

The Economics of Non-Timber Forest Benefits: An Overview

Joshua T. Bishop

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The Author

Joshua Bishop is Director of the Environmental Economics Programme at the International Institute for Environment and Development, London. He may be contacted at:

Environmental Economics Programme

IIED

3 Endsleigh Street
London WC1H 0DD
UK

Tel: (44) 0171 388 2117
Fax: (44) 0171 388 2826
Email: josh.bishop@iied.org

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Abstract

Economic development is often associated with rising demand for environmental amenities. Forests are a particular focus of environmental concern; in many countries the value of non-timber forest benefits - many of them non-marketed - may be increasing faster than the prices of wood products. One result is that certain forest areas are increasingly valued more for the environmental benefits they provide than for their timber. Hence the “set-side” of timber-rich areas for wildlife conservation, and the increasing attention of public agencies to managing forests for recreational or aesthetic values.

Problems arise when policy-makers try to balance the twin objectives of timber production and environmental protection. When values conflict, what is the appropriate trade-off? What opportunities exist for “win-win” solutions, where timber and non-timber benefits are complementary? This paper focuses on recent advances in the economic evaluation of forestry activities and, in particular, on how techniques for valuing non-timber forest benefits in monetary terms can assist the development of forest policy and management systems. The paper considers the nature of non-market values and the need for valuation, as well as the different techniques used. It briefly considers the long-term dynamics of forest value and outlines the use of valuation results in forest policy and management.

Introduction

Forests have been central to human survival for as long as we have inhabited the earth. How people use and value forests at a particular place and time, however, depends in large part on their scarcity or abundance relative to changing human needs. In recent years, human population growth, migration and industrialisation, and other socio-economic changes have had a dramatic impact on the world's forest resources. Deforestation in tropical regions is widely acknowledged as a global problem, as is the decline in so-called "old-growth" forests in all countries (Barbier *et al* 1994; Brown & Pearce 1994; Dudley *et al.* 1995; Sharma 1992). The recent increase in secondary forests in temperate regions, while less well-known, will also have a profound effect on the future supply of forest goods and services (Arnold 1991; Sedjo & Lyon 1990). Meanwhile, human demands on forests are changing rapidly, as we become more aware of the important environmental benefits they provide.

Economic development is often associated with rising demand for environmental amenities. Forests are a particular focus of public environmental concern; in many countries the demand for non-timber forest benefits - many of them non-marketed - may be increasing faster than demand for wood products. One result is that certain forest areas are increasingly valued, by the public as well as their political representatives, more for the environmental benefits they provide than for their timber. Hence the "set-aside" of extensive areas of timber-rich forest for wildlife conservation. Hence also the increasing attention of public agencies to managing forests for recreational or aesthetic values. Problems can arise, however, when policy-makers try to balance the twin objectives of timber production and environmental protection. When market and non-market values conflict, what is the appropriate trade-off? What opportunities exist for "win-win" solutions, where timber and non-timber benefits are complementary?

Understanding the changing pattern of land use and environmental preferences is essential to a better understanding of the current debate on forest policy, which is raging at global, national and local levels. Calls for increased forest conservation, timber certification and trade policy reforms, more "sustainable" forest management and other initiatives are driven by growing concern that the world's forests will require more protection and better management if they are to meet future human needs, including demand for both timber and non-timber forest goods and services.

This paper focuses on recent advances in the economic evaluation of forestry activities and, in particular, on how techniques for valuing non-timber forest benefits in monetary terms can assist the development of forest policy and management systems. We first consider the non-market nature of many non-timber forest benefits, and the reasons why markets often fail to account for them. The paper then reviews the different techniques used to evaluate non-market benefits in monetary terms, and explores the long-term dynamics of forest value. We conclude with a brief discussion of how the results of valuation studies can contribute to improved forest policy and management.

Market and Non-Market Values in Forestry

Economists use the term "total economic value" to refer to the various benefits which may be obtained from a natural resource. These benefits include the *direct use value* of a resource as an input to production or as a consumption good, its *indirect use value* through protecting or sustaining

economic activity, and its *non-use value* to people who derive satisfaction the mere existence of a resource, even though they may never see it or consume any product obtained from it (Pearce *et al* 1989).

