem services provided by forests – watershed protection, biodiversity conservation and carbon sequestration, for example (see Table 1) – are gaining increasing attention from governments and the forest industry, as well as from private citizens. People are becoming aware of the dangers and costs of allowing forest services to be degraded or lost. Forest degradation and conversion can have local impacts, such as floods and landslides, as well as broader impacts, such as global climate change.

This growing awareness is drawing attention to the economic benefits of healthy forest ecosystems, benefits that until recently have often been taken for granted. Indeed, as human demands increase and natural resources become scarcer, those who bear the costs of degradation – such as downstream water utilities, local governments, private insurers and society as a whole – are exploring opportunities to reduce these costs. Forest owners are beginning to seek compensation for the costs of maintaining healthy forests. The linkage between degraded ecosystems, rural poverty and human health is also becoming more apparent.

At the same time, there is greater awareness of the limitations of government protection and regulatory approaches to forest conservation. Approximately 15 million hectares of natural forest were lost each year during the 1990s, the vast majority of it in tropical countries (FAO 2001). Frustration with traditional approaches is spurring action by a broad range of stakeholders. Private companies, individuals, non-governmental organizations (NGOs) and communities are getting involved, driven by the desire to reduce costs, capture new income, improve public relations, manage risks and protect current well-being. This action is being backed up by a willingness to pay for the protection of ecosystem services.

A recent global survey found almost 300 new cases of payments in all continents (See Box 1). For example, a private Costa Rican utility company voluntarily pays into a fund that provides money for private upstream landholders to increase forest cover. This reduces sedimentation, thus providing sufficient water flow for hydroelectricity generation. In Paraguay, AES, an international power company, paid US$2 million to form a protective reserve for one of South America's last remaining areas of undisturbed dense tropical forest. This helps to offset carbon emissions. In Karnataka State, India, farmers have formed a fund with the assistance of an NGO, the Government of India and the Swiss Agency for Development Cooperation to help other local farmers with watershed protection activities such as regenerating forest and maintaining fallow land.

Table 1 *Major forest ecosystem services*

- Purification of air and water
- Regulation of water flow
- Detoxification and decomposition of wastes
- Generation and renewal of soil and soil fertility
- Pollination of crops and natural vegetation
- Control of agricultural pests
- Dispersal of seeds and translocation of nutrients
- Maintenance of biodiversity
- Partial climatic stabilization
- Moderation of temperature extremes
- Wind breaks
- Support for diverse human cultures
- Aesthetic beauty and landscape enrichment

Source: Daily 1997

Increasingly, public authorities – particularly when faced with budgetary crisis – require those who most obviously benefit from ecosystem services to provide financing. This is the case in Colombia, for example, where hydroelectric and water utilities are required by law to allocate a fixed percentage of revenues to an ecosystem fund. The fund pays private landowners for watershed management and purchases hydrologically sensitive lands for management by government agencies. In addition to direct-investment approaches of this nature, some governments are experimenting with new fiscal approaches. In Brazil, a number of states have pioneered a new tax allocation system under which a percentage of state tax goes directly to municipalities that actively protect watershed areas.

Despite this flurry of interest and activity, payments and markets for ecosystem services are a nascent activity. The innovations remain limited in scale, scope and impact. While this reflects a growing global trend, it is not yet clear what promise markets for ecosystem services hold for tropical forest countries and industries. Most of the activity to date has been in more developed countries – where biophysical science tends to be stronger and legal frameworks and institutions permit more sophisticated markets to develop. That being said, a number of interesting cases are under way in developing countries and markets are evolving quickly and often in seemingly unpredictable ways.

Box 1 *The growing number of markets for ecosystem services*

A global review of markets for forest environmental services conducted in 2001 identified over 280 cases of actual and proposed payments. These include 75 deals for carbon sequestration, 72 for biodiversity conservation, 61 for watershed protection, 51 for landscape beauty and 28 for sales of 'bundled services'. These cases were drawn primarily from developing countries in the Americas, the Caribbean, Africa, Asia and the Pacific.

The study suggests an impressive expansion of markets and also highlights the tremendous variety of market structures. Schemes differ according to the number and type of participants involved, the payment mechanisms employed, the degree of competition and their level of maturity.

Source: Landell-Mills & Porras 2002

Tropical forest producers in the legal trade are battling to remain competitive with illegal operators and natural forest producers are losing market share to fast-growing plantations – many outside tropical areas. While there is growing demand for certified wood, certification often raises costs without bringing greater returns. The legal tropical industry is searching for new ways to reap financial returns from their forests and remain viable enterprises. Some environmental groups hope that markets for ecosystem services will provide forestry with sufficient additional income to compete more effectively with alternative land-uses, such as soybean farms in the Brazilian Amazon or oil palm plantations in Malaysia, and to finance large-scale restoration of degraded forest lands.

These great but uncertain expectations are driving producer country governments to investigate their interests and options in these markets. Most of the interest, finance, and – at least in the case of carbon – definition of market rules to date has originated in the more developed, temperate countries. What is in this for tropical developing countries? Can they design and influence markets so that they can benefit fairly? Will these markets be a significant source of new financing – or will this pass as another fad, distracting from more fundamental obligations?

At the same time, industrialized country governments are beginning to assess their own interests and exposure. Will they be expected to finance the costs of protecting globally significant biodiversity? Will their industry remain competitive if producer country industry rights itself? Will they be expected to finance the costs of building legal and regulatory environments in developing countries to permit fair market trade?

And, of course, indigenous communities and other low-income forest people have their own interests and concerns. Will these markets be used as wedges to further alienate them from their traditional lands? Or could perhaps these markets be a driver for increased tenure security and incomes?

The purpose of this paper is to take a modest step towards helping policy-makers assess these questions by providing a preliminary assessment of the status and potential for markets for ecosystem services to contribute to tropical forest conservation. The terms of reference are provided in Annex 1. Data on these markets are difficult to attain, either because they are proprietary or because the market is evolving quickly and no data on these topics are collected regularly by governments or intergovernmental organizations. The analysis depends upon the limited available secondary literature and on information and materials provided by colleagues in the Katoomba Group, a network of global innovators in ecosystem service markets. A more substantive analysis will require an organized effort to collect new primary data.

Section 2 of this paper reviews the diverse reasons for growing interest in ecosystem service markets in tropical countries. Section 3 assesses the status of markets for the major ecosystem services: biodiversity conservation, watershed protection and carbon sequestration and storage. Section 4 assesses emerging markets from the perspective of forest owners and producers, including commercial timber producers, forest and farming communities, and government forest agencies. Section 5 steps back from the descriptive assessment of these markets to raise some of the important strategic issues facing tropical countries in positioning themselves to participate (or not) in ecosystem service markets. This addresses issues of international competitiveness, legal and regulatory frameworks, property rights and the politics of protecting ecosystem services, domestic equity concerns, and the need to build institutions to reduce transaction costs and financial risks. Key findings on the scale and characteristics of, and potential future markets for, forest ecosystem services, and challenges for their future development, are summarized in Section 6.

2 Reasons for interest in ecosystem service markets

Historically, it has been the responsibility of governments to ensure access to ecosystem services where these are scarce relative to demand. The main instruments have been direct forest management by government agencies, regulation of private forest use, public investment to improve private management, or targeted taxes and subsidies (Table 2). But in recent decades several factors have stimulated those concerned with tropical forest ecosystem services to begin exploring ways to create market-based instruments. These factors include: lack of financial incentives for providing forest ecosystem services; concern about the sustainability of commercial timber production in natural tropical forests; the need to find new means to finance forest conservation; and the potential contribution of such markets to link environmental management to economic development and poverty reduction.

Lack of financial incentives to provide ecosystem services

Most ecosystem services are considered 'public goods' – positive benefits resulting from good forest management that can be enjoyed by all. Under present property rights and institutions, those forest managers responsible for providing benefits cannot exclude the beneficiaries from enjoying the service ('non-excludable'), and the beneficiaries are not in competition with one another ('non-rival'). This undermines the formation of markets, since beneficiaries have no incentive to pay suppliers. Thus, in most of the world, forest ecosystem services are not traded in markets and have no 'price'. The failure of forest owners and producers to capture financial benefits from conserving ecosystem benefits leads to the over-exploitation of forest resources and the under-supply of ecosystem services.

Thus, where the opportunity costs of forest land for agricultural enterprises, infrastructure and human settlements are higher than the use or income value of timber and non-timber forest products (NTFPs), forest will be cleared. Such income cannot usually generate enough income to forest owners to justify natural forest conservation. In some cases, deforestation occurs because of perverse policy and institutional incentives – such as credit, agricultural and logging subsidies – or land tenure rules (Nasi et al. 2001). But even in the absence of perverse public policies, forest environmental services would still be under-supplied by the market, in most cases due to their nature as 'externalities' or 'public goods'. Forest owners and producers ignore the value of ecosystem services in making decisions about land-use and management because they receive little or no direct benefit from them.

Table 2 Instruments to promote forest ecosystem services

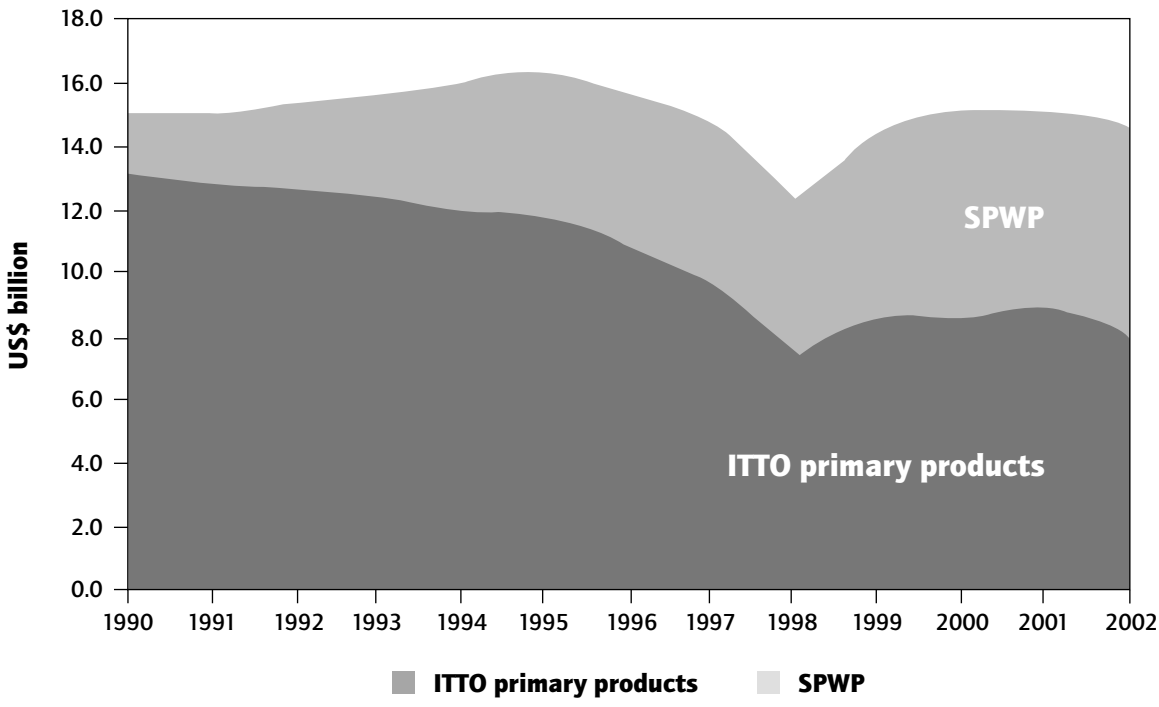
Lead actors	Instrument	Examples	Who pays?
Government	Public direct management of forest resources	National forests and forest protected areas	Government (taxpayers)
Government	Regulation of private forest resource management	Harvest permits, rules on logging methods	Private forest owners & managers
Government	Support services for forest owners/users' own initiatives	Technical assistance program for forest owners to improve management	Government or NGOs
Government	Public pricing policies to reflect ecosystem costs and benefits	Lower tax rate on forested land	Mixed; indirect incentive (outcome not measured)
Government /market	Open trading deals under a regulatory cap or floor	Carbon trading under the Kyoto Protocol	Consumers or producers subject to cap (least cost)
Government /market	Public payments to private land and forest owners to maintain or enhance ecosystem services	Agro-environmental payments for forest conservation easements on farms	Government
Market	Self-organizing private deals	Payments by a water bottling company to upstream watershed managers	Private company, NGO, community (user)
Market	Ecolabelling of forest or farm products	Forest certification	Consumer, intermediary

Economists and others have argued that mechanisms are needed by which forest and other resource owners are rewarded for their role as stewards in providing ecosystem services. Anticipation of such income flows would enhance the value of forest assets and thus encourage their conservation. Compared to previous approaches to forest conservation, market-based mechanisms promise increased efficiency and effectiveness, at least in some situations. Experience with market-based instruments in other sectors has shown that such mechanisms, if carefully designed and implemented, can achieve environmental goals at significantly less cost than conventional 'command-and-control' approaches, while creating positive incentives for continual innovation and improvement. Where the benefits and costs of conservation vary spatially, market-based instruments seek out and concentrate on higher-benefit cases (Pagiola et al. 2002).

The search for sustainable incomes in the tropical timber industry

The tropical timber trade has undergone dramatic transitions in the last decade. According to ITTO (2003), the export value of primary products (logs, sawnwood, veneer, and plywood) from natural forests in ITTO producer countries has declined some 40% – from US$13 billion to US$8 billion per year since 1990 (Figure 1). At the same time there has been rapid growth in secondary products exported – up some 200% since 1990, from US$1.5 billion to US$5 billion, and in plantations – up from 28 million to over 60 million hectares. Plantation products are the majority basis for the secondary product industry, and plantation products (including pulp, paper and reconstituted panels) now constitute the majority of the value of the aggregate tropical timber trade.

Figure 1 *Tropical timber export trends*



ITTO primary products = plywood, sawnwood, veneer, logs

SPWP = secondary processed wood products: furniture, moulding, woodwork, etc – excludes pulp, paper and reconstituted panels

Source: ITTO (2003)

Table 3 *Estimated financial flows for forest conservation (US$)*

Sources of finance	Sustainable forest management (early 90s)	Sustainable forest management (early 2000s)	Protected areas (early 90s)	Protected areas (early 2000s)
Official development assistance	2 billion–2.2 billion	1 billion–1.2 billion	700 million–770 million	350 million–420 million
Public expenditure	NA	1.6 billion	NA	598 million
Philanthropy*	85.6 million	150 million	NA	NA
Communities**	365 million –730 million	1.3 billion –2.6 billion	NA	NA

* Under-estimates self-financing and in-kind NGO contributions
** Self-financing and in-kind contributions from indigenous and other local communities. Estimated community-managed forests in 1990: 100 million hectares.
NA = not available
Source: Khare (2003)

During the same period, the problem of illegal logging, the largely stagnant prices for tropical timber products from natural forests, the widespread government practice of subsidizing plantations, and increasing standards of practice, have all made sustainable production from natural forests a financially challenging proposition. Legal producers from natural forests are finding it difficult to compete with illegally harvested wood and plantation products. In this climate, legal producers with natural forests are eagerly searching for additional sources of revenue.

Need for new means to finance forest conservation

Until recently, the financing and management of natural protected areas remained the responsibility of the public sector. There are presently 102,102 protected areas worldwide, covering an area of 18.8 million km^2, of which 17 million km^2, or 11.5% of the Earth's terrestrial surface, are forests. Two-thirds of these have been assigned to an IUCN management category of protection. However, over the last few decades, severe cutbacks in the availability of public resources have undermined the effectiveness of such strategies, and budgets for government protection and management of forest ecosystem services are declining (Table 3). Land acquisition and compensation for lost resource-based livelihoods are both often prohibitively expensive. For example, it has been estimated that US$1.3 billion would be required to compensate people fully in just nine Central African parks (Cernea & Schmidt-Soltau 2003). At the same time, public responsibility for nature protection is shifting with processes of devolution and decentralization. Protected areas in the tropics are mostly dependent for financing on international public or private donors. But the donation-driven model is not sustainable, either economically or environmentally (Swingland 2002). Sovereignty is an issue, as about 30% of private forest concessions in Latin America and the Caribbean and 23% in Africa are already foreign-owned.

Moreover, the dominant model of excluding people from natural habitats which are targeted for conservation disenfranchises them. In India, for example, 30 million people are targeted for resettlement from protected areas (Khare et al. 2000). An estimated 240 million rural people live in the world's high-canopy forest landscapes. Population growth in the world's remaining 'tropical wilderness areas' is twice the global average (Cincotta & Engelman 2000). In Latin America, for example, 80% of all forests are located in areas of medium to high human population density (Chomitz 2003). Over a billion people live in the 25 biodiversity 'hotspots' identified by Conservation International; in 16 of these hotspots, population growth is higher than the world average (Cincotta & Engelman 2000). There is an urgent need to identify alternative conservation systems that respect the rights of forest dwellers and owners and that address conservation objectives in the 90% of forests outside public protected areas. Markets for ecosystem services potentially offer a more efficient and lower-cost approach to forest conservation.

Potential contribution to economic development and poverty reduction

Roughly a quarter of the world's poor and 90% of the poorest depend substantially on forests for their livelihoods (World Bank 2001; see Box 2). In China, most forests are found in officially designated 'poor countries' (Lele et al. 2002). In India, two-thirds of forests are in economically poorer tribal areas; some 100 million people are estimated to be forest dwellers, while another 275 million live in the vicinity of

forests (Kumar & Saxena 2002). Finding new sources of forest income for these populations is important for economic development and poverty reduction, as well as to conserve forests as populations continue to rise, as is predicted in low-income tropical countries.

Moreover, as a result of public forest tenure reforms worldwide, indigenous and other rural communities now own or control a quarter of all natural forests in tropical developing countries, and this share is projected to double by 2020 (Table 4; White & Martin 2002). Agroforestry on small-scale farms and community forest plantations are also expanding rapidly and offer opportunities to promote patterns of agricultural development that also enhance ecosystem services. A major challenge is to translate these assets into new streams of income and wealth at a time when prices for timber, pulpwood and other products are relatively stable or declining. Markets for ecosystem services could potentially provide financial benefits from the sale of ecosystem services, improved human capital from associated training and education, and strengthened social capital due to investment in local cooperative institutions.

