



THE AUSTRALIAN NATIONAL UNIVERSITY
Centre for Resource and Environmental Studies
Ecological Economics Program

Working Papers in Ecological Economics

Number 9706

August 1997

**ECONOMIC INSTRUMENTS FOR ENVIRONMENTAL AND NATURAL
RESOURCE CONSERVATION AND MANAGEMENT IN THE SOUTH
PACIFIC**

by

Colin Hunt

CRES, ANU, Canberra ACT 0200, AUSTRALIA

Tel: +61 6 249 4277

Fax: +61 6 249 0757

E-Mail: dstern@cres.anu.edu.au

WWW: <http://cres.anu.edu.au/~dstern/anzsee/EEP.html>

The Ecological Economics Program (EEP) was established in CRES as the result of a successful application to the Institute of Advanced Studies 1994 Strategic Initiatives round. EEP's objective is to promote the development of ecological economics by conducting research and acting as a focal point for ecological economics activities in the Canberra region. To this end, EEP:

- hosts the office of ANZSEE, the Australia New Zealand Society for Ecological Economics
- runs a seminar series
- runs a working paper series on the World Wide Web
- can serve as a host for individuals wishing to do ecological economics research as visitors to the ANU (Contact Mick Common for more information).
- supervises research students. People interested in doing a research degree in ecological economics should contact Mick Common or David Stern for more information.

The **working paper series** reports on research conducted in EEP by academic staff, visitors, and students, and invited seminar presenters.

Working Papers in Ecological Economics

- 9601** David I. Stern. Progress on the environmental Kuznets curve?
- 9701** Michael Young. Water rights: an ecological economics perspective.
- 9702** David I. Stern and Robert K. Kaufmann. Time series properties of global climate variables: detection and attribution of climate change.
- 9703** Ken Menz and Katie Ellis. Fire as an economic disincentive to smallholder rubber planting in Imperata areas.
- 9704** Roger Attwater. Property entitlements and land reform in upland Thai catchments.
- 9705** Mick Common, Tim Bull, and Natalie Stoeckl. The travel cost method: an empirical investigation of Randall's difficulty.
- 9706** Colin Hunt. Economic instruments for environmental and natural resource conservation and management in the South Pacific.

**ECONOMIC INSTRUMENTS FOR
ENVIRONMENTAL AND NATURAL RESOURCE CONSERVATION
AND MANAGEMENT
IN THE SOUTH PACIFIC**

(Draft of 12 August, 1997)

Colin Hunt

National Centre for Development Studies, ANU, Canberra
phone 61 6 249 0177
email Colin.Hunt@anu.edu.au

Summary

Trends in natural resource exploitation and consumption patterns have increased the need for resource conservation and pollution control in the South Pacific.

The need for greater government resources, implied by the intensification of environmental management, has coincided with budgetary restraints in the South Pacific that have often been severe.

Economic (as opposed to command and control) instruments are of increasing interest because they possess the potential to shift from government to producers or consumers the onus to comply with environmental measures.

In this paper, argument about the applicability of economic instruments in conservation and management in developing countries in general and the South Pacific in particular, is prefaced by a brief exposition of the theory and a description of the types of instruments. (The typology follows Panayotou (1995).)

An analysis of some twenty case studies in the South Pacific enables some conclusions to be drawn about the conditions necessary for the application of economic instruments and enables some recommendations to be made about their adoption.

The paper reports on work in progress and as such acknowledges gaps.

Meanwhile comments are welcomed by the author.

INTRODUCTION

The South Pacific region is defined as that served by the South Pacific Commission, containing 22 island states separated by vast ocean expanses. The largest country in population and land area is Papua New Guinea (462,243 km² and 3.6m) and the smallest Tokelau (10 km² and 0.0016m).

