Securing the supply of household, local, national and global forest values

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1999

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Keywords: forests, forest goods and services, economic resources, economic valuation, sal, conflict, India.

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I. Introduction

The problem of forests in the world may be summarized as follows. Firstly, both the quantity and quality of forests is declining. Secondly, the security of the supply of goods and services from forests is under threat. And finally, there are welfare losses borne at household, local, national and global levels due to decline of and the insecurity in the supply of goods and services from the forests.

Forest policy analysts have pointed to several causes for this decline in forests, goods and services, and welfare. These are broadly grouped under the heads of policy failures, market failures and institutional failures. There has also been considerable variation at both national and international levels in deforestation rates which has lead to the suggestion of combining local field-level investigations with cross-national research, to " build theory and amass evidence" about the causes of deforestation (Rudel and Roper, 1997). More generally however, there is little agreement on the key causes of deforestation, which factors are significant and their relation to forest loss, e.g. income has been posited to be linked both positively (UNICEF model (Grant, 1994) and negatively (Ehrlich, 1991) to forest cover.

There are also several caveats. Most cross-national studies use some measure of forest condition, or change, as their dependent variable. The variable of choice is the rate of deforestation from FAO statistics. However, FAO's forest loss estimates in the past have been extrapolated from rural population figures and assumptions about the impact of shifting cultivators on forest cover. This leads to the curious situation where population is both an independent variable, and is the source of the dependent variable as well (Rudel and Roper, 1997). Secondly, there is an increasing groundswell of case-studies which point towards the role of community institutions in mediating population and market pressures. The institutional variable is difficult to measure, and is therefore rarely considered in studies with a large number of observations. Thus, while

econometric studies of deforestation can be an empirically rigorous path for identifying causative factors, they are often led by data availability.

This paper proposes to apply the concepts of value as well as resource and property characteristics to explore the large number of goods and services provided by forests and how markets and institutions may be better used to secure those values. The varying scale at which those values accrue to diverse stakeholders is a constant theme through the three case-studies of changing forest use. The final section illustrates how the nature of the goods and services and the property and institutional regimes devised for their control and management influence the supply of these goods and services. It explores the implications of two diverse trends in forest management, the increasing decentralization in forest management and the simultaneous increase in the global values derived from forests, against the backdrop of forest values and resource/property characteristics.

II. What good is a forest for?

Forests have multiple uses. The range of possible goods and services flowing from a forest is a function of (a) the kind of forest in question, and (b) the interaction of biotic and abiotic factors which broadly determine the forest eco-system. Within the set of feasible multiple uses it is often the case that uses conflict ecologically, in the sense that maximizing a set of uses can restrict other uses. Thus for example, managing a forest for timber typically involves favouring timber species and may reduce the extent of fuelwood, fodder and non-wood products flowing from the forest, especially if non-timber species have been restricted (Saigal et al, 1996). This can also be true for environmental services - the hydrological function conflicts with certain types of forest management operations but not others (Chomitz and Kumari, 1996), as does the conservation of species diversity. To complicate the picture, the preferred uses of forests vary at different scales - preferences at local, regional, and higher scales may have some congruence as well as significant differences. Income levels may also play a role in determining the preferences - e.g. field studies have shown that fuelwood extraction is negatively linked to income (Pattanayak, 1998). A further complication arises from the tenurial conditions which influence the extent of exclusion and the nature of the product or service which influences the level of rivalry in utilization of the good or service.

So, the question of what set of forestry outputs are maximized largely depends upon the degree of ecological complementarity or competition between different elements of the output set, the extent of congruence in the preferences at different levels, the tenurial conditions and the consumptive nature of the product or service. This section explores each of these issues.

Ecological complementarity/competition:

- Management practices by definition are designed to change the flow of goods and services from a forest. A timber oriented policy reduces the number of non-timber quality producing species and favors timber species. Extensive felling, and road-building affects soil erosion and water quality, while management for leaves and other non-timber forest products could significantly retard timber output. On the other hand - low-intensity felling practices coupled with diligent application of best management practices could have little or no impact on the flow of other direct and indirect forest services. Examples of complementarity abound as well - shade tolerant trees are established in the presence of a closed canopy of existing trees, while sal (*Shorea robusta*) establishes well in denser undergrowth, than mono-culture plantations.

Conflict between subsistence and commercial uses:

-subsistence and commercial uses of the same resource often generate conflict among users. Thus most material outputs from the forest - e.g. fuelwood, fodder, timber, several NTFP's can be used either for self-consumption or for sale. In recent environmental history in India - conflict over allocation of ash trees to a sports company and denying their local use, for plows, snowballed into the Chipko movement in the Garhwal Himalayas in the 1970s. In several joint-forest management sites, users have to resolve the competing demands for local self-consumption versus sale of fuelwood and fodder (Agarwal and Saigal, 1996) between themselves, and with the other partner, the forest department.