Box 2 *Rough estimates of forest-dependent poor*

Grouping	**Estimated population**
Indigenous peoples who depend primarily on natural (usually closed canopy) forests for their livelihoods (hunting, gathering, shifting cultivation)	60 million
Rural people who live in or at the margin of natural forests or woodlands who rely on the forest as a safety net or for supplemental income	350 million
Smallholder farmers who grow farm trees or manage remnant forests for subsistence and income	500 million–1 billion
Artisans or employees in formal or informal forest-based enterprises	45 million
Estimated total	**0.955–1.455 billion**

Sources: Calibre & SCC (2000); Krishnaswamy & Hanson (1999)

Table 4 *Forest tenure in tropical producer countries*

Country	**Public land (million hectares)**		**Private land (million hectares)**	
	Administered by government	**Reserved for indigenous & community groups**	**Indigenous/ community**	**Individual/ firm**
Brazil	423.7	74.5	0.0	57.3
Democratic Republic of Congo	109.2	0.0	0.0	0.0
Indonesia	104.0	0.6	0.0	0.0
Peru	no data	8.4	22.5	no data
India	53.6	11.6	0.0	5.2
Sudan	40.6	0.8	0.0	0.0
Mexico	2.75	0.0	44.0	8.3
Bolivia	28.2	16.6	2.8	5.4
Colombia	no data	no data	24.5	no data
Tanzania	38.5	0.4	0.0	0.0
Myanmar	27.1	0.0	0.0	0.0
Papua New Guinea	0.8	0.0	25.9	0.0
Cameroon	22.8	0.0	0.0	0.0
Central African Republic	22.9	0.0	0.0	0.0
Gabon	21.0	0.0	0.0	0.0
Guyana	30.9	0.0	2.8	0.0
Total	**926.05**	**112.9**	**122.5**	**76.2**

Source: White & Martin (2002)

3 Status of main ecosystem service markets

The past decade has seen the widespread emergence of systems of financial payments for ecosystem services (Landell-Mills & Porras 2002). This section provides an overview of the types of ecosystem service markets. It then describes, for the major ecosystem services (watershed protection, biodiversity protection, and carbon sequestration and storage), the types of payment mechanisms being used, some examples, the scale of current markets, and the potential for market growth. The final sub-section considers the overall scale of ecosystem service markets relative to other forest financial flows. The discussion touches upon critical strategic issues related to international competitiveness, legal frameworks, the politics of ecosystem service markets, equity concerns, and the challenges of institutional development. These issues are addressed in detail in Section 5.

Types of ecosystem service markets

Four broad types of market mechanisms for ecosystem services can be distinguished, in declining order of the level of government involvement:

1) **public payments to private land and forest owners to maintain or enhance ecosystem services:** in this system, governments determine what ecosystem services are priorities for protection, and pay landowners or managers directly to manage their land and forest for this purpose. Examples of public payment instruments include: permanent conservation easements (guarantees that such land will not be logged or farmed); contract farmland set-asides for conservation (such as North American and European set-aside programs); programs to co-finance investments in afforestation or sustainable forest management (SFM); and payments for the confirmed presence of endangered wildlife species. Generally, payments are made to individual landholders, but may also be paid to common-property forest owner groups or organized watershed users. Payments may be standardized or negotiated individually;

2) **open trading under a regulatory cap or floor:** in this system, a government defines a mandatory level of a specific ecosystem service to be provided, but to achieve this level the regulated party can choose either to comply directly with the requirement or to pay others – who are in a position to supply the service more cheaply – to do so. Essentially, government regulation creates demand, but independent buyers and sellers can respond flexibly by trading with one another. For example, to ensure no-net-loss of high-biodiversity wetlands, a system of 'tradable development rights' may be put in place. Then any land developer who wishes to convert a wetland must pay another landowner to restore a similar type and quality of wetland. Another example is carbon emission offset trading, whereby carbon polluters face a regulatory cap on emissions that they can meet either by reducing their own emissions or by paying other parties to do so or to sequester an equivalent amount of carbon;

3) **self-organized private deals:** this approach involves direct, usually closed, transactions between offsite beneficiaries of forest services and forest landholders responsible for the services. Instruments include the purchase of development rights to land and direct payment schemes for ecosystem services. For example, a company selling bottled water may pay upstream landowners to use best management practices on their land to ensure their supply of quality water. A conservation NGO may pay the owners of high-biodiversity-value forest for a long-term 'conservation concession,' analogous to a logging concession, to be managed explicitly for conservation. Government agencies may play a minor role in facilitating such deals through appropriate contract law; and

4) **ecolabelling of forest or farm products:** the fourth approach is also handled by private actors, but the payment for ecosystem services is embedded in a traded product. Producers sell forest or farm products produced under management systems certified to enhance forest ecosystem services. Products are sold to consumers who prefer to support suppliers who are good environmental managers. But there need be no direct transaction between the consumer and the producer of ecosystem services; rather, third-party certification or marketing agents are involved. Examples include Forest Stewardship Council wood and non-wood product certification, and 'salmon-safe' labelled products from farmers in the northwest US that maintain forest protection of waterways important for salmon.

The actual payments for ecosystem services to forest owners or producers for providing ecosystem services may take various forms: direct payment of a fixed sum, a fixed sum per hectare, or a fix sum per unit of ecosystem service produced; payment of a premium on farm or forest products sold; payment to a community or cooperative which in turn distributes income or services to its members; or payment to a third-party provider of technical assistance, infrastructure or other services.

Watershed protection services

The hydrological services of forests are among the most valuable of the many ecosystem services from forests – and indeed many if not most national parks and forests have often been justified in part based on their water benefits, as have many government regulations limiting private land-use. Unfortunately, the relationship between forest cover and the production of ecosystem services is complex, variable and in general not very well understood.[2] Although the relative importance of the ecosystem services will depend upon the interests of landowners and downstream beneficiaries, in general the most important services include the regulation of water flow, maintenance of water quality, control of erosion and sedimentation, and maintenance of aquatic productivity. These services are described in more detail in Box 3.

Rationale for financial approaches

Public-sector agencies have traditionally made most investments in watershed management, but that may be changing. Typically, funds for watershed management and protected areas come from government general revenues and are not based on the value of water that these areas provide. This approach has been effective in some places, but there are also serious limitations. One problem is that many governments have serious revenue shortfalls caused by ineffective tax systems or depressed economies. Burgeoning social welfare demands compete with public-sector investments in protected areas and natural resources management; the latter have actually declined in many countries during the past decade. A related problem is that using general revenues may not be equitable since some people and businesses use much more water than do others.

[2] The complex relationships between forests and the production of ecosystem services, and of the many persistent myths regarding these relationships, are covered in Pagiola et al. (2002), Kaimowitz (2000), Johnson et al. (2001), Chomitz and Kumari (1998), and Calder (1998).

There is also growing recognition that traditional watershed management projects, which rely either on regulatory approaches or subsidies to encourage the adoption of soil conservation techniques on private lands, have generally not proved effective (Kaimowitz 2000). Meanwhile, watersheds continue to degrade and most water-users around the world pay less than it costs to provide the service. Given these problems, investors and policy-makers around the world are exploring alternative, more effective and lower-cost approaches to achieve watershed management goals (Tognetti 2001, Trust for Public Lands 1997).

Types of payment schemes and examples

The desirability and potential for financial incentive mechanisms for watershed management varies widely from place to place. Differences in the nature of the service provided, who supplies it, who receives it, how economically important it is, and what legal and regulatory systems are in place are just a few of the factors that shape payment schemes. The main groups of beneficiaries include hydroelectric power generators, municipal water supply systems, irrigation systems, industrial users, and populations in flood-prone areas (Pagiola et al. 2002).

In most situations, forest-owner responsibilities to protect ecosystem services are poorly defined, as are the rights to be compensated for providing them. This is complicated by the difficulty of tracing the origin of the ecosystem service as one moves downstream. Furthermore, water-related ecosystem services are often thought of as public goods flowing from a mixture of private and public lands, for which downstream beneficiaries may thus be reluctant to pay. For these reasons, governments often retain an important or even predominant role in protecting water-related ecosystem services. Still, a variety of economic tools, including markets and other financial mechanisms, are being used to help restore, maintain and enhance water-related ecosystem services on forestlands. Diverse examples are presented in Table 5.

Self-organized private deals: in some situations, private entities have developed their own mechanisms to pay for watershed protection with little or no government involvement. These cases are more likely to be found where an ecosystem approach can provide water services at a lower cost than traditional treatment investments, where private interests need water quality or flow that goes beyond regulatory standards, or where there is no effective regulatory system in place. Financing is from private sources but

Box 3 *Biophysical relationships that link forests, water and people*

The biophysical relationships between forests and water are highly variable from one location to another depending on climate, soils and vegetation types; there is no substitute for site-specific information. The following are a few simplified basic relationships to keep in mind.

Forests can slow the rate of runoff in a watershed: forest vegetation takes up water and delays the time to soil saturation (after which water pools or runs off the land into the nearest watercourse). Forest soils also usually have a higher water storage capacity than non-forest soils (Falkenmark et al. 1999). The more complex structure of the forest ground surface and underlying soil allows more efficient soil infiltration compared to a deforested watershed. By slowing the rate of runoff, forests may help to minimize flooding in smaller watersheds (although they will not influence large-scale flooding).

Forests can reduce soil erosion and sedimentation of waterways: interception of rain and snowfall by forest canopies means that less water falls on the ground compared to a deforested watershed. Understorey forest vegetation and leaf litter protects the soil from the impact of rain that does fall through the canopy. Extensive root systems help hold soil more firmly in place and resist shallow-seated landslides compared to clear-cut or heavily disturbed watersheds. Sedimentation levels in forested watersheds are generally lower than in nearby agricultural or urbanized watersheds, but the degree depends on soil types, topography and climate (Falkenmark et al. 1999).

Forest soils filter contaminants and influence water chemistry: forest soils are more waterlogged than other soils (except wetlands) and contain more nutrients, allowing them to filter out contaminants (Falkenmark et al. 1999). Clearing and cultivating forest soils tends to greatly accelerate decomposition and release large amounts of nutrients that leach into groundwater, surface water runoff, and streams. For example, streams in agricultural areas in temperate regions typically have nitrate levels ten times higher than streams in nearby forested watersheds (which is also partly the result of fertilizer applications).

Forests reduce the total annual water flow in a watershed: contrary to popular opinion, forests generally reduce the total annual streamflow (Calder 1998). This is because trees consume water for transpiration, which is then evaporated back into the atmosphere. In general, trees consume more water than other types of vegetation, including grasses and annual crops. The degree to which forests reduce streamflow, however, depends on various factors. For example, shallow-rooted trees tend to use less water than deep-rooted trees. Young regenerating forests tend to use much more water than mature and old-growth forests.

Forests can increase or decrease groundwater recharge: forest cover can lower groundwater recharge because more precipitation is intercepted by vegetation and returned to the atmosphere through evapo-transpiration. In some areas, however, removal of forest cover can result in a crusting of the soil surface that reduces or prevents water infiltration and groundwater recharge (Falkenmark et al. 1999).

Forest loss shifts aquatic productivity: forest cover plays an important and complex role in sustaining aquatic productivity (Revenga et al. 2000). Trees shade waterways and moderate water temperatures. Woody debris provides fish with habitat while leaves and decaying wood provide nutrients to a wide array of aquatic organisms.

Forests may influence precipitation at a large regional scale, but the effect of forest cover on rainfall in most areas is limited: the distribution of forests is a consequence of climate and soil conditions – not the reverse. Some evidence suggests that large-scale deforestation has reduced rainfall in China and some climate models indicate that extensive forest losses in Amazonia and Central Africa could lead to a drier climate (Institute of Hydrology 1994). Still, afforestation is not an effective strategy to increase rainfall (Kaimowitz 2000).

Source: Johnson et al. (2001)

Table 5 *Examples of water market payments*

Name of case study	Water-related ecological service provided	Supplier	Buyer	Instruments	Intended impacts on forests	Payment
Self-organized private deals						
France: Perrier Vittel's payments for water quality	Quality drinking water	Upstream dairy farmers and forest landholders	A bottler of natural mineral water	Payments by bottler to upstream landowners for improved agricultural practices and for reforestation of sensitive infiltration zones	Reforestation but little impact because program focuses on agriculture	Vittel pays each farm about US$230 per hectare per year for seven years. The company spent an average of US$155,000 per farm or a total of US$3.8 million
Reforestation but little impact because program focuses on agriculture	Regularity of water flow for hydroelectricity generation	Private upstream owners of forest land	Private hydroelectric utilities, Government of Costa Rica and local NGO	Payments made by utility company via a local NGO to landowners; payments supplemented by government funds	Increased forest cover on private land; expansion of forests through protection and regeneration	Landowners who protect their forests receive US$45/hectare/year, those who sustainably manage their forests receive US$70/hectare/year, and those who reforest their land receive US$116/hectare/year.
Cauca River, Colombia: associations of irrigators' payments	Improvements of base flows and reduction of sedimentation in irrigation canals	Upstream forest landowners	Associations of irrigators; government agencies	Voluntary payments by associations and government agencies to private upstream landowners; purchase by agency of lands	Reforestation, erosion control, springs and waterways protection, and development of watershed communities	Association members voluntarily pay a water use fee of US$1.5–2/litre on top of an already existing water access fee of US$0.5/litre. The total investment was over US$1.5 billion between 1995–2000
Trading schemes						
United States: nutrient trading	Improved water quality	Point-source polluters discharging below allowable level; non-point source polluters reducing their pollution	Polluting sources with discharge above allowable level	Trading of marketable nutrient reduction credits among industrial and agricultural polluting sources	Limited impact on forests; mainly the establishment of trees in riparian areas	Incentive payments of US$5–10 per acre
Australia: irrigators financing upstream reforestation	Reduction of water salinity	New South Wales State Forests (state government agency)	An association of irrigation farmers	Water transpiration credits earned by State Forests for reforestation and sold to irrigators	Large-scale reforestation, including planting of desalination plants, trees and other deep-rooted perennial vegetation	Irrigators pay US$40/hectare/year for ten years to NSW State Forests. Revenues are used by State Forests to reforest on private and public lands. Private landowners receive an allowance but rights remain with State Forests.

Table 5 (continued)

Name of case study	Water-related ecological service provided	Supplier	Buyer	Instruments	Intended impacts on forests	Payment
Public payment schemes						
New York City: watershed management program	Purification of New York City's water supply	Upstream landowners	Water users taxed by New York City with supplemental funds provided by federal, state and local governments	Taxes on water user; New York City bonds; trust funds; subsidies; logging permits; differential land-use taxation; development rights; conservation easements; development of markets	Adoption of low impact logging; retirement of environmentally sensitive land from agricultural production; forest regeneration	Dairy farmers and foresters who adopted best management practices were compensated with US$40 million, which covered all their additional costs. Foresters who improved their management practices (such as low impact logging) received additional logging permits for new areas, and forest landowners owning 50 acres or more and agreeing to commit to a ten-year forest management plan are entitled to an 80% reduction in local property tax
Columbia: environmental services tax (eco-tax) for watershed management	Regularity of water flow for industrial uses; regularity and water purity for drinking water	Private landowners and municipalities	Industrial water users and municipalities	Eco-tax on industrial water users; payments by municipalities and watershed authorities to landowners	Improved forest management; expansion of forests	NA
State of Paraná, Brazil: public redistribution mechanism	Rehabilitation of private and public areas for watershed protection	Municipalities and private landowners	State of Paraná	Public-sector redistribution mechanism: State provides additional funds to those municipalities with protected areas and which harbour watersheds that supply neighbouring municipalities	Rehabilitation of degraded forest areas	US$170/hectare
US: conservation reserve program	Reduction of soil erosion; improvement of water quality and regularity of stream flow	Owners of cropland and marginal pasture lands	US Department of Agriculture	Conservation easements; restoration cost-share agreements; yearly rental payments to landowners for engaging in conservation; additional incentive payments	Though the program is directed at farms, advantages to trees are many: tree-planting, strips, riparian buffers, grassed waterways, field windbreaks, shelter belts, living snow fences, and establishment of bottomland timber	Farmers receive US$125/hectare/year and are compensated for 50% of costs to establish approved conservation practices. Total government cost: US$1.8 billion/year

Source: Johnson et al. (2001), Perrot-Maître and Davis (2001), Pagiola (2002)

may take various forms, including user fees, transfer payments, land purchases, cost-sharing arrangements, and/or low-interest credit.

In France, for example, the most important water sources for Perrier-Vittel, the world's largest bottler of natural mineral water, are in heavily farmed watersheds where nutrient runoff and pesticides threaten the aquifers the company relies on. Perrier-Vittel found that reforesting sensitive infiltration zones, financing farmers to build modern facilities, and switching to organic farming practices are cheaper than building infiltration plants.

In Colombia, large agricultural producers in the Cauca Valley assess their own fees through their water users' association in order to finance watershed management practices in upland areas and thereby improve base flows and reduce sedimentation in irrigation canals. These practices include reforestation, erosion control on steep slopes, land purchases and protection agreements for springs and stream buffers, and economic development in upland communities.

Neither case required legal or regulatory reform; rather, the contracts were based on intensive negotiations between the potential buyer and seller of water services. A critical factor affecting their performance was that both efforts developed a participatory process early on to negotiate the actions and payments. Public-sector institutions played support roles in both cases. In the Perrier-Vittel case, a government research agency helped finance and conduct research that led to the program. In Colombia, a regional public development agency carries out some of the watershed management activities and provides technical assistance to local communities and landowners carrying out watershed protection.

Open trading schemes: trading schemes are beginning to emerge in countries with stronger environmental regulation, where government sets either a very strict water quality standard or a cap on total pollution emissions. In most cases, individual facilities or landowners have a defined maximum allowable amount of emissions they can release. The opportunity for trading requires the government to say, in effect, that it does not care who takes action as long as the overall standard is met or the cap is not exceeded. Emission credits are earned based on the production of emissions lower than the set standard and companies and landowners can make economic decisions as to whether it is cheaper to lower their emissions or to buy credits from others who have been able to do so.