While the Pacific island countries are disparate in natural resource and environmental endowments and in population density, culture and ranking in the human development index (UNDP, 1996), they commonly face problems of natural resource and environmental depletion (Thistlethwaite and Davis, 1996) and urbanisation (Connell and Lea, 1993; Connell and Lea, 1995).¹ While major industrial centres and the problems associated with them are absent, growing populations are gaining access to urban housing, piped water and sewage and at the same time to a wide range of consumer goods and foodstuffs. The environmental problems associated with demands on resources and on the assimilative capacities of fragile environments have been well documented.²

Solutions are less common, however, and the application of economic and financial instruments have received very little attention despite the interest in economic instruments at the international level. The Brundtland report paved the way for the 1992 United Nations Conference on Environment and Development (UNCED) and the subsequent Rio Declaration and Agenda 21 specifically refer to the need for the adoption of economic instruments.

This publication attempts to begin to rectify this situation by increasing awareness of the both the principles and the practice of the application of economic instruments to environmental management in the region.

OBJECTIVES

The research has three main objectives:

1. Identify and analyse cases where economic instruments are already being employed in environmental management and conservation in the South Pacific.
2. Identify characteristics of economic instruments that make them amenable to application in the South Pacific.
3. Examine the potential for the further employment of such instruments in the South Pacific.

¹ See also the National Environmental Strategies prepared by all PICs.

² For example the South Pacific Regional Environment Programme (SPREP) has convened regular meetings to consider environmental issues.

CRITERIA FOR ASSESSING THE APPLICABILITY OF INSTRUMENTS

The internalisation of costs associated with economic activity are the main focus of economic instruments in environmental management. The industrialised countries have been the main source of the development of the theory and practice of economic instruments. It is necessary to take a developing country perspective given the contrasts in the economic, social and cultural conditions between the industrialised countries and the developing countries. However, the conditions for the successful application of economic instruments in environmental management and conservation would appear to be universal. The Industry Commission (1997) suggests that they are as follows:

- a) the problem can be defined,
- b) there is public or industry support for intervention;
- c) there exists expertise and capacity to design, implement and monitor the instruments,
- d) goals are set against which the effectiveness of the interventions can be measured.

We shall adopt these criteria in evaluation of the case studies that will be presented to illustrate the present application of economic instruments in the South Pacific and in the discussion of the potential for their future application. However, before we turn to South Pacific in particular, a section on economic instruments in developing countries generally follows.

THE APPLICATION OF ECONOMIC INSTRUMENTS IN DEVELOPING COUNTRIES

There is an inherent bias against resource protection in developing countries, for example GDP rankings overlook differences in purchasing power. But even if this adjustment is made, together with inclusion quality of life indicators such as education, health and longevity (for example by the human development index of UNDP) the ranking still does not include protection of the environment and resource conservation. Ironically, expenditure on such activities would, in fact, further depress rankings according to income (Panayotou, 1995).

Environmental management and conservation are often seen as having high opportunity costs when rapid development is a priority and capital and budgetary funds to deliver 'essential services' are limited. This attitude is against a background in developing countries of relatively low average incomes and, as a consequence, a lower marginal utility of environmental services compared with extra income. This translates into a relatively low willingness to pay for environmental protection.

Yet natural resource management, and the instruments available to achieve it, is of great interest to policy-makers in many low-income developing countries because of the recognised need to secure a future stream of benefits from these resources. At the same time, the growing urban centres (even in agrarian developing countries such as those in Oceania) demand the application of effective instruments for pollution control. However, the application of instruments that directly attack externalities, such as pollution taxes and tradeable permits, require sophisticated collection mechanisms or new administrative arrangements (Bernstein, 1993). Less efficient but more applicable, are instruments such as taxes that reduce productions and/or consumption and at the same time raise revenue.

Equity issues can also be influential in the development of environmental management policy. Conservation measures may result in the benefits being channelled to a few or to a certain section of society. A consideration is the existence of large labour surpluses that can benefit from labour-intensive, rather than capital-intensive, conservation or protection activities.