Examples of direct use values in forestry include timber and non-timber products, but also non-commodity benefits such as forest recreation (Table 1). Indirect use values include the role of forests in protecting watersheds and fisheries, and the storage of carbon in trees (to offset the atmospheric accumulation of "greenhouse" gases implicated in global warming). Non-use values in forestry comprise such intangible benefits as the continued existence of certain species of wildlife, which the general public wishes to protect for posterity.

In general, direct use values are most likely to be reflected in market prices. Indirect use values may be reflected in the prices of certain goods and services which depend heavily on the underlying environmental benefit, while non-use values are rarely reflected in market prices or decision-making. Clearly, however, the absence of a market price does not mean that a thing has no economic value.¹

Most forest land owners are aware of the many environmental benefits they provide, in addition to supplying timber or other commodities to the market. Public agencies in many countries, some of them responsible for managing millions of hectares of forest land, often make special efforts to provide non-timber benefits. This includes restricting logging in areas of exceptional natural beauty, for the sake of recreational uses, or on steep slopes, so as to protect water quality and reduce the risk of flooding downstream. Similarly, some companies provide access to their land to hikers, hunters and fishermen on a voluntary basis.

While such efforts are welcome they are usually limited in scope and often inadequate relative to public demand. The reason is that forest land owners and managers in most countries get little or no material advantage from providing environmental benefits. Both in the private and the public sectors, land owners and managers tend to focus on the direct costs and tangible benefits of their activities. Thus foresters produce timber because they can sell it, while farmers convert forest land because they can cultivate it for profit or subsistence.

Many non-timber forest benefits, on the other hand, cannot easily be bought and sold (e.g. biodiversity, watershed protection, carbon storage). Others generate little or no revenue for the land owner, although they may have significant value to the general public (e.g. aesthetic values). Where non-timber forest benefits are also non-marketed, private land owners will have little motivation to produce them unless compelled to do so. Similarly, public forest agencies may under-estimate the importance of such benefits, which are often less visible than the revenue, taxes and jobs generated by the timber and agriculture industries.

¹ Economists distinguish financial from economic values. The former refer to market prices, while economic values (or "efficiency prices") are estimates of the prices which would prevail in a competitive market, free of market imperfections (e.g. monopolies) or policy interventions (e.g. taxes or barriers to trade). Efficiency prices are usually considered a more accurate reflection of the contribution of economic activity to human welfare.

Table 1: Forest Values and Valuation Techniques

	USE VALUES			NON-USE VALUES
V A L U E S T E C H N I Q U E S	1. Direct	2. Indirect	3. Option	4. Existence
	Wood products (timber, fuel)	Watershed protection	Future uses (as per 1 & 2)	Biodiversity
	Non-wood products (food, medicine, genetic material)	Nutrient cycling		Culture, heritage
		Air pollution reduction		Intrinsic worth
	Educational, recreational & cultural uses	Microclimatic regulation		
	Human habitat	Carbon store		
	Amenities			
	↓	↓	↓	↓
	Market prices and analysis	Production function	Contingent valuation	Contingent valuation
	Related goods & approaches	Preventive expenditures		
	Contingent valuation	Replacement costs		
	Hedonic prices			
	Replacement costs			
Note: Not all valuation techniques can be applied to all of the uses under which they are listed. Equally, some uses may be amenable to more than one valuation technique, depending on the context. Source: Derived from Barbier (1991)				

Even where forest benefits are partly or informally traded, they often escape notice. In many developing countries, for example, rural populations exploit non-timber forest products such as vines and edible fruit for both subsistence and sale, but this activity is rarely recorded and is thus easily ignored by forest authorities. Similarly, in the developed world, entry fees to forest recreational areas often grossly under-value the true willingness-to-pay of visitors and thus the full value of recreational benefits.

The fact that many non-timber forest benefits are not traded or do not have a directly observable market price is not a problem in itself. However, the use of forests to produce tradeable commodities such as timber or agricultural crops often reduces the availability of non-timber goods and services, with the result that non-market (environmental) values are lost. If the latter are significant, forest resources will be used inefficiently, both in terms of the area devoted to timber (or converted to agriculture), and in terms of the technology of production (i.e. management). We now turn to why the market often fails to account for non-timber benefits, even when they are important in economic (as opposed to financial) terms.