The type of good also has a impact on the outcome of forests. The type of good (private, public, common pool, toll) is a function of the ease of excluding others from its use and the impact of a user on the resource. If consumption is rival i.e. use diminishes the good, and exclusion is easy, then the good is private - e.g. wood from a tree- my use reduces the amount available for others, and I can easily exclude others from using the wood. In public-economics theory, forests and pastures are good examples of common pool resources - there is rivalry in consumption - my sheep reduce the amount of fodder available for yours, and exclusion is costly. The four types of goods, by physical characteristics, are defined in the matrix below.

Table 1. Nature of the resource

	Subtractability of resource (Rivalry in consumption)		
Cost of Exclusion		yes	no

	low, easy	Private goods - trees, livestock, fish, food	club/toll goods - toll highway (with few exits, entrances),
	high, difficult	Common pool - Most environmental resources	Pure public Public lighting, defence

However, when we view the value of forests, in the context of the type of goods and services derived from forests, it becomes apparent that there is a variety of physical types of goods and services available from the forest. Products once extracted from the forest are essentially private goods, while recreational use is a public good, though too many users may detract from the enjoyment of others, turning it into a common-pool good. Other indirect-use values - clean stable water supply may also be characterized as a common pool good - available to all in a vicinity (whether subterranean or overland flows) and difficult to exclude others.

While the type of good is more a function of its physical characteristics/intrinsic nature; rights, although guided by the nature of the good, are very much a societal construct and refers to the clarity, security and exclusivity of that right. Thus a private right to own land implies that the right-holder knows clearly what s/he is entitled to do, it is secure and protected from arbitary confiscation and ownership is vested exclusively with the right-holder and not other right-holders. A public right to access or use on the other hand is non-exclusive - it does not allow the right to exclude others. Finally, owners of rights may be public or private depending on whether they represent just themselves or the general population. Thus a joint-stock company owning a milllion hectares of forest in Maine, USA is a private body (representing only its shareholders), having a private right (can exclude others) over a common-pool resource. Similarly, a formal/informal village cooperative having exclusive rights of extraction over a nearby forest is also the same, a private group of people exercising their largely private rights (can exclude non-right others from using resources) over the common-pool resource. However mismatch between the (intrinsic) nature of the resource or good, the nature of rights (an institutional construct), and the nature of ownership (private or public) can lead to less than efficient outcomes (McKean, 1998).

The worldwide disquiet with the loss of forests and biodiversity - both locally and in areas increasingly perceived to be a global heritage, is reflected in the increasing number of people and organizations devoted to rhetoric, research and action about the same. This disquiet may be reframed as unease over

which sets of goods and services available from the forest are being emphasized and which are being lost. There is consternation that certain uses are being over emphasized at the expense of other forest functions. Bio-diversity, water-shed protection - the hydrological cycle and soil conservation functions, nutrient recycling, carbon sequestration and subsistence uses of forest dwellers are all examples of uses of forests that are declining at the expense of other uses. Decline in physical quality of life in many areas - water, fuelwood shortages etc also suggest that some local uses are getting short thrift. The scale of diversion of forest lands to other uses is disturbing particularly when the forest ecosystem in consideration is thought to be of significant value. The next section discusses various uses of forests in a framework of economic value.

III. Framework of forest values

Forests have been characterized positively and negatively in the past. On the one hand, forests have been seen as occupying land with valuable alternate uses, as the home of wild animals which destroy crops, steal livestock and attack humans, and of 'primitive' forest dwellers. In several countries, including Brazil (Southgate, 1992) and India, grant of land rights is linked to clearing land and putting it to 'productive' use. On the other hand, forests have also been recognized as providing several kinds of goods and services that are useful to humans. These include the flow of timber and Smallwood as well as other products - berries, leaves, tubers, herbs, shrubs, roots, and various animals and birds. They also include environmental services - stabilization of the hydrological cycle, soil conservation, carbon sequestration and perhaps attraction of convectional rainfall. In addition, there has also been some appreciation that forests are the home of various plants and animals and that both have a right to co-exist peacefully with humans. In several cultures, forests have also been revered as the abode of gods and spirits (Gadgil, 1995).

Clearly then, forests are seen to provide several kinds of services. These services are related to attributes of forest ecosystems which themselves are a function of the natural environment and human interventions. The services are preferred by individuals and therefore have utility. In this view, forests are both natural as well as environmental resources and modeled as assets that yield a variety of valuable services (Freeman, 1993). Valuation methods have been devised to measure this utility accruing to individuals. These forest values are based on a neo-classical framework of economics. It is important to state that the ethical framework reflected in this system of valuation is based on welfare change measurement and is anthropocentric (humans assign the values) and utilitarian (things count to the extent that people want them) (Randall, 1988). Thus though forests may well have the right to exist in their own right, in this view their right to exist is valued in terms of the extent humans derive utility from knowing that a forest or forests exist for their own sake.

While individual and societal preferences for forests have been around for a long time, their reflection in economic valuation is more recent and largely a function of increasing interest and advances in methods measuring the value of these goods and services. The concern for decline in forest cover, bio-diversity and forest services in general is also reflected in the expansion of the concept of economic value to encompass indirect and non-use values.