In the US, for example, highly regulated factories (or point sources) that must spend large sums on pollution control technologies to comply with their limits on nitrogen and other organic pollutants are paying unregulated farmers (or non-point sources) in the Midwest to reduce their emissions. Trading allows those factories seeking to reduce their emissions to find the most cost-effective means of doing so. And, since the farmers can often achieve significant reductions at a fraction of the cost to factories, pollution standards can be met at less cost to factories and to the community as a whole. In Australia, land-clearing has exacerbated salinization problems in many parts of the Murray-Darling Basin. This occurs because the lost vegetation no longer takes up water and transfers it back to the atmosphere, so watertables rise and bring dissolved mineral salts to the surface. New South Wales State Forests, a state government agency, recently launched a pilot project in which downstream irrigation farmers are purchasing transpiration credits from State Forests, who are planting trees on state land upstream (Brand 2002). This pilot project is designed to test the possibility of generating a new market in water transpiration to benefit irrigation farmers and other water users. If the pilot is successful, farmers, other water users and governments could purchase units of transpired water from landowners who planted forest or restored native vegetation. The next step in establishing this trading scheme would be for the government to establish forest cover targets for individual landowners or watershed areas.

Financing for trading schemes typically comes from those companies or landowners that have found that buying credits or units from other sources is cheaper than changing their own processes to comply with the regulatory limitation. Authority for trading schemes, however, must come from state, federal or local regulatory agencies. A strong regulatory system and effective monitoring systems are key requirements for any trading scheme.

Public payment schemes: in public payment schemes, government or a public-sector institution pays for the watershed service. Financing can come from various sources, including general tax revenues, bond issues, or user fees. Payments are made to private landowners and private or public resource managers. Box 4 discusses one recent national scheme developed by Mexico.

***Box 4** A new fund to finance forest ecosystem services in Mexico*

The Government of Mexico recently announced the creation of a new, US$20 million fund to pay Indigenous and other communities for the forest ecosystem services produced by their land. Indigenous and other communities own approximately 80% of all forests in Mexico – totaling some 44 million hectares – as collectively-held private land. The Mexican Forestry Fund has been under design since 2002, guided by a consultative group with government, NGO and industry representatives. The purpose of the Fund is to promote the conservation and sustainable management of natural forests, leverage additional financing, contribute to the competitiveness of the forest sector, and catalyze the development of mechanisms to finance forest ecosystem services. Operational manuals are being prepared and priority conservation sites have already been identified. The Fund proposes to pay US$40/hectare/year to owners of deciduous forests in critical mountain areas and US$30/hectare/year to other forest types.

New York City's watershed management program is an alliance between federal, state and municipal governments to protect water quality in the Croton and Catskills watersheds that supply the city's nine million residents with some of the highest quality drinking water in the United States (Box 5). In Brazil, the state of Paraná has an ecological tax to finance payments to those municipalities that take action either on their own or in cooperation with private landowners to protect watersheds (see Box 6).

In both cases, intensive negotiations between downstream and upstream governments, businesses and citizens' groups were necessary to establish these mechanisms. Significant changes in the regulatory environment were also needed to enable downstream beneficiaries to pay for watershed improvements in upper watersheds. Because of the public goods nature of hydrological services, publicly financed transfer payments are likely to remain the most common financial mechanism used to protect water-related ecosystem services.

Current status of watershed service markets

Demand is the main driver of watershed markets and the private sector dominates their establishment. Landell-Mills and Porras (2002) found that in 62 cases of watershed protection markets in 22 countries (24 cases in eleven tropical producer countries), the private sector accounted for 65% of sellers and 60% of buyers of watershed services. Private investors included companies for whom watershed properties are a key input to their production capabilities, companies who are required to offset their water pollution, and private home-owners who use water for everyday functions. Still, governments are the most influential buyers of watershed services. Agencies such as water boards and electricity suppliers have the most defined interest in maintaining water flow and quality. Although individual landowners are the primary sellers of water services, governments also play a role in maintaining supplies.

Of the various types of watershed payment mechanisms, Landell-Mills and Porras (2002) found that intermediary-based transactions are most common, accounting for 44% of all mechanisms employed among the 62 cases. Intermediaries either have significant local knowledge or are established specifically to manage the transaction process and include NGOs, government agencies and communities. Intermediary-based transactions are used as a way of pooling demand and for risk-sharing and fundraising.

Of the cases studied by Landell-Mills and Porras (2002), 68% involved local markets while only 11% were national and 3% were international. In larger markets, downstream beneficiaries of watershed properties are less willing to pay for upstream water protection and, where watersheds cross political boundaries, other types of risks may prevent payments from occurring. The majority of markets are characterized as emerging, while the most mature markets rest in developed countries, most notably the US.

As indicated in the examples given above, benefits are highly variable from one watershed to the next. In many watersheds, the opportunities for watershed protection payments do not yet exist or are extremely limited. This is especially true in remote, very large, or sparsely settled watersheds and in countries with poorly defined or ineffective legal and regulatory frameworks. In other places, the opportunity is there but its development is hindered by a lack of

***Box 5** New York City pays for watershed management*

Three watersheds serve nine million people in New York City and surrounding suburbs. The watersheds are 830,000 hectares in size (nearly the size of Delaware) and deliver 1.2 billion gallons of water per day. New York City has historically had high-quality drinking water. It was able to avoid the water-related problems that plagued most other cities until the 1980s, when suburbanization, destructive road construction, and highly concentrated farming activities polluted major watersheds.

City commissioners initially turned to filtration as the solution to clean up non-point source contamination, but it would cost US$4–6 billion dollars annually to filtrate just one watershed. Initial calculations showed that a comprehensive program of watershed protection would cost far less than filtration, would maintain water quality even more effectively, and would produce numerous other benefits. Instead of paying to clean up the results of degrading the water, the City decided to invest in preserving the 200 km^2 of rural Catskill environment that was responsible for providing it with the world's best urban water. Farmers and City commissioners met and developed a plan that would best suit both actors.

Termed 'whole-farm planning', the program requires the City to pay both the operating costs of the program and the capital costs for pollution control investments on each farm as an incentive to farmers to join. Farmers then administer the program through a self-selected Watershed Agricultural Council, which provides the technical assistance needed to custom-design pollution control measures for each farm, maximizing their effectiveness and minimizing their cost. The measures are selected for their pollution control benefits and are also designed into and integrated with farmers' business plans and management practices. Thus, farmers not only solve their pollution problem cost-free, but they also gain significant ancillary benefits as well. Five years after implementation, 93% of all farmers were participants in the program. Whole-farm planning successfully reduced watershed pollution loads and enabled the City to avoid the multi-billion dollar cost of filtration.

information about the source of the ecosystem service and who exactly benefits from it. Even where this is known, the beneficiaries of the service may have little interest in paying for a service they now believe they are getting for free.

Hydroelectric generators, municipal water systems, irrigators and industrial users, rather than the general population, are the most likely beneficiaries to pay for watershed services – since their relationship to the service is more direct, regular and predictable. A variety of innovative financing mechanisms are being used in watershed management, but transfer payments from downstream water users to upstream stakeholders for ecosystem conservation are the most common approach and account for the largest current source of financing by far. These systems do not involve the direct buying and selling of services *per se*, but rather the 'selling' of land-uses that generate those services. Overall, there is no blueprint that fits all situations: mechanisms tend to be site- and user-specific, depending on the nature of the ecosystem services, the number and diversity of stakeholders and the legal and regulatory framework in place.

Self-organized private deals are few, are likely to occur when the water services provided are private goods (drinking-water supply, electricity, agricultural products), and will be limited to the particular watersheds upstream of their investment where a strong link between land-use actions and watershed service can be demonstrated. These deals tend to take place only if the monitoring and transaction costs are covered by the market price received or can be subsidized. Trading schemes are rare – especially in developing countries – but growing, and private-sector participation in trading schemes stems from opportunities for large cost savings.

Scope for increased demand

The future scope for using financial incentives to encourage the conservation of forest watersheds – particularly in developing countries – is potentially huge for at least three reasons. First, the global demand for clean water is immense. The global population tripled in the last 100 years, but water use increased sixfold. Most population estimates project that the global population will grow by two billion over the next 30 years and another one billion in the subsequent 20 years – and virtually

all of this growth will take place in developing countries. These trends suggest that water demand will either double or triple current use over the next 50 years. In India, for example, urban and industrial use is projected to increase 135% over the next 40 years (Dudley & Stolton 2003).

Second, the majority of the world's population lives downstream of forested watersheds, making them all susceptible to the costs of watershed degradation. One rough estimate is that about 13% of the world's land area is currently needed to protect water supplies for the global population – an area that will grow with population. These downstream populations, and their interest in reducing vulnerability, flooding and degradation are likely to grow with education and spending power. Already, some 40% of the world's largest cities rely on protected areas and multiple-use forests for their drinking water (Dudley & Stolton 2003); this includes 19 of the largest cities in the tropics (Annex 2). Payments for afforestation and agroforestry establishment may be justified in many more watersheds where forests were historically cleared.

Third, investments in sustainable watershed management are often substantially cheaper than investments in new water supply and treatment facilities. By investing approximately US$1 billion in land protection and conservation practices, New York City has avoided spending US$4–6 billion on filtration and treatment plants (Echavarria & Lochman 1999). Other cities in the United States – Portland, Oregon; Portland, Maine; and Seattle, Washington – have found that every US$1 invested in watershed protection can save anywhere from US$7.50 to nearly US$200 in costs for new filtration and water treatment facilities (Trust for Public Lands 1997). In South Africa, removing thirsty alien tree species in Cape Town's watershed and restoring native vegetation produces water at a fraction of the cost of water delivered through diversion or reservoir projects (Gelderblom & van Wilgen 2000).

Biodiversity protection services

Biodiversity is defined as the variability among living organisms in terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. Components of biodiversity include genetic variability within species, populations of species, ecological communities, ecosystems and landscapes. Lowland and montane tropical rainforests probably hold more than 65% of all terrestrial species, while tropical woodlands hold a high share of all dryland species (Wilson 1992). Conservation of this diversity requires provision for all species and ecological communities of adequate natural and managed habitat to provide nesting sites, protective cover, clean water, breeding territory, food sources in all seasons, predator-prey balance, and the presence of interdependent species (such as pollinators). While human intervention serves to protect biodiversity in many tropical ecosystems, biodiversity is widely threatened by deforestation, fragmentation, forest degradation and pollution. Annually, an estimated 14.2 million hectares of tropical forest are lost to deforestation (FAO 2001).

Barbault and Sastapradja (1995) estimate that loss rates of tropical forest of just under 1% per annum could result in 1–10% of the world's species being lost over the next 25 years.

Scientific studies indicate that biodiversity cannot be conserved by a small number of strictly protected areas. Conservation must be conceived in a landscape or ecosystem strategy that links protected areas within a broader matrix of land-uses that are compatible with and support biodiversity conservation in situ (Agius 2001, McNeely & Scherr 2003).

Benefits of biodiversity protection

Biodiversity performs a wide range of services, including:

- **providing habitat conditions that support diverse wild plant, animal and microorganism populations of economic, subsistence or cultural value:** for example, wild animals account for 25% of protein requirements in West Africa and as much as 75% in Congo; in Botswana 50 different species account for 40% of protein consumption. Wild species are the source of traditional medicines basic to the health care of about 80% of people in developing countries. Over 5000 species of plants and animals are used for medicinal purposes in China alone. In dry ecosystems, open woodlands are critical sources of fodder for livestock herds (Kerkhof 2000). The health of natural freshwater and coastal fisheries is strongly affected by adjacent forests;

- **maintaining ecosystem functioning:** research indicates that increased species' diversity generally provides more opportunities for species' interactions, which in turn improves the rates of resource use that govern ecosystem efficiency and productivity. Species' diversity may increase the reliability of ecosystem function, especially under conditions of dynamic environmental change. Many of these functions are critical to agriculture and forestry. Bats, bees, beetles and other insects are the principal pollinators of fruit trees, most important oil crops, coffee, coconut and major staple food crops including potato, cassava, yams, sweet potato, taro and beans (Prescott-Allen & Prescott-Allen 1990). Worldwide declines in pollinator populations threaten both the yields of major food crops and the biodiversity of wild plants. For example, the estimated cost to North American farmers from the one-quarter decline in wild and domestic honeybees since 1988 is US$5.7 billion per year (Buchmann & Nabhan 1998). Ecosystem functions are also critical for controlling human and livestock disease vectors (Weinhold 2004);
- **conserving genetic and chemical information of potential future utility:** for example, the seed industry (the leading user of genetic resources) constantly seeks new genetic material to improve plant yields and performance, and draws on sources of genetic material from the wild. In 1993 in the US, 57% of the top 150 prescription drugs contained at least one major active compound from biological resources. 2–10% of the crop protection product market of US$30 billion was developed from natural genetic material (Landell-Mills & Porras 2002). The combined commercial worth of all genetic materials has been estimated at US$500–800 billion per year (ten Kate & Laird 1999);
- **providing insurance against future change:** for example, the greater resilience of diverse environments and species may be required to adapt to climate change;
- **providing spiritual, aesthetic and cultural values:** for example, nature tourists dependent on access to biodiverse habitats and wild species comprise 40–60% of all international tourists. Nature tourism is increasing at a rate of 10–30% a year. UK nature and beach tourism generates £14 billion per year – 3.5 times the annual level of public farm subsidies (Pretty 2002); and
- **ensuring the continued existence of wild organisms as legitimate claimants on earth's resources:** some conservation advocates and investors are driven by ethical, philosophical and religious imperatives to conserve biodiversity. Many consumers of 'biodiversity-friendly' products and investors in biodiversity-friendly companies are motivated by these concerns. The socially responsible investment community uses environmental screens that often include biodiversity protection. Socially screened portfolio assets in the US surpassed the US$2 trillion mark in 2001 (SIF 2001).

Market mechanisms

The market for biodiversity protection can be characterized as a 'nascent market'. Many approaches are emerging to remunerate financially the owners and managers of tropical forest resources for their good stewardship of biodiversity (Table 6). Diverse examples are listed in Table 7.

Land markets for high-biodiversity-value habitat: national governments (public parks and protected areas), NGO conservation organizations (eg the Nature Conservancy) and individual conservationists have long paid for the purchase of high-biodiversity-value forest habitats. Direct acquisition can be expensive, as underlying land and use values are also included. Local sovereignty concerns arise when buyers are from outside the country or even the local area, or where extending the area of non-commercial real estate reduces the local tax base. New commercial approaches – such as through conservation communities, ecotourism-based land protection projects and the eco-real estate projects being organized in Chile (Corcuera et al. 2002) – are being developed to encourage the establishment of privately owned conservation areas. These build on growing consumer demand for housing and vacation in biodiverse environments.

Payments for biodiversity-conserving use or management: a lower-cost approach to securing conservation is to pay only for the biodiversity services themselves by paying landowners to manage their assets so as to achieve biodiversity or species' conservation. Probably the largest-scale payments for land-use or management agreements are government agro-environmental payments made to farmers in North America and Europe for reforesting conservation easements and management contracts aiming to conserve aquatic and terrestrial

Table 6 *Types of payments for biodiversity protection*

Purchase of high-value habitat
• Private land acquisition (purchase by private buyers or NGOs explicitly for biodiversity conservation)
• Public land acquisition (purchase by government agency explicitly for biodiversity conservation)
Payment for access to species or habitat
• Bioprospecting rights (rights to collect, test and use genetic material from a designated area)
• Research permits (right to collect specimens, take measurements in area)
• Hunting, fishing or gathering permits for wild species
• Ecotourism use (rights to enter area, observe wildlife, camp or hike)
Payment for biodiversity-conserving management
• Conservation easements (owner is paid to use and manage defined piece of land only for conservation purposes; restrictions are usually in perpetuity and transferable upon sale of the land)
• Conservation land lease (owner is paid to use and manage defined piece of land for conservation purposes, for defined period of time)
• Conservation concession (public forest agency is paid to maintain a defined area under conservation uses only; comparable to a forest logging concession)
• Community concession in public protected areas (individuals or communities are allocated use rights to a defined area of forest or grassland in return for commitment to protect the area from practices that harm biodiversity)
• Management contracts for habitat or species' conservation on private farms, forests, grazing lands (contract that details biodiversity management activities and payments linked to the achievement of specified objectives)
Tradable rights under cap-and-trade regulations
• Tradable wetland mitigation credits (credits from wetland conservation or restoration that can be used to offset obligations of developers to maintain a minimum area of natural wetlands in a defined region)
• Tradable development rights (rights allocated to develop only a limited total area of natural habitat within a defined region)
• Tradable biodiversity credits (credits representing areas of biodiversity protection or enhancement that can be purchased by developers to ensure they meet a minimum standard of biodiversity protection)
Support biodiversity-conserving businesses
• Business shares in enterprises that manage for biodiversity conservation
• Biodiversity-friendly products (ecolabelling)

wildlife habitat (OECD 1998). In Switzerland, 'ecological compensation areas' using farming systems compatible with biodiversity conservation have expanded to include more than 8% of total agricultural land. In the tropics, diverse approaches include: nationwide public payments in Costa Rica for forest conservation (Chomitz et al. 1999); and payments by conservation agencies, such as the conservation concessions being negotiated by Conservation International (Rice et al. 2001), and forest conservation easements negotiated by the 'Cordão de Mata' project with dairy farmers in Brazil's Atlantic Forest in exchange for technical assistance and investment resources to raise crop and livestock productivity (McNeely & Scherr 2003). Some countries that use land taxes are using tax policies in innovative ways to encourage the expansion of private and public protected areas, as illustrated in Box 6 for Brazil.

Payment for private access to species or habitat: private-sector demand for biodiversity has tended to take the form of payments for access to particular species or habitats that function as 'private goods' but which in practice serve to cover some or all of the costs of providing broader ecosystem services. Pharmaceutical companies have contracted for 'bioprospecting rights' in tropical forests (Box 7). Ecotourism companies have paid forest owners for the right to bring tourists into their lands to observe wildlife, while private individuals are willing to pay forest owners for the right to hunt, fish or gather NTFPs.

Tradable rights and credits within a regulatory framework: multi-actor markets for ecosystem services have been established successfully – notably for sulphur-dioxide emissions, farm nutrient pollutants and carbon emissions – by creating rights or obligations within a broad regulatory framework. Developing such markets for biodiversity is more complicated because specific site conditions matter so much. The US has operated a wetlands' mitigation program since the early 80s in which developers seeking to destroy a wetland must offset that by buying mitigation credits. A variant of this approach is being designed for conserving forest biodiversity in Brazil by permitting flexible enforcement of that country's '50% rule', which requires landholders in Amazon forest areas to maintain half of their land in forest, as well as in other regions where lesser proportions of land are set aside for forest use (Chomitz 2002). Careful designation of comparable sites is required. Another approach under development in Australia is biodiversity credits.

