AN ECONOMIC VALUATION OF THE TERRESTRIAL AND MARINE RESOURCES OF SAMOA

Mohd-Shahwahid H.O
Richard McNally

May 2001

FOR

THE DIVISION OF ENVIRONMENT AND CONSERVATION, DEPARTMENT OF LANDS, SURVEY AND ENVIRONMENT, GOVERNMENT OF SAMOA,

AND

WWF-UK, WWF-SOUTH PACIFIC

This report was researched and written by Mohd Shahwahid H.O; editing has been carried out by Richard McNally WWF-UK.

For further information please contact:

Richard McNally
Panda House,
Weyside Park,
Godalming,
Surrey GU7 1XR

Tel: +44 (0)1483 412 587
E-mail: rmcnally@wwf.org.uk

Mohd-Shahwahid H.O,
Universiti Putra Malaysia,
Serdang, 43400 UPM
Selangor,
Malaysia

msho@econ.upm.edu.my

ACKNOWLEDGEMENTS

The author would like to extend his gratitude to the officers of the Division of the Environment and Conservation Unit (DEC), particularly Cordelia Toto'a Ale, Faraimo Tiitii, Talie Foliga, Afele Faiilagi and Christine Ainuu, who assisted in the field surveys and in organising the workshop; the finance committee for guidance and sound advice provided in ensuring effective implementation of the research work; the interviewees, include Michael King, Kevin Passfield and Antonio Mulipola of the Division of Fisheries, Maliki Iakopo and officers of the Division of Forestry, Andrew Ah Liki of Bluebird Company, Paul Phillips of the Public Works Department and Paul Meredith of the Ministry of Finance. Special thanks are due to Cedric Schuster for the initial contacts and for making these research efforts possible. Finally Rahimah Hussin for editing an earlier draft of this report.

Contents

LIST OF TABLES PAGE

LIST OF FIGURES

Acronyms and Abbreviations

CVM	Contingent Valuation Method
DEC	Division of Environment and Conservation
GDP	Gross Domestic Product
NBSAP	National Biodiversity Strategy and Action Plan
PPP	Purchasing Power Parity
TEV	Total Economic Value
WTA	Willingness To Accept
WTP	Willingness To Pay
WWF	WWF (formerly World Wildlife Fund)

Executive Summary

In devising its National Biodiversity Strategy and Action Plan (NBSAP) the Samoan Government identified the need to identify and incorporate the economic value of its biodiversity. With this in mind the Samoan authorities in collaboration with WWF, commissioned research on the economic value of Samoa's marine and terrestrial resources – particularly forests. This was conducted from 10 October to 24 November 2000 and the findings are provided in this report.

The report is divided into three sections. Section one examines the basic theory behind the economic valuation of biodiversity. The second section provides the results from the study, estimating the values of various functions played by Samoa's marine and terrestrial resources. The last section discusses the lessons learned from this economic valuation exercise and reiterates the policy recommendations.

Agriculture, fishing and, indirectly, tourism are the main sectors of the Samoan economy. These sectors are directly and indirectly dependent on natural resources. Yet the essential role played by these resources in the economy is not explicitly known, since many of their services are not transacted through formal markets, and in some cases markets do not exist to allow payments for their utilisation. In other cases, the values of these goods and services have been misallocated as returns to labour and entrepreneurship making wages and profits excessive. Hence, these natural resources have tended to be used excessively.

Two estimates of the total economic value (TEV) of the goods and environmental services of the forest and marine resources of Samoa were computed. The first estimate of ST$21.0 million per annum [about 2.7% of Samoa's GDP] refers to the TEV from the perspective of the citizens of Samoa, by excluding the values generated for the benefit of the rest of the world. This contribution is particularly significant given that these resources are the primary input in the fisheries, forestry and tourism sectors.

The study found that the economic rent of the resources where not adequately paid for by the resource users. This gave them an economic signal for excessive and unsustainable use. The study strongly recommended the introduction of economic instruments to increase the rent paid in the commercial fisheries sector, particularly the larger enterprises whose landings are meant for exports. A similar tax was suggested for the forestry sector. It also recommended that higher entrance fees are introduced to capture visitors' willingness to pay to access the area.

Incorporating the value of global benefits or values generated by these resources for the benefit of the rest of the world, particularly on climate regulation services, nutrient cycling and biological control, the TEV was raised to ST$232.5 million per annum. This is about 29.9% of the GDP of Samoa. This large value is due to the large area of the marine resources of Samoa relative to its land area. The high value of the global benefits highlights the essential role played by Samoa in providing ecological services to mankind. The large global benefits highlight the fact that Samoa should be compensated by the international community to help conserve its terrestrial and marine resources. There are various economic instruments available for the country to seek such supports from both internal and international sources.

Given the limitations of time and budget, many of these global benefits had to be estimated by use of the benefits transfer approach. The approach was to adopt conservative value estimates after adjusting for purchasing power parity differences between Samoa and the country where the values were derived. The authors' recognise that this and other problems encountered when carrying out the study have brought less credibility to the results.

The lessons learnt from undertaking this study is that it is possible to conduct such an exercise in other South Pacific islands, given sufficient commitment on the part of the research team, an adequate research budget and proper planning. To facilitate the valuation exercise, an inventory of the terrestrial and marine resources is an important information base. A major constraint was the lack of local scientific investigations on physical impacts of development upon terrestrial and marine resources that hampered investigations on the indirect use values of these resources.

The report contains a number of policy recommendations for the Samoan government, which it is currently considering. The Government also intends to use the report in the future when assessing environmental impact assessments, and as a reference to apply future valuation studies. In terms of follow-up, WWF-South Pacific aims to do a study on subsistence livelihoods which are the main values missing in this report. Other island states have shown interest in carrying out such a valuation.

Chapter 1: Background to the Study

In 1999 Samoa's GDP was estimated to be ST$718.4 million. Agriculture and fishing contributed 8.2% and 7.8% of GDP respectively, while tourism earnings were estimated to contribute 18.8% of the GDP (*Samoa Visitors Bureau Research & Statistics Division 2000*). This clearly highlights the dependence of the Samoan economy on the country's natural resources. To ensure the continual growth of these sectors, the country's natural resources must be properly managed.

However, the value of the country's resources are not adequately acknowledged and properly accounted for in the country's national accounts. The fact that there is often no formal market to allocate the services of the natural resources causes their over-use. Sometimes their value is partially captured but misallocated as returns to labour and entrepreneurship [making wages and profits excessive]. It is important that the "missing values'' of natural resources are captured to ensure that they are better managed. The essential role and contribution of natural resources to nation building has to be explicitly enumerated and acknowledged. This calls for efforts to identify these "missing values'' and, if possible, to place monetary tags on the various bio-physical and ecological functions played by these resources.

The Samoan Government identified the need to value its natural resources. The results from the study would be used to develop a strategy on integrating biodiversity conservation within policy and planning. Working in partnership with WWF, a study was commissioned to value the terrestrial and marine resources of Samoa. The study was conducted between 10 October and 24 November 2000 and the findings are published in this report.

This report is divided into three sections. Section one examines the linkages between natural resources and the economy with particular emphasis on economic valuation as a tool used to explicitly monetarise the various functions played by natural resources. This includes a discussion on the basic principles of economic valuation, the different kinds of economic values and the methods available to conduct economic valuation exercises.

Section two provides the results of the study. The values are aggregated to obtain the total economic value of Samoa's natural resources. These aggregated values are then compared with the GDP to provide an indication of their significance in the economic growth of the country. The last section provides lessons learned from the economic valuation exercise and how other South Pacific islands could benefit from conducting such an exercise. Guidance is provided as to embark on similar exercises in other Pacific Island countries.

Chapter 2: Natural Resources, Economic Development and Economic Valuation

2.1 THE ROLE OF NATURAL RESOURCE AND THE ENVIRONMENT IN THE ECONOMY

The natural environment provides a range of goods and services that can be used directly or indirectly in the economy. Raw materials are combined with other production factors, in particular man-made machinery and labour, to transform them into products that satisfy human welfare. For example fishermen and equipment are needed to extract, process and sell the fish from the ocean. However, as we discuss later, the individuals or firms who harvest the resource do not always pay the full costs of use.

Natural resources also provide a wealth of ecological services and functions. A standing forest, for example, may fulfil watershed protection functions by regulating the quantity and quality of water thus reducing flooding downstream and therefore damage to land, property and human life. People also procure welfare directly from the natural environment without extracting it – for example by looking at a beautiful view or taking their dog for a walk in the park. It is difficult to assign property rights for these environmental services and as a result there is no mechanism to determine their price. As a result, they tend to be treated as free and used excessively and unsustainably in the economy.

Another example is coral reefs. One aspect of their value is to increase and concentrate fish stocks. One effect of a change in coral reef quality or quantity would be observed in commercial fisheries markets, or recreational fisheries. But other aspects of the value of coral reefs, such as recreational diving and biodiversity conservation, do not show up completely in markets. The list of environmental goods and services from terrestrial and marine resources is large (see table 2.1).

TABLE 2.1: ENVIRONMENTAL GOODS AND SERVICES FROM TERRESTRIAL AND MARINE RESOURCES

	GOODS AND SERVICES	FUNCTIONS	EXAMPLES
1	Gas regulation	Regulation of atmospheric chemical composition	CO_2/ balance. O_3 For UVB protection, and SO_x levels
2	Microclimate regulation	Regulation of global temperature, precipitation, and other biologically mediated climatic processes at global or local levels.	Greenhouse gas regulation, DMS production affecting cloud formation.
3	Disturbance regulation	Capacitance, damping and integrity of ecosystem response to environmental	Storm protection, flood control, drought recovery and other aspects of habitat response to environmental variability

		fluctuations.	mainly controlled by vegetation structure.
4	Water regulation	Regulation of hydrological flows.	Provision of water for agricultural (such as irrigation) or industrial (such as milling) processes or transportation
5	Water supply	Storage and retention of water	Provisioning of water by watersheds, reservoirs and aquifers
6	Erosion control and sediment retention	Retention of soil within an ecosystem	Prevention of loss of soil by wind, runoff, or other removal processes, storage of silt in lakes and wetlands.
7	Soil formation	Soil formation processes	Weathering of rock, and the accumulation of organic material.
8	Nutrient cycling	Storage, internal cycling, processing and acquisition of nutrients.	Nitrogen fixation, N, P and other elemental nutrient cycle.
9	Waste treatment	Recovery of mobile nutrients and removal or breakdown of excess or xenic nutrients and compounds.	Waste treatment, pollution control, detoxification.
10	Pollination	Movement of floral gametes	Provision of pollinators for the reproduction of plant populations.
11	Biological control	Trophic-dynamic regulations of populations.	Keystone predator control of prey species, reduction of herbivores by top predators
12	Refugia	Habitat for resident and transient populations.	Nurseries, habitat for migratory species, regional habitats for locally harvested species, or over wintering grounds
13	Food production	That portion of gross primary production extractable as food.	Production of fish, game, crops, nuts, fruits by hunting, gathering, subsistence farming or fishing.
14	Raw materials	That portion of gross primary production extractable as raw materials.	The production of lumber, fuel or fodder.
15	Genetic resources	Sources of unique biological materials and products.	Medicine, products for material science, genes for resistance to plant pathogens and crop pests, ornamental species (pets and horticultural varieties of plants)
16	Recreation	Providing opportunities for recreational activities.	Eco-tourism, sport fishing, and other outdoor recreational activities.
17	Cultural	Providing opportunities for non-commercial uses	Aesthetic, artistic, educational, spiritual, and/or scientific values of ecosystems.

*Adapted from Costanza et al. (1997)

2.2 MEASUREMENT OF ECONOMIC VALUES

Neo-classical economists adopt a distinct value-system based on a utilitarian framework. That is to say things only have value if they give humans utility or happiness. If, for example people do not care whether a stream is dirty, this implies that they would not attach any additional value to a less polluted stream, all other things being equal. Typically however some members of society would have a preference for the non-polluted state.

The fact that resources are scarce and demand for them large implies that individuals or society must make choices on how they use the limited resources. Choice is based on complex trade-offs: for example should an individual use their limited income to buy a car or go on holiday, or should she or he plants crops of harvest timber. In essence economic value is a response to a question in which two different states are being compared. When economists say they are valuing something they are actually measuring the amount an individual is willing to give up in other goods and services in order to obtain some good or service or to change from one state to another.

The value to society of a change in the quantity and quality of environmental goods and services – from one state to another - can therefore be measured. Environment values are revealed by the amount individuals would be willing to pay (WTP) for an environmental change when the resources are owned by other stakeholders (e.g. the state) or how much they are willingness to accept (WTA) in compensation for a loss in environmental goods and services when they own them. Values are estimated from those individuals who are directly affected by any changes. Since some of the environmental values are likely to accrue to individuals' in future generations whose opinions are omitted from the decision-making process this implies an inter-generational bias.

In theory Hicksian income compensated demand curves, which are defined in terms of the underlying utility function, can be used to measures welfare changes. An alternative measure can be derived from the well-known Marshallian demand curve that is defined in terms of price and quantity. The equivalence of the welfare measure derived from the Marshallian demand curve to the true measure from the Hicks demand curve is only valid under a number of restrictive assumptions. It is however more practical to use the latter approach as it allows values to be estimated using money as a numeraire, although this in itself creates a form of intergenerational bias[i].

The fact that many environmental goods and services are not traded in market place and therefore do not have a market price implies that the Marshallian demand curve may need to be derived so that the welfare measure can be estimated. The purpose of chapter three is to examine the different techniques employed to value biodiversity.

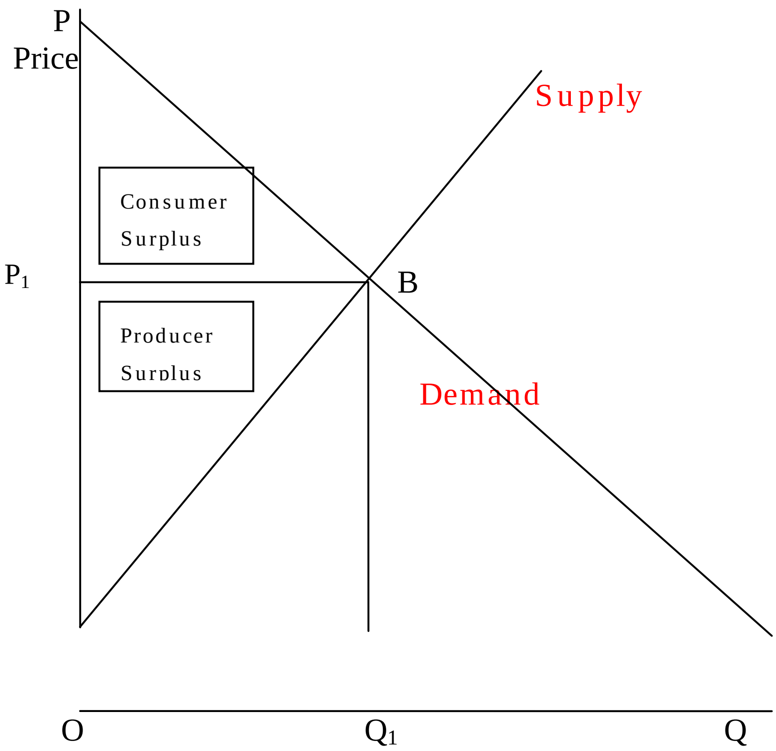
Human impacts upon biological resources can affect the welfare of both consumers and producers of the environmental goods and services. Consumers would include visitors to national parks while producers would include private forest owners who provide and generate goods and services from their lands. Depending upon who is affected by the changes, whether it is the consumer or producer, the relevant value measure is either consumer surplus or producer surplus respectively.

Consumer Surplus

Economists can measure consumers WTP from the demand [or marginal benefit] curve of a typical marketed good. The area below the demand curve is the total WTP or gross benefits that society would receive from consuming a good. However, in obtaining the good, payments would have to be made. From figure 2.1 we see that the net benefits from the consumption of the good at price P_1 are the gross benefits measured by the area below the demand curve (OPBQ_1] less payments (OP_1BQ_1). The net benefits (P_{1P}B) are referred to as the consumer surplus.