Non-Timber Benefits and Market Failure

In principle, markets will allocate resources efficiently if prices reflect both the full marginal costs of production and the full marginal benefits of consumption, including all components of total economic value.² Where prices do not reflect all costs and benefits, however, the so-called "invisible hand" of the market does not work and resources may be used inefficiently, resulting in a loss of human welfare (Baumol & Oates 1988).

Economists have identified various reasons why and how market prices may fail to reflect environmental costs and benefits. Two of the most important reasons for market failure in forestry are what economists call "public goods" and "externalities".

Public goods are characterised by the fact that: (i) no one can be effectively excluded from consuming them and (ii) increased consumption of the good by one individual does not reduce availability to others. For example, no one travelling on a public thoroughfare can be charged for enjoying a pretty view, even if the land in question is privately owned. Nor does one person's enjoyment of the view detract from that of another (provided there is no crowding!). Such aesthetic value is among many public goods provided by forests, along with carbon storage and biodiversity conservation. Economic theory states that the market will systematically under-provide such goods, and that collective action (e.g. by government) is required to ensure their adequate provision.

Externalities are uncompensated costs or benefits arising from economic activity. A classic example in forestry is the decline in availability of game or other non-timber forest products due to logging. Unless the logging company (or land owner) pays compensation to hunters and gatherers for their loss of livelihood, the full economic cost of extracting timber will not have been paid. If similar conditions prevail elsewhere, market prices of timber products will tend to understate true economic costs and consumers will use timber relatively inefficiently.

In addition to public goods and externalities, markets may fail to reflect non-timber forest benefits due to lack of information about their contribution to economic welfare, distortions in prices arising from public policy and regulations, lack of clear or secure property rights over forest lands, and other

² The marginal benefit (or cost) of a good refers to the incremental change in consumer welfare (or producer cost) resulting from an incremental change in the quantity of the good consumed (or supplied). In a competitive market the level of output is determined by prices, which will tend to equilibrate at the point where marginal benefit equals marginal cost and social welfare is maximized. This is the "efficient" level of output, for a given distribution of income (Henderson & Quandt, 1958).

factors. In such cases, the question arises as to how decision-makers can compensate for market failure, and ensure that non-timber forest benefits are given sufficient weight in land use planning and management.

There are many ways to internalise non-market values in the behaviour of producers and consumers, ranging from the introduction of strict environmental standards to ecological tax reform, and from facilitating environmental damage claims in the courts to the promotion of trade in environmental services or “pollution permits”. An extensive literature describes the economics of different approaches to environmental protection (Baumol & Oates 1988; Cropper & Oates 1992; OECD 1989; Portney 1990).

A full review of environmental policy is beyond the scope of this paper. Nevertheless, it is clear that information on the significance of non-market environmental impacts, and the trade-offs between market and non-market values, is an essential input to rational environmental policy-making. Without such information, it is difficult to see how one can determine the urgency, stringency and scope of intervention required. One promising approach is to express non-market environmental costs and benefits in monetary terms, so they can be compared directly with the value of marketed commodities. We now turn to the various methods available for this purpose.

Economic Valuation Methods

To help private firms and government policy-makers make more informed decisions about activities with significant environmental impacts, economists have devoted considerable effort in recent years to developing and applying methods for valuing non-market benefits in monetary terms (Freeman, 1993). All of the methods attempt to express consumer demand, i.e. the willingness-to-pay (WTP) of consumers for a particular non-marketed benefit in monetary terms, or their willingness-to-accept (WTA) monetary compensation for the loss of same. In short, these valuation methods attempt to express the utility derived from non-market goods and services in the metric of the market, which is considered to provide an accurate reflection of the relative preferences of producers and consumers for different goods and services. (Just how “accurate” is discussed in the following section.) The resulting values may be used in cost-benefit analysis or as input to more elaborate economic models.

Methods of estimating non-market or non-timber forest values vary in their theoretical validity and acceptance among economists, their data requirements and ease of use, and the extent to which they have been applied in (and perhaps their relevance to) different countries (Munasinghe & Lutz 1993). The various methods can be divided into three groups:

- i) market price or cost-based methods;
- ii) surrogate market methods; and
- iii) constructed market or contingent methods (see Table 2).