The following table defines and illustrates the various use and non-use values of forests. The sum of all these use and non-use values is called the total economic value (TEV) (Pearce, 1992).

Table 2. Forest values

	Type of Value	**Explanation**	**Example**
	Use value Direct use value	Value derived from consumption of goods or services from a forest	Product flows - timber, fuelwood, fodder, medicinal plants, fibre, berries, roots, leaves etc. Non-consumptive use - recreation, spiritual use,
	Indirect use	Value derived from function provided by a specific forest or forests in general	Hydrological cycle stability, carbon sequestration, soil conservation, local temperature moderation, convectional precipitation.
	Option value	Keeping the option of using a resource for the future - especially in the face of uncertainty over use value and irreversiblity of degradation.	Preserving species and forest eco-system diversity.
	Non-use value Bequest value	the moral value that future generations have the the opportunity to 'use' (or not use) from forests	Saving old-growth redwoods, the tiger, other ecosystems for our children.
	Existence value	satisfaction derived from the pure fact that a forest or/and its constituents exist, for their own sake	- Beliefs of individuals, sects, religions - contributions to environmental groups to save

			tropical forests

It is well accepted that humans derive benefit from some combination of the above values, indeed this classification itself is a reflection of preferences held by people. The next step is to quantify these flows of goods/services in terms of some physical units, e.g. metre^3 /ha for timber or some proxy for the service derived from the forest. Quantification can be a multi-stage process, e.g. Forests may provide clean water, which leads to a reduction in morbidity among humans which can in turn be valued. Valuing other services may be more complex, - e.g. defining water quality, in fresh water bodies with catchment forests, in terms of its recreational utility and then measuring changes in that quality as they affect recreational use (Freeman, 1993). It can also be complicated by the conflicting nature of some goods and services with each other.

Several methods have been evolved to measure these values mainly because of the disjunction between economic values and market prices. Market prices of products traded in the market may reflect their value, as long as markets are not distorted due to various imperfections - monopolies, lack of information, and variance in quality. Prices are also misleading when the goods and services are public (non-exclusive and non-rival) or common pool resources (non-exclusive and rival). In short, market prices reveal value, not in general, but, only in a rather special and limiting case. Many forestry values violate the special case where market price is a valid indicator of economic value.

While some of the values are apparent because the use relates to a product that can be traded in the market, others have to be teased out in a more roundabout manner. Thus timber, fuelwood, fodder and a host of non-timber forest products are traded in the market and their market price (or shadow price) could be a fair approximation. Products that are consumed directly by the collectors can be valued at some ratio of the prices prevailing in local markets. Other products and services may be valued in terms of avoided market transactions, i.e. edible tubers collected for food in times of drought may be valued in terms of the cost of alternate arrangements of buying or providing food. Direct use services may be valued in terms of expenditures avoided, or made to avail of the services. Thus travel costs to forest areas may provide an approximation of how much the recreational use of forests is worth. Alternatively, the value of an environmental service may be derived by isolating its relation with the price of a market good e.g. proximity to forest and its attendant environmental/recreational benefits may be estimated by looking at the variation in real estate prices, using the hedonic pricing method. Indirect use values - e.g soil conservation, smoothening of the hydrological cycle over wet/dry seasons, could be valued by their contribution to agricultural productivity or avoided costs - cleaner drinking water leading to less disease.

In situations where a market does not exist and it is difficult to link to conventional or surrogate markets, contingent valuation can be gainfully utilized to estimate changes in welfare by asking people directly about perceived changes in welfare accruing from a change in environmental quality of a resource. Respondents are given a hypothetical situation and asked to put a monetary value to the change and tag a willingness to accept compensation, or provide a payment for accepting/rejecting the change. Recent literature suggests the Willingness to pay method as appropriate for developed nations (Hanemann, 1994). For assessments in rural subsistence based economies in developing countries, the Willingness to Accept measure is recommended by Shyamsunder and Kramer (1996) especially in situations where the rights to the good under consideration are held by the surveyed population and where respondents face severe economic constraints. Their study uses a WTA format to estimate the loss to rural households from no longer having access to a large area of forest lands for grazing etc.. They add that while a pre-test indicated that some respondents were willing to pay for forest protection (and exclusion), this was more a result of a perceived sense of coercion than being actually willing to pay for conservation. However they qualify that where loss is matched by or lower than benefits, WTP may be theoretically more appropriate. However property rights should be the dominating reason for choice of method. Instead of money, they use a well accepted, non-monetary numeriere (in this case, baskets of rice). A more detailed application of these varied methods for assessing forest value is provided in appendix 1.

In section IV, three examples from different forest regions of the world exemplify the kind of values that are derived from forest areas. The following are discussed: the forest type and the species diversity, the socio-economic profile of local users and other users, the nature of values derived from the forests by different strata of stake-holders.

IV a. Forest values of a dry Sal forest in India.