Table 7 *Value of payments for biodiversity conservation: selected examples*

Payment scheme	Country	Type of payment/commodity	Estimated value
Critical Ecosystems Partnership (World Bank, Conservation International, Global Environment Facility)	Developing countries	Fund to finance diverse groups to protect biodiversity	US$150 million capitalization
Ejido financing of local Pas – 7 million hectares	Mexico		US$14 million
BOCOSA Project (Osa Penninsula)	Costa Rica	Payments to farmers to conserve their lands	US$24/ hectare/year
Payment for environmental services	Costa Rica	Compensation to forest owners for the ecosystem services of their lands, as included in 1996 Forest Law	US$221–344/ hectare/year Total: US$14 million
Shade-grown coffee	Mesoamerica	Coffee trees grown among other trees, enhancing biodiversity	US$5 billion for sale of shade-grown coffee in US alone
Privately protected areas	Chile	Private investments in land conservation including: private parks, land donations to national park system, conservation communities, eco-real estate and ecotourism, and private administration of government conservation lands	NA
Wetland banking	US	Developers who have mitigated off-site draw from bank of 'mitigation' credits to offset damage to wetlands as development is implemented	US$7,500–100,000/acre (cost of banking credits)
Bioprospecting	Worldwide	Biodiversity prospecting, primarily pharmaceutical, to market products and conserve forests	US$17.5 billion (natural-product drugs)
Ecological value-added tax	Brazil	Mechanism that compensates municipalities that have conservation areas. Stimulates improvement of existing areas or creation of new areas	US$150 million (Parana State) US$45 million (Minas Gerais)

Box 6 *Brazil's value-added tax for conservation*

Brazil has been actively promoting its protected areas as critical instruments for biodiversity conservation and watershed protection. Yet results have often been unsatisfactory. Strict government regulations restricting forest exploitation and requiring property owners to rehabilitate degraded areas have limited the profitability of the forest sector. Furthermore, lax enforcement has provided an incentive for landowners to disregard those regulations that have proven expensive to follow.

In 1991, the General Assembly of the State of Paraná passed a law requiring that 5% of the revenues it received from the Circulation of Goods and Services (ICMS), an indirect tax charged on the consumption of goods and services, be distributed according to environmental standards. 2.5% was to go to those municipalities with conservation units or protected areas and the other 2.5% to municipalities that supply water to neighbouring municipalities. The transfer is basically a compensation for the opportunity cost of development foregone by environmental protection but it is not calculated according to scientifically established relationships between forest cover and water improvement. The municipalities are in competition with other municipalities within Paraná for the ecological ICMS. The more areas within the municipalities that are involved in ecological activities, the more revenues the municipalities will receive from the State. But the more that the ecological tax motivates municipalities to expand protected areas, the less each such protected area will be worth at the margin, because the overall tax base expands slowly. Furthermore, the new tax revenues are not earmarked for activities that improve environmental protection locally. An innovative protected area quality ranking system has made the scheme – now adopted in over ten Brazilian states – more effective.

Sources: Perrot-Maître & Davis (2001), May et al. (2002)

***Box 7** From bioprospecting to botanicals*

Bioprospecting was viewed throughout the 1990s as a major potential source of financing for biodiversity conservation. The pioneering agreement between Costa Rica's National Institute of Biodiversity (INBio) and Merck for generalized research on tropical botanical species from a highly biodiverse set of ecosystems has not been followed by other company-country partnerships of this nature, where direct payments were agreed on a per hectare basis based on calculated returns from identifying new pharmaceuticals. Rather, the conservation potential of bioprospecting is coming from more indirect returns from the large role played by natural products and their derivatives – botanicals – as key active ingredients in high-value drugs. While a few countries have tithed financial earnings from bioprospecting to conservation, in most cases financial investments have taken place in parallel as a result of recognition of the importance of conservation for its multiple benefits, including the market.

Local and national benefits of partnerships are thus coming indirectly from sustainable economic activities based on raw material supply, capacity-building and support for biodiversity science, country capacity to undertake research and develop its own biodiversity, and diverse spin-off benefits to research institutions, local businesses and others. For example, while the National Cancer Institute maintains a joint venture with the government of Sarawak for research into two potential anti-cancer compounds, which provides Sarawak with flexible benefit-sharing arrangements over time, the Institute has abandoned a similar arrangement in Cameroon, and another pharmaceutical bioprospecting venture, Shaman Pharmaceuticals in the Amazon, has folded.

The importance of botanicals in medicine continues to be enormous. Natural products or entities derived from natural products made up eleven of the 25 best-selling drugs in 1997, with a 1997 value of US$17.5 billion. Between 10 and 50% of the ten top-selling drugs of each of the top 14 pharmaceutical companies are either natural products or entities derived from natural products.

There are also high values in other industries – seed, crop protection, horticulture, botanical medicine, personal and cosmetic care, and biotechnology sectors. The next generation of issues relate to establishing adequate legal frameworks, recognizing indigenous intellectual property rights, and creating multiple layers of access and benefit-sharing.

Source: Laird & ten Kate (2002)

In this system, legislation creates new property rights for private landholders who conserve biodiversity values on their land; such landholders can sell resulting 'credits' to a common pool. The law also creates obligations for land developers and others to purchase those credits. The approach requires that the 'value' of the biodiversity unit can be translated into a dollar value (Agius 2001).

Biodiversity-conserving businesses: conservation values are beginning to inform consumer and investor decisions. Ecolabelling schemes are developing that advertise or certify that products were produced in ways consistent with biodiversity conservation. The global trade in certified organic agriculture was worth US$21 billion worldwide in 2000 (Clay 2002). International organic standards are expanding to landscape-scale biodiversity impacts. The Rainforest Alliance and the Sustainable Agriculture Network certify coffee, bananas, oranges and other products grown in and around high-biodiversity-value areas. The Sustainable Agriculture Initiative is a coalition of multi-national commercial food producers (Nestle, Dannon, Unilever and others) who are seeking to source commodity supply from producers who are protecting biodiversity. In 2002, over 100 million hectares of forest were certified as well-managed (a fourfold increase over 1996), although only 8% of the total certified area is in developing countries, and most of that is in temperate forests.

Current market demand

Available data suggest that biodiversity protection services are presently the largest market for ecosystem services. A McKinsey-World Resources Institute-Nature Conservancy team estimated the annual international finance for conservation (protecting land from development) market at $2 billion, with the forest component a large share of that. The buyers are predominantly development banks and foundations in the US and Europe (Arnold & Jenkins 2003; see Table 3).

In their study of 72 cases of markets for forest biodiversity protection services in 33 countries (63 cases in 28 tropical developing countries), Landell-Mills and Porras (2002) found that the main buyers of biodiversity services (in declining order of prevalence) were private corporations, international NGOs and research institutes, donors, governments and private individuals. Of these cases, 73% were international markets, and the rest were distributed among regional, national and local buyers. International and many national actors demanding biodiversity protection services tend to focus on the most biodiverse habitats (in terms of species' numbers), or those perceived to be under the greatest threat globally (high number of endemic species where habitat area has greatly declined).

Most of the private corporations identified in the Landell-Mills and Porras (2002) study were interested in biodiversity-friendly companies, horticultural companies concerned with ecosystem services, or pharmaceutical bioprospecting. Such private payments are usually site-specific. Local actors more commonly focus on protecting species or habitats of particular economic, subsistence or cultural value. Development of market-based conservation for tropical forest biodiversity is most advanced in Latin America. Although the highest overall level of expenditure on conservation is found in Africa, very little of this is channelled through market or payment schemes.

Projected growth in market demand

The fastest-growing component of future market demand for biodiversity services from tropical forests is likely to be in the ecolabelling of crop, livestock, timber and fish products for export and for urban consumers in middle-income tropical countries. Pressures continue to increase on major international trading and food-processing companies to source from suppliers who are not degrading ecosystem services (Clay 2002). Demand for organic farm products is increasing at 20% per year, and the international organic movement is strengthening standards for biodiversity conservation (IFOAM 2002). Voluntary biodiversity offsets are also a promising source of future demand, as many large companies are seeking ways to maintain their 'license to operate' in environmentally sensitive areas, and offsets are of increasing interest to them.

The cost of and political resistance to land acquisition are rising. The construction of biological corridors in and around production areas is an increasingly important conservation objective, while many of the most important sites for biodiversity conservation are in more densely populated areas with high opportunity costs for land. Thus, we are likely to see a major shift from land acquisition to various types of direct payments for easements, land leases and management contracts.

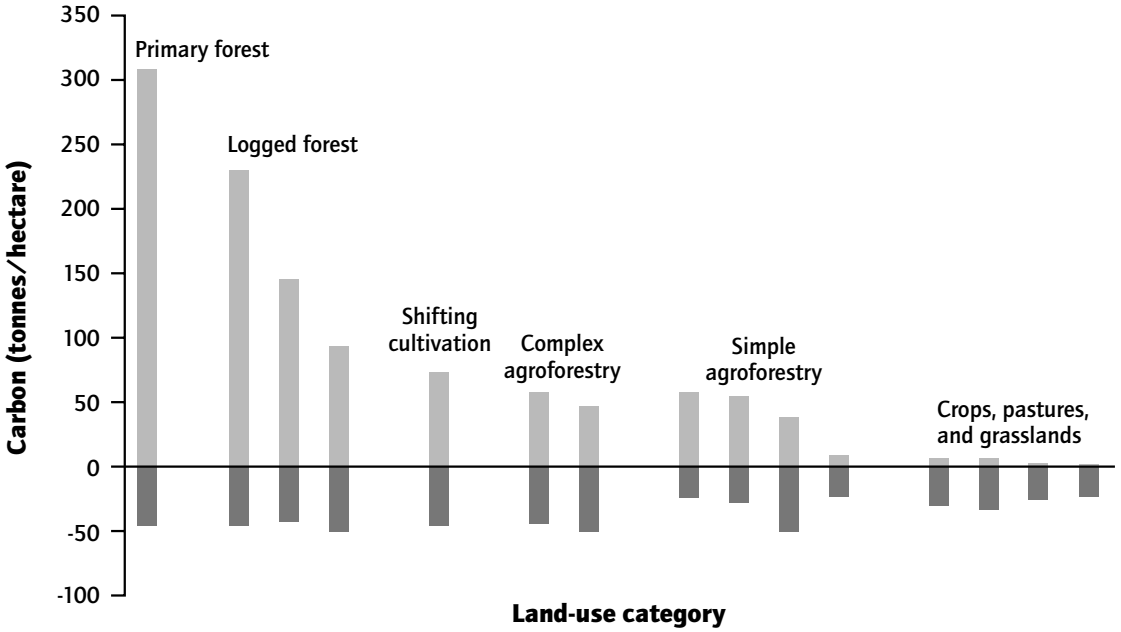
Carbon sequestration and storage

There is now a scientific consensus that human activities, including fossil fuel combustion, industrial processes, and land-use change, have led to rising levels of greenhouse gases, most notably carbon dioxide, in the atmosphere. The increased rate and magnitude of these gases have manipulated the 'greenhouse effect', a natural system that regulates the earth's temperature regime, to warm the earth. During the 20th century, the warmest in the past 600 years, global temperatures increased by 1 degree Fahrenheit. The ten warmest years have all occurred in the past fifteen years, the 1990s being the hottest decade on record. Experts expect more variable and extreme climatic events. Both regional and global assessments have indicated the profound impacts that climate change will have on water supplies, agricultural productivity, biodiversity and human health. While reducing global fossil-fuel emissions is essential to mitigate climate change, forest cover and management can also play an important role in both mitigation and adaptation – with a financial value that tropical forest producers may be able to capture.

Value of carbon sequestration and storage

Forests play an important role in the carbon cycle by absorbing carbon dioxide and releasing oxygen to the atmosphere through the natural process of photosynthesis. Carbon dioxide is converted to carbon (sequestered) and stored in the woody tissue (biomass) of the plant (Figure 2). The rate at which carbon is sequestered varies by the site, age, management and species' characteristics of the forest. Because tropical deforestation, forest fires and other land-use change contribute approximately 20% of global carbon dioxide emissions, forestry activities – to sequester carbon by promoting forest establishment and growth, or to avert the loss of standing forest resources from land-clearing, disease or fire – could potentially be an important strategy for slowing climate change. Forestry can also play an important role in strategies to adapt to climate change.

Figure 2 *Carbon sequestration in the humid tropics by vegetation type*



Source: Tomich et al. (2001)

Market mechanisms

Because fossil-fuel emissions account for the majority of total emissions, international policy action on climate change has emphasized emission reduction from such sources, including energy, transportation and waste. Forestry investment has been seen primarily as a flexibility mechanism by which carbon polluters could lower their costs by complying with part of their emission reduction targets through forest-based carbon sequestration. The market for carbon sequestration and storage from tropical forests has three major segments: the Clean Development Mechanism of the Kyoto Protocol; non-Kyoto trading schemes intended for eventual crediting; and voluntary carbon emission offsets for green organizations and companies.

The Kyoto Protocol: at the Earth Summit in Rio de Janeiro in 1992, the United Nations Framework Convention on Climate Change was signed and the issue of climate change came to the forefront of international environmental discourse. In 1997, the convention produced the Kyoto Protocol, requiring industrialized nations to reduce their greenhouse gas emissions by 5% below 1990 levels by 2012. These (referred to in the Protocol as 'Annex I') countries thereby set national standards to place caps on company emissions and establish a framework by which they may trade their emission credits. In order to reduce emissions at least cost, the Protocol provides three flexibility mechanisms: international emissions trading, allowing Annex I countries to trade emission permits; joint implementation, allowing Annex I countries to earn emission reduction units through projects in other Annex I countries; and the Clean Development Mechanism (CDM), allowing the generation of certified emission reductions from either energy or forestry projects in non-Annex I developing countries.

The CDM provides an opportunity for industrialized nations to meet part of their obligation for emission reductions (up to a maximum of 1% of their 1990 emission level for each of five years). Companies and agencies obliged to meet national greenhouse gas emissions' reduction requirements can do so at a lower cost than domestic abatement while providing host countries with an additional source of investment finance. The CDM will go into effect following Russia's ratification of the Kyoto Protocol, should that occur. At this time, only projects of 'afforestation' and 'reforestation' are eligible for the CDM in its first commitment period of 2008–2012. 'Afforestation' is defined under Article 3 of the Kyoto

Protocol as the conversion of land, which has had no previous forest cover for at least 50 years, to forest, while 'reforestation' is defined as the planting of forest on land which previously had forest but was seriously degraded. These may include diverse types of projects: agroforestry, community forest plantations, agroforest establishment, forest restoration, and large-scale industrial forest plantations. Other forest project types may or may not be included in future commitment periods, including fire control, improved forest management, and forest protection.

The rate at which carbon is sequestered varies by the site, age, management and species' characteristics of the forest. The Kyoto Protocol administers credit, called a certified emission reduction (CER), for each metric tonne of carbon dioxide reduced. CDM projects must meet strict criteria for the certification and registration of CERs. These include baseline forest cover, 'additionality' of carbon sequestration, the level of verified carbon emission offsets, and contribution to sustainable development. These add significantly to the transaction costs of projects.

Rules governing the CDM are still being debated but should be finalized in 2004. Several dozen pilot forest carbon projects have been established to develop experience and methodologies for carbon projects, including under several World Bank carbon funds described in Box 8.

Non-Kyoto market trading: although the US failed to sign the Kyoto Protocol, Americans largely support its fundamental cap-and-trade structure. Voluntary systems have developed in the shadow of Kyoto, encouraging US businesses, municipalities and universities to make verifiable reductions in their greenhouse gas emissions while developing trading partnerships. Such programs have emerged as an alternative market for domestic carbon trading, such as the Partnership for Climate Action, the Chicago Climate Exchange (CCX), and the Environmental Resources Trust (ERT). They have encouraged investment in projects that grow and conserve forests, creating carbon offsets for companies. Additionally, many US states have taken action independent of the federal government, initiating reforestation, afforestation and conservation schemes as part of their climate action plans.

***Box 8** World Bank funds invest in forest carbon projects*

The World Bank has launched three funds to invest in projects for reducing industrialized greenhouse gas emissions while promoting sustainable development and engaging public and private partnerships. The funds buy cost-effective CERs in developing countries as part of the CDM and in economies-in-transition under joint implementation. They have established a unique interface of carbon asset creation, private project finance, and intergovernmental market regulation.

The Prototype Carbon Fund (PCF) began operations in April 2000 and by June 2002 had contributions of US$180 million from six investing countries and 17 companies. The fund has allocated US$90 million to date (October 2003), primarily in renewable energy and energy efficiency projects. Two years after the creation of the PCF, the World Bank launched the Community Development Carbon Fund (CDCF) and the BioCarbon Fund. Because high transactions costs involved with the Kyoto Protocol have led to significant bias towards large-scale projects, poorer rural communities have been left out of the carbon market. The CDCF seeks to work with local intermediaries to lower transaction costs and enhance the lives of the poor through carbon financing. With a target size of US$100 million, the CDCF will finance small-scale projects with specific community development benefits. Such projects include renewable energy, energy efficiency, methane capture, and agroforestry.

The BioCarbon Fund buys CERs from land-use, land-use change and forestry projects admissible under the Kyoto Protocol and for diverse carbon sequestration and conservation projects under emerging alternative or voluntary carbon management programs. The fund's target size is US$100 million and it will target agricultural and forestry projects that enhance other ecosystem services, such as biodiversity and watershed protection, while improving the livelihoods of local people. Example projects include conservation agriculture – such as shade-grown coffee, agroforestry to restore degraded areas, improved agricultural practices, such as shifting from subsistence farming to organic agriculture – and reforestation. The fund is also looking into bundling projects in order to achieve optimum benefits for all stakeholders.

