Can the Value of Ecosystem Services Pay for the Conservation of the World's Remaining Tropical Rainforests?

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Deforestation continues at a significant rate, especially in developing tropical countries. The process is a consequence of pressures to realise the commercial value of the timber and/or the land, the latter typically for either agriculture or settlement. Forests are integral to a variety of increasingly valuable environmental systems — carbon, water and biodiversity. Measures such as stopping illegal logging, and labelling logs from sustainably-managed forests, are important palliatives. However, the real need is to develop price signals that reflect the substantial value of environmental services, and to integrate these into the international commodity economy.

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Introduction

While the recent Millenium Ecosystem Assessment[1] indicated that the extent of forest cover in developed countries has largely stablised, there is a continuing significant loss in both the extent and ecological integrity of forests in developing countries, particularly in tropical regions. The stabilisation of forest cover in developed countries is a result of the completion of the process of clearing most arable forest land for agriculture, and even the abandonment of marginal agricultural land back to forest in some regions. In many tropical regions the conversion of arable land to agriculture, including grazing, palm oil, soybeans and other commodities, is still occurring at the expense of forests.

The economics of land use are not particularly difficult to understand. Most landowners seek to generate commercial returns from their land assets. In the case of forests this may initially be by logging of existing timber resources. The owner may then abandon the land once its value has been extracted, undertake commercial reforestation, convert the land to some form of agriculture or develop the land for human settlement (e.g. housing). The decision is usually affected by a desire to maximise, at best, the net present value of the succeeding land use or, at worst, the short-term profits. At present, converting land to satisfy the high demand

1 See www.milleniumassessment.org

for agricultural commodities and sprawling urban development tends to provide higher returns to land use in many areas, particularly when cast against the long time-frames and uncertainty of growing timber crops.

With the next 50 years likely to see a quadrupling of Gross Global Product, and demands for meat, paper, energy and grain likely to grow at similar or greater rates, there is some concern that we may see the 'endgame' for the natural environment in the coming decades[2]. Certainly in any 'business as usual' world we can see a large-scale and continuing loss of forest cover in the Amazon, Southeast Asia and Central Africa for agribusiness commodity production[3]. Yet at the same time there are a host of government agencies, UN bodies and non-governmental organisations focused on conserving the world's remaining forests because of their important contributions to global climate stability, land and water conservation, and biodiversity. This competition between conservation and development is being won handily by development at the moment, simply because it has the weight of economics and associated market forces behind it. If conservation is to prevail it has to become a higher economic land use, and we need to see emerge a new commercial base for forests, related to valuing their ecosystem services. This paper will review this idea and consider whether new markets for ecosystem services may ultimately contribute to the conservation of forests.

Ecosystem services and forests — is there a commercial value to exploit?

Many books and articles in recent years have discussed the idea of ecosystem services[4]. The concept was initially put forward by Costanza[5], who published a paper quantifying the value of global ecosystem services at between $US17 and $US50 trillion per annum. At the time this was approximately equal to the Gross Global Product, and underscored the degree to which our economy relies on free services provided by nature. The paper, however, was also criticised as trying to put a price on 'God' or suggesting that the priceless and irreplaceable (e.g. nature) could be somehow replaced if we had enough money and technology.

Despite criticism, however, the idea of valuing nature has taken hold, as most people understand that as long as the environment is unpriced, it will not be effectively conserved. In response, a slightly different approach to the idea has emerged, arguing for the value of these things to be priced because it is a more efficient approach to supporting human health and well-being. The classic case of the New York City watershed is often used as an example. In this instance, the city found that investment in the health of its watershed had benefits equivalent to secondary water treatment, and at far lower cost. Other examples have been highlighted recently[6]. This approach argues for a re-distributive model, where environmental impacts must be reduced or offset, ultimately to achieve a no-net impact position on the environment.

This will not happen overnight because of the substantial short-term economic adjustments necessary. However, as can be seen in Figure 1, substantial human impact has already occurred, and is likely to expand in coming years. So whether the argument is one of moral or ethical imperative, or simply commercial good sense, there is an expectation that natural systems, including the atmosphere, hydrosphere and biosphere, will become increasingly valuable in their own right, and that there will be a market price to use them. Then, like any other commodity, as scarcity emerges or competition rises for the use of the ecosystem services, the prices should go up. Forests are somewhat unique in this whole equation, because they are integrated into the major environmental systems steadily being priced.