Forest type: This case study area is the dry peninsular Sal (S*horea robusta*) forests in West Bengal. Sal is the predominant tree species, with several associated trees, shrubs and herbs. Vegetation studies have shown considerable diversity in sal forests. One study finds 37 tree, 26 shrub and 26 herb species (Lal et al 1998). Another reveals extensive regeneration and the presence of 155 species of plants in regenerating sal forest areas, in South West Bengal of which approximately 117 are used by local inhabitants (Malhotra et al in Saigal et al, 1994). The sal forests are managed on a coppice system - however rotation cycles have fallen drastically from 70/80 years to 4-15 years. Short rotations combined with high extractions have led to severe degradation. In recent years, joint forest management, where village communities collaborate with the Forest Department in protection, has led to a marked improvement in the forest cover.

Use pattern: The Forest Department normally manages Sal on a 10 year rotation -which provides pole timber in the 3 to 4 inch diameter class. Going to a 15 year rotation would increase average stem diameter by at least an inch - which would significantly increase their revenues (4" poles sell for 300% more than 3" poles). However where community protection is not enforced strictly, Sal forests are coppiced annually or in alternate years by local people - for fuelwood and in some places *datum* (country tooth-brushes). These products are typically collected for subsistence and sale.

The main other direct use benefit is from the collection of non-wood forest products. Kendu leaves are collected and sold for making *beedis* (country cigarettes). Sal leaves are collected from younger trees with large number of shoots, and converted into leaf plates on a large scale, mainly for sale. Mahua flowers are used as vegetables and brewed into liquor. The fruit is eaten as a vegetable or the pulp dried and burnt as an insecticide. Seeds produce edible oil. Mushrooms are also collected from the forest floor. A wide range of plants are used for medicinal purposes of which a select few are sold widely. Locals also collect leaves for fuel. Grass is collected for stall feeding, livestock are also grazed in the forest. In addition the forest also provides some soil conservation and hydrological cycle stability benefits.

User profile: Local users may be divided into two broad groups. Santhals, a forest dwelling tribal group probably have the widest range of uses for the forests. They have also taken the lead in protection of the forest through community efforts. Layaks, another forest dependent group are adept at value adddition to forest products - converting wood to charcoal, and twigs into bead-chains for sale. Both groups collect a variety of non-wood forest products for consumption and sale. They are small land owners and work as seasonal agricultural labour. Other groups have diversified non-forest occupations - including work as agricultural labour, livestock raising, and agriculture. Almost all communities collect domestic fuel and fodder throughout the year. Timber extraction for housing or agricultural implements is more occasional. Fuelwood sale of green timber is widespread particularly to urban areas. Clearly the low income and forest communities are more dependent upon leaves, small diameter fuelwood, and other NWFP both for subsistence and sale. More affluent land-owners may have a greater demand for timber for household and agricultural implements, they are also the first to shift to other kinds of fuels - coal, kerosene and bio-gas.

The cultural life of forest-dwelling communities is also intimately tied up with forest products - leaves etc form part of several social ceremonies including marriage and their religious spirits are supposed tp dwell in forests. In a well quoted statement, one elder has remarked that "our gods have returned to us", after community protection regenerated the forest (Saigal, 1994).

In terms of the framework of values - most of the material uses whether for subsistence or sale, may be classified as direct use value. All local residents are likely to benefit from the indirect use - ecosystem services, though larger landholders may derive proportionately greater benefits.

In terms of option value as well as the non-use values of bequest and existence - I could not find direct studies. However given the reverence for all living things felt by several forest-dwellers and other caste groups, it would be reasonable to assert that there is a significant element of such value placed on forests.

Going beyond the local - a wider net of citizens benefit from the trade and ultimate consumption of forest products and thus derive income and satisfaction - both have value. People passing through denuded landscapes are very often troubled by these and value the green cover (especially along road sides!) This could contain elements of both kinds of values; direct use value - an improvement of their ride/walk through the forest road for recreation or work, a bequest value - that their successors may enjoy the same and an existence value - that the trees have as much a right to thrive as other living beings. People who have not visited the area and are not likely to, may still value the outcome of local community efforts to protect the forest, and perhaps the effort itself. The forest department may derive value from fulfilling its policy objectives - maintaining forest cover, improving productivity of forests and maximizing the output of preferred output - usually timber.

It is significant to note that there is a divergence in what different groups value. Forest dwellers and others value the NWFP and fuelwood production capability of forests. Larger farmers, not directly dependent on forests for income have a higher preference for the timber producing role of forests. The forest department, in practice, often prefers the timber output role of forests and has oriented its silviculture accordingly. Thus longer rotations lead to greater canopy closure which reduces tendu growth and therefore the outflow of *tendu* leaves. Successful protection implies forgoing fuelwood collection significantly; it also reduces Sal leaf output - due to reduction of the number of regenerating shoots after multiple shoot selection. In short, different stake holders value the forest differently and in their quest to maximize their own values, are in conflict. The conflict is also a function of rights, users try to maximize the output over which they have defacto, rights - thus local users have the right to collect most NTFPs while the Forest department has rights largely over timber and a few NTFPs of higher value.