Sources: Prototype Carbon Fund (2003), Biocarbon Fund (2003)

***Box 9** Indigenous communities in Mexico sell carbon services to auto federation*

The Scolel Té project has allowed companies, individuals or institutions willing to offset their greenhouse gas emissions to buy emission reductions from agricultural and forestry projects in Chiapas, Mexico's poorest state. Buyers, including the International Federation of Automobiles, purchase credits from a local trust fund called Fondo BioClimático, which provides small-scale farmers with the technical assistance needed to switch from swidden agriculture to agroforestry. Local actors help farmers create plans for systems that either combine crops with trees or enrich fallow lands. All plans are assessed for maximum social, economic and climate sequestration potential. The fund supports projects including live fences, shade-grown coffee, plantations, tree-enriched barren areas, and the intercropping of forestry and agricultural crops. The projects are independently verified and certified by the Société Générale de Surveillance. These activities all provide substantial income to farmers to cover the costs of implementing new farming systems, to purchase foods and medicines, and to improve households. The new system has utilized traditional knowledge to make significant contributions to agriculture, biodiversity and livelihoods.

Source: Orlando et al. (2002)

The CCX, which planned to begin trading in October 2003, has developed a comprehensive set of guidelines to foster emissions' trading between participating entities. They include International Paper, American Electric Power, Ford Motor Company, the City of Chicago, and Tufts University. Participants must reduce their emissions to a level below their average between 1998 and 2001 and may invest in offset projects in the US, Mexico and Brazil. Offset activities include both forest and soil sequestration as well as agricultural methane conversion.

Retail 'green' markets: a third component of the carbon market is in voluntary payments by companies, individuals and organizations who wish to be environmentally responsible by making their activities 'carbon-neutral'. Such buyers undertake an internal 'carbon accounting' to then reduce emissions or purchase emission offsets. A number of companies and NGOs (such as the NGO Future Forests) have set up forest carbon projects in developing countries to serve this market by producing carbon offsets. Within the ERT, a non-profit which pioneers markets for environmental protection, the Ecolands program facilitates transactions between landowners and buyers who wish to buy carbon offsets and also invest in wildlife conservation and/or watershed restoration. ERT worked with the Rocking C Ranch to measure and sell carbon credits from the reforestation of southern Oregon riparian forest to the Oregon Climate Trust. In addition to trading sequestration rights, the project improved vital fish habitat and led to an enhanced forest management plan.

The rigour of the carbon accounting in these projects is variable, but increasingly buyers will demand quality comparable to that in Kyoto-compliant projects. An example of a transaction in this market is the Scolel-Te project in Mexico, funded by the International Automobile Federation (Box 9).

There are a number of ongoing efforts to develop criteria and standards for 'high-quality' forest carbon projects that would be guaranteed to have significant positive impacts on rural livelihoods and on biodiversity conservation. Such 'gold standard' carbon may sell at a higher price or be preferred by some buyers.

Current market demand and prices for carbon credits

Of the 75 payment schemes in 27 countries (29 payment schemes in 15 tropical producer countries) for forest-based carbon offsets surveyed by Landell-Mills and Porras (2002), 20 were registered as joint implementation projects under the Kyoto Protocol, while the rest were independent schemes. Twenty-four of the cases reviewed were in Latin America, while only five occurred in Africa. Unlike the other markets, the carbon market has given rise to a series of ancillary services such as investment funds, advisory services, insurance and legal counsel. The private sector dominates the market as a buyer of carbon credits, and its role is growing as supplier and intermediary. Most reviewed trades were internationally brokered.

The growing international concern for global climatic change is the driver of the carbon market. National, regional and local emissions' standards, as well as pressure from NGOs and insurance companies, have all been catalysts for action in the market. Most carbon exchanges are currently in an early stage of development, but their heightened emergence, along with ancillary services to reduce transaction costs, demonstrate the increasingly sophisticated nature of the carbon market.

Given restrictions on forest carbon trading through the CDM, it is possible to estimate the upper bound of potential income flows through that mechanism. If we assume a value of US$10/tonne of carbon, the maximum level would be US$300 million per year during the first commitment period of 2008–2012. This is based on the fact that land-use, land-use change and forestry can account for no more than 1% of the 5% decrease in emissions required for Annex I countries. Given the difficulty of establishing projects, the level is likely to be much lower. Few data are available on the value of carbon trades through the non-Kyoto and green retail markets, and much of this is proprietary. Estimates of the per-tonne price of carbon negotiated on these deals range from US$3 to US$40. The average deal in the World Bank's Biocarbon Fund (see Box 8) was US$3.88/tonne of carbon dioxide (US$14.23/tonne of carbon) between 1996 and 2002.

Market projections

As global commitments to reduce and offset emissions rise in later commitment periods, and with the eventual launch of binding US strategies, the demand for forest carbon offsets is likely to increase significantly. In July 2003 the European Parliament voted to approve the rules surrounding the world's first international market in greenhouse gases, the European Emissions Trading System. This market, expected to become operational in January 2005, will affect some 10,000 installations across 25 countries, instantly creating a market that some experts estimate could be worth around US$29.6 billion per year, although most of this would be for energy projects. Observers of the non-Kyoto markets note that they have been surprised by recent increases in the number of companies and other organizations seeking to offset their 'carbon footprints'.

A major question for tropical forest producers, however, is whether they will be in a competitive position to supply this demand. They will face competition from non-tropical forests and from non-forest sources of carbon sequestration and mitigation. On the other hand, it seems likely that any realistic global strategy to mitigate climate change will eventually need to focus attention explicitly on reducing the 20% of forestry-related emissions, both by reforming policies and by paying for such emission reductions.

While at this time, the non-Annex I (developing) countries contribute a modest share of total carbon emissions, it is estimated that in the near future they will account for a majority of emissions. A long-term global strategy to mitigate climate change must therefore ultimately involve the 'Annex II' developing countries. If (when) these countries make commitments to reduce or offset emissions, national markets for forest carbon could grow rapidly.

Niles et al. (2003) estimate that over the next 20 years, 48 major tropical and subtropical developing countries have the potential to reduce the atmospheric carbon burden by about 2.3 billion tonnes of carbon if all types of biocarbon projects are eligible. Given a price of US$10/tonne of carbon and a discount rate of 3%, this mitigation would generate a net present value of about US$16.8 billion collectively for these countries. This would require a significant global effort on more than 50 million hectares to implement carbon-friendly practices in agriculture, forestry and on previously forested lands. Such a goal would probably imply shifting from a project- to a program-based approach. Pretty et al. (2003) calculate that the carbon benefits of 40 sustainable agriculture and natural resource management projects in China and India alone provide offsets potentially worth US$324 million at US$5/tonne of carbon. Present international dialogue has not yet reached a point where it can enable the realization of this opportunity.

Scale of ecosystem market potential

Ecosystem service markets are certainly expanding rapidly. But to what extent do they represent a major new market for tropical forest owners and users of ecosystem services? We consider here estimates of the actual economic value of these services, the current scale of impacts on income and forest conservation, and the projected future scale of such impacts.

Economic value of ecosystem services

Table 8 presents a summary by Pearce and Pearce (2001) of the range of recent estimates of the economic value of ecosystem services from a hectare of tropical forest, assuming that non-market ecosystem values are actually captured through some

Table 8 *Estimated economic value of forests (US$/hectare/year unless otherwise stated)*

Forest good or service	Tropical Forests	Temperate Forests
Timber Conventional logging Sustainable Conventional logging Sustainable	200–4,400 (NPV) 300–2,660 (NPV) 20–440 30–266	-4000 to + 700 (NPV)
Fuelwood	40	–
NTFPs	0–100	Small
Genetic information	0–3,000	–
Recreation	2–470 (general) 750 (forests near towns) 1000 (unique forests)	80
Watershed benefits	15–850	10 to +50
Climate benefits	360–2,200 (gross present value)	90–400 (afforestation)
Biodiversity (other than genetics)	?	?
Amenity	–	Small
Non-use values	Not available	70?
Option values	2–12	12–45
Existence values	4,400 (unique areas)	

NPV = net present value

Source: Pearce & Pearce (2001)

market creation mechanism. The dominant values are carbon storage and timber (though timber value must be adjusted for loss of carbon in harvest wood). Conventional, unsustainable logging is more profitable than sustainable timber management. Other values do not compete with carbon and timber unless the forests have some unique features (in themselves or as habitat for unique species) or are subject to potentially heavy demand due to proximity to towns.

This analysis does suggest that valuing the ecosystem services would indeed have a huge impact on forest conversion. Converting primary forest to any other use other than agroforestry or very-high-value timber extraction is likely to fail a cost-benefit test. Converting secondary forest to logging, crops and ranching could make economic sense, while conversion to agroforestry makes a lot of economic sense assuming that most of the ecosystem services are retained (Pearce & Pearce 2001).

Current scale of markets

A rough back-of-the-envelope estimate suggests that the current value of international, national and local direct payments and trading markets for ecosystem services from tropical forests could be worth several hundred million dollars per year, while the value of certified forest and tropical tree crop products may reach as much as a billion dollars. While this is a large and significant amount, it represents a small fraction of the value of conventional tropical timber and other forest product markets. For example, by comparison the total value of tropical timber exports is US$8 billion (including only logs, sawnwood, veneer and plywood), which in turn is a small fraction of the total wood exports and domestic timber, pulpwood and fuelwood markets in tropical countries. NTFP markets are far larger still (Scherr, White & Kaimowitz 2001). The total value of international trade in NTFPs is US$7.5–9 billion per year, with another estimated US$108 billion in processed medicines and medicinal plants (Simula 1999). Domestic markets for NTFPs are many times larger (eg domestic consumption accounted for 94% of the global output of fresh tropical fruits in 1995-2000; FAO 2000). Nonetheless, these rough figures are quite interesting when compared with the scale of public and donor forest conservation finance summarized in Table 3. There is no way to know at this time how much total area of tropical forests receives financial benefits from these markets.

At this time, national government agencies are the largest-scale buyers of watershed services; conservation agencies (especially international) and overseas consumers of certified products are the leading buyers of biodiversity services; developed country utilities, private companies and NGOs are the leading buyers of carbon services.

Projected future scale of markets

It seems certain that the scale of markets for ecosystem services will grow rapidly. If the Kyoto Protocol is ratified, the CDM is implemented with relatively flexible rules, and the US develops a parallel carbon trading scheme, the market for carbon could expand dramatically, especially as obligations increase after the first commitment period.

Increasing water scarcity will result in more watershed service payments, especially around large urban areas, irrigation areas, etc. However, it is not necessarily the case that this will lead to natural forest conservation and afforestation unless the biodiversity services are also valued.

The growth in payments for biodiversity services will be greatest in high- and middle-income countries and to protect natural assets of especially high biodiversity value. It is still not clear that funding from conservation agencies and governments will be available for dramatically higher levels of payments. The greatest opportunities may lie in changing standards for agricultural production, although this will initially impact mainly on areas that produce commodities for export.

4 Benefits and risks to forest owners and producers

It is important for individual producers to understand the opportunities and threats of markets for ecosystem services before deciding to participate. It is also important for rural communities to play a proactive role in the design of markets wherever possible and to have in place local institutions that can help to negotiate fair deals with buyers that will not only provide individual producer benefits but also support community goals for landscape development.

Potential benefits

Payments for ecosystem services can potentially benefit forest owners and producers by increasing forest income, encouraging sustainable production, increasing the scale and value of forest assets, and providing non-income livelihood and community social benefits (Box 10).

Financial benefits

Like any type of market, markets for ecosystem services present both opportunities and risks for tropical forest owners and producers (Table 9). The degree of competition in both supply and demand will, of course, determine the prices paid for these services. Buyers will tend to seek the lowest-cost suppliers of services. In most current markets, potential supply far outstrips market demand, suggesting that prices will typically be fairly low.

Box 10 Types of compensation mechanisms for environmental services

- Direct payments to individual producers
- Direct payments to producer associations
- Provision of social services and infrastructure
- Price premiums for products
- Financing inversions for improving management
- Technical assistance and support for commercialization
- Projects of community ecotourism
- Expansion of rights over natural resources

Sources: Rosa et al. (2003), Scherr et al. (2001)

A major benefit for producers from regular, direct ecosystem service payments (from easements, concessions, access payments, etc) is the reliability of income, given that other income sources from forestry, farming and tourism, etc, are typically quite variable from season to season or year to year (Figure 3). Experience to date with ecolabelling and certification is more variable. In some markets, there is a sizable premium that more than makes up for the expenses of certification. In forest certification, premiums have tended to be modest (0–30%) and the major economic impact has been from preferred market access (Molnar 2003).

Because many ecosystem payments will provide only supplemental income, it makes sense to consider their role as a catalyst or enabling mechanism for adopting better management practices. Even a modest level of payment, reliably paid over many years, can provide the increment to net income that makes a sustainable forest enterprise viable, justify the restoration of degraded forest, or increase resource-use efficiency. For low-income producers in tropical countries, even small increments to income can function as a strong incentive for conservation. Figure 4 illustrates how payments for ecosystem services would be able to provide the incremental income to make SFM in the Colombia lowlands profitable.

Some producers may be able to sell several ecosystem services from the same forest. The Landell-Mills and Porras (2002) study found 17 cases in the tropics of bundled environmental services. Most of these mixed carbon sequestration and biodiversity protection, and sold the two together. A few cases used the 'shopping basket' approach that is economically more efficient but is more difficult to implement under conditions of incomplete markets.

Non-financial benefits

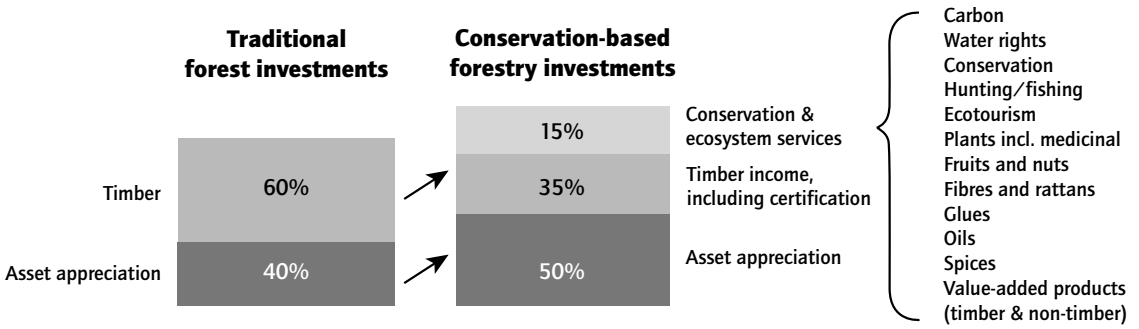
Producing for ecosystem service markets can provide non-income benefits to forest owners and producers. Producing and protecting ecosystem services for outside buyers may have important co-benefits for locally-valued ecosystem goods and services, such as: higher-quality local water supplies; the establishment of new forest resources such as fuel, medicines and wild game; and improved air quality due to a reduction in forest fires. New or healthier forest resources may also help to reduce landslides and control soil erosion and sedimentation.

Payments made to community organizations can facilitate social investment and may help to protect forest-based cultural heritage. Participation in payment-for-ecosystem-services schemes can build local capacity for enterprise management

Table 9 *Potential benefits and threats of ecosystem service markets for local livelihoods*

Potential contributions of ecosystem service markets to reduce rural poverty
• Establish higher productivity and more sustainable farming and forest systems for local livelihoods (biomass, water, biodiversity services)
• Provide cash income that can be used by local people for consumption or investment purposes (from ecosystem service payments, increased gathering of products for sale, improved enterprise productivity)
• Restore the local ecosystem services of forests and agroforestry, such as watershed maintenance, pollinator species and soil control
• Provide a resource for community social investment
• Contribute to improved business and market organization in local communities
• Provide training and technical assistance and improve environmental knowledge and appreciation
Potential threats of ecosystem service markets to local livelihoods
• Loss of rights to land, harvest products or environmental services. If a project infringes upon the sovereignty of local people, their rights to access the resources or services that the land provides could be lost
• Loss of land ownership rights. In the case of a large entity purchasing land for the objective of selling ecosystem services, local ownership claims may be ignored
• Loss of employment when local forest harvesting rights are excluded for ecosystem service protection
• Loss of control and flexibility over local development options and directions, where easements or long-term contracts specify a narrow range of management alternatives

Figure 3 *Profiting from investments in ecosystem services*



A long-term commitment to conservation and sustainable forest management can increase asset returns by 15-25% from:

- **higher inventory levels**
- **higher valuations of older stands**
- **biodiversity preservation**
- **reduction of risk from pests & disease outbreaks**
- **reduction of risk from government regulation on timber flows**

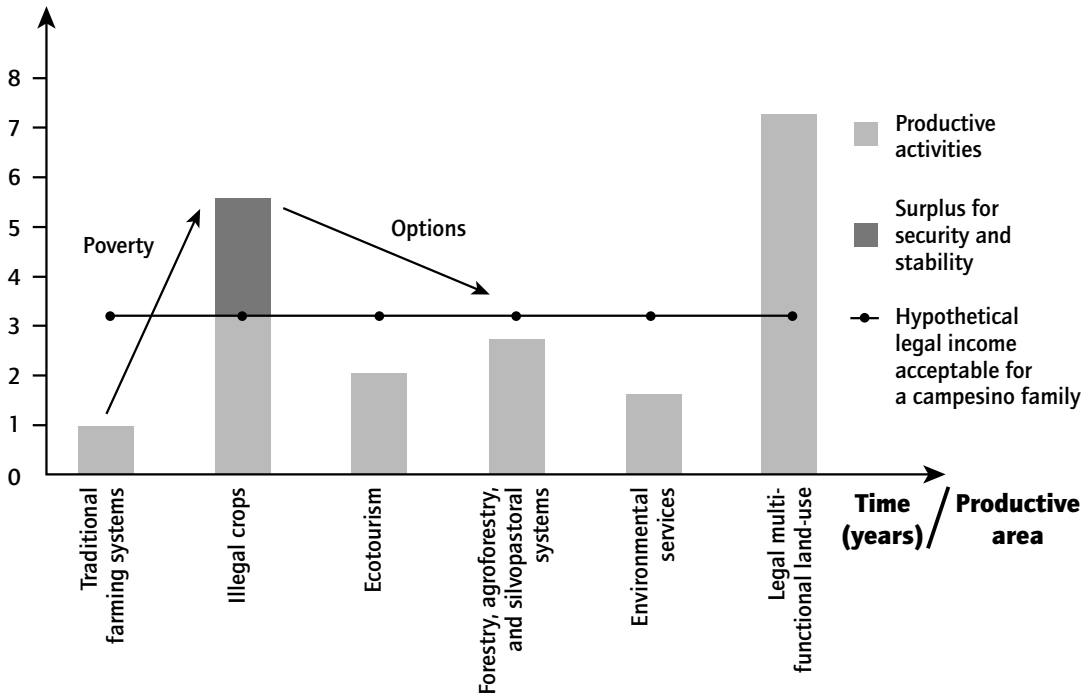
Source: Pacific Forest Trust (based on a number of US forest companies), in Arnold & Jenkins (2003)

and development, marketing and social organization. Markets may spur the formalization of resource tenure and the clarification of property rights over ecosystem services. Moreover, payments for ecosystem services explicitly recognize forest managers for their role as environmental stewards, which can potentially strengthen their position in negotiations with beneficiary groups.