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2 See Speth, G. 2004. *Red Sky at Morning*. Yale University Press.

3 See for example recent WWF study forecasting that 22 million ha of forest and savannah in South America will be converted to soybean cultivation by 2020, available at: http://www.panda.org/about_wwf/what_we_do/forests/news/news.cfm?uNewsID=14910, and
Linden, E., Lovejoy, T. and Phillips, J.D. 2004. Seeing the forest. *Foreign Affairs* **83**(4)**,** 8–962B; http://www-stage.foreignaffairs.org

4 See for example Daily, G. and Ellison, K. 2002. *The New Economy of Nature*. Island Press/Shearwater Books, Washington, DC, or Pagiola, S., Bishop, J. and Landell-Mills, N. (eds) 2003. *Selling Forest Environmental Services: Market-based Mechanisms for Conservation*. Earthscan Books, London

5 Costanza, R., d'Arge, R., de Groot, R. *et al.* 1997. The value of the world's ecosystem services and natural capital. *Nature* **387,** 253-260.

6 See www.ecosystemmarketplace.com

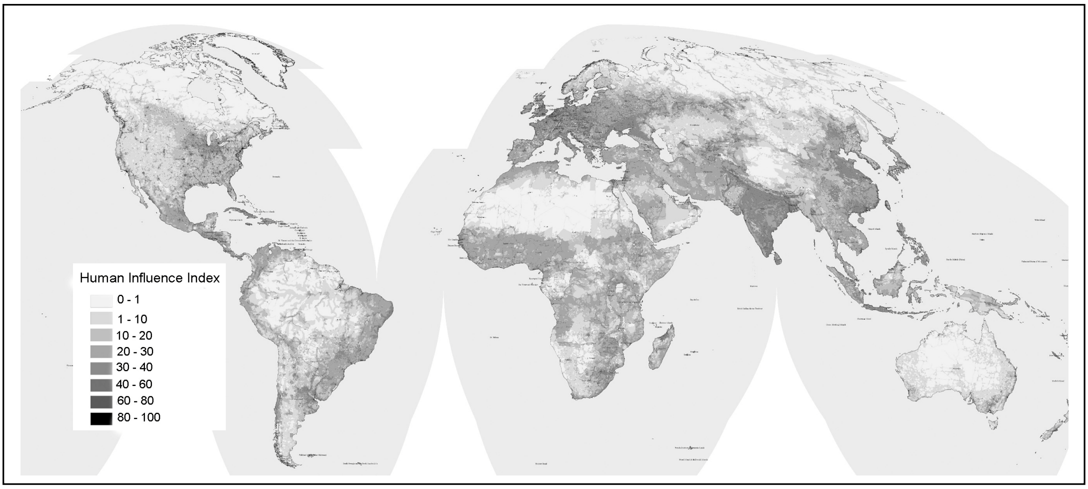

Figure 1. Degree of human influence on the earth's ecosystems. (Source: Columbia University Center for International Earth Sciences, www.ciesin.org.)

For example, forests are a key part of the global carbon cycle, act as a regulator to soils and freshwater quality, and play host to a substantial proportion of global biodiversity. Thus, as these things rise in value, forests will increasingly be seen as a kind of natural infrastructure that may be managed as much for ecosystem services as for timber or energy products.

Status of environmental and ecosystem markets — an early focus on carbon?

The history of using market-based or price-based mechanisms for controlling pollution and environmental impact has been reviewed elsewhere. However, the use of market-based mechanisms to control acid rain in the United States in the 1990s has generally been seen as a key initial example of the approach. Flowing on from the perceived success of the sulphur dioxide markets, the United States argued that the use of a market-based approach should be at the centre of global efforts to reduce greenhouse gas emissions. The Kyoto Protocol is now operating with a range of market-based mechanisms, but somewhat ironically, without the participation of the United States.

As political pressure mounts to reduce greenhouse gas emissions, there have emerged a number of markets for greenhouse gas emissions or emission offsets. Emission offset credits are created from activities that reduce emissions, such as flaring methane emissions, planting forests (which absorb carbon dioxide as they grow), or installing renewable energy systems that do not emit greenhouse gases (such as windpower, solarpower or biomass energy). These markets are both compliance driven (e.g. based on government regulatory requirements) or voluntary (e.g. based on corporate or personal commitments to reducing greenhouse emissions). The total market for greenhouse gas emissions is rising steadily year by year (Fig. 2).