The simplest valuation methods are those which rely on market prices, with or without adjustment for market imperfections or policy distortions. These methods include the use of *market surveys* to collect the prices of many so-called minor non-timber forest products, which may be traded on a small-scale or occasionally, and which are often neglected by official economic statistics. Note that

even when market prices for non-timber forest products exist, they may still understate the full economic value of the resource.³

Where the forest benefit in question is not traded, but a *close substitute* is widely marketed, researchers may use the price of latter (adjusted for any quality differences) to approximate the value of the non-marketed good. Alternatively, one may consider the cost of measures taken to prevent or compensate for the loss of a non-market benefit (i.e. the *replacement* or *relocation cost* or the amount of *defensive expenditure*) to be a proxy for the value of the benefit itself. For example, where logging or road construction in upland forest areas has led to increased runoff and sedimentation, some studies use information on the costs of dredging or flood control as a rough estimate of the non-market benefit of watershed protection. Such *cost-based* approaches must be used with extreme caution, however, particularly where potential rather than actual expenditures are concerned, as it is not always clear that the environmental benefit in question justifies the costs of replacement, relocation, etc.

A second group of methods rely on the fact that certain non-market values may be reflected indirectly in consumer expenditure, in the prices of marketed goods and services, or in the level of productivity of certain market activities. The *travel cost* method, for example, is based on the assumption that consumers value the experience of a particular site at no less than the cost of getting there, including all direct transport costs as well as the opportunity cost of time spent travelling to the site (i.e. foregone earnings). This survey-based method is widely used to estimate the value of forest recreational benefits (see Willis *et al*).⁴

Another method in this second group is *hedonic pricing*, which attempts to isolate the specific influence of an environmental amenity or risk on the market price of a particular good or service. This approach has been used to estimate the negative impact of noise pollution or the presence of waste disposal facilities on the market prices of residential property or, conversely, the positive impact of proximity to water or public green space (Garrod & Willis, 1992).⁵ The hedonic pricing method requires relatively large data sets, in order to account for and eliminate the influence of all other variables which affect market prices. The approach also assumes that markets for land are competitive, and that both buyers and sellers are fully informed of the environmental amenity or hazard.

³ For example, if there are no clear property rights over the resource or other restrictions on harvest levels, market prices may fail to reflect *user costs* (e.g. the stumpage value of standing timber).

⁴ This approach is sometimes used to value "travel time" for gathering fuelwood or for water collection.

⁵ A similar approach may be used to evaluate the impact of occupational hazards or other environmental factors on wages, based on the assumption that the supply of labour varies with local living and working conditions.

Table 2. Methods for valuing forests

Valuation method	Relevant forest benefits	Strengths and weaknesses
<u>Market price or cost-based:</u> - Market prices - from surveys of producers and consumers and/or official statistics. - Substitute goods - uses market prices of substitutes for non-marketed forest benefits. - Cost-based valuation - uses data on the costs of measures taken to preserve and/or replace forest goods and services. The simplest and most direct methods.	Price-based valuation is generally applied to non-timber forest products which are partly or informally traded, in order to estimate subsistence and/or unrecorded consumption. Substitute goods approaches may be used wherever close market substitutes for non-timber benefits exist. Cost-based approaches include defensive or preventive expenditure, replacement or relocation cost; may be used (with caution) to value any type of non-timber forest benefit.	Market prices clearly reflect consumer preferences, but may need adjustment for policy distortions or over-exploitation. Aggregation or extrapolation of values based on potential production is not valid unless account is taken of likely price effects (elasticity of demand). Cost-based approaches are usually considered less reliable than other methods. One test of validity is evidence that people are prepared to incur costs to secure relevant benefits.
<u>Surrogate markets:</u> - Travel cost – uses survey data on direct costs (e.g. fares, accommodation) and, in some cases, opportunity costs of time spent travelling to and from a site, evaluated at some fraction of the average wage rate. - Hedonic pricing - uses statistical methods to correlate variation in the price of a marketed good to changes in the level of a related, non-marketed environmental amenity. - Change in production - uses data on the physical relation between level (or quality) of a non-market benefit and level (or quality) of output of a marketed good/service.	Travel cost is often used to estimate demand for forest recreation at specific locations. Related methods used mainly in developing countries estimate the value of non-marketed, non-timber forest products in terms of the opportunity cost of time spent collecting and/or processing them. Hedonic pricing used to estimate the impact of proximity to forested land and/or logging on the prices of residential and commercial property. Change-in-production (or (dose-response) methods are used to estimate both on- and off-site impacts of land use change, e.g. the effect of logging on hunting, downstream water users, fisheries, climate.	Provided the relation between the NMB being valued and the surrogate market is correctly specified, such methods are considered reliable. Travel cost estimates may need to account for various objectives (benefits) in a single trip. Hedonic pricing requires large data sets, in order to isolate the influence of the NMB on price relative to other factors. Change in production methods require good data on biophysical relationships (dose-response).
<u>Constructed or contingent markets</u> Contingent valuation method - uses consumer surveys to elicit hypothetical ("contingent") willingness-to-pay for a benefit, or willingness-to-accept compensation for the loss of that benefit. Experimental markets - controlled experiments in laboratory setting, involving direct questioning or other methods to elicit information on consumer preferences and trade-offs.	Recreational values are often estimated using contingent valuation. Constructed market or contingent methods are the only known way to estimate non-use values, e.g. landscape or biodiversity values, for which price data do not exist and/or links to marketed goods cannot easily be established.	Contingent valuation estimates are considered reliable if strict procedural rules are followed. Experimental methods (used in social science laboratories) are more easily controlled but are not widely used in forestry.