Benefits for different types of producers

The opportunities and threats of markets for ecosystem services will play out differently for commercial timber producers, forest communities, farming communities and government forests.

Figure 4 *Bundling of income streams*



Source: Adapted from Villa Lopera, A. (2000). Figure 2. Hypothetical behaviour of rural producer facing different rural productive activities and average income potential from CDM forest projects. In Analisis preliminary de beneficios colaterales.

Commercial timber producers

Whether forest management for timber or non-timber forest products is compatible with supplying ecosystem services depends very much on the specific service to be delivered and on biophysical conditions. Ecosystem services are typically quite compatible with the production of NTFPs, but carbon sequestration, for example, will commonly compete with income from timber produced on the same piece of land. Many producers report that managing forests for ecosystem services (for example, to comply with timber certification requirements) has resulted in greater efficiency of production (Conroy 2001). Forest owners with more limited resources will commonly wish to produce multiple outputs (Scherr et al. 2001). Timber companies can often benefit from the diversification of income sources, and some private companies have reported earning more than 10% of their income from ecosystem service payments. Advances in forest ecology are also beginning to identify a wider range of forest management systems that will produce higher levels of ecosystem services than conventional systems, especially for carbon and watershed services.

Modifying forest management in order to protect or enhance ecosystem services may affect the asset value of forests. Where systems lead to enriched forest stands or enhanced value for recreation, tourism or other forms of access, asset value may increase substantially. Where permanent easements or long-term leases prevent other economic uses, asset value may decline.

Forest communities

Local forest communities who rely heavily on their forest resource asset for income may welcome ecosystem service payments as part of a 'portfolio' of income streams. Business strategies will usually seek to ensure both subsistence security and sustainable income in the face of market risks and uncertainties.

Biodiversity payments intended to achieve the full protection of endangered habitats (land acquisition, permanent easements, and long-term leases) must typically pay the full opportunity cost of the productive value of the land; otherwise, landowners will not relinquish their rights. In remote areas, that value may be a fairly low. Elsewhere, available payments for watershed, biodiversity or carbon

services will not necessarily compensate for the full opportunity costs of leaving the land or forest out of productive use, nor cover the entire cost of adopting management systems that protect ecosystem services. Moreover, given poorly developed market institutions, transaction costs can be very high, so that forest producers will typically receive payments that are much less than the original buyer pays for the service (see next section). These modest payments are therefore most attractive to producers who are already managing ecosystem services fairly well and thus incur few additional costs. Indeed, forest communities who have a strong historical record of forest biodiversity conservation and management have recently argued that they should be remunerated for good stewardship. Many payment schemes, however, tend to target producers with the most destructive practices, creating a problem of perverse incentives.

An advantage for poorer and more remote forest communities is that, unlike conventional forest and agricultural markets, they can potentially sell ecosystem services even with poor market infrastructure, weak market institutions and unreliable access to external inputs. Some observers also suggest that for indigenous communities without a market-oriented culture, ecosystem service markets offer a greater opportunity than forest-product markets (Richards 1997). At this time, payments for the conservation of globally important biodiversity and for region-specific watershed protection services are the most likely source of payments for such forests.

There is also an emerging dialogue within the international indigenous peoples' community (and to some extent, the rural development community), especially in Latin America, that sees a primary role for indigenous and rural communities as the stewards of nationally and globally important ecosystem services. In order to realize such a role, however, the structure of ecosystem service payments and markets needs to be shaped to reward good stewardship, rather than focusing, as it currently does, on modifying the behavior of 'bad actors'.

Farming communities

Ecosystem service payments are, at present, a potentially more important tool for forest ecosystem restoration than for the conservation of standing forest. The effective demand for ecosystem services

Box 11 *Financial contributions of ecosystem service markets to household incomes*

Payments for ecosystem services can contribute to rural livelihoods in both economic and non-economic ways, but there are currently few data demonstrating the extent to which they increase household incomes. Farmers' annual income is directly affected by market forces for the crops they produce. The annual income of farmers participating in the Scolel Te project in Chiapas, Mexico, ranges from US$800–US$3000, depending primarily on coffee and corn. Carbon payments also vary depending on the size and land-use system of land registered into the project. Farmers in Scolel Te generally receive US$8 per tonne of carbon sequestered; in a year they sequester anywhere between 13 and 2,000 tonnes of carbon. Therefore, carbon payments have been estimated in the range US$120–$16,000 per farmer.

Forty-four percent of surveyed New York Catskill farmers participating in the Water Agricultural Program maintained that watershed payments had enhanced their economic well-being. In Costa Rica, ecosystem service payments rewarded farmers a total of US$57 million in 1997–2001; however, one survey of participants in the Costa Rican scheme showed that for three-quarters of respondents these payments accounted for less than 10% of individual family income.

The bigger point surrounding payments for ecosystem services is that while they may be small and variable compared to household income, they continue to have significant impacts on the livelihoods of participants. Almost all of the farmers surveyed in New York had other sources of income outside farming. Watershed payments provide them with additional economic benefits, such as infrastructure improvements and marketing assistance, which help to increase the net worth and efficiency of watershed farms. Carbon payments in Scolel Te are, unlike crop prices, consistent sources of capital for farmers investing in more sustainable land-use systems and livelihoods. Ecosystem service payments provide a form of financial stability that allows households to make sound investments in their futures while continuing to work for their primary revenues.

Sources: Orrego (2003), Rosa et al. (2003), Pagiola et al. (2003)

tends to be greater in areas of higher population density, where a higher share of the natural forest has been converted to other uses and where the scarcity factor has increased the financial value of ecosystem services. The current structure of the carbon market focuses only on tropical afforestation and reforestation. Higher population density favours the formation of local watershed protection organizations that may be able to negotiate local or – if federated – regional 'deals' (Scherr et al. 2001). The establishment of agroforestry systems (together with afforestation in critical areas of watersheds) offers a way of enhancing ecosystem services in regions of annual cropping and of creating biological corridors to enable wildlife movement across agricultural landscapes (Box 11). Poor rural communities that are suffering from resource degradation are also beginning to become buyers of ecosystem services, paying other nearby landowners and communities to protect critical water sources and waterways. Box 12 describes an example of such a system in India.

Product certification for crops produced in ways that protect biodiversity and water quality is likely to become increasingly important for farmers producing

***Box 12** Rural communities in India develop equitable watershed service markets*

The gradual siltation of Sukhna Lake, a popular recreation site in the city of Chandigarh, and fears of its complete disappearance, led to the development of a watershed project in the village of Sukhomajri in the state of Haryana in India. One side of Sukhomajri Hill drained into Sukhna Lake and the other side drained into Sukhomajri village, where runoff water flooded and destroyed agricultural lands. The Central Soil and Water Conservation Research and Training Institute (CSWCRTI) regenerated both watersheds by constructing conservation structures (check-dams and gully plugs) to stop the flow of silt. When the rain came, the check-dams filled with water presented an opportunity for the irrigation of the fields below; three additional check-dams were constructed to take advantage of this opportunity. The village people were asked to refrain from allowing their grazing animals into either the Sukhomajri watershed or the Sukhna Lake watershed. CSWCRTI investment in runoff ponds compensated the village for providing Chandigarh with the environmental service of protecting the hillside in the Sukhna Lake watershed.

In Sukhomajri, a problem quickly emerged: the runoff ponds provided the irrigation water to only a minority of landowners with holdings below the pond. However, others in the village, including the landless, had no incentive and stood to lose if they were forced to abandon the hillside as a grazing resource. The stand-off was eventually resolved by a simple but ingenious solution that ensured that all households would benefit from eliminating grazing in the watershed. First, pipes were laid so that most fields in the village would receive water. More importantly, all households, both landed and landless, would share equally in the ownership of water in the catchment ponds. Moreover, water rights would be tradable so that landless villagers could either sell their share to landowning households that could use it for irrigation, or hire cropland and utilize their water share directly.

The Hill Resource Management Society (HRMS), with representation from each household, has become the main instrument for managing the system. Anyone who requires water from the pond buys it from HRMS, which in turn distributes the proceeds equally among its members. In addition to water, villagers also have shared rights to collect Bhabber grass growing in the watershed. This system has become so successful that Sukhomajri became the first village in India to be charged income tax on the value of biomass grown on common lands. Siltation in Sukhna Lake declined by 95%, saving the city of Chandigarh about US$200,000 annually in dredging and related costs. Vegetative cover on the hillside increased from 13 trees per hectare to 1292 trees per hectare, increasing the value of forest to an estimated US$20 million capable of generating at least US$700,000 per annum. In the 1990s the forest yielded nearly US$3000 worth of grass annually. Other benefits accrued in the form of increased milk and crop yield.

The Sukhomajri case involves two upstream/downstream environmental relationships with two separate institutional arrangements. The first involves the relationship between Sukhomajri and the City of Chandigarh and the second involves the relationship between upstream and downstream land-users within the village. In both cases, a form of market mechanism was utilized to secure the provision of environmental services in the form of soil conservation to prevent the siltation of downstream water bodies.

Source: Kerr (2002)

for export. Government regulations mandating the production of certified crops are being introduced in many countries to protect critical watersheds where land-use is dominated by agriculture. Certification may not bring net additional income but may be necessary to access major markets or to produce legally.

Government forests

Despite the active pace of forest devolution over the past 15 years, 75% of forests in developing countries continue to be controlled by governments (as well as much land designated officially as forest that has no trees). What role will payments for ecosystem services play in managing and conserving these forests? A preliminary analysis suggested that it will be difficult for public land managers to charge for public goods, given that the public has already paid through taxes. However, it may be possible to charge companies and other specific users of private goods (for example, through bioprospecting agreements, or for the management of a specific watershed providing a commercial bottling plant). Public forests may also be positioned for biodiversity protection payments for internationally-valued biodiversity, and for payments for carbon sequestration from afforestation on public lands. Especially in carbon markets, public lands will be competing directly with private land- and forest-owners, which may create political concerns.

Potential risks

In areas where land and forest tenure are not formalized, politically powerful groups may claim lands belonging to the poor in order to receive ecosystem service payments. Given the lack of formal legislation in many countries regarding ownership of the ecosystem services themselves, it is possible that local people could be coerced to modify land and forest management in ways that reduce their own incomes, while payments for ecosystem services are made to other actors. Where the poor are dependent upon forests they do not own for food, fuel, building materials and medicines, the 'locking up' of those forests for conservation easements or concessions could reduce food security, access to medicines, employment and income earned from harvesting forest products. There is a danger that such rules will limit potentially positive changes in livelihood choices, such as among indigenous peoples in the Peruvian and Brazilian Amazon who are required by law to remain collectors of subsistence fruits in their ancestral domains. In some cases the long-term implications of these contracts are not clear to local people.

Local people need to be involved in negotiating the specifics of use and management contracts, to avoid the risk that critically important local ecosystem services may be lost. For example, afforestation of a local watershed with fast-growing tree plantations for carbon sequestration could dry up local water sources. If the performance of watershed services is measured in terms of water flow, there may be incentives in a drought year to divert water from irrigating local crops to increase downstream water delivery. To address equity concerns, it is essential that the poor have a voice in setting market rules (Rosa et al. 2003). Easements, concessions, long-term land leases and management contracts may lock forest owners into particular management commitments for long periods of time. This reduces their flexibility to respond to new economic opportunities and threats. As prices change over time, payments for ecosystem services and income from new management systems may no longer cover opportunity costs.

Where payments are dependent upon the delivery of specific ecosystem outcomes, factors outside producers' control (such as the spread of fire from a neighbour's land, disease, extended droughts, the introduction of invasive species) may result in a failure to achieve contractual obligations and in non-payment. All producers participating in payment-for-ecosystem-services' schemes thus need to have some type of insurance strategy. Formal insurance policies are little used in tropical forestry, although new insurance products are being developed for large-scale companies (Cottle & Crosthwaite-Eyre 2002). Alternative approaches must be used to mitigate performance risk, such as self-insuring by implementing the new use or management practices over a larger area of land than is actually contracted.

Linking ecosystem service markets to rural development

Local producers and communities rely on ecosystem services for their livelihoods and, as pressures on ecosystems intensify with population growth and economic development, will increasingly have to manage resources for the provision of ecosystem services. It is important that the capacity of communities to plan for ecosystem service provision is strengthened as regional, national and international markets for ecosystem services evolve so that participation in markets contributes to livelihood security rather than threatens it. Compensation for ecosystem services can be designed creatively to make such contributions and to reflect the wide range of local values of ecosystem services (Rosa et al. 2003).

Increasingly, the ecosystem services performed by forests will be rewarded in the landscape mosaics found in agricultural ecosystems. Thus, ecosystem services will need to be evaluated and managed as part of this broader system, often calling on improvements in agricultural, grazing and other land management systems to complement afforestation and forest conservation. If ecosystem service markets can be shaped to support and assisting in financing this process, there could be important benefits for rural development.

5

5 Strategic issues for tropical countries

Market-based instruments for ecosystem services are developing most rapidly in high-income, temperate countries. The development of international conservation finance, environmental certification and international carbon trading schemes – all very much concerned with protecting or utilizing tropical forest resources – have thrust low- and middle-income tropical countries into these fast-evolving ecosystem service markets. The decline in public budgets for forestry and conservation, meanwhile, has encouraged domestic advocates to actively explore financial opportunities in ecosystem service markets. With a few notable exceptions (such as Colombia and Costa Rica), tropical developing country governments have not yet begun to position their countries strategically in these markets. In fact, there are important strategic issues to consider, with implications for public policy and investment. These include:

- international competitiveness;
- legal and regulatory framework;
- property rights and the politics of protecting ecosystem services;
- domestic equity; and
- reducing transaction costs and financial risks.

International competitiveness

At present, the biggest buyers of tropical forest ecosystem services are in the industrialized countries, and, with the exception of watershed services, that is likely to remain the case for at least the next decade. To what extent will tropical countries be able to compete in these markets, and what will determine competitiveness? To what extent should countries invest in the institutional developments required to market tropical forest ecosystem services? What is the likely payoff? To what extent are developing country governments being asked to invest in international public goods? Although the low-income countries are often the richest in terms of biodiversity, carbon storage potential, and watershed services, they may suffer similar disadvantages in these markets as they do in international product trading.

Biodiversity markets

The three principal international markets for biodiversity will likely be for certified timber and other ecolabelling, direct payments for high-biodiversity-value forest conservation, and nature tourism. These markets behave very differently. In certified timber and crop markets, the principal service 'commodity' being sold is the guarantee that biodiversity has not been harmed by logging or farming. Producers from industrialized countries compete directly with those from the tropical countries, except in some niche markets for high-value tropical fruits, beverage crops (coffee, tea, cocoa) and certain timber species grown in natural tropical forests. Tropical producers, especially in low-income countries, are at a competitive disadvantage. Timber certification systems are not yet well adapted to tropical forest conditions and especially not for non-industrial producers. The process of crop certification is just beginning, but could potentially pose serious market disadvantages for tropical and especially low-income producers. Until certification standards are so adapted, and greater efforts are made to support the certification process, that disadvantage will continue. In many parts of the tropics, land tenure insecurity and other factors will continue to limit certification. Many international buyers do not support the logging of tropical forests, yet these enterprises are in many places essential to make ecologically sustainable forest management financially viable.

In the direct payment market for tropical forest conservation values, tropical countries have few developed-country competitors. Countries and forest owners with very high-biodiversity-value resources (endangered species, high endemic species, etc) may have considerable capacity to negotiate with international buyers, regardless of national market or institutional conditions. Such areas are, however, likely to be a relatively small share of the total tropical forest area, although possibly important in a few countries.

In the nature tourism market, tropical countries will compete sharply with one another for buyers. Biodiversity value will be only one of many factors determining competitiveness, most of which will relate to the availability of investment and infrastructure, marketing, and other factors, including landscape beauty.

Carbon markets

Until such time as the tropical countries establish obligations for carbon emission reductions, the main buyers of carbon in those countries will be international, through the CDM, through retail 'green' markets, and through whatever mechanisms emerge for the US. Unlike other ecosystem services, carbon sequestration is site-neutral. It will thus behave as a classic commodity, forced to compete primarily on the basis of price and to struggle with trade barriers. The latter are already evident. Emission offsets based on forest carbon in the CDM have been capped and important types of forest carbon projects are not eligible. It is likely that any US system will favour domestic rather than foreign producers of carbon offsets. CDM projects are burdened with a large number of regulatory requirements and procedural hurdles that are not required for forestry projects in developed-country emission trading schemes or joint implementation projects.

Nonetheless, it still seems likely that tropical developing countries will be able to compete on the basis of low cost. In many places, the cost of producing carbon offsets is indeed quite low due to good conditions for forest growth, low opportunity costs and low labour costs. Where carbon projects have significant co-benefits, many of the production and transaction costs may be offset by other income flows or investment sources. However, there will be potentially stiff competition among the tropical countries. The critical factors in competition are likely to be institutional: those countries that can mobilize carbon trading in areas with secure tenure, secure investment environments, good availability of business service providers, etc, will likely out-compete the others. This means that the greatest opportunities will be in middle-income developing countries, unless low-income countries do very strategic planning to identify investment opportunities and strengthen support.

Strengthening capacity

Participation in some ecosystem markets requires a fairly high level of production, marketing or information management skills, and may be unsuitable where key actors do not have those skills. Producers need a high level of business skills to negotiate private deals effectively. Public institutions must have adequate human capacity to implement regulatory schemes effectively. Private businesses and market agents need to have the capacity to handle complex organizational demands for instruments such as trading permits. In order to compete in international markets for ecosystem services, or to attain an adequate level of efficiency in domestic markets, there will need to be much greater investment in human and institutional capacity. A strong argument can be made for a much greater role for developed countries in supporting capacity-building for ecosystem service markets, especially for markets primarily serving developed-country buyers. International assistance may be essential in order to attract the necessary level of private investment.