With the greenhouse gas market now at 250 million t per annum and with a total value of $US5 billion in 2005, this is a significant economic activity and provides some insight into how markets for other ecosystem services may operate in future.

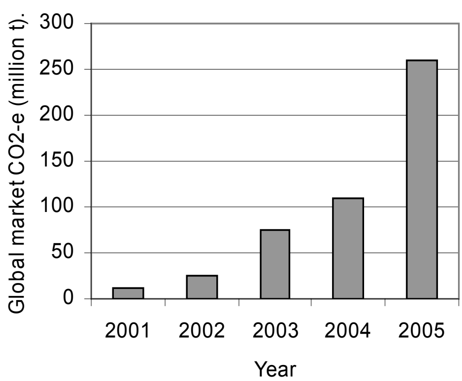

Figure 2. Total size of the global greenhouse gas market by year. (Source: World Bank data provided by Natsource, updated by New Forests Advisory Pty Ltd 2005.)

First, it should be noted that the major trade in carbon credits or emission allowances is driven by government regulation and emission reduction compliance requirements, or the implicit expectation that such regulation is emerging. Voluntary or retail carbon trade is only about 5% of the total market. Next, we can also see that the market quickly determines a cost-curve for offsets and exploits the low-hanging fruit first. In this case carbon markets have quickly identified that the destruction of industrial gases such as sulphur hexaflouride or nitrous oxide are very-low-cost strategies to generate emission reductions, relative to say wind farm development. Third, we can see that these markets, being largely the creation of government regulation, are very risky and potentially volatile as governments change, political will increases or decreases, or public interest in climate change increases or diminishes.

Loss and degradation of forests has been responsible for about 20% of the greenhouse gas emissions in the past 150 years. This is a sizable contribution, and the ongoing loss of forests in tropical areas will continue to contribute to carbon dioxide emissions. It has been argued, therefore, that the protection of forests or the regeneration of forests cleared in the past could be an important part of the overall action on climate change. However, the use of forests as an offset has been controversial, with many parties demanding a focus on reducing emissions, rather than offsetting them. The parties opposed to integration of forests into emissions trading largely prevailed in the Kyoto protocol negotiations, and there is a very limited role for forestry offsets created via reforestation.

There was a shift in attitude, however, at the recent Climate Change negotiations in Montreal (December 2005, the Conference of the Parties to the UN Framework Convention on Climate Change), and a group of tropical countries led by Papua New Guinea and Costa Rica successfully raised debate on the potential to credit countries who reduce deforestation as a way of reducing greenhouse gas emissions. Research indicates that a carbon price applied to intact tropical forest would substantially slow the rate of deforestation, as even a small price per tonne of carbon dioxide emission substantially affects the economics of converting land to soybean, palm oil or other agricultural crops. Creation of carbon pools at a regional or even national scale would also create effective mechanisms to monitor carbon stocks, to address natural disturbances like wildfire, and to support payment schemes to individual landowners or community groups. In fact many NGOs and scientists have argued that payments to reduce deforestation could be one of the most important tools necessary to reduce the loss of the remaining tropical rainforests.

How the international carbon market will evolve remains highly uncertain. The decision of the United States and Australia to withdraw from the Kyoto Protocol has led to the emergence of two camps on how to address climate change. Somewhat strangely the EU-led group is seeking an extension of the Kyoto Protocol framework with a continued strengthening of greenhouse emission reduction targets and a continued emphasis on market-based mechanisms. The US and Australia on the other hand are leading a process to focus on direct government support for research and technology development, which seems to be the reverse of the normal political orientation of the respective governments. Nevertheless there is mounting pressure for action, and a large range of political positions within Australia and the United States on climate change policy. This may lead to shifts in position over time.