The consumer surplus is the difference between what consumers are prepared to pay for a good and what they actually pay. Take the example of a recreational fisher who would be willing to pay US$20 to use a particular site, but only incurs US$15 a day to get there: the net benefits or economic value of the visit is not US$20 but US$5 (20-15). If the fishing ground were removed, the recreational fisher would lose US$5 in economic value. The US$15 that is spent to get to the area would not be lost, but would be used elsewhere in the economy.

FIGURE 2.1: CONSUMER AND PRODUCER SURPLUSES



Producers

With producers, for all units of the goods they produce other than the market clearing price – where demand intersects with supply - their marginal production costs are less than the market price. At the market-clearing price, the price equals the marginal cost of producing the last unit of output. The area above the supply curve and below the price line is the producer surplus. This represents the production value, or net benefits, to the producer. Producer's welfare can be measured directly and is observable when a firm sells its production. From Figure 2.1 the producer surplus is shown as the area OP_1B: the total gross revenue (OP_1BQ_1) minus the total variable cost involved in production (OP_1BO).

The net benefits or economic value of producing this good is not the gross revenue, but the net revenue. For example if the commercial landings of a fishery where £2million, this is not the economic value of the fishery. The question that must be asked is how much would the fishermen be willing to accept in compensation to be as well off with and without the fisheries. The answer would be £2million if the fisheries were a costless activity. The fact that the fishermen have to pay costs, such as fuel, labour, gear and that these resources could be put to other productive uses if the fishery closed implies that the economic value of the fishery to the harvesters is somewhat less. This again highlights the important distinction between the economic value of biodiversity and its market value.

Part of the producer's surplus is made up of the economic rent associated with natural resources. To loggers existing forests have a substantial benefit over new forests in that they can be harvested immediately. This advantage is the economic rent (or stumpage value) that should accrue to the owner of the resource. The fact that Governments have given out concessions for firms, for example to harvest timber of mine minerals, without capturing anywhere near all the rent has allowed firms to appropriate this value as part of their producer surplus. This allows firms' to increase their profits and encourages them towards ''rent-seeking'' activities.

Implicitly it is assumed that market prices reflect economic scarcity and therefore willingness to pay for the goods and services. However the market price for extractable environmental goods such as timber or fish are not related to the long run ''marginal user'' or ''environmental costs'' and in many instances, do not even approximate market and economic scarcity values (Barbier, Burgess and Folke 1994). If this is the case there is a loss of resource rent from the environmental goods and services that should accrue to the owner. This leads to lower prices for the concessionaires and again an economic incentive to use less efficient and unsustainable practices.

While not an exact measure of net benefits or welfare changes the sum of consumer surplus and producer surplus gives a useful approximation of how environment-related policy or project proposals affect societal welfare.

2.3 CATEGORIES OF TOTAL ECONOMIC VALUE

Following the taxonomy adopted by economists, the terrestrial and marine resource values can be categorised as:

Direct Use Values

These describe either the values derived from extracting environmental goods such as timber and/or non-extractive services such as the educational, recreational and amenity benefits which accrue from attractive environments.

Indirect Use Values

These are the ecological functions and services of natural resources that indirectly provide support and protection to people and economic activity. For example, protecting forests and hence watersheds helps control erosion and flooding of productive land downstream. Terrestrial and marine resources provide a myriad of ecological services and functions that indirectly help support or protect economic activity and human welfare.

Option and Quasi Option Values

Individuals may like to conserve natural resources so that their children, grandchildren or future generations have the option to enjoy them. This is known as the option value. Option values arise because of the uncertainty of future supplies of resource benefits. The value involves the benefit of risk-averting behaviour in the face of uncertainties and irreversibilities'.

A variant of this is the quasi-option value. Individuals or companies may want to conserve nature if they believe there are potential economic benefits that could be derived from the resource – for example, new medicines. There is value in waiting for further information until the decision-maker has greater certainty as to the value of the environmental resource in question.

Existence Values

This captures individuals' desire to see environmental resources conserved, even though they never intend to use them (either directly or indirectly). The categorisation of the goods and environmental services from terrestrial and marine resources in accordance to the economic value taxonomy is shown in Table 2.2

TABLE 2.2: ENVIRONMENTAL GOODS AND SERVICES OF TERRESTRIAL AND MARINE RESOURCES CATEGORISED ACCORDING TO ECONOMIC VALUATION TAXONOMY

Direct Use Values		**Indirect Use Values**	**Option Value**	**Existence Values**
Commercial Use Values: -Biomedical resources -Commercial fishing -Commercial forest products -Eco-tourism	Subsistent Use Values: -Fuel wood and building materials -Subsistence dependence: .Traditional medicines . Food (fish, game & edible plants)	-Nutrient retention and maintenance of nutrient cycles -Sediment retention -Shoreline stabilisation -Flood control -Maintenance of water cycles -Regulation of climate -Absorption / decomposition	All direct and indirect uses in the future, which involves future uncertainty and potential irreversibility.	All values not associated with direct or indirect human uses.

		of pollutants		

2.4 METHODOLOGIES TO VALUE THE ENVIRONMENT

There are four basic approaches to placing economic values on environmental effects. These are price-based valuation methods, surrogate market valuation methods, hypothetical market approach, and cost-based approaches. Each will be briefly examined.

Price-Based Valuation Methods

The price-based valuation methods, either the direct market prices or their shadow price versions, are best adopted when the environmental goods and services are transacted in formal markets. Using market prices gives an underestimate of the true WTP, since consumer surplus is ignored. How serious this underestimate is depends on the elasticity of demand: the more elastic (flat demand curve) the smaller the consumer surplus, and thus the smaller the error. For relatively small projects or highly competitive industries, any effects on price are probably absent or negligible and consumer surplus can be safely ignored.

As has been discussed, the value of the environmental stock that provides an input into the production of a commercial commodity is the potential rent generated by the resource. This is the total gross revenue derived by the producer minus the total variable cost involved in production.

Care must be taken to correct prices when markets do not exist, or they are underdeveloped and/or subject to serious distortions. Here, shadow prices will need to be found. Alternatively, prices of similar goods transacted in the marketplace could be used. When there are no perfect substitutes for the good in question (which is generally the case), the surrogate market prices may require slight adjustments: for example, using the market price of coconut lumber as a value for timber. Since these products are not perfect substitutes – coconut lumber being of inferior quality – adjustments need to be made.

Many goods and services from terrestrial and marine resources are not sold and purchased in formal markets. Hence other market valuation methods have to be relied upon when valuing them.

Surrogate Market Valuation Methods

Surrogate market valuation techniques are used when there is no formal market to measure an environmental value but there exists information about a related good or service transacted in the marketplace that can be used to infer the value. Techniques where the value can be derived from other markets include the hedonic pricing method (HPM), the travel cost method (TCM) and the change in productivity (CoP) approach.

The TCM estimates how much people value an environmental location by the costs they are willing to incur in travelling to it. It implicitly considers the environment in terms of the provision of recreational services rather than basic ecological goods and services. The fact that people incur costs to visit these sites enables a demand function for the attraction to be established, in which the visitor rate is related to the travel cost. Once this relationship has been established it is possible to trace out a demand curve by examining the effects of a change in entrance fees on visitor numbers. It can be used to attach values to environmental quality by either examining changes in the visitor rate due to changes to the environment, or by comparing the visitor rate with several sites of similar travel cost. Where they are available, it can be used to estimate the recreational and amenity value of protected areas.

The CoP method can be used whenever an environmental service or function acts as an input into the production of marketable goods. For example, the watershed protection functions of forests help control the quantity and quality of water flows. Deforestation can contribute to a reduction of agricultural productivity through soil erosion, sedimentation and flooding. This technique estimates the changes in output as a result of lost environmental services. However, identifying and measuring the complex ecological linkages can be very difficult, unless data and models exist.

Constructed or Hypothetical Market Approach

In situations where market values cannot be observed, either directly or indirectly, market-like behaviour can be inferred through surveys or direct questions. The most widely used technique of this type is the contingent valuation method (CVM). By setting up a carefully worded questionnaire, CVM elicits individuals willing to pay (WTP) for an environmental benefit (e.g. to preserve the view of a beautiful landscape, improve air quality), or how much money they would be willing to accept (WTA) for a loss of environmental quality. The aim of CVM is to elicit valuations that are as close as possible to what would be revealed if a market actually existed.

To be carried out successfully, CVM requires careful sampling, training of enumerators and long periods of preparation and analysis. Information can be obtained directly from respondents or via a personal interview or mail questionnaire. The whole process can be very expensive. It is the only technique able to capture non-use environmental values.

Cost-based Approaches

The most widely applied techniques in this grouping are the preventative/defensive expenditure and replacement costs. The former captures people’s valuation of ecological services by observing their actual expenditures to prevent its loss, or to defend themselves from the consequence of its loss. Farmers, for example, may plant trees to prevent soil erosion or defend their fields against flooding through building dykes. The replacement cost approach examines how much people have or would pay to restore their damaged environment to its original state. For example, the expenditures made to restore an environmental resource once it has been damaged by cyclones can be used as a proxy monetary estimate of economic value.

These cost-based approaches are based on a number of dubious assumptions: that such actions are effective and able to perfectly substitute environmental quality; there is complete information and therefore environmental risks are well perceived and understood and there are no capital constraints. In principle, the costs incurred voluntarily in a free-market situation to mitigate or reverse an environmental impact will be equal to or less than the value of the impact. However, the reverse can be true when there are large secondary benefits. For example double glazing helps keep out heat as well as noise. A classification of the valuation methods is given in Table 2.3

TABLE 2.3: CATEGORIES OF ECONOMIC VALUATION METHODS

Price-Based Valuation	Surrogate Market Valuation	Constructed Market Valuation	Cost-Based Valuation
Market Prices Shadow Prices Related or Substitute Good For Evaluating Timber and Non-wood Products (food, medicine, handicrafts) Fisheries	Hedonic Prices Travel Cost Change in Productivity For Evaluating Environmental Amenities Recreation and Eco-tourism Regulatory Ecological and Environmental Functions (flood Control, nutrient cycling, carbon sink, micro-climate regulator)	Contingent Valuation Choice Modelling For Evaluating Recreation and Eco-tourism Ecological and Environmental Functions Protected areas Cultural and Religious Values	Opportunity Cost Replacement Cost Relocation Cost Preventive /Defensive Expenditure Dose Response Function For Evaluating Damages to protected areas Losses of ecological and environmental Functions Health impacts

2.5 USING THE ECONOMIC VALUES IN PLANNING AND POLICY MAKING

The economic values of environmental goods and services can be used to influence decision-making in a number of ways:

- to assess the impact on a country's economy;
- project, programme and policy formation; and
- to propose economic instruments.

To assess the impact on a country's development

Environmental damage can impose significant costs on a country – for example from foregone crop output due to soil erosion and/or damage due to air pollution. This can result in appreciable losses in the country's economic growth. Valuation studies can be employed to estimate the magnitude of the losses. For example, an economic impact assessment of the forest fires in Indonesia in 1997 highlighted the magnitude of damage for the Indonesian economy as well as those of neighbouring countries (see Glover and Jessup 1999). In China it has been estimated that productivity losses caused by natural resource loss cost US$14-27 billion, approximately 4-7% of GDP; in Pakistan the health and productivity losses caused by environmental damage have been valued at 3.3% of GDP (DFID 2000). Quantifying these impacts plays an important role in highlighting the extent of economic damage caused and the need to put in place measures to arrest such impacts. Where environmental damage costs are shown to be high, countries are increasingly trying to find means to limit further damage.

The fact that these environmental costs have not shown up explicitly in measures of national product gives planners less incentive to treat such damage as a priority. If GNP is to be a true measure of the aggregate wellbeing of a nation, not simply to record economic activity, it must be adjusted to take into account the depreciation of natural capital and any losses to human welfare from the extraction, processing and disposals of materials and energy to receiving environments. Both adjustments require the use of valuation techniques.

Policy and project evaluation

The traditional use of economic valuation of the environment is to extend project appraisal to account for environmental impacts or to assess returns from the conservation option. An extended Cost-Benefit Analysis was carried out by Ruitenbeek (1989) to investigate the benefits of conservation and continued controlled exploitation in the Korup National Park in Cameroon. Results showed that the benefits associated with conservation where substantially larger than the unsustainable exploitation of the forest. This provided conclusive evidence both to international donors and policy-makers that conservation was clearly the right option. An example of partial CBA is provided in Mohd Shahwahid *et al.* (1999) which compares the feasibility of two project options: permitting timber harvesting and total protection of a forest catchment area. Similarly, information on the economic costs and benefits of policy changes can greatly assist governments in setting priorities. Economic valuation can be used to estimate and incorporate environmental values.

It should be noted that there are a number of pitfalls of using CBA when making decisions pertaining to the environment. Issues such as choosing a discount rate, dealing with intergenerational transfers and equity, and decision-making under risk and uncertainty are important to the application and outcome of the analysis. These are not discussed here. It may be more appropriate using alternative decision-making methodologies such as multi-criteria analysis. With MCA, management options are measured against a number of different criteria (e.g. costs, equity, pollution levels). This offers a structured yet flexible means by which to analyse complex problems. It overcomes the difficulty of translating all values into monetary units by using subjective scoring methods, and offers a more participatory approach. It does tend to use economic valuation to measure some of the criteria. For a good example of an application of MCA see Brown et al (2000).

To propose the introduction of economic instruments

Economic instruments are measures that help correct the failure of the market system to send the right price signals to resource users. Since individuals have an incentive to use natural resources excessively, economic instruments can be introduced to rectify this. Quantifying the economic value of biodiversity, and identifying who gains and who pays for existing unsustainable practices, will give an indication of the appropriate economic instruments that need to be introduced.

Take the example of forestry. The shortfall of local benefits from conserving forest resources to cover foregone benefits renders protection very difficult and costly to enforce. The reason for this shortfall is that only a fraction of the forest's value – e.g. fuelwood or non-timber products – accrues to the local populations. The rest accrues to direct beneficiaries outside the immediate local area (soil and water conservation, eco-tourism) and outside the country (existence, carbon sequestration). Another user who benefits directly from the forests are timber companies. The fact these users may not have to pay for the benefits they receive from the forest, or the damage they cause to it, means that various financial instruments should be introduced to help correct this market failure.

Tables 2.5 provides a list of economic instruments that can be used to capture the economic values of forest resources. To determine the magnitude of the instrument, be it a tax or charge, an economic valuation of the environment needs to be carried out.

TABLE 2.5: ECONOMIC INSTRUMENTS TO CAPTURE ECONOMIC VALUES OF FORESTS

Action	Mechanism
Appropriating local values of forest resources	Visitor entrance fees Watershed fees Airport taxes
Appropriating global values of forest resources	International donor contribution Carbon offsets Debt-for-nature swaps Bio prospecting Forest conservation trust Transferable development rights
Forest use by timber companies	Higher stumpage fees Environmental performance bonds Reforestation fund Fiscal measures in forestry

Source: McNally 1999

Chapter 3: The Study: Valuing Samoa's Terrestrial and Marine Resources

3.1 INTRODUCTION

In cases when a product has a market price and when we know the production cost structures of the firms in a sector – for example in the fishing industry - we can use this information to work backwards to derive the resources economic rent. In this study this has been carried out for the forestry and marine resources. However, many of the economic goods and services provided by forest and marine resources have not have been transacted in the market. In some cases it may be possible to infer their values by examining surrogate markets.

Where it is not possible to use the surrogate market approach a constructed or hypothetical market approach could be used. Here, the monetary value for environmental goods and services is established through the setting up of a "hypothetical" market. People's WTP to obtain the object being valued, or WTA to forego the benefits, are obtained directly from respondents via a personal interview. In this study, visitors' willingness to pay to enter recreational sites on the island is estimated.

Finally, owing to the limitations of time, budget and lack of scientifically investigated environmental damage and environmental input-output production functions the benefits transfer approach was applied to value some of the indirect use and non-use values.