The third method in this group is variously called the *change-in-production* approach, the *input-output* or *dose-response* approach, or the *production function* approach. Whatever the name used, all involve an attempt to relate the incremental output of a marketed good or service to a measurable change in the quality or quantity of a natural resource (Maler 1992). One example is the relation between forest disturbance along streams and rivers, or near coastlines, and the productivity of fresh-water or marine fisheries, which has been observed in several locations (Gammage 1997). This approach is very demanding of reliable data on the bio-physical links between the non-market benefit and the marketed good or service.

A third category of non-market valuation methods includes several so-called “constructed market” techniques, among which the most widely used is the *contingent valuation (CV) method*. In the latter case, researchers obtain information on the value of an environmental benefit by posing direct questions to consumers about their willingness to pay for it (or their willingness to accept compensation for losing it). Several variants are used, but in most cases the aim of CV is to elicit individual expressions of value (or “bids”) from survey respondents for specified increases or decreases in the quantity of a non-market good. The CV method is widely used to estimate recreational benefits (see Willis *et al*). Moreover, CV is the only method currently available to estimate non-use benefits such as existence value. On the other hand, because in most cases no actual payment is made, many observers question the validity of constructed market techniques. While the CV method has been accepted by the United States legal system as a basis for assessing environmental damages, the procedural requirements for using CV estimates in court cases are very strict (Arrow *et al* 1993).

In addition to the above valuation methods, some other techniques are used by economists to shed light on the trade-offs between market and non-market benefits. Among the most useful are *opportunity cost* and *cost-effectiveness* approaches. In these cases, no attempt is made to estimate non-market benefits in monetary terms; the focus instead is on the market costs or the opportunities foregone in order to secure or protect the benefits in question. The idea is that certain means of providing an environmental benefit will be more efficient than others, either in terms of the inputs required or the loss of market values.

Criticism of Valuation

Critics of valuation raise various objections to attempts to estimate non-market values in monetary terms, ranging from minor methodological quibbles to sweeping rejection of any attempt to estimate non-market values. Some of the most common complaints are that valuation is too costly, or that the methods are imperfectly developed, although this could also be said of many other decision-making processes!

Others highlight the potential bias in how people respond to surveys, including the frequency of “protest bids” in CV studies and indications that many people prefer to rely on moral judgement or a rights-based approach, when asked to consider certain environmental benefits (Hanley & Milne 1996). Extreme versions of the latter view consider any economic approach to environmental decision-making to be tainted by association with market forces, which are identified as the root cause of all environmental problems. From this perspective, any attempt to express non-market

benefits in monetary terms implies a “slide down the slippery slope” of reducing all concepts of value to an economic bottom-line.

Another frequently noted problem is that monetary estimates fail to account for distributional considerations, i.e. the relative importance of non-market values to different groups of people (this problem is not, of course, confined to non-market valuation studies but affects much economic analysis). In some cases this leads to arguments for social weights to favour the poor, or altogether different criteria for land use decisions, e.g. historical precedence.

Others refer to the poor record of valuation studies in influencing public policy (again a problem which afflicts several branches of applied economics). And some make the further point that valuation by itself may be meaningless, if there is no mechanism to capture and convey consumers' willingness-to-pay for non-market values to the people who, by their actions, can either fulfill or frustrate that demand.