With regards to the outlook for forests as part of the global carbon market, it appears that the following will be key considerations in coming years:

- Forests will likely be only a small part (e.g. less than 10%) of an international carbon market, owing to complexity in monitoring, the costs to bring forestry offsets into a market, and requirements related to additionality and permanence.
- Despite the above comment, technology and monitoring systems, as well as legal and accounting systems, will evolve and improve in the coming years, allowing effective commercial systems to be overlain on forest carbon management.
- It appears likely that avoided deforestation, alongside reforestation, will be included in future schemes, but how the rules will be designed is highly uncertain.
- Some jurisdictions such as that of California are also allowing ‘improved forest management’ or a reduction in harvest intensity to qualify for credits.
- As carbon price signals expand, look to see wood products begin to substitute for higher-embodied-energy materials, and look to see an expansion of wood-based energy systems.

Will other environmental markets follow?

Unlike the globally homogenous atmosphere, issues related to soil and water conservation and biodiversity conservation are much more heterogenous and geographically localised. Therefore, rather than talking about a global water market or a global biodiversity market, we see a myriad of local initiatives, regulations and offset programs. The case of New York City and the water supply from the Catskills is a good example of a local solution designed in the context of the regional issues affecting water quality. In many other areas local communities have invested in their catchments to conserve or improve water quality.

However, there is likely to be an increasing standardisation or convergence of water-related instruments as part of the globalisation of trade and environment issues. Already we can see the tradable rights to water being privatised in many regions, and a developing capacity to monitor water prices by country, by region and even by watershed. Table 1 shows the water allocations and pricing in New South Wales, Australia. Note that water prices vary from region to region, rise over a given season, and can be bought and sold either as permanent allocations, or on a 'spot' market for megalitres of water.

Once water is privatised and tradable, it becomes a commercial asset, and owners of these assets will want to protect their asset value. This will likely lead to efforts to protect water quality, possibly by payments for upstream land management or vegetation conservation. It may also lead to specialised investment funds buying up water rights and leasing the rights to irrigators or speculating on the spot market prices. The value of water can also potentially be leveraged to create funds for investment in water efficiency. For example, the Murrumbidgee Irrigation area may have in the order of $A1 billion in water property rights. These rights could be sold to a central water bank owned by an investment company. The billion dollars gained by the landowners could be used to invest in substantially improved water use efficiency and water conservation infrastructure.

Table 1. Pricing ($ per megalitre) for water ('NSW Regulated' as at 3 January 2006) on the spot market, and for traded rights. (Symbols: ↑ = Up; ↓ = Down; □ = No-change) (Source: Water Exchange Australia, http://www.waterexchange.com.au/)

Zone	Allocations[a]				Permanent[a]	Forward water contracts ($ ML^{-1})				
	Current price	High price[b]	Low price[b]	Volume (ML)	Current price	2006	2007	2008	2009	2010
Coleambally	40 ↑	75	30	1,560	600 □	0 □	0 □	0 □	0 □	0 □
Gwydir Valley	200 □	200	200	213	2,300 ↓	0 □	0 □	0 □	0 □	0 □
Hunter Valley	0 □	0	0	0	600 ↑	0 □	0 □	0 □	0 □	0 □
Lachlan Valley - Upper	65 ↓	350	65	3,440	500 ↓	25 ↑	25 ↑	25 ↑	0 □	0 □
M.I.L.	51 ↑	128	38	6,433	525 ↓	0 □	0 □	0 □	0 □	0 □
MacIntyre Valley	120 ↑	120	50	265	2,100 ↓	0 □	0 □	0 □	0 □	0 □
Macquarie Valley	150 ↓	200	140	10,120	1,200 ↓	42 ↑	42 ↑	42 ↑	42 ↑	0 □
Mid Murray	50 ↑	180	40	15,091	800 ↓	35 ↑	30 □	30 □	30 ↑	30 ↑
Murray Valley Lower	40 □	110	30	16,816	1,150 ↑	75 ↑	75 ↑	35 ↑	35 ↑	35 ↑
Murrumbidgee Irrigation Area	40 □	80	25	7,836	700 ↑	0 □	0 □	0 □	0 □	0 □
Murrumbidgee Valley	44 ↑	80	27	27,264	800 □	35 ↑	0 □	0 □	0 □	0 □
Namoi Valley	120 □	120	120	63	2,100 ↓	0 □	0 □	0 □	0 □	0 □

[a] The price of allocations is effectively a spot market price for the purchase of a certain quantity of water. Permanent water refers to a right to a megalitre of water each year in perpetuity. In this case the pricing is for 'General Security Water', which is effectively a share in a variable supply of water in the region concerned. Another category of 'High Security Water' trades at a higher value, not quoted here.