This view is not new and has been mentioned by several observers. An influential paper on forests and the poor concludes that " the discipline of forestry has traditionally been identified with either ecological stability or as a source of industrial raw material, and not with the incomes of the poor" (Saxena, 1996). This conflict revolves around control of land, control of the mix

of outputs from the forest - through promoting selective species and distribution of rights to enjoy the outputs from forests.

IV b. A tropical forest in Bolivia

The second case-study focuses on the uses and values of a forest, along the Rio Chapare in northern Bolivia. Consequent to the negation of the "Law of Colonization" of 1966, in the 1990's, indigenous groups are being given legal authority over their traditional territories. About 400 Yuracare families claim approximately 250,000 hectares of the Rio Chapare watershed as their territory. The basic facts for this view of values is derived from Becker et al (1998)

Forest type: The forest is broadly classified as lowland moist tropical forest. It ranges from transitional forest between dry and moist, to moist, to wet tropical forest. The Chapare influences the forest along the river thru silt deposition, a high moisture regime and erosion. The number of tree species was approximately 45 -60. The forest includes two timber species of traditional importance, Gabun (*Virola peruviana*) and Guayabochi (*Calycophyllum sproceanum*) as well as commercial species like Trompillo(*Guarea*). There is a number of fruiting trees species in the area which are actively promoted by the Yuracare. The average basal area is in the range of 27 -40 m^3 at the three sites where forests were assessed. Interestingly at a "pristine upper Amazon alluvial flood plain forest" of Manu, Peru, while the species density was almost double the density in the Yuracare area, the basal area was lower (Gentry et al (1990) in Becker et al, 1998)

Use pattern: The Yuracare are the primary users of the forest. They use the trees for timber, for collecting fruit and for attracting animals to the fruit, which are then hunted. They probably prevent patchy depletion by seasonal variation in resource use and collection of resources over a large area. They practice a long-term bio-diverse perennial agriculture in small patches planting productive areas with yucca, bananas and fruit trees, which eventually leads to a mature rainforest "dominated by domestic and wild fruiting species" (Becker et al, 1998). In recent years they have also supplied commercial timber to the outside market - including valuable species like Mahogany and Spanish timber. This mixed subsistence-commercial use is reflected in the forest composition - commercial species have lower diameters than fruiting species. The study also indicated that depletion was evident only for traditional timber species.

Use and non-use value: Prior to colonial influence, the Yuracare likely valued the production of fruit both for direct consumption and for attracting game, as well as the animals itself. Timber was valued for local consumption. In the 1990's while these values still exist, external consumers are putting a value to the timber and the Yuracare are supplying the timber. It can therefore be said that they have added net income from timber sales to the set of values derived

from the forest and the outside world is deriving a direct use benefit (of timber supply) as well. Beyond local values - there is some value placed in the continued existence of the forest (and perhaps, of the Yuracare) - for its species diversity and high carbon stock and is probably an amalgamation of option, existence and bequest values.

IV c. Southwest US

The final exploration of forest values is centered in the south-west US. While reference is made to a specific National Forest in Arizona, examples will be taken from other areas as well. This case-study is based upon an exhaustive article by Kenworthy (1998).

Forest type: The Apache-Sitgreaves National Forest is located in eastern Arizona, US. Forest species include sycamores, cottonwoods and walnuts in riparian zones and pinyon pine and juniper in steeper areas. Much of the area is fairly arid and much of the vegetation is concentrated in riparian belts like that of the Blue River. These riparian zones support 75-85 % of wildlife in these areas. Threatened species include the loach minnow - a three inch fish. The south-west willow flycatcher, a migratory songbird that divides its time between Central America and the southwest US, is down to 500 breeding pairs and is listed as endangered.

Use pattern: Timber harvesting and grazing have been important uses of the federal forests. Federal timber receipts in the Greenlee County area have declined from about 600,000 a year to about 67,000. A ½ cent sales tax makes up the short fall. Several ranches in the Blue river area have also depended on grazing allotments on National forest - which are often up to 50,000 acres for a few hundred head of cattle. Recreational use - e.g. trail riding is also increasing.

Use and non-use value: Both timber extraction and cattle grazing provide some level of employment, though the level of subsidies, especially for logging may be significant.

However this is facing threat from the habitat requirements of threatened and endangered species. Most ranches are concentrated in riparian areas which have access to both water and good fodder. However cattle damage habitat by eroding stream banks, increasing silt and destroying stream-side vegetation. Several ranching families are increasingly being forced to cut back herd sizes based on carrying capacity, and are turning to alternate livelihoods. Thus direct extractive activities are losing out and publicly owned forests are being viewed as more valuable for recreation, wildlife and aesthetics. Generally speaking, in areas upland of urban centers, forests may be particularly valuable for their hydrological function in providing a stable supply of clean water.

These changes in how society values uses or non-uses of forest lands beyond the immediate extractive activities has led to several actions -including the Endangered Species Act and its active enforcement through grazing control, restrictions on timber logging etc, the campaign against timber logging on National forests - Zero Cut.