3.2 PRICE-BASED EVALUATION METHODS FOR APPRAISING USE VALUE OF COMMODITY PRODUCTION FROM TERRESTRIAL AND MARINE RESOURCES

When a good is traded in the market and information exists on the costs of production, this information can be used to derive the economic rent of natural resources. In this section basic models are constructed to estimate the rent for forestry and marine resources.

3.2.1 The economic value of the marine resources in fish production

The estimation of the economic value of marine resources helps determine the direct contribution of the marine resource in fishing activities. The statistics on production, export and domestic consumption provide the gross value of the fish commodity that has been harvested from the marine resources. The selling price of a commodity comprises of the sum of compensations for the use of various inputs (factors of production) in the production process. Running costs include payments for fuel, bait, ice, labour man-hours and maintenance of fishing gear. Fixed inputs include man-made fixed assets such as the boat and fishing gear. In many cases, the important natural asset that serves as the habitat and feeding grounds – the marine resource itself – has been ignored or treated as a free asset.

The use of each of the above inputs, except the natural asset, is compensated. Compensations are made for the use of fuel, bait, ice, and labour (wages). There is also compensation (profit) for the entrepreneurial risk that is taken. It is argued that a portion of the residual value ought to be allocated to the natural assets as a return for providing services, particularly as the habitat and feeding ground of the fish. This portion is being argued as the rent from the marine resource for producing the stock of fish that is caught - the economic value of the marine resource for the food production service. However, too often this value is being captured as excess profit by fishermen.

A basic model to estimate the economic rent of marine fishery resources

An approach to compute the economic rent from fishing is to calculate the difference between the selling price and the direct costs of production and other returns to fixed assets. Only a portion of the total profit margin is imputed and allocated to the fisherman for his effort and entrepreneurial skill; the rest is to be allocated as the rent from the marine resource for producing the stock of fish that is caught. Thus economic rent can be written as:

$$R = FP - ADC - AIC - APM \quad (3.1)$$

where:
R is the resource rent per unit of fish caught;
FP is the price per unit of fish sold to the middlemen;
ADC is the average direct cost of fishing and transporting (not inclusive of a normal profit margin for the fishermen);
AIC is the average indirect cost of fishing; and
APM is the equitable profit margin allocated to the fishermen for the effort and risks taken up.

Rent valuation requires information on prices, quantities of fish stocks caught and a breakdown of the cost elements. The formula for calculating the resource rent from the fish stock caught is adapted from the formula for stumpage timber value of Davis (1977), and Mohd Shahwahid and Awang Noor (1998) and is given below:

$$\mathbf{R} = \sum_{i=1}^{n} \sum_{j=1}^{k} \mathbf{Q_{ij}} \{ (\mathbf{FP_{ij}} - \mathbf{ADC_j} - \mathbf{AIC_j} - \mathbf{APM_j}) \} \quad (3.2)$$

where:
R is the rent from the stock of fish caught per unit;
$\mathbf{FP_{ij}}$ is the selling price of fish species i and grade class j to the middlemen;
$\mathbf{Q_{ij}}$ is the quantity of fish caught by species group i and fishing boat/gear j;
$\mathbf{ADC_j}$ is the average direct fishing cost using fishing boat/gear j (not inclusive of the fisherman's equitable profit margin);
$\mathbf{AIC_j}$ is the average indirect fishing cost using fishing boat/gear j; and (3.3)
$\mathbf{APM_j}$ which is the equitable profit margin allocated to the fishing boat/gear owner j, which can be estimated by

$$\pi \sum_{i=1}^{n} \mathbf{Q_{ij}\, FP_{ij}} \quad (3.4)$$

where
π is the average profit margin obtained by the entrepreneur for taking the business risk.

It can be seen from the above equations that the variation in rents from a marine resource will result mainly from the differences in the stock of fish caught, fish prices that vary across species and grade classes, the direct fishing cost of each fishing boat/gear, the returns to fixed capital invested and the profit margin to be allocated to the entrepreneur who may be the boat and gear owner as well.

The economic rent of Samoa's fisheries sector

In Samoa fish are caught for subsistence purposes, for the local market (artisan fishing) and to export (industrial fishing). Large alias are used to fish tuna for exporting and include large catamarans and mono hulls with lengths of 12m to 24m, employing six sets of fishing gear per trip with 1,450 hooks per set. The trip length for the larger alias is at least five days. Medium size catamarans (from 10m to 12m) employ two sets of fishing gear per trip with 325 hooks per set, and are also used in long-line tuna fishing. The trip length is shorter – normally three days.

Due to the larger fishing boats, longer trip length and the adoption of long-line fishing methods requiring the purchasing of baits, the direct and indirect costs incurred for industrial fishing are higher than for artisanal fishing. Artisan fishing tends to use smaller canoes (4m-4.5m long). The cost of subsistence fishing is very low owing to its short nightly trips, the use of small canoes (some of which are home-made) and the use of various fishing gears including spear fishing, gill nets, cast nets and hand lines. Often no ice coolers are brought along.

The cost of production for each of the different fishing types is given in table 3.1. The direct or running cost of fishing dominates the total cost, except in the case of the larger monohulls that incur high fixed costs. Fuel, bait and wages are the main running costs. In subsistence fishing, only wages play an important role since the canoe has to be manually paddled and other fish caught are used as bait. From the profitability indicators of table 3.2, it could be implied that fishing is a lucrative industry. An important factor for this is related to the issue of treating the fishery resource as a "free good", and any surplus from effort being treated as the full return of fishing.

TABLE 3.1: THE AVERAGE PRODUCTION COST ACCORDING TO FISHING CATEGORIES (ST$/trip)

Fishing vessel	**Large Monohulls**		**Large Catamaran**		**Extended Alias**		**Alias**		**4-4.5m Canoe**		**2 m Aliar**	
Cost Items	ST$/ trip	%	ST$/ trip	%	ST$/ trip	%	ST$/ Trip	%	ST$ / trip	%	ST$/ Trip	%
Fuel, oil, hydraulic fluid for each trip	4,500	13.7	800	18.2	300	22.5	300	26.1	50	14.6	0	0.0

Bait	4,125	13.1	963	21.8	293	22.0	275	23.9	0	0.00	0	0.0
Ice	1,143	3.50	286	6.51	73	5.46	55	4.75	8	2.38	0	0.0
Food purchased for trip	600	1.84	125	2.84	70	5.25	50	4.35	10	2.92	5	16.72
Crew wages	9,331	28.6	1,361	30.9	346	25.9	259	22.58	135	39.3	23	77.57
Direct	19,700	60.3	3,535	80.4	1,082	81.1	939	81.76	203	59.2	28	94.29
Loan repayments	5670	17.3	380	8.64	101	7.60	84	7.35	45	13.2	0	0.00
Depreciation of vessel	4200	12.8	281	6.40	75	5.63	63	5.44	50	14.7	2	5.71
Insurance of vessel	1680	5.14	113	2.56	53	3.94	44	3.81	34	9.82	0	0.00
Boat repairs maintenance	1260	3.86	84	1.92	23	1.69	19	1.63	10	2.95	0	0.00
Registration fees	150	0.46	4	0.09	0	0.00	0	0.00	0	0.00	0	0.00
Indirect	12960	39.6	862	19.6	251	18.8	209	18.24	139	40.7	2	5.71
Total	32,660	100	4,396	100	1,333	100	1,148	100	342	100	30	100

TABLE 3.2: PROFITABILITY INDICATORS BY FISHING ENTERPRISES (%)

Profit rates	**Large Monohulls**	**Large Catamarans**	**Extended Alias**	**Alias**	**4-4.5m Canoe**	**2 m Canoe**
Over cost	74.41	88.95	58.27	37.8	57.34	158.56
Over sales	42.66	47.08	36.82	27.4	36.44	61.32

Data compiled from the Division of Fishery (2000), Passfield (2000), Passfield and King (2000), Passfield and Mulipola (1999) and further discussions with King, Passfield and Mulipola enabled the computations of the marine fishery economic rent. From Table 3.3, it is clear that the value of the marine resource for the production of fish is influenced by what profit margin is assigned to the different fishing enterprises. The higher the assigned profit margin, the smaller is the economic rent. Also, the rent per trip is higher for the large monohulls and catamarans, owing to their larger catch. These boats conduct longer fishing days per trip and use more sophisticated fishing gears.

TABLE 3.3: DISTRIBUTION OF CONVERSION RETURN BETWEEN THE PROFIT MARGIN FOR THE FISHING ENTERPRISE AND ECONOMIC RENT PER TRIP BY CATEGORY OF FISHING VESSEL

Category of fishing vessel	**Large Monohulls**		**Large Catamaran**		**Extended Alias**		**Alias**		**4-4.5m Canoe**		**2 m Canoe**	
Division of conversion return	ST$	%	ST$	%	ST $	%	ST$	%	ST$	%	ST $	%
Profit margin over sales (10%)	5696	23.3	831	21.2	211	27.1	158	36.4	54	27.4	8	16.3
Economic rent	18754	76.7	3084	78.7	566	72.8	276	63.5	142	72.5	40	83.6
Profit margin over sales (15%)	8544	34.9	1246	31.8	316	40.7	237	54.6	81	41.1	12	24.4
Economic rent	15906	65.0	2668	68.1	460	59.2	197	45.3	115	58.8	36	75.5
Profit margin over sales (20%)	11392	46.5	1661	42.4	422	54.3	316	72.9	108	54.8	15	32.61
Economic rent	13058	53.4	2253	57.5	355	45.6	118	27.1	89	45.1	32	67.4

The above analysis was based on a per trip basis. The frequency of fishing trips varied among the fishing categories. The larger boats such as the monohulls, larger catamarans and alias made the most trips. Artisanal and subsistence fishermen made less frequent trips. Table 3.4 sums up the rents over the year. As would be expected, greater rents were generated by the larger boats, and subsistence fishing provided the lowest.

TABLE 3.4: DISTRIBUTION OF THE CONVERSION RETURN BETWEEN THE PROFIT MARGIN FOR THE FISHING ENTERPRISE AND ECONOMIC RENT PER YEAR 1999/2000

Categories of fishing vessel	**Large Monohulls**		**Large Catamaran**		**Extended Alias**		**Alias**		**4-4.5m Canoe**		**2 m Canoe**	
Division of	ST$	%	ST$	%	ST$	%	ST$	%	ST$	%	ST$	%

conversion return												
Profit margin over sales (10%)	189867	23	44302	21	16877	27	12658	36	2692	27	387	16
Economic rent	625148	76	164456	79	45261	72	22071	63	7118	72	198	83
Profit margin over sales (15%)	284801	35	66453	31	25316	40	18987	54	4038	41	580	24
Economic rent	530215	65	142304	68	36822	59	15742	45.33	5772	58	1791	75
Profit margin over sales (20%)	379734	46	88605	42	33754	54	25316	72.90	5384	54	773	32
Economic rent	435281	53	120153	57	28384	45	9413	27.10	4426	45	1597	67

The fishery production of Samoa was 9,159 million tonnes (mt) valued at more than ST$51 million in 1999/2000. In terms of quantity, the main channel of distribution went to the export market involving some 4,480 mt or 49%, with only 275 mt or 3% sold in the domestic market. A substantial quantity, 4,400 mt (47.5%), was caught for subsistence purposes. Using this information, it was possible to compute the total rents attributable to fishing in the marine resources.

Dividing the various fishing categories into export and domestic markets and subsistence fishing, and using the above ranges of economic rent, the total economic values generated by the marine resources for the production of fish were computed (table 3.5). For illustration, when the entrepreneur and vessel owner was assigned a profit rate over sales of 20%, then it can be concluded that the value of the marine rent for fish production was ST$15.6 million or 59.2 % of the conversion return. Conversion return is the total returns net of all accounted costs (except for the profit margin to the boat operator for risk taking). A greater proportion of rent was contributed by subsistence fishing due to a large number of subsistence fishermen, low production cost and high prices fetched by reef fishes.

TABLE 3.5: DISTRIBUTION OF CONVERSION RETURN BETWEEN THE PROFIT MARGIN FOR FISHING ACTIVITY AND ECONOMIC RENT PER YEAR 1999/2000

Categories of fishing activity	**Exports**		**Domestic**		**Subsistence**		**Total**	
Division of conversion return	ST$	%	ST$	%	ST$	%	ST$	%
Profit margin over sales (10%)	2323463	30	145709	27	2907912	16	5377084	20

Economic rent	5660571	70	388997	73	14924528	84	20974096	78
Profit margin over sales (15%)	3485195	44	218563	41	4361868	24	8065626	31
Economic rent	4498839	56	316143	59	13470572	75	18285554	69
Profit margin over sales (20%)	4646927	58	291417	55	5815824	33	10754168	41
Economic rent	3337107	42	243289	46	12016616	67	15597012	59

Policy implications

It is interesting to investigate the level of rent capture in marine resource for the purpose of food production in Samoa. At present, no royalty or income taxes are imposed on the returns from primary production, particularly from the common marine resources. Fishing vessels are being charged a licence fee so that the fishing fleet can be limited and monitored. The rates are as reported in table 3.6. However, compliance has been very low. The fee is highest (ST$5,000 for vessels of 15m and above in length) and lowest (ST$200 for vessels less than 12m in length). This fee can be treated as a source of revenue to the Government. Hence its collection can be considered as a source of state revenue and its collection is considered as an attempt to capture the economic rent.

TABLE 3.6: VESSEL CATEGORIES WITH ALLOCATED FEES AND NUMBER OF LICENSED FISHING VESSELS

Vessel size	Fee	Number licensed	
< 12 m	200	16	
12m<15m	500	2	
>15 m	500 0	3	

An indicator of rent capture was computed to determine the proportion of the rent accounted for by the licensing fee. The proportion of the fee over the computed average annual economic rent suggests that only a small amount was being captured (table 3.7).

TABLE 3.7: INDICATOR OF RENT CAPTURE BY THE GOVERNMENT FROM FISHING

Categories of fishing vessel	Large Monohull	Large Catamaran	Extended Alias	Alias	4-4.5m Canoe	2 m Canoe
Profit margin scenario	%	%	%	%		%

10%	0.80	0.12	0.00	0.01	0.03	0
15%	0.94	0.14	0.01	0.01	0.03	0
20%	1.15	0.17	0.01	0.02	0.05	0

This analysis is not intended to suggest that the Government should impose any resource utilisation levy upon subsistence fishermen. It would be counter-productive to discourage them from being involved in such activities, since fishing utilises their economic labour resources and is a main source of protein for the local population. The main issue on subsistence and inshore fishing is more one of relieving the pressure upon inshore resources. The instrument adopted by the Fishery Division is to encourage villagers to fish in areas outside the reefs. Low-cost boats capable of fishing over the reef slope and up to five miles beyond where the depths are 100 metres were introduced. This will enable fishermen to target not only reef fishes, but also pelagic fishes through trolling.

There is merit, however, in introducing economic instruments such as landing fees to raise rent capture among commercial fishing, particularly on the larger enterprises whose landings are meant for exports. This would help relieve pressure on these fisheries.

Although the actual value of the natural resource rents is only one component (as well as labour, capital etc) contributing to fish production in Samoa, it is the critical, primary input. As fishing is critical to the Samoan economy – accounting for over 7% of GDP – it is vital that the resource is not used unsustainably, affecting the future productivity of the resource. Moreover it must be recognised that the market price may not be a true reflection of scarcity or marginal user costs. In principle, the sustainable yield of the main commercial species of fish should be estimated and the annual catch limited to this level. To achieve this level, taxes, input restrictions or quotas could be introduced. The pros and cons of the different instruments are discussed in McNally (2000).

3.2.2 The Economic Value of the Forest Resources in Timber Production

To assess the economic value of forest as a producer of timber requires the estimation of the economic rent from logging activities. With knowledge of this value, concerned parties can better appreciate the economic significance of the resource and implement better resource management practices. An important spin-off is to observe what proportion of the rent is captured by the relevant parties – the state government, the concessionaires and/or customary owners of the forest.