While many of the criticisms of valuation are valid, the problem remains that environmental protection is often incompatible with other social and economic objectives. In forestry, for example, people must often choose between alternative, incompatible uses of land resources, e.g. preservation, timber production or conversion to agriculture. Moreover, the view taken here is that many if not most land use decisions will inevitably have a strong economic basis, and that factors which are not quantified risk being ignored. We must acknowledge, however, that economic valuation of forest benefits can provide only part of the total picture, and that economic efficiency must be considered alongside other criteria such as social and cultural value, historical claims, distributional impacts and other political factors. Equally, we must be aware of how market and non-market values shift over time, particularly in periods of rapid socio-economic change. Hence we now examine the dynamics of forest values.

Income Growth and Non-Timber Forest Values

Non-timber forest benefits have always been an important part of forest value. Their relative importance varies, however, in different places and stages of economic development. For example, in traditional, hunter-gathering societies, forest lands have long been valued for low-intensity harvest of game and edible wild plants, as well as the occasional felling of vines and timber for fuel and other subsistence uses. This may be considered the "original" use of forests, which can still be found in remote areas of Latin America, Africa and southeast Asia.

As populations grow and economies develop, forest values change dramatically. Initially, forests are often valued mainly for the agricultural potential of the land they cover, or for timber for construction and industry. As economies mature, however, agricultural land use tends to intensify and stabilise. At the same time, there is often a shift away from solidwood to paper and other materials, resulting in stagnant demand for many timber products. Forests themselves are increasingly specialised, with some areas under intensive management for the production of timber, while others are devoted to recreational uses or simply preserved for their amenity and landscape values. Finally, as we have seen recently in many of the richest economies, there is increasing public demand for the protection and set-aside of mature forests, not just locally, for recreational or amenity purposes, but even in

remote areas that most people will never see. This reflects the emerging importance of "non-use" or preservation values, sometimes associated with the role of forests in conserving biological diversity and maintaining climate functions.

This trend can be seen in many countries in southeast Asia (Malaysia among them) which have recorded exceptionally high rates of economic growth in recent years. Economic development has led to the emergence of an educated and urbanised middle-class. Rising average incomes are in turn associated with increasing demand for environmental protection and amenities, as well as increased means with which to pay for them. One example of such changing preferences is increased demand for outdoor recreation, reflected in the rapid rise in domestic tourism and visits to parks, reserves and forest recreational areas. Experience in the more developed countries suggests that this and other expressions of public demand for, and concern about, the environment will further intensify as incomes continue to rise.

Meanwhile, the demand for traditional forest products - timber and pulp - is also expected to increase with economic growth. Recent forecasts suggest that consumption of industrial roundwood in Asia will grow at just over 1% per year over the next 15 years (FAO 1997).⁶ Domestic timber prices are also expected to rise in many countries, due to the increasing scarcity of easily accessible, mature stands of timber in the region, although price increases will be moderated by plentiful supplies from other parts of the world (Perez-Garcia & Lippke, 1993).

How are these trends related? Recent experience in the more developed countries suggests that forests are increasingly valued, by the public as well as their political representatives, as much (or even more) for the environmental benefits they provide as for their timber. Hence the "set-aside" of large timber-rich areas for wildlife conservation. Hence also the increasing attention of public agencies to managing forests for recreational or landscape values. The key factor is the relative rates of growth in timber and non-timber values, which in turn reflects the income-elasticity of demand for different forest benefits.⁷ Even if the value of forest land for timber production is initially much higher, in certain areas, than for production of non-timber benefits, this may change with time. Over a sufficiently long period, non-timber values may well overtake and surpass timber values, reflecting the relatively high income elasticity of demand for environmental amenities, compared to demand for wood products.

Of course, demand for different non-timber forest benefits will not grow at the same rate, and may even shrink in some cases. Demand for forest recreation and landscape amenity values can be expected to grow rapidly with urbanisation and rising incomes, whereas the demand for certain non-timber forest products may fall. For example, higher rural incomes can lead to decline in both the range and volume of forest products used for subsistence, but this may be offset for certain products by increased commercial exploitation and sales in urban markets. Recent work on the consumption of an edible forest fruit in Malaysia has found that urban consumption has increased at almost the same rate as incomes (Woon *et al*).

⁶ This may be compared to average annual growth of about 2.2% over the period 1970-90 (FAO, 1997).