IV d. *Valuing forests, looking beyond prices*

The three case-studies illustrate variations in forest use patterns and their value. The increasing concern over loss of forests and bio-diversity at local, national and international levels suggests that the value of eco-system services and of bio-diversity has increased dramatically. A exhaustive total economic valuation may indicate a high value per hectare of the forest (a controversial valuation exercise last year estimated the total economic value of terrestrial forests at $4.9 trillion or approx. $2300/ha (will check again, Constanza et al, 1998) . However, the current financial return from direct-use of the forest may be quite low and less than the financial opportunity cost of converting the forest to some alternative use. To illustrate with an example from Kenya, the opportunity cost of foregoing agricultural development on parks and forest could be $161 million a year, while the value added by wildlife tourism sector is only $27 million and the economic value of wildlife tourism could be as much as $450 million per annum. Despite the seeming variation, “the ... assessments can be quite consistent. Financial returns can be less than opportunity cost while economic value can be greater than opportunity cost. The pessimism of the former conclusion is offset by the latter finding, but only if ways can be found to capture the broader economic value. Of course most markets function by dividing net benefits among producers and consumers and it would be unreasonable to expect suppliers of tourism to capture the entire consumer surplus" (Wells, 1997).

In the early 1990's interest was fuelled in the development of new markets for the preservation and utilization of bio-diversity. A pharmaceutical prospecting deal was signed between Merck and Costa Rica, where Merck got access to some biodiversity prospecting rights (and lots of publicity) and Costa Rica got approximately two million US$ and an undisclosed share of future royalties from marketed discoveries. However, biodiversity suffers from the same problem as freshwater - there’s lots of it around and the loss of one acre or one species, at the margin, is not likely to cause a significant decrease. Of course, its total value may be infinite. Therefore at the per unit level it does not command a high price. In fact a study estimates the current bio-prospecting rights for pharmaceuticals in the region of $2.29/ in western Ecuador to about 11 cents in the eastern Himalaya and 2 cents in the California floristic province. This hardly counters the pressure from other market oriented uses like grazing, firewood collection or conversion to agriculture (Simpson, 1997).

At the same time, in the aggregate it is valued highly - for providing ingredients for medicines, improved and new crop varieties etc. In the long run, biodiversity will likely be the source of much medical and agricultural advancement. In our framework of value - biodiversity has a very high option value. In addition, taking the ground swell of concern about threats to biodiversity and the disappearing rainforest, it seems that a large number of people place a bequest value and existence value on the forest as well. The values placed on forests increases with understanding of their role and changes in other sectors, thus increasing greenhouse gas emissions has led to higher values placed on the carbon sequestration function of forests. Clearly there is a need to devise mechanisms for the beneficiaries to be able to influence forest management and secure these values.

World wide trends suggest an increase in the perceived value of biodiversity and carbon sequestration, globally. In this context, a quick overview of international environmental agreements, in the 1930's, the 1970's and the 1990's is instructive. A big change is that the focus has expanded from vanishing wildlife and natural habitat (the 1939 Convention relative to the Preservation of Fauna and Flora in their natural state and the 1973, Convention on International Trade in Endangered Species (CITES)) to specifically mention forests. A reading of the 1972 Declaration of the United Nations Conference on the Human Environment (1972), a non-legally binding statement of principles suggests that virtually all the values are embodied in the principles, in some form or the other (table 3 in appendix 2)

The next major treaties/agreements were signed in 1992 at the United Nations Conference on Environment and Development at Rio. Four treaties have relevance to forestry values - the Rio Declaration, the Convention on Biological Diversity, the Framework Convention on Climate Change and the Forestry Principles. Of these the Forestry Principles are the most important for our purposes and can arguably be thought to reflect, in place, the values placed on forests by all nations. The Forestry Principles are fairly detailed and clearly recognize the range of value which is provided by forests (see table 4 in appendix 2). Several of them refer to the whole gamut of values we have identified. Thus sec. (f) of the Preamble talks about ecological processes (indirect use), present and potential capacity (option and bequest value) to satisfy human needs (direct use) as well as environmental values (existence value?) and principle 2(b) refers to "social, economic, ecological, cultural and spiritual need of present and future generations". The North- South contentions are reflected in the very wording of the title - ‘non-legally binding’, but ‘authoritative’.

A parallel trend in the last decade has been the large increase in decentralizing forest management, involving local stakeholders and often turning over forest areas from forest departments to local forest management in groups. This includes extractive reserves in Latin America, joint forest initiatives in Kenya,

Uganda, India, and user group forestry in Nepal. The basic change is tenurial, local groups are given the right to exclude outsiders thus creating a kind of shared private right among the group for the common pool resource. This mechanism has been successful in reversing forest degradation in several areas, by creating appropriate property rights and conferring direct and indirect use values on members and downstream residents. However there are concerns about the attenuation of certain uses and the impact on disadvantaged sections that are more dependent on NTFP's (Sal forest case study, India.).

Given the wide range of economic values of goods and services from forest ecosystems, to varying stake holders and the reflection in international agreements but the difficulty in securing them in practice, the following steps may help in securing highest possible values for the largest number.