The economic rent that can be derived from allocating a logging concession is basically the value of the standing timber. Two approaches to estimate the economic rent from a concession are the market evidence method and the residual value method. The market evidence method estimates the rent of a timber stand by comparing prices of standing timber recently sold from stands with similar characteristics. This method is a good first estimate of the economic rent. But in certain countries, there is no market transaction for the standing timber in forest concessions. Further, even if transactions exist, no two concessions are exactly similar in terms of species, volume, wood quality composition, accessibility and terrain, so erroneous estimates can sometimes be made.

The residual value method calculates the economic rent as the difference between the selling price of the nearest end-product made from standing timber and the stump-to-market processing costs. The nearest product made from standing timber that has a market price is sawn logs. Thus, the average rent of the standing timber equals the difference between the price a buyer will pay for the logs and the average total costs of harvesting (not inclusive of a fair or equitable profit margin for the concessionaire) and transport from the forest to the buyer. Only a portion of the total profit margin is imputed and allocated to the concessionaire, while the rest is allocated to the resource owner (be it state owned or community forests).

The residual value method was used to estimate the economic rent of the forestry resources in order to compare it with existing forest taxes (royalty charges) to determine whether the state is capturing the full rent owed to them.

A basic model to estimate the economic rent of timber production

The resource rent refers to the value of standing trees with diameters of 30cm and above. This diameter limit reflects the fact that logs are marketable if they are larger than 30cm diameter breast height (dbh). The formula for calculating economic rent for a logging concession was modified from Davis (1977), and Mohd Shahwahid and Awang Noor (1998):

$$\mathbf{SV} = \sum_{i=1}^{n} \sum_{j=1}^{k} \mathbf{V_{ij}} \; \{ \mathbf{LP_{ij}} - \mathbf{ALC} - \mathbf{APML_{ij}} \} \qquad (3.5)$$

where:

LP_{ij} is the log price of species group i and diameter class j;

ALC is the average harvesting cost per unit volume;

$APML_{ij}$ is the equitable profit margin allocated to the logging concessionaire for harvesting logs of species group i and diameter class j;

SV is the economic rent per hectare; and

V_{ij} is the volume of timber in species group i and diameter class j.

A complication in the computation is the absence of a formal market for sawn logs. Hence the computation must begin with the price of rough sawn timber. This requires obtaining the breakdown of production costs from logging to saw milling. An interview with a saw miller was conducted to obtain this information. However, the lack of published data and the reluctance of the industry to provide a detailed breakdown of their sawn timber production by species and grades prevented detailed investigation. Equation 2.1 was modified in accordance with available data.

$$\mathbf{SV = V\{[\,(STP - ASMC - APMSM) / CF] - ALC - APML\,\}} \qquad (3.6)$$

Where:

SV is the economic rent per concession per annum;

V is the total volume of logs (m^3) harvested from each concession per year;

STP is the rough sawn timber price per m^3;

ASMC is the average saw milling cost per m^3;

APMSM is the average profit margin for saw milling operations (ST/m^3 sawn timber);

CF is the conversion factor of logs into sawn timber;
ALC is average harvesting cost per m^3; and
APML is the average equitable profit margin allocated to the forest concessionaire and logging contractor for undertaking logging operations.

The CF is to reflect that the volume of log inputs required in the production of 1 m^3 of sawn timber is more than the volume of the sawn timber produced. In fact the log volume is a reciprocal of the CF. This factor is dependent on the saw milling technology to recover as much output from the log input. The higher the CF, the less is the volume of log input utilised in production and the lower is the cost of log input. The multiplication of the cost of log input by CF provides us with a good estimate of the imputed price of one m^3 of log. The challenge is the appropriation of an equitable profit margin for the concessionaire (who is also the saw miller) and the logging contractor. The profit margin is the return due to these two parties for undertaking the risk in the logging operations. We used three percentages for profit margin to provide an indicator of how sensitive the computation of resource rent would be to different assigned margins.

The economic rent of Samoa's timber sector

The average price ex-mill of Tava (*Pometia pinnata*) sawn timber is ST$590/$m^3$. Based on an interview with an employee in a mill, a breakdown of the cost elements of this price is reported in table 3.8. The wage component was low in the saw milling industry of Samoa, probably due to low industrial job opportunities. Fuel, lubrication, electricity usage and mill maintenance also took up a small proportion of total cost. In many countries saw milling is quite a competitive industry with profit rates close to the national average returns on investment. Hence, we have allocated a profit rate over cost of 15% that was computed to be 12.79% over selling price. This procedure has enabled us to appropriate the residual as the cost of log procurement.

The cost of procuring the logs took a large component of total saw milling costs since the production of every m^3 of sawn timber requires 2 m^3 of log inputs. This is due to the low recovery rate of 50% in the saw milling operation in Samoa. High log procurement costs were also due to the logging operations on difficult terrain.

TABLE 3.8: THE AVERAGE PRODUCTION COST AND PRICE OF SAW MILLING

Cost elements	ST $/$m^3$	%
Cost of procuring***	348.31	71.32
Wages and salaries	68.40	14.01
Fuel, lubrication, electric, mill maintenance	53.77	11.01
Indirect cost*	17.88	3.66
Average total cost	488.36	100.00
Profit margin**	71.64	12.79
Average sawn timber price	560.00	100.00

* includes depreciation, insurance and interest charges
** includes profit margin for saw milling operation

***inclusive of profit margin for the concessionaire and the logging contractor.

The information on the costs of log procurement was further disaggregated into direct and indirect cost of logging, and a residual termed conversion return. The term conversion return was introduced by Davis (1979) to depict the surplus of prices from the production cost. The latter is not yet inclusive of a fair profit margin to be allocated to the concessionaire for taking the risk in the logging business. The conversion return is to highlight the fact that the surplus comprises of two components – the profit margin to the concessionaire and a residual to be accounted as the value of standing timber for the resource owner. Currently, the conversion return included the profits share for the concessionaire (who happens to be the saw miller) and the logging contractor, and the royalty payment made to the Government and resource owners. Table 3.9 provides the estimated cost structure of the logging operations.

TABLE 3.9: ESTIMATED BREAKDOWN OF LOGGIING COSTS (ST$/$m^3$)

	ST/m3 log	**Proportion**
Direct logging cost	40.72	55.87
Indirect logging cost	32.16	44.13
Average total cost	72.87	100.00
Conversion return	101.28	58.16
Average log price	174.16	100.00

The value of stumpage from the forest resource is dependent on how much we allocate as fair profit margin to the concessionaire and logging contractor for undertaking logging business risk. In tropical log producing countries such as Malaysia, a range of between 20% to 30% of sales was used, given that logging can be a risky business. Three scenarios were provided: 20%, 30% and 40% of selling price. Table 3.10 provides the rents estimated under the three scenarios of overall profitability assumed for the concessionaire and logging contractor.

TABLE 3.10: DISTRIBUTION OF CONVERSION RETURN BETWEEN THE PROFIT MARGIN FOR THE CONCESSIONAIRE AND THE ECONOMIC RENT

Scenario for fair profit margin to the concessionaire		**Division of conversion return**	**ST $**	**%**
20%	Per volume basis (/m^3)	Profit margin for concessionaire and logging contractor	34.83	34.39
		Economic rent	66.45	65.61

	Per ha of forest land	Profit margin for concessionaire and logging contractor	731	34.39
		Economic rent	1395	65.61
30%	Per volume basis (/m^3)	Profit margin for concessionaire and logging contractor	52.25	51.59
		Economic rent	49.04	48.41
	Per ha of forest land	Profit margin for concessionaire and logging contractor	1097	51.59
		Economic rent	1030	48.41
40%	Per volume basis (/m^3)	Profit margin for concessionaire and logging contractor	69.66	68.78
		Economic rent	31.62	31.22
	Per ha of forest land	Profit margin for concessionaire and logging contractor	1463	68.78
		Economic rent	664	31.22

The estimated economic rents decline from ST\$66.45/m^3 or ST\$1395/ha to ST\$31.62/m^3 or ST\$664/ha as the profit margin for the concessionaire and logging contractor is raised from 20% to 40% of sales.

From the above results, it is clear that the value of the natural forest for timber production is influenced by what profit margin is assigned to the integrated logging and saw milling operations and to the logging contractor. Using the annual production figure of 1997 (table 3.11) as a basis, it was possible to compute the economic value of the natural forest as a producer of timber material (table 3.12). When we assigned a low profit margin to the concessionaire and logging contractor, the annual economic value of the forest was estimated as ST$ 1,012,185. If a higher profit margin was assigned, the value declined to ST$481,636.

TABLE 3.11: LOG PRODUCTION ACCORDING TO CONCESSIONAIRE (1997)

Name of company	Log concession area (ha)	Log production (m3)	Estimated harvesting area (ha)	Remaining years of harvesting

Samoa Forest Corporation	1,290	5707	190	7
Bluebird Company A	1,540	5,019	186	8
Bluebird Company B	490	2,970	149	3
Sava'i Sawmillers Ltd	555	692	69	8
Strickland Brothers	605	844	47	13
Total	4480	15232	641	7

Source: Iakopo (1998)

TABLE 3.12: ESTIMATED ANNUAL ECONOMIC VALUE OF THE NATURAL FOREST IN TIMBER PRODUCTION

Profit margin	Division of conversion return	ST $
20%	Rent	1012185
30%	Rent	746910
40%	Rent	481636

Policy implications

It is interesting to investigate the level of rent capture in Samoa. A royalty rate ST$0.22/boardfoot or ST$7.77/m^3 is being charged upon every m^3 of timber extracted. When the concession falls on a community forest, the community would receive two-thirds of the royalty collected, while the rest would go to the Government. Table 3.13 provides an index of the proportion of royalty collected to the estimated economic rents. A low index suggests that the rents have been inequitably extracted by the concessionaire. This implies that the resource owners have not been capturing the full rent due for the extraction of their natural resources by the concessionaire. Opportunities exist to capture a higher proportion.

TABLE 3.13: INDICATOR OF RENT CAPTURE BY RESOURCE OWNERS FROM THE FOREST CONCESSIONS

Profit margin to the concessionaire	% Rent capture
20%	11.69
30%	15.85
40%	24.57

Other countries in the tropical region have resorted to introducing various kinds of instrument to capture a higher proportion of this rent. Malaysia imposes a variety of instruments. A royalty charge similar to that applied in Samoa is updated from time to time to keep track of the changing prices of logs. The royalty rates that go to the State treasury vary according to the species of logs extracted. A lump sum area-based forest premium is charged as a compensation for surrendering the rights of the stumpage to the concessionaire.

Further, to raise the efficiency of rent capture, concessions are being tendered. This system has proved to be successful. In the conventional practice, saw millers purchase logs from logging licensees who have the experience and access to obtain logging rights. With the tender system, logging rights are being allocated to the highest bidder. Saw millers have directly gone into the tendering process and at times are paying a fee equal in value to the resource rents (Mohd Shahwahid and Awang Noor 1998). Saw millers are satisfied if they attain a normal profit or even a slight loss. Log procurement activity is being treated as a cost centre while the saw milling is being treated as the profit centre enhanced by the security of the log supply.

Again it must be highlighted that the market prices may not be a fair reflection of economic or scarcity prices, depressing prices downwards. To ensure that the resources are used sustainably, various other policy measures may need to be introduced. Using the example of Malaysia, a volume-based silvicultural charge for every m^3 of logs extracted to finance future forest rehabilitation activity is in place. This or other instruments could be used (see McNally 2000).

3.2.3 The Economic Value of the Forest Resources in Handicraft Production

Subsistence employment has traditionally formed the basis of Samoa's economic and social structure. A high proportion of Samoans, particularly in the rural areas, procure a livelihood from subsistence activities. This has a lot to do with Samoa being an isolated island state. If we define subsistence activities as the non-monetary sectors in the Gross Domestic Product (GDP), the proportion of GDP is substantial, albeit declining from 22% in 1994 to 17% in 1999. In 1998, non-monetary agriculture was 2.52 times that of the amount of market transactions of agricultural produce. Similarly, in fishing and handicraft, the non-monetary proportions were 0.51 and 2 times respectively of the value of the transactions in the market.

Despite the importance of subsistence activities, we observed that even in remote areas such as Uofato village, the role of the market economy has become increasingly visible with more handicraft produce like kava bowls, Samoan weapons and mats being sold in the market every week.

Valuing Resources from the Forests as Inputs to Household Production

To estimate the value of resources collected from the forest as inputs to household production, a study was conducted at the village of Uofato. The village is renowned for its carvers and the high quality products they produce (Lockwood 1971). The researcher, accompanied by officers from the Department of Environment and Conservation (DEC), interviewed seven households (41% of the total households in the village) about their handicraft activities - mainly wood carvings, mat making, collection and drying of 'ava herbs and boat making.

The aim of the interview was to acquire data on the non-timber forest products (NTFPs) collected and processed, and to determine the extent of their marketability. NTFPs serve important economic and subsistence functions among rural communities (Arvidsson 1996). Economic rents were computed for products transacted in the market. All direct inputs, and the imputed value or shadow wage of labour of the individual collector and processor, were deducted from the selling value of the products. The shadow wage was estimated using the concept of the opportunity cost of time – in this case, the imputed net return from subsistence fishing. The questionnaire used to solicit this information is provided in Appendix I.

The results of the investigation into the cost and earnings of wood carvers and the associated economic rent due to the Ifelele tree are reported in table 3.14. Working on an assumption of the carvers earning a fair profit margin for undertaking business risk and uncertainty of 30% over sales value, it was possible to extract the proportion of rent to be allocated to the Ifelele tree in providing the wood material in use by the carvers. The proportion was estimated to be around 24.5% of the sales value of various kava bowls and Samoan weapons. As a preliminary investigation into the value of the forest resources as inputs for the handicraft industry, the rent proportion of Ifelele of the sales value of carving products was used as a basis for obtaining the rents on NTFP resources at the national level.

TABLE 3.14: COST AND EARNING STRUCTURE OF HANDICRAFT ACTIVITY FROM 1 IFILELE TREE AND 1m^3 OF IFELELE LOG

	Per 1 Ifelele tree		**Per 1 m3 Ifelele log**	
	ST	%	ST	%
Sales	6860	100.00	6075	100
Value of Ifelele tree	**1680**	**24.48**	**1487**	**24.48**
Wood extraction cost	220	3.21	195	3.21
Processing cost	2902	42.30	2570	42.30
Total production cost	4802	70.00	4253	70.00
Fair Profit*	2058	30.00	1823	30.00

* assuming that a fair profit for risk undertaken is 30% over sales

The historical growth rate for the handicraft sector was computed at 0.8% per annum. Using this rate of growth to project over and above its 1998 contribution into the GDP, the sectoral GDP was estimated as ST 2.2 million for the year 2000. The component of economic rent in the sectoral GDP can be estimated by taking into account the proportion of rent over the wholesale price and deducting profit margin for the handicraft retailers. Out of the final sales value in the sectoral GDP, it was estimated that the rent component for the NTFP resources was ST432, 447 for the year 2000.

Policy implications

There is potential for boosting the output from the production of non-timber forest products. This is due to the existing skill base and the increasing number of visitors to the Island. Training programmes to help the local population develop these skills, further facilities to access micro-finance, and improved marketing and distribution channels, would all enhance this sector.

3.3 CONSTRUCTED MARKET APPROACH: APPRAISING THE USE VALUE OF RECREATIONAL SERVICES PROVIDED BY FOREST AND MARINE RESOURCES

The forest and marine resources provide a myriad of ecological services and functions. In the case of coral reefs, one aspect of their value is to increase and concentrate fish stocks. One effect of changes in coral reef quality or quantity would be observed in commercial fisheries markets. But other aspects of the value of coral reefs, such as recreational snorkelling and biodiversity conservation, do not show up completely in markets. Similarly, forests provide timber through well-established markets, but the recreational values of forests do not show up in the market place. Further, forests hold soils and moisture, and create microclimates, all of which contribute to human welfare in complex and generally non-marketed ways.