[b] The high and low price is recorded over the current growing season

The landowners could then lease back water from the water bank — possibly as little as half as much as previously needed — to support their more efficiently irrigated crops.

Such a scheme may also lead to a diversification of crops that require water at different levels and at different times of year, and the water bank could optimise the allocations. It may also lead to the water bank acting as a central buyer of watershed conservation services from upstream landowners, increasing the capacity to pay for water quality services. These schemes are still 'on the drawing board' but may become a reality in the next three to five years if government policy initiatives and support from the agribusiness sector continue.

Biodiversity conservation is also emerging as a tradable right, particularly in the United States. In this case, the pressure to develop land causes impacts on certain ecosystems or species, and the developer must 'offset' the impact by some mix of protecting habitat elsewhere or re-creation of similar habitat. In most cases the offset must be greater than the biodiversity impact of the development, and the offset must occur within a regional context. In response to the increasing demand for these offsets, a biodiversity banking industry is emerging that will buy up properties and develop them for particular types of habitat in demand in the region, such as intermittently-standing pools of water, particular vegetation types or riparian areas.

This localised biodiversity banking and trading does little, however, to address the loss of tropical rainforest, where there is limited capacity to regulate land clearing, and the concept of biodiversity banking and easements still seems far from the mainstream of business and politics. However, pressures are emerging, for example for certification and labeling of wood products and for sustainable practices in palm oil production, largely driven by international NGOs. These NGOs know that the route to creating more value for nature is to follow the trade in the goods being produced, and then pressure the ultimate end user market, often in a developed country. In this way Nike, for example, was pressured to improve its labour practices in developing countries, and Home Depot made a commitment to source its wood products from sustainably managed sources.

Sustainability labelling is not likely to be sufficient to conserve the world's tropical rainforests. However, if linked with carbon markets, and potentially other instruments that reduce risk to longer-term forest investors, it could lead to shifts in the economics of land use in tropical regions. As has been argued by Vijay Vaitheeswaran of *The Economist*, most developing countries favour economic development over environmental conservation while their economies are in a phase of rapid growth. However, as these economies mature, the political will for conservation grows, and there is a natural stabilisation and even reversal in environmental decline. *The Economist* called this 'the great race' between development and environmental conservation.[7]

Conclusion

It is well known that the loss of tropical rainforest is continuing, with the United Nations Food and Agriculture Organization recently estimating that about 13 million ha per annum are cleared, primarily in Africa and South America.[8] Much of the cause of this deforestation is agricultural development, and the challenge for developing countries to create employment and wealth in rural areas. The reality is that complex forest systems containing substantial carbon stores, a wealth of biodiversity and important water purification services are being replaced with homogenous crop systems, often using high inputs of pesticide or fertiliser. Yet the global economy encourages this form of investment, because it prices palm oil, soy beans and timber, while it does not price carbon conservation, soil conservation, flood control or biodiversity.

The politics of international aid, trade and environmental activism are such that the root economic causes of deforestation are rarely addressed. Rather there is a focus on stopping illegal logging, making palm oil sustainable and labeling logs from sustainably managed forests. This paper argues that while such initiatives may slow deforestation, they will not stop it, and there is a need for much more development of carbon, water and biodiversity markets, and particularly the integration of price signals into international commodity trade. The positive environmental externalities of forests can also be integrated into wider trading schemes for greenhouse gas emissions, environmentally

7 *The Economist*, 4 July 2002. Survey of sustainable development.

8 See the *FAO Forest Resource Assessment 2005* at www.fao.org/forestry/site/32246/en

neutral products and services, and tradable development or conservation rights.

Pricing of these things is essential if investment is to flow into forest conservation rather than forest conversion. While there are growing initiatives such as the Equator Principles and public commitments by major finance sector organisations, the rules of the market are such that little can be done to divert investment unless environmental services are priced and valued.

Governments must lead this shift, through international efforts such as the Kyoto Protocol, through the way that aid is designed (e.g. why not buy environmental services rather than subsidising palm oil?), and how we address trade and environment issues. All this is complex and difficult, but inevitable, as there is no question that as rainforest becomes increasingly scarce, the international community will have to find a better way to value it.