Legal and regulatory frameworks

For the majority of ecosystem services that are 'public goods', the creation of markets requires proactive efforts on the part of governments and non-government actors. While purely private payment schemes require a minimal public legal framework, public schemes often require a fairly complex set of rules. Strategies to develop ecosystem service markets need to be integrated into broader resource planning frameworks.

Laws and regulations

Product certification schemes require little, if any, special public legal framework, although they can benefit from supportive public policies, such as the exemption of certified producers from public environmental regulations. However, the rules and procedures for certification, including criteria and standards, and procedures for verification, must be developed and agreed upon by private buyers, traders and NGOs. As argued by Meidinger et al. (2001), certification thus functions in many ways as a form of civic environmental regulation, although to a large degree the rule-making to date has been limited to a narrow range of elite environmental groups and western scientists.

Direct buyer-seller deals require from the government only adequate contract law and legal services to provide contract enforcement and, ideally, clear legal guidelines as to who 'owns' ecosystem services and who has the right to sell them. For example, some countries have claimed carbon rights for the state, so that private sellers cannot receive payment without government authorization. Due diligence requires that buyers ensure that sellers have legal rights to the land or forest covered by the contract. Depending on the institutional and legal environments in which they are operating, contracts may be quite

***Box 13** China's ecological compensation scheme*

China's Ecological Compensation Fund remunerates organizations, collectives and individuals that manage forests for the ecological services provided by forests. The program was developed in response to increasingly lax forest protection standards, because forest caretakers were disproportionately bearing the costs of public forest benefits and were, therefore, becoming poorer. In 1996, the Ministry of Finance developed an initial plan to issue payments for the public services provided by forests, such as watershed maintenance, salinity control and soil management. It was incorporated into the National Forest Law in 1998 and became ready for implementation in 2000.

The plan focuses on the protection and management of protected and special-use forests, subsidizing afforestation, reforestation and forest management activities and supporting ranging, fire prevention, insect prevention and resource monitoring. Farmers are compensated 5 yuan/mu/year (1 mu = 0.0667 hectares). Pilot implementation has allocated 1 billion yuan to 65 counties and national-level nature reserves in eleven provinces including Hebei, Heilongjiang, Fujian, Shandong, Liaoning, Anhui, Jinagxi and Xinjiang. China's program has led to better forest protection in recent years, but also needs further improvements. Landowners often lack a good understanding of their rights and obligations under the program and complain that subsidies are half what they should be. Funding is drawn primarily from the fiscal budget but as yet has not been collected from all the public beneficiaries of forest ecological services.

Source: Sun (2002)

simple and flexible or detailed and binding with clauses on non-compliance. Private contracts for permanent conservation easements need to be formally recorded in public land records.

Public payment schemes require legislative authorization to allocate budgets and set administrative rules and responsibilities. Such rules define what services are to be purchased, who is eligible to be a supplier, the terms of payment, performance standards and monitoring procedures, and procedures in case of breach of contract. Examples of recently established public payment schemes in tropical countries include the Mexico example in Box 4, and China's Ecological Compensation Fund (Box 13). In Mexico, clear legal tenure of forest ejidos and communities has facilitated the initiation of payments and markets for ecosystem services.

Instruments that rely on formal contracts and reliable contract enforcement will require a well-functioning legal system. Mechanisms to assess and address liability in case of non-performance are required. In Guatemala, for example, markets for watershed services needed plans to offer three times the area to ensure the delivery of contracted services to the investor.

To establish open trading markets, governments must first establish regulations creating a market for ecosystem service credits by legally mandating (and enforcing) a group of buyers for such credits, such as carbon polluters in carbon markets or land developers in biodiversity markets. Governments must then specify what types of 'commodities' (for example, types of habitat in specific ecosystems) can be traded and set the 'rules of the game' for trading the credits. One of the few jurisdictions to establish an extensive legal and regulatory framework for trading has been New South Wales, Australia (Box 14).

Land-use planning

While international buyers currently dominate markets for ecosystem services in tropical countries, over the long run their most important markets will be domestically focused. To the extent that market-type instruments can reduce the overall cost of providing critical ecosystem services and increase the efficiency and effectiveness of providing them, it is desirable to promote their use domestically. A little-asked question is whether the types of market rules and institutions that are being developed for international markets are the most suitable and cost-effective for domestic markets. It may be that less stringent, more easily measured or locally developed indicators would be more suitable. More flexible and informally negotiated contracts may sometimes be more appropriate for local agreements.

Box 14 *New South Wales, Australia, establishes legal framework for ecosystem service markets*

Over the past 200 years, approximately 95 million hectares of forest and woodland vegetation in Australia have been cleared for pastoral grazing and agricultural cropping. As a result, Australia's forest and land-use sector was a net emitter of carbon dioxide in 1990, the baseline year of the Kyoto Protocol. About 15–20% of Australia's greenhouse gas emissions arise from the on-going clearance of forests and woodlands. Dryland salinity, caused by this deforestation, continues to threaten millions of hectares of productive farmland and the water supplies of some major cities. It is important from a socioeconomic perspective that land-use changes take place in areas where marginal cropping or grazing activities are currently occurring. Changing these areas back into forestry can help to diversify regional economies and will increase the long-term economic product in many areas.

Pioneering efforts have been made to support the commercialization of ecosystem services from forests to achieve these goals. In late 1998, the New South Wales (NSW) state parliament passed carbon-rights' legislation that allows investors to record ownership of the rights to carbon sequestration in forests on land titles. Most recently, in January 2002, the Government of NSW indicated that, as part of its goal of reducing greenhouse gas emissions by 5% per capita from 1989–1990 levels, it would impose a penalty of 10–20 Australian dollars per tonne of excess emissions. The government also indicated that carbon sequestration credits could be used as offsets against this commitment and released a detailed position paper on the carbon-credit accounting, registry and trading systems.

Source: Brand (2002)

Over the long term, ecosystem service markets in tropical countries should serve as one element in meeting the broader objective of securing ecosystem services critical to sustainable development. Landscape-scale planning and the coordinated management of natural resources is needed that encourages the efficient, equitable and integrated provision of diverse ecosystem services and products. Markets should be promoted where and how they can contribute most effectively to those objectives. For example, Binning and Moles (2001) describe in detail an example in Australia that emphasizes the provision of ecosystem services to support the local economy and local consumer needs. The discipline imposed by markets for ecosystem services – in terms of their requirements for explicit information on supply, demand, price, cost and management impacts – can potentially contribute to better overall resource management.

Stakeholder participation, negotiation and institution-building are critical in all strategies – self-organized private deals, trading schemes and public payment schemes. While some initiatives have succeeded well by organizing formal alliances between users and suppliers, such alliances are as yet uncommon.

Property rights and the politics of protecting ecosystem services

Introducing market mechanisms into ecosystem management raises important and difficult questions about ethics, equity and politics. Issues include who has rights to ecosystem services, the political balance between landholders and beneficiaries of ecosystem services, and potential public resistance to market mechanisms.

Rights to ecosystem services

Of fundamental importance is the distribution of rights and responsibilities. Do landowners have the right to pollute water, emit carbon or destroy biodiversity? Do consumers have a right to clean water, smoke-free air or a biodiverse ecosystem? In most situations, people adhere both to legal/formal systems of rights and to customary/informal rights. Should landowners be paid to provide what they might already have a moral and legal responsibility to protect? Will the use of market tools disproportionately benefit certain groups who may be responsible in the first place for the decline in water quality and supply? Clearly defined rights and responsibilities are an important factor in the use of market tools to protect ecosystem quality. The degree of confidence to attach to these tools will be determined by the integrity of the legal and regulatory systems that support the allocation of rights, as well as by public attitudes about fairness and equity.

For example, if citizens have a right to high-quality water they may be unwilling to pay landowners for improving degraded water quality. In this situation the market opportunity may be limited to transactions among landowners as they seek the most cost-effective ways of meeting their responsibilities. Beneficiaries might be willing to pay landowners for measurable water quality improvements if the government has not defined water quality standards, has no monitoring system in place, or lacks enforcement capacity. On the other hand, if landowners have the right to pollute, changing their behavior may require compensation from downstream users. These decisions are not technical – they are political. In many tropical countries, property rights on land and forest are far from settled, much less rights to benefit from the sale of ecosystem services. Resolving such tenure questions is an essential first step in setting up markets for ecosystem services.

Political balance between landholders and beneficiaries

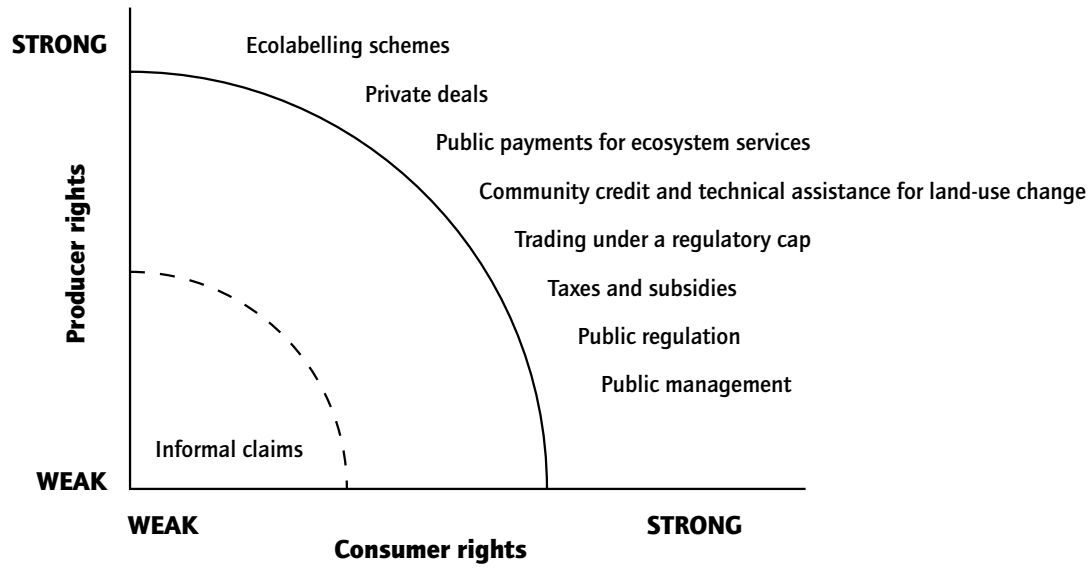
The choice of policy instrument with which to protect ecosystem services will often be heavily influenced by political realities. One key factor is the power of landholders relative to ecosystem service users (Figure 5). Where the rights of landholders are very strong, regulatory approaches may be difficult to implement. Where the rights of service users are very strong, they may demand that forest landholders absorb all the costs of meeting environmental objectives. For some cap-and-trade schemes, governments must either be powerful enough to implement change despite important opponents, or be able to negotiate consensus. If governments are too weak to regulate effectively using conventional regulatory mechanisms, they will often be too weak to regulate a cap-and-trade system for ecosystem services. An attractive feature of ecolabelling mechanisms is that they do not generally rely on coercion of either buyer or seller, and can often be implemented without public policy action. Political acceptance of a policy instrument will require that beneficiaries be willing to lobby for action.

The decisions about which among the possible ecosystem service suppliers should be paid are also political. There is a serious 'moral hazard' issue for ecosystem service payments that are made primarily to 'bad actors' so they will mend their ways. Strategies are needed that will explicitly reward good husbandry in the past and present, as well as in the future.

Public resistance

Major political resistance has arisen in many countries to the commercialization of some services, as illustrated in ongoing World Trade Organization negotiations about including services under that organization's umbrella. Many feel that services such as water are so basic that they are a public responsibility. Much of the high-visibility debate has been about the privatization of downstream

Figure 5 *Property rights and policy instruments to promote ecosystem services*



water distribution services and markets for water itself as a commodity (as distinct from watershed protection services), and the establishment of large-scale private conservation areas.

There has been a very mixed reaction from indigenous communities to the development of ecosystem markets, due to concerns about their potential loss of sovereignty, use and access rights, their weak position in market negotiations, and threats to local culture posed by the commercialization of important natural values. In the case of carbon, for example, indigenous people and local communities, supported by civil society groups such as the Amazon Alliance in Ecuador and the Amazon Working Group in Brazil, participated actively at the conferences of the parties to the United Nations Framework Convention on Climate Change in the Hague and Marrakesh. While some community groups have pointed out the risks of forests in the CDM (eg Forum of Indigenous Peoples 2000), others emphasize the potential benefits, provided safeguards are included (eg Declaration of Brazilian Civil Society on the Relation Between Forests and Climate Change 2000; Amazonian Indigenous Forum 2001).

Ecosystem markets that involve public payments or cap-and-trade markets, where they are implemented, will need to address these debates carefully and involve diverse stakeholders in their design. Public oversight of private deals may also be required in many places to ensure that ecosystem services previously available to the public are not diverted to private benefit.

Domestic equity concerns

How emerging markets for ecosystem services impact on poor people is an important ethical issue. But equity concerns also affect economic efficiency, since the exclusion of certain groups from markets hinders the ability of those markets to ensure that the lowest-cost supplier is rewarded and that all consumers are supplied. Moreover, if markets exacerbate inequalities, they can undermine social stability. The long-term viability of markets for ecosystem services depends on retaining the support of key local stakeholders, including low-income landowners and users. Thus, it is important to make sure that new markets include low-income producers and reduce potential livelihood threats.

Participation of low-income producers in markets for ecosystem services

Without proactive effort, there will be a tendency to favour large-scale landowners in ecosystem service markets. Experience to date shows that compensation for reduced forest use or access has gone primarily to wealthier and more powerful forest users. Costa Rica's impressive system for forest ecosystem service payments imposed a minimum land area requirement for participation that effectively excluded the poor. Commodities may de facto exclude the poor where their design is incompatible with important local land-uses, or incompatible with subsistence security.

Since governments and large-scale private landowners control a majority of tropical forest area, in many sites they will control a majority of forest (or afforestation) sites of high ecosystem value. To be credible, markets must be set up to deliver specified services, and thus it is problematic and probably not sustainable to design such markets explicitly to deliver payment flows to low-income forest owners, if largeholders are in fact the principal suppliers of those services (Pagiola 2002).

However, under many circumstances it does make sense to direct payment flows to the poor. In many parts of the world (the Philippines, parts of Central America and the Kenyan highlands, for example), low-income farmers actually dominate land-use in upper watersheds and should be the principal beneficiaries of watershed service payments. In the case of biodiversity conservation, there is considerable opportunity for mobilizing service payments to indigenous communities who have historically been good stewards of biodiversity (Molnar 2003). If largeholders are responsible for the past deterioration of ecosystem services, regulation is an alternative approach for these groups, as they have the capacity to self-finance improved resource management (if politics permit). Then, public payments could be reserved for low-income producers who require supplemental finance to make land management changes.

Low-income producers may, in many cases, have potential comparative advantages in supplying ecosystem services. These include: control over environmentally critical resources, local presence that improves protection against exploitation by outside groups, in-depth local ecological knowledge, a long-term commitment to their territory, and/or lower opportunity costs for land and labour. An especially

strong case can be made for structuring markets for carbon sequestration to benefit low-income farmers and forest producers. Carbon can be sequestered in almost any type of site. The highest rate of sequestration per hectare is found in fertile, humid areas where trees grow most rapidly, but carbon payments are made per ton of carbon sequestered, not per hectare. Thus, sequestration investments can go to areas most in need of ecosystem restoration, increased farm productivity, or forest benefits for the poor.

Designing market mechanisms to reduce livelihood threats

As discussed in Section 4, it is important to design ecosystem service markets so that they do not threaten the livelihoods of vulnerable groups. Even where there are no technical, legal or institutional barriers to the participation of low-income people in ecosystem service markets, they are at a disadvantage in competing with other potential suppliers, much as they are in forest product markets. Inequity may result from inadequate skills and education, a lack of scientific understanding of ecosystem services, inadequate finance, poor market information, lack of market contacts, weak bargaining power, weak producer organizations, or a lack of access to business services. Proactive efforts can usefully address these constraints in the building of new ecosystem service markets (Rosa et al. 2003; Scherr et al. 2001).

In designing new market instruments, it is important to consider potential impacts not only on participating low-income producers and other households that rely on lands and forests affected by market schemes, but also on poor consumers of critical ecosystem services.

Institutions to reduce transaction costs and financial risks

The financial benefits realized by ecosystem service market suppliers are likely to be far lower than the price paid by buyers. Because these are very new markets, there has been little development of the intermediary institutions found in mature markets to reduce what are called 'transaction costs'. If such markets are to deliver real benefits, governments, civil society and producer organizations need to pay particular attention to developing institutions to reduce these transaction costs and the level of financial risk.

Transaction costs and risks

Transaction costs include the cost of attracting potential buyers (such as establishing ecosystem service potential), costs of working with project partners (such as negotiating with project participants and capacity-building), and costs of ensuring that parties fulfill their obligations (such as contract development and enforcement, legal costs and insurance, and monitoring of ecosystem services). In cases where buyers are physically and socially remote from sellers, a chain of intermediaries may be required for the transfer of funds. One preliminary assessment suggests that transaction costs in forest carbon projects (presently the most complex market) absorb more than 50% (and in some cases more than 90%) of the value of total payments made, while the forest producer directly receives only the residual (Niles et al. 2003). The effectiveness of ecosystem service markets will be greatly diminished without aggressive action to reduce transaction costs.

To develop payment systems, technical experts, producers and buyers must agree on the biophysical linkages between land-uses and ecosystem service benefits, and develop suitable methods for measuring and monitoring the provision of the service. Pagiola et al. (2002) identified the lack of good information over land-uses and services as the 'Achilles heel' of payment schemes. People do not tend to willingly part with their money unless they are confident that they will receive something of equal value in return.

Institutions to reduce transaction costs and risks

Institutional innovations are thus needed to reduce transaction costs. As costs such as project design, management and certification are characterized by economies of scale, project size has an important effect on unit costs. Where highly specialized expertise is needed intermittently or for limited periods – to design ecosystem monitoring methods, for example, or to develop service contracts – specialized companies, public agencies or experienced NGOs can provide necessary business services. Intermediary groups with expertise in community organization can take responsibility for local project management and mediation between investors and local people. Because carbon can be sequestered in almost any site (unlike more site-specific biodiversity and watershed services), area-based projects (sometimes called

'bubble projects') can be designed in which an entire jurisdiction commits to a defined increase in forest cover or area of forest protected. This increases land-use flexibility and is especially useful for landscape mosaics dominated by non-contiguous forest patches (Smith & Scherr 2002).