The Contingent Valuation Method (CVM) was used to value the recreational services offered by forest and marine reserves. A “hypothetical” market was prepared so that visitors could express their willingness to pay (WTP) for use of the recreational services at Mount Vaea Forest Reserve and Palolo Deep Marine Reserve. Given the fact that in order to maintain the quality of these recreational services greater funding is required, the reason for payment was framed as how much people would be willing to pay to keep these sites in pristine condition. This established a rationale for eliciting people’s willingness to pay for the services where only a small direct payment is sought. These reserves provide recreational opportunities as well as other ecological functions. Hence, the questionnaire highlighted all the benefits provided by the resources, reminding the visitors that only the recreational benefits were being evaluated (see Appendixes II and III for the questionnaire).

To elicit the WTP, the payment vehicle selected was an entrance fee. The advantage of this payment vehicle is that the respondent can easily relate to it and it is currently being employed at Palolo Deep. To ensure that the WTP responses are valid, standard socio-economic questions on age, income, gender and education of respondents were collected. The intention is to isolate the influences of these variables on WTP by running a multiple regression of WTP on these variables. To ensure that no pro-environment behaviour is swaying the WTP bids, information on membership of environmental groups was also sought.

The payment card approach was used to elicit visitor’s WTP. Respondents were given a series of values from which to choose how much they were willing to pay. The advantage of this approach is that the respondent has to only bid once from the range provided.

Prior to implementing the CV survey, the questionnaire was assessed by several staff at the Unit of Conservation in the DEC, and informal group sessions were initiated among other staff members of the Division as a means of verifying whether all the relevant issues relating to the valuation exercise had been covered, and whether the use of the entrance fee payment vehicle was appropriate. A pilot test on sample respondents was conducted at the sites and further adjustments were made to the questionnaire. Owing to the short time available to carry out the study, all respondents visiting the sites during the surveys were interviewed. When visitors came in a group, one respondent was randomly selected.

During the data analysis, it was found that the rate of non-responses, protest responses, zero or extremely high responses was low: not exceeding 10%. Further inquiries suggested that the zero WTP responses were a combination of zero worth or income constraints with a small proportion expressing the view that natural resource recreational services should be a free good provided by the Government.

The mean and median WTP bids were computed. A multiple regression between the WTP bids and selected socio-economic variables was run and the statistical goodness of fit tested. The sample mean WTP estimate was multiplied by the number of visitors to obtain the total value.

Mount Vaea Forest Reserve Trail

Mount Vaea Scenic Forest reserve trail is covered by tropical rainforest and is a popular recreational area. In the national park a botanical garden has been established with the plantings of many forest tree species interspersed among existing mature trees at the foot of Mount Vaea Scenic reserve. A trail to the summit of Mount Vaea leads to the tomb of Robert Louis Stevenson, the renowned author. The trail is a steep climb providing a view of the beautiful forest, birdlife and great views of Apia. The scenic reserve trail is located 4km from Apia along the Cross Island Road. Walking the trail will take about an hour. At present no entrance fee is charged. The trail is being maintained by the DEC of the Department of Lands, Surveys and Environment.

Palolo Deep Marine Reserve

Palolo Deep Marine Reserve is a fringing reef encompassing a lagoon comprising a total area of 137.5 ha (Toloa 1999). It was formalised as a marine reserve in 1974 under the National Parks and Reserve Act and remains the only recognised national marine reserve in Samoa. This is an excellent place to swim and snorkel. The best snorkelling site is about 100 metres offshore, where a deep chasm in the lagoon is filled with colourful coral and marine fish. The marine reserve is about 1km north-east of Apia, Samoa's capital. It is managed by a local family under the supervision of the DEC. An entrance fee of ST$2 per person is collected by a private entrepreneur who manages the site.

3.3.1 Eco-tourism/Recreational Values

Tables 3.15 and 3.16 provide the results of the CV survey on visitors' maximum WTP for forestry and marine recreational services. The mean WTP was ST$1.77 for the Mount Vaea Forest Reserve and ST$4.75 for the Palolo Deep Marine reserve. International visitors have placed higher WTP values on both attractions. But the disparity was more distinct in Mount Vaea than in Palolo Deep.

TABLE 3.15: ECONOMIC VALUES OF THE ECO-TOURISM/RECREATIONAL SERVICES OF THE MOUNT VAEA FOREST RESERVE

WTP/entrance	Domestic Visitor	International Visitor	Overall Visitor
Mean (ST$)	0.67	4.25	1.77
Standard Error (ST$)	0.16	1.9	0.43
Median (ST$)	0.25	2.75	1
Range (ST$)	0 to 3.5	0 to 10	0 to 10

TABLE 3.16: ECONOMIC VALUES OF THE ECO-TOURISM/RECREATIONAL SERVICES OF THE PALOLO DEEP RESERVE

WTP/entrance	Domestic Visitor	International Visitor	Overall Visitor
Mean (ST$)	4.25	4.88	4.75
Standard Error (ST$)	0.56	0.51	0.40
Median (ST$)	4.50	4.00	4.00
Range (ST$)	2 – 6	2 – 17	2-17

A regression analysis was conducted to identify significant factors influencing visitors' WTP. It was found that only age was a statistically significant explanatory variable with a negative coefficient in the case of Mount Vaea (see table 3.17). This is not surprising, since the climb to the summit makes this site more attractive to younger visitors. The independent variables used did not explain the behaviour of the WTP bids in the case of Palolo Deep (table 3.18). The small sample size obtained at Palolo Deep did not show sufficient variability in the independent variables to explain visitors' WTP bids. For a better statistical diagnosis, further data collection is suggested.

TABLE 3.17: REGRESSION ANALYSIS BETWEEN WTP AND SELECTED INDEPENDENT VARIABLES FOR MOUNT VAEA FOREST RESERVE

Variable	Coefficients	t Stat
Intercept	1.86	1.38
Marital status	0.77	1.78
Age	-0.06	-3.13**
Sex	0.18	0.53
Educational level	0.02	0.19
Income	8.45E-06	1.34
NGO membership	0.54	0.79

**Statistically significant at the 5% level of significance
F statistic of 2.48 is statistically significant at the 5% level of significance
R^2 and adjusted R^2 are 0.36 and 0.22 respectively

TABLE 3.18: REGRESSION ANALYSIS BETWEEN WTP AND SELECTED INDEPENDENT VARIABLES FOR THE PALOLO DEEP MARINE RESERVE

Variable	Coefficients	t Stat
Intercept	6.54	2.35**
Marital	0.48	0.59

status		
Age	-0.06	-1.42
Income	8.43E-06	0.90
Number of visit per year	-0.02	-0.63
Sex	-0.60	-0.82
Educational level	-0.05	-0.02

**Statistically significant at the 5% level of significance
F statistic of 0.93 was not statistically significant
R2 was 0.16

Policy implications

The policy implications of these findings are clear. A small entrance fee of ST$1.50 should be introduced for people wanting to visit the Vaea Forest Reserve, and the entrance fee to the Palolo Deep should be increased to ST$4.40. International visitors should be expected to pay higher fees, which correspond to their willingness to pay and the fact that local people view these recreational areas as public goods, paid for by their taxes. They should either be exempt from the entrance fees or charged less. The revenues from entrance fees must be recycled back into the reserves to maintain a high level of quality of the sites.

3.3.2 Total value of recreational opportunities

While all visitors may contribute to the development of tourism, the trend in holiday arrivals gives the best indication of what is happening in the tourism sector. Of the total number of people visiting Samoa in 1999, 26,323 (30.9%) were holiday arrivals, compared with 39.0% who were visiting relatives and friends, 12.7% who came for business purposes, and 17.3% others.

According to the Tourism Council of the South Pacific (1992), the average length of stay of all visitors in 1990/91 was 7.1 nights. This has a bearing on the number of sights that can be visited. Visitors for pleasure consider the natural scenery as Samoa’s second most important attraction, followed by the suitable climate related to beach visits. This reinforces the general consensus within the industry that the visitor’s preference is for scenic touring and beach-related activities. A total of 61% of pleasure visitors took an organised tour excursion, each taking an average of 2.3 tours.

Assuming that the average pleasure tourist visits about three sites per tour, this implies that some seven sites were visited. This is about the same number mentioned by most visitors interviewed at Palolo Deep and the Mount Vaea Forest Reserve. An estimated five sites were related to the beach and marine resource-based activities, with forest related resources taking up only two sites.

Obtaining the economic values of these recreational services to domestic visitors is difficult because no complete records are kept of their arrivals. However, the number of domestic visitors to Mount Vaea and Palolo Deep can be estimated from the collected data. On an average weekday there were 10 visitors and at the weekend 15; on average there was a weekly visitor rate of 80 people, 60 % of whom were domestic. This implies that over the year there were 2,300 domestic visitors, the remainder being international tourists. This in turn implies that Mount Vaea Forest Reserve has generated an economic value of ST$1,544 per annum for domestic tourists and ST$ 6,515 per annum for international tourists.

In the case of Palolo Deep, there were also no records of the number of visitors, nor a breakdown of international and domestic visitors. Although this information could be obtained from a record of entrance fees, it could not be accessed because the site is being operated by a private enterprise. However, it can be ascertained from the survey exercise that on average there were about 15-20 visitors each day, domestic visitors accounting for less than 10% of the total. The economic values of the recreational services generated by Palolo Deep were estimated to be ST$22,136 per annum for international tourists and ST$2,142 per annum for domestic visitors.

It was not possible to estimate the total economic values of forest and marine resource recreational services for domestic visitors because no records of daily visits to all the sites in the country are available.

It was possible, however, to estimate the total economic value of the recreational services provided by the marine and forest resources for international visitors. This was achieved by multiplying the number of holiday arrivals by the mean WTP estimated for a forestry and marine site by the number of sites. This provided an estimate of the economic value of the recreational services to international visitors of ST$346,545/year for forest resources and ST$1,390,329/year for marine resources (see table 3.19). It was recognised that simple multiplication of a physical quantity by a “unit value’’ can cause serious error. The extent of the error depends on the substitutability of the forest-based or marine-based resource units and income effects. Given that there are not many sites close together, this was not deemed to cause serious distortions to the results.

TABLE 3.19: THE ECONOMIC VALUES OF RECREATIONAL SERVICES PROVIDED BY THE FOREST AND MARINE RESOURCES

Resource	International Visitors (ST$/year)	Domestic Visitors* (ST$/year)
Forest	346,545	1,544
Marine	1,390,329	2,142
Total	1,736,874	3, 686

* For Mount Vaea Forest Reserve and Palolo Deep only. The national sum could be multiples of these depending on an inventory of domestic visits.

Policy implications

It is clear that tourism generates considerable rewards for Samoa. However, there is a dearth of basic information on visitors to the country. It is recommended that the Division of Environment and Conservation, in collaboration with the tourist authorities, make a systematic inventory of visitors to Samoa's main natural and cultural attractions. Surveys, questionnaires and other data collection methods could also be used to ascertain visitor views on the sites as well as their willingness to pay. This would give the authorities a better understanding of the demand function for these areas, and therefore how best to maximise revenue from tourism inside ecological and social constraints.

3.4 CONSTRUCTED MARKET APPROACH OF APPRAISING INDIRECT USE AND OPTION VALUES OF ECOLOGICAL FUNCTIONS OF THE FOREST AND MARINE RESOURCES: THE CONTINGENT VALUATION METHOD (CVM)

A CVM study was also used to elicit Samoan citizens' WTP for the indirect use and option values generated by the ecological functions of marine and terrestrial resources. Hence the study did not capture the value of these resources to the citizens of the rest of the world. The resources of interest were limited to the tropical rainforest, mangroves and marine resources.

Respondents were specifically requested to ponder upon a simplified but informative list of benefits or services generated by each of these resources. For example, in the case of the rainforest, respondents were given a brief description of the functions of the tropical rainforest, as illustrated below:

- The forest plays an essential role in regulating the composition of gases in the atmosphere. For instance, the forest absorbs carbon dioxide from the air, stores the carbon and releases oxygen back into the air.
- It provides important climate regulation services both locally and globally, for example rain and cooler temperatures to adjacent area.
- It regulates hydrological flows. Rain is intercepted by the forest tree canopy, slowing down the speed of the rainfall and allowing time for the soil to absorb the water droplets. This prevents large surface flows into rivers that can cause sudden floods.
- It plays an important role in erosion control by protecting soils in the uplands and avoiding siltation of dams, lakes and wetlands.
- It serves as the habitat, and refuge for wildlife.
- It is rich with biological diversity comprising of birds, reptiles, large animals, trees, palms, orchids and climbers which are the source of gene pools for breeding programmes to support future human needs for food and medicines.

Only the indirect use functions and benefits were illustrated, since the survey was intended to capture the indirect and option values of forests. The direct use values, such as timber and non-timber products and recreational services, were estimated by other valuation methods. To ensure that respondents were clear with this point, they were reminded of the rainforest's other role as a source of food and raw materials, as well as being the place where we seek opportunities for recreation, spiritual tranquillity and education. Similar descriptions were made of the other two resources. The respondents were then asked to place their maximum WTP per annum to a conservation trust fund for use to manage these resources, not only for current generations but also for their children.

The survey was conducted among local populations at various locations in Apia and the questionnaire was translated into the Samoan language. The target was to obtain about 250 responses; this was deemed an appropriate sample size to provide a sufficient variation in the socio-economic characteristics of the respondents within limits of time and budget. However, this target was not achieved owing to the difficulties in obtaining qualified enumerators from the National University of Samoa.

Ecological and Environmental Values

The analysis was conducted on 100 samples. The mean annual economic value of the ecological functions of the natural forest and marine resources were estimated to be ST$4.75 per person with a median at ST$3.50 per person (table 3.20). The values were quite evenly distributed among the three resource types considered with slightly higher bids being placed upon the rainforest and the lowest attached to the mangroves.

TABLE 3.20: ECONOMIC VALUES (INDIRECT AND NON-USE) OF THE ECOLOGICAL FUNCTIONS OF THE NATURAL FOREST AND MARINE RESOURCES

Annual WTP/person per annum	Rainforest	Marine	Mangrove	Natural Resource
Mean(ST$)*	1.90	1.63	1.22	4.75
Standard Error(ST$)	0.21	0.25	0.17	0.55
Median(ST$)	1.45	1.00	0.65	3.50
Range(ST$)	0 to 8	0 to 12	0 to 6	0 to 20
Total Value	323,106	277,242	207,152	807,500

*Round-numbered

With the population of Samoa being 170,000, the total economic value of the ecological function of the natural forest and marine resources to the people of Samoa was estimated to be ST$807,500 per annum. A breakdown by resources suggests that the rainforest provided ST$323,106/year, marine resource contributed ST$277,242/year with the rest provided by the mangrove resource. It was found that the mean WTP bid did vary depending on the person’s employment status (see table 3.21).

TABLE 3.21: AVERAGE ECONOMIC VALUES OF THE ECOLOGICAL FUNCTIONS OF THE FOREST AND MARINE RESOURCES

Work Status	Mean WTP/person (ST$/year)
Government services	5.63
Private sector	7.64
Unemployed	5.92
Retired	4.25
Full time student	2.83

Plantation	2.88
Others	1.00
Overall	4.75

A regression analysis was conducted. Age and educational levels were found to be statistically significant. The positive coefficients suggest that more elderly and educated tend to have a greater perception of their country's ecological functions and are willing to contribute more to a conservation fund.

TABLE 3.22 : REGRESSION ANALYSIS BETWEEN WTP AND SEVERAL INDEPENDENT VARIABLES

	Coefficients	**t Stat**
Intercept	-4.91	-1.91
Marital	-1.86	-1.59
Age	0.20	3.30**
Sex	-0.73	-0.71
Education level	0.37	2.35**
Income	4.02E-05	0.53
Resident	1.31	1.30

**Statistically significant at 5% level of significance

3.5 COST-BASED APPROACH OF ASSESSING THE VALUE OF MANGROVE FORESTS IN REDUCING COASTAL EROSION AND COASTLINE PROTECTION: COST AVOIDED METHOD

Mangrove forests protect the coastline by reducing coastal erosion. With the mangrove forest intact, the Government can avoid the cost of constructing seawalls or conducting beach replenishment activities by dumping sand on the eroded coastal land. The latter alternative is more expensive owing to the need to dredge sand from lagoons and the fact that the Government does not have the proper dredger and equipment to do this. The construction of seawalls is the most practical approach when dealing with coastal erosion in Samoa, due to the availability of rocks domestically and the fact that a seawall requires very low maintenance (Phillips, pers comm).