1. Information: Valuation exercises and economic analysis at several scales and in diverse ecosystems will indicate the range of values of forest goods and services. This information should be segmented by stake-holders - local, regional, national and global. This information will go a long way putting the diverse, often competing uses and values on the table, especially of the poor, so that more accurate opportunity costs are available for favoured projects. There is a need to clearly account for the three kinds of figures for forest areas, (a) the financial return, (b) the opportunity cost of the best alternative land use and (c) the economic value of the forest area (including both direct use and indirect use). Conceptually speaking, some of the economic value should be transferred to bolster the financial return from preferred management practices such that the sum of the two is greater than the opportunity costs of the alternative land use/management practice. A critical element in this regard is wide-spread dissemination of both methods and results, to all stake-holders.

2. Management tools: There is an urgent need for decision making tools that incorporate the uses and values of all stake-holders and especially the subsistence direct and the indirect uses that are not traded in the market. In the past, for e.g. `scientific forestry' and afforestation projects have largely focused on marketable timber species, often at the expense of other uses. More recently, there is a possibility that the focus on the carbon sequestration and the development of a trading market for the same may lead to a the tying of aid to the maximizing of this one global forest value. While this is not a problem with complementary uses, there are likely to be several competing goods and services that may be adversely affected by this focus, e.g. if the choice of species is more towards high sequestration species which have a lower NTFP and fodder potential. In addition, given the history of forestry projects in the past, the reporting/certification requirements may prevent local users from obtaining preferred outputs.

In addition to providing information about these diverse uses, there is clearly a need to develop a contractual micro-planning process by which all stake-holders can come together and resolve these issues. Clearly, in such a situation, the highest representation should be of local people who may have high opportunity costs and, given the common pool nature of the resource and often its common-property or open access status, the largest impact in influencing the final outcome of the project.

3. The nature of rights and the ownership entities should be in consonance with the nature of the good or service from the forest. Thus creating private rights in a public good or a common pool resource amounts to awarding an exclusive right in a resource which cannot be held exclusively.

Similarly, an open access forest is possibly an example of a common-pool good whose use rights are held publicly *de facto*, while being restrictive - *de jure*, due to enforcement problems. In such a case, creating a private ownership held by the users as a group will provide the appropriate incentives for optimizing most direct use values. In general, matching rights and ownership entities with the nature of the good or service will create more appropriate incentives for users at all levels and ensure more efficient outcomes.

4. Forest ecosystems vary across space due to both biotic and abiotic influences. This could induce significant variation across space, in the volume and value of goods and services derived from a forest area. To maximize the uses where they have the most value, it may be useful to use spatially explicit tool to account for the eco-system variation and the ensuing variation in value. Thus, areas around streams would have the higher value in terms of preventing sedimentation as compared to more 'inland' areas, and higher slope areas more than lower slope ones. Areas with the best soil are likely to have the best growth of trees and therefore the highest value for say timber. Water infiltration into aquifers would be a function of forest cover, soil and ultimately the geology and rates would vary accordingly.

5. Finally, we need innovations that increase the proportion of total economic value captured by those who are bearing the costs and provide incentives to forest users to use them in a sustainable manner. Timber certification, by providing a premium to suppliers, is one such method which can provide an incentive to timber harvesters to follow best management practices, so as to reduce the impact of their logging on the forest as well as make the possibility of future harvests more likely. Refundable forest fees can have similar impacts on logging behavior. A counter innovation is the outright purchase of forest lands with low opportunity costs and converting them to reserves, directly or through debt-for-nature swaps. These are based on the analysis that in certain situations of high real interest rates, long rotation cycles and slow growth rates, unrestricted logging would be more financially profitable (two to five times) than logging in a way that would ensure a continued supply of

mahogany. In such situations, it is suggested that if the opportunity cost is too high at the outset, and unsustainable logging is not highly damaging, versus an option of sustainable-high impact logging, it may be more appropriate to pick the option that better meet conservation objectives - preserve areas after low-impact sustainable logging (Rice et al, 1997).

This analysis points towards trade-offs, whose values are valued and which values are sacrificed in forest ecosystem management. The nature of forests goods, rights and ownership patterns affects the translation of values into incentives. It also suggests that since there is opportunity costs associated with refraining from direct extractive activities, those who value preservation need to make their values count in some manner and those values at local levels should be given careful consideration while negotiating the security of values at other levels.

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Appendix I

The following section discusses several methods and proxies for monetizing different values of the forest and draws extensively on Dasgupta (1994) and Kramer et al (1995). It is based on work done on a BC methodology for assessing forestry.

A Market price

For cash costs, market prices are a fair approximation. In a few situations shadow prices may also be used. For traded products, prices at farm gate or the village market will be used. However for sensitivity analysis, the prices at the nearest weekly market or town will also be collected, as well as the official procurement price if any.

B Productivity Analysis

For environmental resources that are inputs in the production of traded goods (irrigation water, timber, and agricultural soil), accounting values of changes in their supply can be estimated directly. When the flow of all other inputs is held constant, the value of the resulting changes in outputs of the traded good indicates the value of the change in the supply of the environmental resource.