⁷ The income-elasticity of demand refers to the percentage change in demand for a given product resulting from a one percent increase in income, usually calculated as an average value for a population based on time-series data. Income-elasticity may be negative or positive, depending on whether the good is "inferior" or "normal".

Change in the relative importance of different forest values can have important distributional consequences, particularly where these values are conflicting. For example, the designation of forests as protected areas can be seen as a means by which certain interest groups (typically not the poor) secure recreational, amenity or non-use values. This may result in significant loss to another group, e.g. subsistence farmers who rely on forest land for extraction of non-timber forest products, or for shifting agriculture. Where the values of domestic and foreign consumers differ widely the resulting conflict may be international in scale, as shown by recent heated debates about tropical forestry and timber trade policy in global fora.

Similarly, efficiency and equity objectives in forest land use often conflict. Cost benefit analysis may lend weight to certain values and associated land use options which are unavailable to poorer groups, due to their limited access to capital and information. These groups must therefore confine themselves to 'inferior' uses. For example, a study of a new national park in Madagascar estimated the value of additional benefits to international tourists at two to three times the loss, in terms of lost agricultural land, incurred by local villagers, despite measures allowing them access to buffer zones (Kramer *et al* 1995). While such a change in land use may be economically efficient, since the potential for compensation exists, it will aggravate poverty where compensation is absent or inadequate.

Valuation for Forest Policy and Management

In contrast to the considerable advances made in valuing non-timber forest benefits, there has been relatively little progress in applying the results of valuation studies to forest policy and management. However, this is probably due to political and institutional barriers rather than a reflection of the quality or relevance of valuation studies. Despite the discouraging record to date, a number of potential applications can be identified.

The integration of forest values in policy is a crucial step. Forest land users and managers are often reluctant to modify their management practices, even where they acknowledge the importance of environmental benefits, due to the constant pressure to increase revenue and reduce costs. Careful design of forestry regulations, concessions and tax policy can encourage forest managers and land users to account for non-market benefits in their own interests. This in turn can reduce the need for and costs of supervision by regulatory agencies, while achieving a more efficient mix of market and non-market benefits.

Information on the economic value of non-timber forest benefits can be applied at different geographic scales: in determining the appropriate extent and type of forest cover (i.e. for land use planning); and in deciding how individual forest stands should be managed. In both cases the scope for improving policies runs the gamut from zoning and property rights to regulation and pricing schemes.

How much forest is needed, of what type and where?

Virtually all forests have some positive non-market value. This implies that the value of keeping land under forest is almost always greater than the amount which can be realised by private firms

producing for the market. This, in turn, means that private land owners will systematically under-provide forested land.

Similarly, valuation studies suggest that the general public prefers forested landscapes composed of mixed species and varying ages. For recreational purposes (e.g. trekking, camping) the public generally prefers mature forests with little undergrowth, high canopies and relatively few stems, to younger, denser stands. Both of these preferences run counter to the usual aims of industrial forestry, which in turn implies that private firms will tend to under-supply older and more diverse forest landscapes.

The traditional solution to this problem is for the state to provide recreational and amenity forests on publicly owned land, in which industrial uses are strictly limited or forbidden. An alternative to public provision is to introduce land use zoning or other restrictions on the use of private land, to ensure greater forest cover and/or more diverse forests in areas of relatively high demand.

One interesting implication of travel cost and other valuation studies is that many forests may be misplaced. In effect, there should be more (and more diverse) forests near population centres. On the other hand, existing land use restrictions in some areas may already provide an appropriate level of forest cover with respect to recreational, landscape and other non-market values. This applies particularly to blanket restrictions on farming or logging of slopes above a certain steepness, irrespective of opportunity costs or actual downstream water uses and flood risk.

Non-timber values and private property rights

Economists often argue that a fundamental cause of the under-supply of non-market benefits (and the over-supply of non-market costs or “externalities”) is the lack of exclusive property rights. The notion is that private property, where it is enforceable, creates an opportunity for profitable exchange and thus an incentive for more careful management. As a rule, therefore, economists tend to favour the creation of property rights over regulation or price policy. One advantage of such an approach is that government need not concern itself with the difficult task of setting prices but can devote its efforts to enforcing property rights and contracts.