Given that the clearance of mangrove forests for development has been controlled in Samoa, no seawall construction is required to mitigate this problem. Nevertheless, the coastal protection functions provided by mangrove forests can be assessed using the avoided cost approach. The expenditure avoided can be estimated based on the costs of construction of seawalls along the coast. This information, although based on costs avoided, gives some indication of the minimum magnitude of benefits produced by avoiding adverse environmental impacts (Dixon and Sherman 1990).

A typical seawall in Samoa has three layers of substrates: (i) a filter cloth, (ii) a gravel filter layer 0.6m thick; and (iii) a two-layer rip-rap of 1.2m thickness, composed of two layers of rocks. The function of the seawall is to dissipate the energy of the waves as they come into contact with the rock layer. The filter cloth and gravel filter layer are there to allow water to seep through without eroding the soil, while the rock layer is to ensure the coastal land remains intact. When the wave current is strong, a wall with a slope of 1:3 is the norm in Samoa. For coastal areas where mangroves are typically placed – at bays, for example, the current of the waves is slower. The seawall does not need to be so thick and can have a steeper slope of 1:2. These adjustments reduce the expenditure on construction around 45% (Phillips pers com).

A typical construction cost of a seawall in Samoa is ST$500 per linear metre (lm). The cost structure comprises roughly of 20% on labour, 35% on equipment rental, and 45% on material. Given the lower specification of seawall design needed for areas currently covered with mangrove forests, the construction cost would not be more than 50% - less than ST$250/lm. The coastline covered with mangrove forests was estimated to 25.7 km by an FAO study (Anon. 1989). This suggests that the cost avoided on seawalls could be as large as ST$6,425,000. The value estimated represents the capitalised value of this ecological function. The estimate obtained is a subset of the many ecological functions generated by the natural forest resource.

It should be stated that these values do not necessarily reflect the citizens' willingness to pay. As important as this ecological function is, each member of society may not be willing to forgo development in the area for flood defence purposes and be willing to pay for these ecological services. Therefore care must be taken in including these values into the total economic value of Samoa's biodiversity.

3.6 ASSESSING ECONOMIC VALUES OF OTHER GOODS AND SERVICES USING THE BENEFIT TRANSFERS TECHNIQUE

To determine the total economic value of Samoa's terrestrial and marine resources values captured for environmental goods and services from other countries had to be used. We recognise the severe limitations of transplanting values from one context to another. The use of the benefit transfers approach is motivated by the limitations of time, budget and a lack of scientifically investigated environmental input-output production models and environmental damage functions for Samoa.

A comprehensive literature review was conducted on the value of various environmental goods and services that were not computed in this study. Information collected included the valuation methods adopted, location, date and stated value (the principal source is Costanza *et al.* [1997]). These values had the benefit that they were all converted into 1994 US$ equivalent on a per ha per year basis. This was achieved by adjusting for purchasing power parity differences between the country of origin and the United States. This makes conversion to Samoan Tala (ST$) easier by using a single ratio of purchasing power GNP per capita for the United States to that of Samoa. These values were then inflated to the year 2000 by multiplying them against the consumer price index of Samoa. These exercises are necessary to adjust for income effects. An illustration of the procedures involved in the benefit transfers exercise is given in Table 3.23 below:

TABLE 3.23: AN ILLUSTRATION OF BENEFIT TRANSFERS ON CARBON SEQUESTRATION/FIXATION VALUES OF NATURAL FORESTS

Study	**Adger *et al* (1992)**	**Formula**
Method	Avoided damage cost	
Study site	Mexico	
Policy site	Samoa	
1994 Unit values (US$/ha/yr)	88	
1994 Unit values (ST$/ha/yr)	216.11	US$88 x (ST$2.46/US$1)
1994 adjusted purchasing power parity unit values (ST$/ha/yr)	10.81	ST$216.11 x 0.05*
2000 adjusted purchasing power parity unit values (ST$/ha/yr)	13.32	ST$10.81 x 1.23 #
2000 adjusted purchasing power parity total values (ST$/ha/yr)	2,298,940	13.32 x total forest area @

Note:* purchasing power parity = [Samoan GDP per capita / US GDP per capita]
[Consumer price index $_{2000}$]/[Consumer price index $_{1994}$]
@ 172,567 ha (source: Iakopo 1998)

The authors recognise the limitations of using the information collected by Constanza et al (1997). These relate to the problem of “scaling up’’ estimates of environmental values taken from studies examining small changes, adding them together and applying them to the whole ecosystem. For a detailed critique of this approach refer to Bockstael et al (2000). It must also be noted that many of the estimated values of the ecological functions use the cost-based approach. While these approaches appear logical, they do not necessarily reflect the citizens’ willingness to pay. As important as the ecological functions are, each member of society may have alternative preferences. However, for the sake of arriving at the total economic value of Samoa's marine and terrestrial biodiversity, these limitations have had to be put aside.

The benefit transfers technique was used to obtain the values of the forest in providing ecological functions, food and raw materials, and giving cultural values (a) to the local population and (b) globally (table3.24). The value of the ecological services and functions of the forest was examined for two reasons: first, to provide an alternative estimate to the CVM estimate; and second, to obtain a breakdown of the different ecological functions forests provide. Using this approach the total value of the ecological functions of the forest was estimated to be ST$4.3 million – that is higher than the value obtained directly from the survey. The values for food and raw materials collected from the forest were estimated because time limitations prevented a comprehensive analysis being carried out in the study. The cultural values were examined because they were not derived in the study.

TABLE 3.24: ECONOMIC VALUES OF SELECTED FUNCTIONS OF THE FOREST RESOURCES OBTAINED USING BENEFIT TRANSFERS TECHNIQUES

Functions	Source of Value Estimates	Economic Valuation Technique	Research Site	Purchasing Power Parity Adjusted	
				Unit Value ST$/ha/ yr	Benefit Transfers Value (ST$)
Climate regulation	Adger et al (1995)	Avoided damage cost	Mexico	13.32	2,298,940
Disturbance regulation	Ruiteenbeek (1989)	Change in productivity	Cameroon	0.30	52,249
Water regulation	Kumari (1995)	Change in productivity	Malaysia	3.78	653,108
Water supply	Kumari (1995)	Change in productivity	Malaysia	1.67	287,368
Erosion control	Mohd Shahwahid (1999)	Change in productivity	Malaysia	1.25	214,874
Genetic resources (Support for species & genetic diversit)	Adger et al (1992)	Option value	Mexico	4.84	835,978
Total Ecological Function					4,342,517
Total Food	Lampietti and Dixon (1995)	Net income	various countries	0.91	156,746
Total Raw Material	Lampietti and Dixon	Net income	various	9.39	1,619,708

	(1995)		countries		
Total Recreational Services	Lampietti and Dixon (1995)	Travel cost method	various countries	2.12	365,740
Total Cultural Values (Folklore & cultural support)	Adger et al (1992)	Contingent valuation method	Mexico	0.15	26,124
Total					6,510,835

The benefit transfer technique was also used to obtain estimates of other economic values of marine resources, in particular as a provider of ecological services, as a supplier construction material and fish for the aquarium trade, as well as cultural values (table 3.25). As with the forest resources, a very large value was obtained for the ecological functions of the marine resources. This value is ST$207.7 million per year – many times more than that estimated using the CVM study. An explanation is given below for this disparity in values. A large part of this value is due to the role of the ocean as a receptacle for effluent and in nutrient cycling, climate regulation and in biological control. The values transferred from other countries for the provision of construction materials such as sand and dead corals, and fish for the aquarium trade, are relatively small.

TABLE 3.25: ECONOMIC VALUES OF SELECTED FUNCTIONS OF THE MARINE RESOURCES OBTAINED USING BENEFIT TRANSFERS TECHNIQUES

Functions	**Source of Value Estimates**	**Economic Valuation Technique**	**Research Site**	**Unit Value ST$/ha/yr**	**Benefit Transfers Value (ST$)**		
					Coral Reefs	Open Seas	Overall Marine Resources
Climate regulation service	Costanza et al. (1997)	Economic activities	Global	5.80	40,007	75,335,349	75,375,356
Receptacle for effluent sink and nutrient cycling	Costanza et al. (1997)	Replacement cost	Global	9.40	64,868	122,149,483	122,214,351
Biological control	de Groot (1992) for coral reefs and Costanza et al. (1997) for open sea	Shadow price for coral reefs and replacement cost open seas	Galapagos for coral reefs and global for open seas	0.76 Coral reefs 0.74 open seas	5,118	9,834,902	9,840,020
Disturbance	Spurgeon	Replacement	Philippines	34.10	235,263		

regulation	(1992)	cost					235,263
Waste treatment	de Groot (1992)	Replacement cost	Galapagos	8.78	60,585		60,585
Habitat/refugia	de Groot (1992)	Shadow price	Galapagos	0.06	418		418
Total Ecological Functions					406,258	207,319,734	207,725,993
Construction material	de Groot (1992)	Market value	Galapagos	0.79	5,432		5,432
Aquarium trade	McAllister (1980)	Market value	Philippines	0.44	3,029		3,029
Total raw Material					8,461		8,461
Premium estate value	Costanza et al. (1997)	Change in real estate value	Global	9.84	669	1,258,867	1,259,536
Books/films	de Groot (1992)	Market value	Galapagos	0.003	21		21
Education / research	de Groot (1992)	Market value	Galapagos	0.11	731		731
Total Cultural Values					1,421	1,258,867	1,260,288
Total					416,140	208,578,602	208,994,742

3.6.1 Explanations for the High Estimated Values for Climate Regulation Services, Nutrient Cycling and Other Ecological Functions from the Benefit Transfers Approach

The reason for the very high estimated values for the ecological functions of both forest and marine resources from benefit transfers technique is best illustrated by observing the case of the marine resource. Samoa has jurisdiction over 100,000,000ha of territorial sea and 150,000,000 ha of the exclusive economic zone, totalling 250,000,000 ha. Costanza *et al.* (1997) disaggregated the value of the ecological functions of the seas into climate regulation services (carbon sink), effluent sink and nutrient cycling, biological control, coastal damage regulation, waste treatment and habitat/refugia for fisheries (table 3.25).

The climate regulation function of marine resources was valued at US$38/ha/yr in 1994. Converting this into Samoan currency, adjusting this to reflect purchasing power parity (PPP) in Samoa and inflating to year 2000 provides a value of ST5.8/ha/yr, giving a total of ST75,375,356/yr. However, the climate regulation service provided by the marine resources surrounding Samoa is shared globally and not just among the citizens of Samoa. Arguably it can be valued in accordance to the WTP of world citizens, therefore not requiring adjustment for

PPP. To obtain a more appropriate value to Samoa we need to know the proportion of this function that benefits Samoa's citizens. This will clearly generate a lower estimate.

Policy implications

The results of the benefit transfers approach is interesting as it reveals that many of the benefits of Samoa's biodiversity accrue to people who live outside the country, who have not visited it, or have no intention of visiting the area. Capturing these global benefits requires financial transfers from the international beneficiaries (who are predominantly from industrialised countries) to the nations where the biodiversity is located. The international community continues to contribute far less than the benefits it receives. It is vital that these values are adequately incorporated and that greater funds are channelled into protecting Samoa's biodiversity. This could be achieved through greater international donor contributions, carbon offset agreements, debt-for-nature swaps, bio-prospecting and the establishment of Trust funds (for an explanation of these concepts see McNally 2000).

Samoa would stand to gain from any development of international trading in carbon emission/offset rights. Judging by the size of Samoa's open seas relative to its terrestrial area, the country could request substantial incremental international funding for its role in generating global climate regulation services.

3.7 TOTAL ECONOMIC VALUES OF SAMOA'S FOREST AND MARINE RESOURCES

The estimated total economic value (TEV) of selected terrestrial and marine resources in Samoa is provided in table 3.26 and table 3.27. Table 3.26 presents the TEV from the perspective of the citizens of Samoa, by excluding the values generated for the benefit of the rest of the world. Table 3.27 includes those values generated by Samoa's resources that benefit the rest of the world, particularly concerning climate regulation services, nutrient cycling and biological control.

The total economic value accruing to the citizens of Samoa was assessed at ST$21.0 million per annum – approximately 2.7% of the GDP. This contribution is significant because the resources are the primary input in the fisheries, forestry and tourism sectors, which make-up approximately 35 percent of Samoa's' GDP.

When the value of global benefits are included in the computation of TEV, so the value increased to ST$232.5 million per annum – around 29.9% of Samoa's GDP. This large value is principally attributed to the large area of the country's marine resources. The high value when including global benefits is suggestive of the essential role played by Samoa in providing ecological services to mankind.

A number of points need to be raised in relation to these results. First, in aggregating the different components of total economic value there is the possibility of double counting. For example, the same forested area cannot be valued in terms of carbon sequestration as well as for its value in producing non-timber forest products. The trade-offs between uses of the natural resources would need to be understood to ensure that no double counting takes place. As this was not explicitly considered, the inference is that the results are an overestimation of the total economic value. On the other hand, the estimation neglects other economic values such as the existence value, and therefore could be seen as an underestimation.

It must be stressed that the actual contribution of Samoa's natural resources to its economic growth is considerably more. This is because these resources are the primary input in the production of fishery, timber and non-timber materials, without which those sectors could not exist. How important they are depends on whether Samoa can and will diversify into other sectors. The country's comparative advantage lies in its fishing sector, so the upkeep and sustainable use of its fish stocks are crucial to its long-term growth prospects. In addition, its natural resources are the key attraction to tourists, without which the multiplier from the tourism earnings could not be generated.

TABLE 3.26: TOTAL ECONOMIC VALUE OF THE FORESTED AND MARINE RESOURCES AS ACCRUED TO THE CITIZENS OF SAMOA

Resource	**Goods & Services**	**Kinds of Value**	**Economic Valuation Techniques**		
				ST/year	Percentage
Forestry	Timber~	Direct Use	Economic Rent	481,636	2.29
	Raw Materials for Handicrafts	Direct Use	Economic Rent	432,447	2.06
	Other Raw Materials	Direct Use	Benefit Transfers of net Income estimates	705,625	3.36
	Food	Direct Use	Benefit Transfers of Net Income Estimates	156,746	0.75
	Recreation ”	Direct Use	Contingent Valuation	346,545	1.65
	Ecological functions^	Indirect & Option	Contingent valuation	323,106	1.54
	Cultural Values		Benefit Transfers of Contingent Valuation Estimates	26,124	0.12
Sub-total				2,472,230	11.77
Marine	Fishery~	Direct Use	Economic Rent	15,597,012	74.25
	Raw Materials		Benefit Transfers of Net Income	8,461	0.04

			Estimates		
	Recreation ”	Direct Use	Contingent Valuation	1,390,329	6.62
	Ecological functions^	Indirect & Option	Contingent Valuation	277,242	1.32
	Cultural Values		Benefit Transfers of Market Price Estimates	1,260,288	6.00
Sub-total				18,533,332	88.23
Total Forestry and Marine Resources				**21,005,562**	**100.00**

*may include values of resources collected from marine resources
“from international visitors only. Information on the number of domestic visitors is not available yet.
using a social discount rate of 4%.
~ value varies as a sensitivity analysis of fair profit margin for business risk is conducted.
^ Willingness to pay of citizens in Samoa only.