Transaction costs can be greatly reduced by developing projects in communities where there are already active local organizations and participatory development programs in place, with community representatives already selected and authorized to negotiate with outsiders. For example, organized indigenous communities in El Salvador have done their own diagnostic studies of local needs and priorities and are actively marketing specific ecosystem services from specific areas in a way designed to contribute to meeting those priorities (Rosa et al. 2003). If critical ecosystem services are found in areas with little organization, NGOs or public agencies with an interest in co-benefits may be willing to cover selected transaction costs for the level of community organization needed for payments for ecosystem services.

The participation of smaller-scale forest producers in ecosystem service markets also requires institutional innovations to reduce marketing costs and reduce risks to outside buyers and investors. As some markets mature, more open trading systems will begin to replace closed deals, and producers, buyers and investors will develop cooperative institutions. Intermediary organizations will attract investors by 'bundling' projects within a country or region to market carbon offsets, biodiversity credits or watershed services.

Many market schemes require the organization, training and management of large numbers of people to develop management standards, assign values to credits, provide technical assistance to design interventions, negotiate contracts, and monitor and verify compliance. Technical specialists and land-users need to work jointly to define the appropriate 'commodity' that reflects clear, verifiable links between forest management and ecosystem service output, and to develop alternative performance standards where there is an imperfect understanding of ecosystem functions.

Trading deals require master registries for the jurisdiction in which obligations and credits are recorded. Secondary markets for such credits may be established in security exchanges. In many cases, existing institutions, such as financial services, legal services and other business-support services must acquire specific knowledge and skills to work in ecosystem service markets.

Projects may be pooled together in a 'mutual fund' type arrangement to significantly lower transaction costs and the risk of individual project failure, and to offer specialization. For example, the independent non-profit Face Foundation has developed a portfolio of five projects in five countries, affecting 135,000 hectares that are sequestering 82 million tonnes of carbon (Emmer & Verweij 2000). The World Bank's Prototype Carbon Fund, BioCarbon Fund and Community Development Carbon Fund are other examples. National and local environment trust funds could also pool investments.

6 Key findings

This initial global overview of markets for the ecosystem services of tropical forests draws some key conclusions, identifies critical issues, and highlights gaps in knowledge and information that need to be addressed if tropical forest producers are to move forward aggressively to benefit from these markets.

Current status of ecosystem service markets

Current ecosystem service markets present four key features that shape opportunities for tropical forest countries.

1. **The total value of direct ecosystem service payments in tropical countries is presently modest, but has grown dramatically over the past decade and is significant, particularly to low-income producers.**

The total value of direct ecosystem service payments for tropical forests is probably in the order of several hundred million US dollars annually, a relatively small percentage of the total value of the tropical wood products' trade of approximately US$20 billion. Ecolabelling markets, including certified lumber, crops, livestock products, and fish, appear to be worth several billion US dollars annually (Clay 2002). Though limited now, the aggregate value is likely to rise fairly rapidly over the next two decades, and its share of the total income from tropical forests may rise even faster if trends in tropical timber exports continue to stagnate.

While international markets for ecosystem services receive the greatest attention, it is likely that only payments for globally important biodiversity, transboundary watershed management and international carbon trading will involve international payments. The vast majority of payments in the future for watershed conservation, biodiversity conservation and carbon sequestration or storage will be domestic. Nonetheless, the shape of domestic markets will be heavily influenced by the designs, methods and rules being developed for international trade.

Water and biodiversity markets are characterized by highly location-specific value, highly fragmented demand, high variation in price and a limited number of buyers – all characteristics of niche markets. It is unlikely that this will change much in the foreseeable future. Rather, the number of niche opportunities will expand greatly as interest and experience expand in using this instrument and as more standardized institutions are put in place to reduce the cost of transactions. Carbon sequestration and storage, by contrast, could eventually become a true global commodity – with fully interchangeable products. The developing countries that will be able to compete will be those with good governance systems, biological conditions for lower-cost plantation establishment and forest restoration, and positive legal frameworks. For the present and for some years to come, however, the carbon market will continue to behave much more as a niche market and will probably continue to do so until the major international and national mechanisms are fully implemented and intermediary institutions develop.

2. **Markets for forest ecosystem services are expected to grow, in both developed and developing countries, over the next 20 years.**

Demand and payment for the watershed services of tropical forests is expected to intensify as water demand grows in developing countries and downstream users realize the economic benefits of watershed protection programs. Ecolabelled products are the fastest growing segment of biodiversity markets, with much of the market focused among middle-income countries. Growth in the carbon market will depend on the status of the international rules and debate concerning climate-change mitigation.

3. **Governments play a critical role as the principal buyers of many ecosystem services and as catalysts for many private-sector direct-payment schemes.**

Government agencies (federal, state, municipal) are likely to be the principal direct buyers of ecosystem services in many tropical countries, and will be the catalysts to bring in foreign buyers and investors and to build the market institutions needed for domestic private actors to become engaged. Important new public funds are being set up to finance ecosystem services (such as in Mexico and China, etc). Careful attention needs to be paid to designing such funds to make sure that they support broader policy objectives, do not create disincentives for good but unpaid conservation behaviour, and explicitly address possible equity concerns. Indirect payments for ecosystem services – via certification schemes – are dominated by private-sector actors. Conservation NGOs are key players in biodiversity payments in tropical countries.

It is notable that forest officials or forest industry are generally not the main actors driving the development of forest ecosystem markets. Rather, the main actors are the potential buyers: carbon-emitting utilities in the case of carbon, municipalities in the case of watershed services, and conservation agencies in the case of biodiversity protection services. The forestry community has been more reactive. Yet in many cases the forest sector is over-estimating the potential size of the market and under-estimating the institutional developments required for them to work effectively and equitably. Forest industry and policy-makers would benefit by taking more of a leadership position to shape these markets as they grow and to actively cultivate potential buyers.

4. **Ecosystem service payments will in most cases cover only a modest – but potentially catalytic – share of the costs of good forest management.**

Ecosystem service payments will not usually be sufficient to justify forest conservation in areas where there are even modest opportunity costs for the land. For this reason, governments will find it most rational to concentrate on catalyzing a market-based mechanism where investment will go to the most cost-effective sites and opportunities. The tendency of present models to channel scarce investment resources to actors engaging in negative behaviour or in sites with less economic potential is in direct conflict with the opportunities for bundling ecosystem service market payments to make on-going initiatives – certified timber or ecotourism enterprises, organic or bird-friendly crop and perennial cultivation – viable and sustainable.

Issues to consider when engaging in ecosystem service markets

While markets for ecosystem services are growing steadily and can be expected to grow even more rapidly in the next decade, a number of issues limit their potential contribution to forest incomes and ecosystem service provision.

1. **Property rights and national legal frameworks are necessary for ecosystem service markets to develop, yet these are poorly developed in most producer countries.**

Few countries have established systems of rights over or market regulations for ecosystem services, or thought through equity implications. It is important to consider who will make the rules in emerging markets; in many cases, other sectors will be most influential. Forest producers and civil society need to take a proactive role to ensure that the rules support the public interest. Otherwise, favoured industries and groups will take low-hanging fruit, leaving few development opportunities.

The idea of paying for basic ecosystem services is still a new one for most people around the world, and not always a welcome one. Underlying some of these concerns are real potential problems of accountability, transparency and equity in the structure of new markets. Political debate and negotiation with a wide range of stakeholders is essential to build an appropriate policy and regulatory framework within which private-sector actors can conserve forest ecosystem services effectively and efficiently.

2. **These markets are not likely to contribute substantially to poverty alleviation unless proactive efforts are made to recognize rights and shape markets to provide equal access to low-income producers of tropical forest ecosystem services.**

There are important reasons to involve low-income forest producers in these markets. These include the opportunity to address problems of income generation and poverty alleviation, and the fact that smallholders and traditional forest dwellers are more responsive to small payments, making these more cost-effective. Investments by NGOs can have an important role in building capacity and organizing low-income producers and communities to reduce transaction costs. Legal and policy analysis is also needed to ensure that low-income producers are recognized as the owners of the ecosystem services that they generate.

3. **New market institutions are needed to reduce transaction costs and financial risks.**

A major challenge of ecosystem service market development is to ensure that critical institutions are established to reduce transaction costs and to provide intermediation between buyers, sellers, investors, certifiers and other key groups in the value chain. If appropriate action is not taken to address this at both national and international levels, many market opportunities will simply fail to materialize, especially in poorer countries.

New market institutions are also needed for technical design and monitoring, registers, the setting of rules and standards and other key activities that must be adapted to particular markets. Efforts must also be made to ensure that the specialized rules for certain markets do not act to negate the potentials from other markets, at local, national or international scales. For example, it is important that criteria and standards for certified timber and other forms of ecolabelling are consistent where forest owners pursue multiple goals.

Principal gaps in knowledge

Ecosystem service markets could potentially offer a powerful new set of incentives for tropical forest conservation and restoration, and new income opportunities for forest producers. Watershed, biodiversity and carbon-service markets will almost certainly continue to develop rapidly. However, it remains quite unclear which producers, consumers and types of forest resources will be the real beneficiaries of market development. It is also unclear under what conditions the creation of ecosystem service markets will be the most effective policy instrument for achieving forest policy goals. Most markets are still incipient and their further development will require concerted government action. Decisions taken over the next few years will shape market effectiveness, efficiency and equity for decades to come.

Yet few national, state or local government entities in tropical countries have access to the information needed to shape policy on market design. While there are some public-sector sources of information and capacity-building (eg from the World Bank, FAO, etc), the scale of these efforts is very small and most input is generic rather than tailored to national or local requirements. Most market expertise is available only from the private sector, generally companies and consultants who are motivated by the opportunity to promote business deals. Where site-specific design input is commercially available, the pricing of services reflects the fact that most expertise and commercial demand are presently found in the industrialized countries. While technical expertise for measuring ecosystem services is become more available through universities, it is often difficult for governments or NGOs to access or apply this in a site-specific project.

In particular, policy-makers and program leaders require:

- objective technical assistance to identify the opportunities and risks of using different types of market instruments, and for designing them to be effective, efficient and equitable;
- opportunities to exchange experiences, perspectives and lessons about the use and design of ecosystem service markets with peers in other countries and regions;
- insights for the design of appropriate legal and regulatory frameworks, and the assignment of property rights around ecosystem services;
- practical data on producer costs for managing ecosystem services, market transaction costs, and the costs of establishing and operating different types of market mechanisms;
- better documentation of the biophysical linkages between land-uses and ecosystem service benefits, and suitable methods for measuring and monitoring the provision of services;
- objective analysis to synthesize the practical lessons being learned from functioning markets;
- objective analysis for the site-specific design of market rules and institutions; and
- capacity-building to develop national sophisticated expertise in analyzing, designing and implementing ecosystem service markets in the public, private and civic sectors.

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Annex 1

ITTO terms of reference for environmental services study

The paper should set out the main issues of relevance to tropical forests for various environmental services. It should give an overview of the current status and future potential of markets and trade of environmental services provided by tropical forests. The paper should:

- set out the conventional wisdom, contemporary understanding and views, as well as uncertainties that still exist in the field of marketability of environmental services;
- identify markets in services flowing from forests, with particular reference to environmental services, and global biodiversity benefits, including their relation to tropical-timber producing forests;
- explore issues, potentials and constraints of emerging environmental service markets, including, *inter alia*, carbon, water and bioprospecting;
- analyse environmental services internalized by forest owners/managers versus external benefits; and
- identify and describe instances where remuneration for environmental services has contributed to the economic and financial viability of sustainable forest management.

Annex 2

Tropical cities that manage forests for water services

City	Protected area is source of water	Multiple-use forest is source of water
Bogotá, Columbia	Chingaza National Park (50,374 ha)	
Brasília, Brazil	Brasilia National Park (28,000 ha)	
Brisbane, Australia	Brisbane Forest Park: D'Aguilar National Park (2,050 ha)	
Cali, Columbia	Farallones de Cali National Park (3,200 ha)	
Cape Town, South Africa	Cape Penninsula National Park (29,000 ha) Hottentots Holland Nature Reserve (24,569 ha)	
Caracas, Venezuela	Guatopo (122,464 ha) Macarao (15,000 ha) Avila National Park (85,192 ha)	
Dar es Salaam, Tanzania	Udzungwa Mountain National Park (190,000 ha) Seleous Game Reserve (5,000,000 ha) Mikumi National Park (323,000 ha) Kilombero Game Controlled Area (650,000 ha)	
Durban, South Africa	Ukhlahlamba-Drakensberg Park (242,813 ha)	
Harare, Zimbabwe	Robert Mcllwaine Recreational Park (55,000 ha) Lake Robertson Recreationa Park (8,100 ha)	
Jakarta, Indonesia	Gunung Gede Pangrango (15,000 ha) Gunung Halimun (40,000 ha)	
Johannesburg, South Africa	Maluti/Drakensberg Transfrontier Park Ukhlahlamba-Drakensberg Park (242,813 ha)	
Maracaibo, Venezuela	Perijá National Park (295,288 ha)	
Medellín, Columbia	Alto de San Miguel Recreational Park and Wildlife Refuge (721 ha)	
Mumbai (Bombai), India	Sanjai Ghandi National Park (8,696 ha)	
Nairobi, Kenya	Mount Kenya National Park (58,800 ha) Biosphere Reserve (71,759 ha)	
Santiago, Chile		The Santiago Foothills have been classified as an 'ecological conservation area.' The forests supply potable water for part of the municipal district of La Reina: about 20% of potable water in requirements for Santiago.
Santo Domingo, Dominican Republic	Armando Bermudez National Park (76,600 ha) Juan B. Perez Rancier National Park (40,900 ha) Jose del Carmen Ramirez National Park (73,784 ha) Nalga de Maco National Park Ebano Verde Scientific Reserve (2,310 ha)	
Singapore	Bukit Timah (2,796 ha)	
Yangon, Myanmar		The forested watershed of the two dams, Gyobu and Phugi, which supply drinking water to Yangon, are managed by the Forest Department of Myanmar, which carries out forest conservation activities, i.e. restoration, in the watersheds.

Source: Dudley & Stolton (2003)

Annex 3

Additional resources

The sources listed below provide additional insight into the development of markets for forest ecosystem services.

General information on ecosystem service markets

Landell-Mills, N., & Porras, I. 2002. *Markets for Forest Environmental Services: Silver Bullet or Fool's Gold?* Markets for Forest Environmental Services and the Poor, Emerging Issues. International Institute for Environment and Development, London, UK.

Pagiola, S., Bishop, J. & Landell-Mills, N. 2002. *Selling Forest Environmental Services: Market-Based Mechanisms for Conservation and Development*. Earthscan Publications, London, UK.

Powell, I., White, A. and Landell-Mills, N. 2001. *Developing Markets for Ecosystem Services of Forests*. Forest Trends, Washington, DC, USA.

The Katoomba Group: the Katoomba Group is an international working group composed of leading experts from forest and energy industries, research institutions, the financial world, and environmental NGOs, all dedicated to facilitating strategic partnerships that can launch green forest products in the marketplace: www.katoombagroup.org

World Conservation Union (IUCN): the IUCN is a partnership of non-governmental organizations, scientific institutions, and government agencies that work to apply sound ecosystem management to demonstrate how to sustain livelihoods for those directly dependent on natural resources. IUCN has been actively engaged in restoring ecosystems and regenerating people's lives, economies and societies: www.iucn.org

Resources on carbon sequestration and carbon trading initiatives

Smith, J. & Scherr, S. 2002. *Forest Carbon and Local Livelihoods: Assessment of Opportunities and Policy Recommendations*. CIFOR Occasional Paper No 37. Center for International Forestry Research, Bogor, Indonesia.

Swingland, I. (ed) 2002. *Capturing Carbon and Conserving Biodiversity: the Market Approach*. Earthscan, Sterling, Virginia, USA.

Biocarbon Fund: initiated by the World Bank Group and the Prototype Carbon Fund, the Biocarbon Fund provides carbon finance to demonstrate and test carbon sequestration projects in forest and agricultural ecosystems. It aims to deliver cost-effective emission reductions while promoting the conservation of biodiversity, the reduction of poverty, and opportunities for adaptation to climate change: www.biocarbonfund.org

United Nations Framework Convention on Climate Change: this convention was signed at the 1992 Earth Summit in Rio de Janeiro and from it came the Kyoto Protocol, which requires cooperating nations to abide by stringent reductions in greenhouse gas emissions. To achieve reductions at least cost, the Kyoto Protocol involves two flexibility mechanisms: emissions trading and the Clean Development Mechanism: www.unfccc.int

Information on watershed protection services

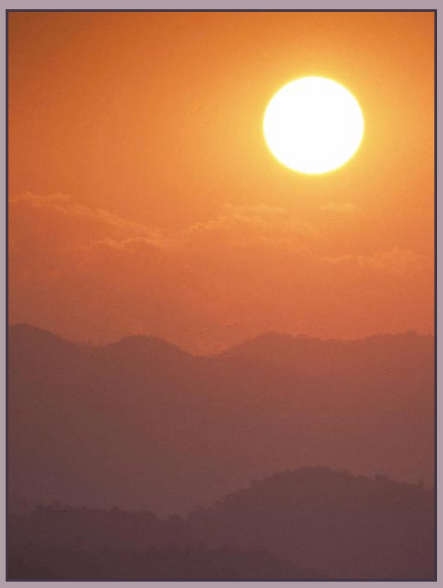
Johnson, N., White, A. & Perrot-Maître, D. 2001. *Developing Markets for Water Services from Forests: Issues and Lessons for Innovators.* Forest Trends with World Resources Institute and the Katoomba Group, Washington, DC, USA.

Ramsar Convention on Wetlands: signed in Ramsar, Iran, in 1971, the Ramsar Convention on Wetlands is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources: www.ramsar.org

World Water Council: an international water policy think-tank, The World Water Council was established in Marseille, France in 1996. It aims to promote awareness and build political commitment on critical water issues at all levels, including the highest decision-making level, to facilitate the efficient conservation, protection, development, planning, management and use of water: www.worldwatercouncil.org

Information on biodiversity protection services

Convention on Biological Diversity: this convention was established at the 1992 Earth Summit in Rio de Janeiro to conserve the earth's rapidly vanishing biodiversity. It aims to do this by promoting the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits from its the use: www.biodiv.org



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