C Opportunity Cost Analysis

Commodities such as firewood and drinking/cooking water are inputs in household production. Household production models may be used to study the impact on the households of the protection and closure of the forest. Using a questionnaire or a PRA approach to establish the extent of dependence on forest products, the welfare losses and gains may be assessed as follows:

(i) Travel Cost Method

Changes in effort, (having to walk further and spend more time in collecting water, fuelwood) may be assessed from travel costs in terms of extra/ less time or distance. The latter may provide an estimate of energy costs (in calories) for the household. There may also be some cash costs involving the mode of transport -e.g. a bus ride.

(ii) Opportunity costs

In some situations, the resource is a substitute for a traded good (fuelwood for kerosene, roots, tubers collected from forest v. purchased food). Its value may be determined from the price of the traded product. For contributions in kind, e.g. grain or labour, extent of contribution may be ascertained from

individuals. This may be valued in terms of opportunity price of grains and labour, respectively.

The same resource may have additional value in special situations like a drought, e.g. the same tubers, etc are famine food and a crucial safety net in times of low availability or purchasing power, and substitute food from the open market or subsidized ration shops). The market price of the traded substitute may reflect this value. Alternatively, its value may be weighted upward to reflect its increased importance.

(iii) Contingent Valuation

The Contingent Valuation method may be used to estimate changes in welfare by asking people directly about perceived changes in welfare. Respondents may be asked to assess the benefits and costs of protection as compared to the without protection scenario and tag a willingness to accept compensation, or provide a payment for accepting/rejecting the change. Recent literature suggests the Willingness To Pay method as appropriate for developed nations (Hanemann, 1994). For assessments in rural subsistence based economies in developing countries, the Willingness To Accept measure is recommended by Shyamsunder and Kramer (1996) especially in situations where the rights to the good under consideration are held by the surveyed population and where respondents face severe economic constraints. Their study uses a WTA format to estimate the loss to rural households from no longer having access to a large area of forest lands. They add that while a pre-test indicated that some respondents were willing to pay for forest protection (and exclusion), this was more a result of a perceived sense of coercion than being actually willing to pay for conservation. However they qualify that where loss is matched by or lower than benefits, WTP may be theoretically more appropriate. However property rights should be the dominating reason for choice of method. Instead of money, they use a well accepted, non-monetary numeriere (in this case, baskets of rice).

However, given the controversy, over such methods, it may be used as a supplementary measure to the productivity analysis. Also, at the first instance the aim can be to attempt valuation by direct/surrogate market prices and see whether these benefits are sufficient to carry the project. If not, an assessment can be made whether the gap would be outweighed by the benefits determined by the CV method.

D *Non- extractive values*

Indirect use values, e.g. environment functions are covered by the productivity method. However certain important non-use values remain. Local residents may place an intrinsic worth on living resources. It is difficult to place quantitative values on these existence values as distinct from use values. While

existence value may be estimated using a Contingent Valuation technique, it may be sufficient in this exercise to take note of and call attention to it.

The other source of value, option value arises from the uncertainty in future use values and irreversibility in their use. One assumption in treating a degraded forest is that it can regain its full potential. If this is accepted, then the irreversibility condition may not apply to degraded forests and therefore the additional optional value may not be relevant especially at the level of a single forest patch. On the other hand it may be appropriate to check this with knowledgeable respondents in the field and with forest ecologists, whether most plant and animal species can reoccur in degraded forests. The scale of degradation may also be a deciding factor.

Appendix 2:

Table 3. Forest values reflected in the Stockholm Declaration, 1972

	Type of Value	Reflections in the Stockholm Declaration -1972
	Use value Direct use value	Principle 3: maintain capacity to produce vita renewable resources
	Indirect use	Principle 6: Not exceed the capacity of the environment to render them harmless
	Option value	P.5: Guard against exhaustion of non-renewable resources
	Non-use value Bequest value	P. 2: Safeguard the environment for the benefit of current and future generations Also P.4: 'heritage' - see below.
	Existence value	P. 4: Special responsibility to safeguard and wisely manage the heritage of wildlife and its habitat

Table 4. Values reflected in the language of the Forestry Principles of 1992.

	Type of Value	Reflection in the Forestry Principles - 1992
	Use value Direct use value	2a. "..right to utilize ...forest in accordance with development needs"

		6a. "renewable source of bio-energy" 6d. refers to industrial raw material and renewable energy sources.
	Indirect use	Catch all principles - 2b. refers to several ecosystem functions including water, carbon sinks, habitat.
	Option value	Have several references to sustainable management, which implies a desire to preserve resources etc for the future.
	Non-use value Bequest value	P.2 b. Reference to future generations
	Existence value	A roundabout reference that forests embody complex and unique ecological processes which are of value to amongst others, the "environment as a whole".

Notes to readers

This is an independent study conducted by Mr. Chetan Agarwal and Submitted to Prof. Matthew Auer of Indiana University, Bloomington, Indiana, USA.