TABLE 3.27: TOTAL ECONOMIC VALUE OF THE FOREST AND MARINE RESOURCES OF SAMOA

Resource	Goods & Services	Kinds of Value	Economic Valuation Techniques		
				ST/year	%
Forestry	Timber~	Direct Use	Economic Rent	481,636	0.21
	Raw Materials for Handicrafts	Direct Use	Economic Rent	432,447	0.19
	Other Raw Materials	Direct Use	Benefit Transfers of Net Income Estimates	705,625	0.30
	Food	Direct Use	Benefit Transfers of Net Income Estimates	156,746	0.07
	Recreation al@	Direct Use	Contingent Valuation	346,545	0.15
	Ecological functions^	Indirect & Option	Benefit Transfers of Avoided Damage Cost, Change in Productivity, and Option Value Estimates	4,342,517	1.87

	Cultural Values	Direct Use & Option	Benefit Transfers of Contingent Valuation Estimates	26,124	0.01
Sub-total				6,491,640	2.79
Marine	Fishery~	Direct Use	Economic Rent	15,597,012	6.71
	Raw Materials	Direct Use	Benefit Transfers of Net Income Estimates	8,461	0.00
	Recreation @	Direct Use	Contingent Valuation	1,390,329	0.60
	Ecological functions^	Indirect & Option	Benefit Transfers of Replacement Cost, Market Price and Shadow Price Estimates	207,725,993	89.35
	Cultural Values	Direct Use	Benefit Transfers of Market Price Estimates	1,260,288	0.54
Sub-total				225,982,083	97.21
Total Forestry and Marine Resources				232,473,723	100.00

*may include values of resources collected from marine resources

@from international visitors only. Information on the number of domestic visitors is not available yet.

using a social discount rate of 4%.

~ value varies as a sensitivity analysis of fair profit margin for business risk is conducted.

^ These are the global benefits provided by resources of Samoa. Not restricted to the willingness to pay of citizens

Chapter 4: Lessons Learned and Policy Recommendations

In this final section we examine the basic lessons that were drawn from conducting a valuation exercise in a country with limited exposure to such techniques. We also put forward a number of recommendations on how best the results from the study can be used to assist future policy and planning in the country to achieve sustainable development.

Some of the main observations and lessons derived from undertaking the economic valuation of the terrestrial and marine resources of Samoa are:

1. It is possible to conduct such an exercise given:
   - sufficient commitment on the part of the research team, particularly support provided by local counterparts;
   - research budget; and
   - research time.

2. Success is dependent on members of the research team having knowledge of the subject matter, in particular the theory and practical aspects of the economic valuation methods. In Samoa, Government officials and civil society groups attended a capacity-building workshop following the completion of the study. Members of the research team could, however, have benefited more from an early exposure to the valuation methods. This would have helped them become more aware of the purpose of the data collection and analysis activities. A small workshop for the research team should have been conducted early in the project cycle, particularly if non-economists were team members.

3. Owing to a lack of time, the economic valuation exercise was limited to valuing the role of the resources in the production of major goods and services – fish, timber, handicraft, recreational opportunities and overall ecological functions. Other values were obtained by the benefit transfers technique, using estimates from research conducted in other countries. The adoption of the benefit transfers approach clearly brings less credibility to the results. Given more time, valuation of the wider and less tangible uses of Samoa’s marine and terrestrial environment could have been attempted, provided there was the local support.

4. Experience suggests that research budgets have in many cases been too tight. This may be unavoidable. Bearing this in mind, an alternative strategy is to focus economic valuation research in specific sites where there exists a dominant natural resource. Retrospectively, in Samoa an in-depth economic valuation exercise should be conducted in:
   - Sataoa and Sa’anapu for a mangrove resource site;
   - Uofato village for an evaluation of community dependency upon the natural forest and marine resource as a source of income and subsistence utilisation; and
   - Afulilo Dam and Fagaloa Bay as a potential site for research on evaluating on-site and off-site economic impacts of development projects (hydro-electric power).

The results from such in-depth analyses would furnish the decision-maker with more credible results. These would be more useful in informing and changing policy and planning since they stand up to greater criticism.

5. To facilitate the valuation exercise, an inventory of the terrestrial and marine resources is an important information base for many economic valuation efforts. A major constraint was the lack of local scientific investigations on physical impacts of development upon terrestrial and marine resources that hampered investigations on the indirect use values of the ecological functions of these resources. Basic research on bio-physical environmental impacts is the base for good change in productivity economic valuation exercises. Hence, such basic research should be given equal priority by governments.

POLICY RECOMMENDATIONS

Based on the results of the study, the following policy recommendations to the Samoan authorities where put forward:

A) The introduction of economic instruments to capture the different economic values of biodiversity

The fishing industry

The study highlighted that only a small proportion of the marine resource rent was being captured by the State authorities and was therefore being distributed as excessive profit. The Government should not impose any resource utilisation levy upon subsistence fishermen, given the importance of this product as their main source of protein. Instead, a levy should be placed upon commercial fishermen, particularly the larger enterprises whose landings are meant for exports. Such a tax could help relieve pressure on these fisheries without making the export uncompetitive on the open market – thereby ensuring a healthy, viable fishery now and into the future.

The forest sector

As in the case of the fisheries sector, the owners of the resource (e.g. the state, the community) have not been capturing the full rent to which they are entitled; this is going to the concessionaire as profit. Opportunities to address this include higher stumpage fees or royalty charges. Concessions could be tendered so that logging rights are allocated to the highest bidder. To ensure that the resources are used sustainably, various other policy measures may need to be introduced. Using the example of Malaysia, a volume-based silvicultural charge for every m^3 of logs extracted to finance future forest rehabilitation activity could be introduced; alternatively a reforestation tax could be established.

Non-timber forest products

There is potential for increasing output from the production of non-timber forest products, particularly in light of the increasing numbers of visitors to the island. Further training programmes to assist local people develop their skills of production, marketing and distribution would help this sector prosper. There may also be opportunities to expand sustainable production of these and other non-timber forest products as well as non-fish marine products (e.g. coral, aquatic fish). Further in-depth analysis of potential income generating schemes should be carried out.

Tourism

Tourism generates considerable rewards for Samoa. However, there is a dearth of basic information on visitors to the country. It is recommended that the Division of Environment and Conservation, in collaboration with the tourist authorities, makes a systematic inventory of visitors to Samoa's main natural and cultural attractions. This would help the authorities maximise revenue from this sector inside ecological and social constraints. The results from the study show that a small entrance fee of ST$1.50 should be introduced for people wanting to visit the Vaea Forest reserve, and the entrance fee to the Palolo Deep should be increased to ST$4.40. International visitors should be expected to pay higher fees, which corresponds to their willingness to pay. Entrance revenues must be recycled back into the reserves to ensure a high level of quality.

Ecological values

It became clear from the study that many of the ecological benefits of Samoa's biodiversity accrue to people who live outside the country, who have not visited it or who have no intention of visiting the area. Capturing these global benefits requires financial transfers from the international beneficiaries (who are predominantly from industrialised countries). The international community continues to contribute far less than the benefits it receives. It is vital that these values are adequately incorporated and that greater funds are channelled into protecting Samoa's biodiversity. It is important to examine and introduce methods by which this could be achieved (e.g. international donor contributions, carbon offset agreements, debt-for-nature swaps, bio-prospecting, and Trust funds).

B) Changes to national accounts

Many goods and services provided by the terrestrial and marine resources, although essential, have not been directly accounted for in Samoa's GDP. The contribution of Samoa's natural resources to its economic growth is considerable, particularly as they are the primary input in the fisheries, forestry and tourist sector. Given that its comparative advantage lies in the fishing sector, and bearing in mind its remoteness, the sustainable use of its natural resources are clearly crucial to its long-term growth prospects. In addition its natural resources are the key attraction to tourists without which the multiplier from the tourism earnings could not be generated. To ensure sustained development now and into the future, these economic values of biodiversity need to be incorporated into the country's national accounts.

C) Incorporating environmental values into the decision-making framework

Information on the economic costs and benefits of policy changes affecting the environment can greatly assist governments in setting priorities. To ensure that the optimal policy is chosen, environmental costs and benefits must be properly accounted for within the decision-making process, particularly within environmental impact assessments and cost-benefit analyses (CBA). Given the limitations of using CBA when dealing with complex environmental problems, it may be more appropriate to use alternative decision-making methodologies such as multi-criteria analysis when dealing with decisions pertaining to the environment. This is particularly so when there are many intangible benefits and a diverse range of stakeholders.

Recognition of these values, and the decision-making tools to capture them, need to be properly incorporated into the Government's planning framework – for example its National Biodiversity Strategy and Action Plans (NBSAP). When determining options managers and planners must be required to ensure that environmental values are properly taken into account. Guidelines on how to use valuation methodologies and incorporate these values inside decision-making methodologies such as extended CBA, EIA or MCA, are contained in this report and a forthcoming publication (McNally and Shahwahid 2001).

References

Adger, W.N, Brown, B, Cervigini, R and Moran, D (1995), "Towards estimating total economic value of forests in Mexico'', *Centre for Social and Economic Research on the Global Environment (CSERGE) Working Paper 94-21*, University of East Anglia and University College London.

Anon, (1995), *Techniques to Value Environmental Resources: An Introductory Handbook,* Australian Government Publishing Service, Canberra.

Arvidsson, M (1996), "Non-timber forest products, a resource in conservation of the Samoan rainforests: a minor field study'', *International Rural Development Centre Working Paper 312, Uppsala. 67*, Swedish University of Agriculture Sciences.

Awang Noor, A. G, Vincent, J.R and Yusuf, H (1992), *Comparative Economic Analysis of Forest Revenue System in Peninsular Malaysia*, Osborn Center Forestry Policy Grants Program.

Barbier E.B (1994), "Valuing environmental functions: tropical wetlands'', *Land Economics 70(2):155-173*.

Boado, E.L (1988), "Incentive policies and forest use in the Philippines'', in R. Repetto and M. Gillis (ed), *Public Policies and the Misuse of Forest Resources*. Cambridge, pp165-198, Cambridge University Press.

Costanza, R, d'Arge, R, de Groot, R, Farber, S, Grasso, M, Hannon, B, Limburg, K, Naeem, S, O'Neill, R.V, Paruelo, J, Raskin, R.G, Sutton, P, van der Belt, M (1997), "The value of the world's ecosystem services and natural capital'', *Nature 387: 253-265.*

Davis, K. P (1977), *Forest Management*, McGraw Hill Publications, New York.

de Groot, R.S (1992), *Functions of Nature: Evaluation of Nature in Environmental Planning, Management and Decision-Making*, Wolters-Noorhoff, Groningen.

Division of Fishery (2000), *Annual Fishery Report of the Division of Fishery*.

Dixon, J.A. and Sherman,P.B (1990), *Economics of Protected Areas, A New Look at Benefits and Costs,* Earthscan Publications Ltd, London.

Gillis, M (1988a), "Indonesia public policies, resource management and the tropical forest'', in R. Repetto and M. Gillis (ed), *Public Policies and the Misuse of Forest Resources*, pp 43-105, Cambridge University Press, Cambridge.

Gillis, M (1988b), "Malaysia public policies, resource management and the tropical forest'' in R. Repetto and M. Gillis (eds), *Public Policies and the Misuse of Forest Resources*, pp 115-153, Cambridge University Press, Cambridge.

Glover, D. and Jessup, T (ed.) (1999), *Indonesia's Fires and Haze: The Cost of Catastrophe*, Institute of South East Asian Studies (ISEAS) and Economy & Environment Program for Southeast Asia (EEPSEA)

Iakopo, M (1998), "Country Report – Western Samoa'' In Tang Hon Tat, Finiasi Louisa, S. Teunissen, E. and Masianini B. (eds.) Procs. Of Heads of Forestry Meeting "Setting the baseline for future forests and trees activities" UNDP/FAO South Pacific Forestry Development Programme, Field Document No. 11 RAS/92/361. Pp139-149.

Kumari, K (1995), "An environmental and economic assessment of forest management options: A case study in Malaysia", *The World Bank. Environmental Economics Series 026*, The World Bank, Washington, D.C.

Lampietti, J.A. and Dixon, J.A (1995), "To see the forest for the trees: a guide to non-timber forest benefits'', *The World Bank Environmental Economics Series 013*, The World Bank, Washington, D.C.

Lockwood, B (1971), *Samoan Village Economy,* Melbourne, Oxford University Press, London.

Martel, F (1991), *National Forest Policy Review: Projection of Saw log Supply from Plantation Forests.* Western Samoa.

McAllister, D.M (1980), *Evaluation in Environmental Planning: Assessing Environmental, Social, Economic and Political Trade-offs*, The MIT Press.

McNally, R (1999), *Economic Instruments in Marine and Forestry,* WWF-UK, Godalming

McNally, R and Mohd Shahwahid, H.O (2001), *Practical Economics: A Handbook for Understanding and Applying Environmental Economics, WWF -UK, Godalming*

Mohd Shahwahid, H.O. and Awang Noor A.G (1998), "Economic rent from hardwood timber extraction in the west coast of Peninsular Malaysia, *Malaysian Journal of Agricultural Economics* (MJAE) Vol 12 :1-15.

Mohd Shahwahid H.O. and Awang Noor A.G (1999), "Estimating the non- timber values of forest: beginning with natural stands of rattan'', *Tropical Biodiversity 6(3):* 161-177.

Mohd Shahwahid H.O. Awang Noor A.G. Abdul Rahman M.D. and Shaharuddin A, (1999), "Cost and earning structure of the logging industry in Peninsular Malaysia'', *The Malaysian Forester*, 62 (3):107-117.

Mohd Shahwahid H.O. Awang Noor A.G. Abdul Rahim N. Zulkifli Y. and Razani U (1999), "Trade-offs on competing uses of a Peninsular Malaysian forested catchment'', *Environment and Development Economics 4(4):*281-314 1999.

Mulipola A. P (1997), "An assessment of the subsistence and artisinal inshore fisheries on Savaii Island, Samoa'', *Masters of Applied Science (Fisheries) Thesis*. Australian Maritime College.

Oliver, W (1999), "An update of plantation forestry in the South Pacific'', *RAS 97/330. Working paper No. 7*, Pacific Islands Forests & Trees Support Programme, SPC/UNDP, AusAID/FAO.

Passfield, K (2000), "Facts and figures for the 1999 Samoan long-line fisheries'', *Information Sheet 27 - Fisheries Division*, Ministry of Agriculture, Forests, Fisheries and Meteorology.

Passfield, K. and King, M (2000), "The Samoan tuna longline fishery'', *Information Sheet 27 - Fisheries Division*, Ministry of Agriculture, Forests, Fisheries and Meteorology.

Passfield, K. and Mulipola, A (1999), *Profile of the Commercial Tuna Fishery in Samoa*, Samoa Fisheries Project by the Government of Samoa- AusAID.

Ruiteenbeek, H.J (1988), *Social Cost-Benefit Analysis of the Korup Project, Cameroon*, WWF, Godalming.

Samoa Visitors Bureau Research & Statistics Division (2000), *November Report Update,* Government of Samoa.

Spurgeon, J.P.G (1992), "The economic value of coral reefs'', *Marine Pollution Bulletin 24(11):*529-536.

Sulaiman H. N (1977), "A method of forest revenue assessment based on inventory data'', *Malaysian Forester 40(3):*144-159.

Tourism Council of the South Pacific (1992), *Samoa Tourism Development Plan 1992-2001*.

Treasury Department (2000), *Update of the Samoan Economy: Gross Domestic Product*, Government of Samoa.

Vincent, R. V (1990), "Rent capture and the feasibility of tropical forest management'', *Land Economics 6 (2):* 212-23.

Vincent, J. R. Awang Nor A. G. and Yusuf H (1993), *Economics of tropical timber fees and logging in tropical forest concessions*. Unpublished report.

Appendix I: Survey Questionnaire for Valuing the Role of Forest Resources in Producing Raw Materials for the Handicraft Industry

SURVEY QUESTIONNAIRE

VALUING NATURAL RESOURCES AS INPUTS TO THE HOUSEHOLD PRODUCTION SYSTEM

October 2000

Division of Environment and Conservation,
Department of Lands, Surveys and Environment,
Government of Samoa, Apia

Enumerator's name:
Respondent's name:

Village: Date :
Age : Sex :

Who are the respondent : Husband Wife Son
Daughter Grandfather/Grandmother Others

---

1. List the species and quantities collected <u>per month</u> from the natural resources. If further processed, which parts of the species are utilised

Species	Parts of species/ plant / tree collected	Quantities collected per month (mention units used)	Direct use or further processed	Handicraft / other processed products	Proportion for own consumption and for sale

2. When are the season for species/tree/plant collection, and making of handicraft/processed products (months)

Species Collection	Seasons	Handicraft and other processing products	Seasons (which months)

3. Where are the species/tree/plant species collected from ? Location:_________________
Distance from your home/workshop :_______________km
Travel time from home/workshop:________________hr

4. If you know, can you list down the prices of the collected items from the forest/marine resource.
If not, do you know of similar items that have a price.