Promising areas for property rights-based solutions to the under-supply of non-timber forestry benefits include concessions for non-timber forest products and for recreational uses.⁸ These may overlap with timber concessions, requiring logging companies (or land owners) to make proper compensation for loss of non-timber benefits. Constraints on the viability of private concessions include the difficulty of excluding poachers and/or free-loaders, and competition from publicly-owned lands, where access to comparable benefits may be free or below cost.

Non-timber values and forestry regulations

⁸ The results of valuation studies may be used to provide a bench mark or reserve price for auctioning concessions.

Where private property rights are not feasible⁹, it may be possible to account directly for the value of non-timber benefits in forestry regulations. In fact, many public agencies already account for environmental values either explicitly or implicitly. Timber cutting limits and rotation length, careful road layout, mandatory low-impact logging methods, stream-side buffer strips and wildlife corridors, etc. are all increasingly standard practice and can help to mitigate damage or loss of non-timber benefits due to logging.

The weakness of such regulatory approaches is their insensitivity to differences in the costs and benefits of compliance at different forest sites. Many forestry regulations are applied uniformly to all areas in the same way, regardless of the type of forest involved or its location. And yet evidence from valuation studies suggests that demand for many non-timber benefits varies widely from place to place, mainly as a function of the proximity and density of human populations but also as a function of forest characteristics (e.g. age and species composition, topography and accessibility, presence or absence of streams and water falls). This in turn implies a need for greater flexibility and sensitivity of forestry regulations to the effective demand for non-timber benefits at particular sites. Valuation studies can help by demonstrating the relation between key characteristics and WTP for non-timber benefits.

Non-timber benefits and forest pricing policy

Land owners are clearly sensitive to taxes in their choice of land use. Similarly, timber concession holders and logging firms are sensitive to royalties, taxes and other fees. The results of valuation studies may be incorporated in such policies and can be expected to induce changes in land use and logging practices.¹⁰

For example, the sale price of timber concessions on public forest land can be adjusted to account for the relative importance of non-timber benefits in different areas and the impact of timber harvesting on them (positive or negative). This can apply whether the price of timber concessions is fixed administratively or by auction. At the margin, higher (or lower) prices will lead firms to lose (increase) interest in harvesting timber from certain areas altogether (i.e. forests which are less accessible or less densely stocked with mature commercial timber species). Similarly, on private land, rates of tax may be adjusted up or down according to the level of provision and the importance of non-timber forest benefits in that area. Of course, both measures require detailed knowledge of local conditions and thus may be best administered by local government.

Finally, the results of recreational demand studies (using travel cost and/or contingent valuation) can be and often are used to set entry and license fees for forest recreational areas, including day trippers, campers and hunters.

⁹ For example, an exclusive right to the carbon storage benefits of a particular forested area is a ridiculous notion: firstly, because one person's enjoyment of the climate benefits secured thereby does not detract from another's, and, secondly, because it is impossible for the "owner" of the right to prevent others from enjoying the same benefit.

¹⁰ Industry often argues that such measures will erode their competitive position. However, there is considerable evidence which suggests the reverse, namely that adoption of more environmentally sensitive production methods, if combined with appropriate marketing effort, can confer a "green" market advantage and improve profitability.

Conclusion

Economic valuation of forests is an important tool for making more informed decisions about the use of forest lands. A number of reliable methods have been developed to assign monetary values to non-marketed or non-timber forest benefits. There are important differences in the significance of different non-timber forest benefits in developed and developing countries, with implications for the choice of valuation methods.

Information on the economic significance of non-timber forest benefits can and should be incorporated in private property rights, forestry regulations and pricing policy. This potential has not yet been realised, largely due to political and institutional barriers but also because of the lack of regular, reliable information on the use of (and changes in) non-timber benefits. An important priority is to develop routine systems for monitoring and evaluating non-timber forest benefits on a national and local scale.

In summary, the challenge faced by forest managers and policy-makers is:

- i) to assess the current and expected future economic importance of non-timber benefits at the level of the forest site, region and nation, and under different land use and management regimes;
- ii) to make informed trade-offs between the marketed and non-marketed benefits of forestry activities, both at the level of national or regional land use planning and in the management of particular forest sites; and
- iii) to devise regulations and incentives which lead forest managers and land users to account more fully for non-market benefits in their decision-making. Where non-timber values are held mainly by foreigners, this may imply the need for innovative mechanisms for international financial transfers for environmental benefits.

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