Items collected	Prices/unit (mention units	Similar or substitute items	Prices / unit (mention units

	used)		used)

5. Can you specify the monthly labour time, and other inputs that are needed in collecting the items from the forest.

	List of Items Collected from the Forest				
Inputs	1.________	2.________	3________	4.________	5.________
Skilled labour man-days*					
Unskilled/semi-skilled man-days*					
Instruments (specify)__________________:					
Instruments (specify)__________________					
Instruments (specify)__________________					
Transportation (specify)__________________					
Fuel (mention units used)					
Imputed rental of workshop (Number of days needed)					
Other inputs, specify					
Other inputs, specify					

*8 hour man-day

6. Can you specify the cost per unit of labor time and of the other inputs

Inputs	ST/unit
Skilled labour man-days*	
Unskilled/semi-skilled man-days*	

Instruments (specify)_________________:	
Instruments (specify)_________________	
Instruments (specify)_________________	
Transportation (specify)_________________	
Fuel (mention units used)	
Imputed rental of workshop (Number of days needed)	
Other inputs, specify	
Other inputs, specify	

7. If you know, can you list down the prices and quantities made per month of each of the different kinds of handicraft and processed products. If not, do you know of similar items that have a price.

Handicraft / processed products	Prices/unit (units used)	Quantities produced / month (units used)	Similar or substitute items	Prices / unit (units used)

8. Can you specify how much labour time and other inputs that are needed to make <u>each</u> of the following handicraft and processed products .

	List of Handicraft and Processed Products				
Inputs	1.________	2.________	3________	4.________	5.________
Skilled labour man-days*					
Unskilled/semi-skilled man-days*					
Varnish (mention units used)					
Lacquer (mention units					

used)					
Paint(mention units used)					
Electricity (mention units used)					
Fuel (mention units used)					
Imputed rental of workshop (Number of days needed)					
Volume of wood material needed (mention units used)					
Other inputs, specify					
Other inputs, specify					

*8 hour man-day

9. Can you specify the cost per unit of labour time and of the other inputs

	ST/unit
Skilled labour man-days*	
Unskilled/semi-skilled man-days*	
Varnish (mention units used)	
Lacquer (mention units used)	
Paint(mention units used)	
Electricity (mention units used)	
Fuel (mention units used)	
Imputed rental of workshop (Number of days needed)	
Volume of wood material needed (mention units used)	
Other inputs, specify	
Other inputs, specify	

*8 hour man-day

10. Background information:

Household members	Age	Main economic activity #	Other supplementary economic activity	Monthly income @ (ST/month)	Income from collecting & processing activities

specify type of profession
@ total income from all sources

Do you have any comments about the availability of materials from the forest and what can be done to improve the situation?

Do you have any comments about the processed products? Markets, Technical assistance, etc. What can be done to improve the situation?

Appendix II: Contingent Valuation Questionnaire for Recreational services of Mount Vaea Forest Reserve

SURVEY QUESTIONNAIRE

VALUING RECREATIONAL VALUES OF NATURAL RESOURCES

October 2000

Division of Environment and Conservation,
Department of Lands, Surveys and Environment,
Government of Samoa, Apia

In the first section, we would like to evaluate your preference for this recreational site?

The natural resources provide various benefits to humans. We would like you to ponder the following functions being played by a natural forest:

- Flood Mitigation, fresh water supply and regulation
- Micro-climate regulator of nearby areas
- Carbon sequestration and carbon sink
- Sources of timber and non-timber forest products
- Biological bio-diversity comprising of birds, reptiles, large animals, trees, palms, orchids and climbers
- Drugs and herbs. The forest is also a source of traditional medicines and of natural compounds with potential development into modern medicine.
- Recreation and eco-tourism

This section is about valuing the recreational benefits of the natural forest <u>only.</u>

The Mount Vaea Forest Reserve supports a stream, an aesthetic scenery and a cooling environment very suitable for recreational experiences like hiking, wilderness experience, swimming and be in a healthy surrounding. At the foot of Mount Vaea is located a botanical garden. Currently, the management of the botanical garden and the surrounding natural forest is funded by the Government. To ensure sustainable management of this site, additional funding is needed to complement existing budget.

1. Would you be willing to pay an entrance fee to enter the site and obtain the benefits generated by this botanical garden and natural forest?

Yes	1
No	2

Please do not agree to pay if:

- You cannot afford it; or
- If you are not sure about being prepared to pay

If your answer is yes, go to the next question, otherwise go to question 3.

2. The following table consists of a list of prices from ST0.50 to ST15. Ask yourself:

" What is the maximum price that you would be willing to pay (per entrance) to obtain the recreational benefits mentioned above. Tick one level.

(Note: Consider other expenses that you have already paid for this trip and remember that you could spend your money on other things)

<u>ST$ per Entrance</u>

0.50 ____________
1.00 ____________
1.50 ____________
2.00 ____________
2.50 ____________
3.00 ____________

3.50 ____________
4.00 ____________
4.50 ____________
5.00 ____________
6.00 ____________
7.00 ____________
8.00 ____________
9.00 ____________
10.00 ____________
12.50 ____________
15.00 ____________

3. Could you please explain the main reason for not wanting to pay for an entrance fee?
   The Botanical garden and natural forest is a free good 1
   The Botanical garden and natural forest should be funded by the Government 2
   Cannot afford to pay 3
   Others (Please explain ______________________) 4

4. Out of 100%, how do you allocate the benefits you derived from the attractions offered by this recreational site

	Attractions	%
1	Visiting the botanical garden	
2	Robert Louis Stevenson Tomb	
3	Hiking up the trails to Mt. Vaea Forest Reserve	
4	Wilderness experience and aesthetic scenic	
5	Others, please specify ________________________	
	Total	100%

5. How many times have you been here in the last 12 months? _____________

In this final section, we would like to ask you a few questions about you and your group to ensure that our sample is representative.

6. Which country are you from __________

7. Are you married?
   Yes 1
   No 2

8. For each member of your group, please list their age and sex:

Group Member	Age (in years)	Sex (M/F)
Self	____________	____________

9. What is the highest level of education you personally have obtained?

Never went to school	1
Completed primary school only	2
Completed secondary school only	3
Completed Technical/University Degree	4
Completed post-graduate diploma (how many additional years_____)	5

10. What is your own current work status?

	Self	Spouse
Employed full time	1	1
Employed part-time	2	2
Unemployed/looking for work	3	3
Retired	4	4
Full-time student	5	5
Home duties	6	6
Other (please specify ___________________)	7	7

11. Please indicate your total income (before tax) earned last year?
If locals, the income brackets below are in ST, if internationals, Specify the currency (US$/NZ$/AUS$/______)

Annual Income	**Self**	Spouse
5,000 and below		
5,001 – 10,000		
10,001 - 15,000		
15,001 - 20,000		
20,001 - 25,000		
25,001 - 30,000		
30,001 - 35,000		
35,001 - 40,000		
40,001 - 45,000		
45,001 - 50,000		
More than 50,000		

12. Are you a member of any non-governmental organisation (NGO) with interest on the environment?

Yes	1
No	2

13. Do you have any comments about your trip and the site?

We should like to thank you for your co-operation in completing this questionnaire.

Appendix III: Contingent Valuation Questionnaire for Recreational Services of Palolo Deep

SURVEY QUESTIONNAIRE

VALUING RECREATIONAL VALUES OF NATURAL RESOURCES

October 2000

Division of Environment and Conservation,
Department of Lands, Surveys and Environment,
Government of Samoa, Apia

In the first section, we would like to evaluate your preference for this recreational site?

The marine resources provide various benefits to humans. We would like you to ponder the following functions being played by a marine resource such as the Palolo Deep:

- Habitat for fisheries.
- Mangroves, river estuaries and corals are spawning ground and nursery for some fisheries.
- Sources of fish and other fishery catch
- Climate regulation and carbon sink
- Coastline damage control. Mangroves protect the shoreline from surging tides and coral reefs reduce the impact of ocean waves on the coast.
- Nutrient cycling acquisition, storage and release of nutrients. Mangroves capture nutrients from land-based sources, and release them gradually in the aquatic environment, serving as the beginning of the food chain
- Biological diversity comprising of fishes, shellfishes, corals, and plankton. This contributes to ecosystem stability, source of genetic information for cross-breeding and genetic engineering
- Drugs and herbs. The marine resource is also a source of traditional medicines and of natural compounds with potential development into modern medicine.
- Beaches, lagoons and coral reefs have amenity value for recreation and eco-tourism.

This section is about valuing the eco-tourism benefits of the marine resource <u>only.</u>

The Palolo Deep and its natural marine ecosystem support a beach, an aesthetic view of the ocean and beautiful corals and a suitable environment for swimming opportunities. Currently, the entrance fee is insufficient for effective management of the Palolo Deep Marine Reserves. Additional funding is needed to ensure sustainable management of this site.

1. Would you be willing to make additional payment for a more effective management of the marine reserve to ensure that the eco-tourism benefits you obtained from this marine resources be sustained?

Yes	1
No	2

Please do not agree to pay if:

- You cannot afford it; or
- If you are not sure about being prepared to pay

If your answer is yes, go to the next question, otherwise go to question 3.

2. The following table consists of a list of prices from ST0.50 to ST15. Ask yourself:

" What is the maximum additional price that you would be willing to pay (per entrance) to obtain the recreational benefits mentioned above. Tick one level.
(Note: Consider other expenses that you have already paid for this trip and remember that you could spend your money on other things)

<u>ST$ per Entrance</u>
0.50 ___________
1.00 ___________

1.50 ____________
2.00 ____________
2.50 ____________
3.00 ____________
3.50 ____________
4.00 ____________
4.50 ____________
5.00 ____________
6.00 ____________
7.00 ____________
8.00 ____________
9.00 ____________
10.00 ____________
12.50 ____________
15.00 ____________

Could you please explain the main reason for not wanting to pay an additional entrance fee?

The Palolo Deep and marine resource is a free good	1
The Palolo Deep and marine resource should be funded by the Government	2
Cannot afford to pay	3
Others (Please explain ______________________)	4

3. Out of 100%, how do you allocate the benefits you derived from the attractions offered by this marine resource site

	Attractions	%
1	Swimming and sun-bathing opportunities	
2	Snorkelling watching corals	
3	Ocean scenic views	
4	Others, please specify________________________	
	Total	100%

4. How many times have you been here in the last 12 months? ______________

In this final section, we would like to ask you a few questions about you and your group to ensure that our sample is representative.

5. Which country are you from ___________

6. Are you married?

Yes	1
No	2

7. For each member of your group, please list their age and sex:

Group Member	Age (in years)	Sex (M/F)
Self	____________	____________

____

8. What is the highest level of education you personally have obtained?

Never went to school	1
Completed primary school only	2
Completed secondary school only	3
Completed Technical/University Degree	4
Completed post-graduate diploma (how many additional years_____)	5

9. What is your own current work status?

	Self	Spouse
Employed full time	1	1
Employed part-time	2	2
Unemployed/looking for work	3	3
Retired	4	4
Full-time student	5	5
Home duties	6	6
Other (please specify ___________________)	7	7

10. Please indicate your total income (before tax) earned last year?
If locals, the income brackets below are in ST, if internationals, Specify the currency (US$/NZ$/AUS$/______)

Annual Income	**Self**	Spouse
5,000 and below		
5,001 – 10,000		
10,001 - 15,000		
15,001 - 20,000		
20,001 - 25,000		
25,001 - 30,000		
30,001 - 35,000		
35,001 - 40,000		
40,001 - 45,000		
45,001 - 50,000		
More than 50,000		

11. Are you a member of any non-governmental organisation (NGO) with interest on the environment?

Yes	1
No	2

12. Do you have any comments about your trip and the site?

We should like to thank you for your co-operation in completing this questionnaire.

Appendix IV: Contingent Valuation Questionnaire for Ecological Functions of Forest and Marine Resources

SURVEY QUESTIONNAIRE

VALUING THE ECOLOGICAL & ENVIRONMENTAL VALUES OF NATURAL RESOURCES

October 2000

Division of Environment and Conservation,
Department of Lands, Surveys and Environment,
Government of Samoa, Apia

SECTION A

This questionnaire is to find out how much people know and value Samoa's Forests, Mangroves and Marine Resources

- Tropical rainforests, mangroves and marine resources make sure that there is enough oxygen in the air, keeps the temperature down and produce rain for us. These resources are the home and feeding grounds for many different animals, birds, fish, corals and plants and have potential uses for animal and plant breeding and medicines to control serious illnesses. With the presence of these resources, the world ecosystem is stable. There are probably many more uses that we don't know about yet.

Apart from that each of these three resources provides specialise functions.

- Tropical Rainforests help reduce erosion and regulate water flow preventing flooding and drought.

- River estuaries, coastal waters and open seas help recycle the nutrients from erosion while coral reefs reduces the impact of ocean waves on the coast.

- Mangroves absorbs excess river flows preventing floods, absorb and recycle nutrients by playing a waste treatment function and also prevent coastline damages

These are the ecological functions or services of the Tropical Rainforests, Mangroves and Marine Resources that directly and indirectly are our life-support system.

We want **to limit your interest to the ecological services** of these three natural resources only. As you know, these resources are constantly under threat from development, pollution and changing global climatic conditions. These resources need to be managed effectively in order to sustain them

We wish to set up a **NATURAL RESOURCE CONSERVATION TRUST FUND** for this purpose to complement the management programmes undertaken by the government.

1. Would you be willing to contribute to this natural resource conservation trust fund to ensure that these resources are protected and continue benefiting us and our children ?

Yes	1
No	2

Please do not agree to pay if you cannot afford it or if you are not sure about being prepared to pay. If your answer is **Yes**, go to the **next question**; **otherwise** go to question 3.

2. What would be the most you would pay per year to the fund to ensure the natural resources are protected. Tick one level.

<u>SAT$ per year</u>

0.50 ____________
1.00 ____________
1.50 ____________
2.00 ____________
2.50 ____________
3.00 ____________
3.50 ____________
4.00 ____________
4.50 ____________
5.00 ____________
6.00 ____________
7.00 ____________
8.00 ____________
9.00 ____________
State the amount if more than SAT$10.00 ____________

3. If you had only a total of ST$ 1 to contribute, how many sene would you give to each resource ?

	Contributions for conservation of resource	
1	Rain forest resources	_____ sene
2	Marine resources	_____ sene
3	Mangroves	_____ sene
	Total	100 sene

4. Would you please explain the main reason for not wanting to contribute to the conservation fund?

SECTION B

In this final section, we would like to ask a few questions about you to make our analysis more representative.

5. Are you married?
   Yes 1
   No 2

6. Age ______(in years)

7. Male 1
   Female 2

8. What is the highest level of education you have obtained?

Never went to school 1
Completed primary school only 2
Completed secondary school only 3
Completed Technical/University Degree 4
Completed post-graduate diploma (how many additional years_____) 5

9. What is your own current work status?
   Government officer 1
   Private sector 2
   Unemployed/looking for work 3
   Retired 4
   Full-time student 5
   HOME DUTIES 6

   Work on your/family plantation 7
   Other (please specify ___________________) 8

10. Please indicate your total income (before tax) earned last year?

Annual Income	**SAT $**
5,000 and below	
5,001 – 10,000	
10,001 - 15,000	
15,001 - 20,000	
20,001 - 25,000	
25,001 - 30,000	
30,001 - 35,000	
35,001 - 40,000	
40,001 - 45,000	
45,001 - 50,000	
More than 50,000	

11. Are you a member of any non-governmental organisation (NGO) in support of environmental conservation
    Yes 1
    No 2

12. Where is your place of residence
    Apia Town 1
    Upolu, out of Apia 2
    Savai'i island 3
    Apolima island 4
    Manono island 5

13. Do you have any comments to make about this study on valuing the ecological services of the natural resources of Samoa?