Economic instruments can deliver environmental management at lower costs than regulatory instruments. Both a tax on pollution and tradeable permits achieve least-cost solutions and moreover encourage costs savings from the introduction of new technology. However, in mature industrialised economies regulations and standards and a command and control culture may be entrenched. Thus, even though the taxes and tradeable permits enable environmental management to be conducted at lower cost they tend to be accompanied by high adoption costs.

In developing countries, in contrast, there are often opportunities to apply at the outset instruments that are likely to be far less costly and more effective than the command and control instruments. (It should be borne in mind, however, that such instruments may not be expected to achieve the same environmental standards as are targeted in the West.) Moreover, the economic instruments have the capacity to raise funds that can either be applied to offset the cost of their application or be directed to consolidated revenue.

The legal systems of developing countries may be characterised by courts that deal only with 'last resort' cases and therefore do not have the capacity or expertise to handle a large number of prosecutions for breaches of environmental regulations. There may also be severe cultural constraints on the prosecution of environmental offenders. The legal and cultural milieu of developing countries may therefore make the application of economic instruments, that cannot be easily escaped, an attractive alternative to regulations that must rely on the law for their enforcement.

The following section focuses on the applicability of economic instruments to the region.

THE APPLICATION OF INSTRUMENTS IN THE SOUTH PACIFIC

The poor levels of economic growth (compared to Caribbean countries, for example) and the gradual withdrawal of aid, have placed a squeeze on the budgets of Pacific island countries (PICs) and led to the downsizing of government departments. In Papua New Guinea, fiscal restraints already in place (under arrangements with the World Bank and IMF) have been exacerbated recently by the diversion of substantial budgetary funds to the Bougainville crisis.

At the same time, serious problems of unsustainable development have emerged in the region. The National Environmental Management Strategies of PICs highlight the main concerns which can be summarised as, on the one hand, being about the conservation of dwindling natural resources plus the biodiversity they contain, and, on the other, about the increasing assaults on the assimilative capacity of environments by both resource exploitation and urban growth.

The rapid and unsustainable exploitation of forest resources, the high social costs associated with mining and the degradation of coral reefs have tended to be at the forefront of public concern. However, health hazards are pervasive because wastes are disposed of in a form and in quantities in excess of the assimilative capacities of local environments. For example, typhoid is endemic in Port

Moresby³ and in Tarawa serious health problems and high rates of death are caused by contamination of *in situ* environments by wastes (Hunt, 1996a; Kiribati Ministry of Home Affairs and Rural Development, 1995). The lack of attention in the to the financial aspects of improved waste management have been singled out by regional experts (Morrison and Munroe, 1997).

Legal and institutional frameworks

The command and control and regulatory approach to environmental management requires resources for monitoring and enforcement by government agencies. The legal system needs to back-up enforcement through prosecution. However, in the South Pacific generally, the courts are not set up to handle significant levels of environmental litigation. Another institutional characteristic is that the collection of waste, the management of dumps and monitoring for environmental quality all tend to be under different Departments; a structure at odds with the need for the adoption of integrated waste management strategies. Again maintenance of infrastructure may be subject to disputes between Departments over the responsibility for repairs and maintenance (Kiribati Ministry of Home Affairs and Rural Development, 1995).

The cultural and social context

Another major reason for failure of well-intentioned projects is their clash with traditional practices and values.

Many South Pacific adults grew up when most waste was biodegradable. Moreover, population densities in the past were lower and the amount of waste deposited on land or in marine environments was easily assimilated. The practice of communal bathing and ablutions on atolls and small islands was perfectly sustainable. As was the disposal of all household wastes from dwellings on stilts to the tidal zone below.

The present predominance of non-biodegradable plastic in the waste stream has led to its accumulation round and below dwellings or in informal dumps where it becomes an unsightly habitat for disease vectors.

Much higher population densities adjacent to marine and lagoon areas has in some cases led to a level of waste disposal to the local environment far beyond inshore areas to assimilate, leading to high levels of contamination of beaches, inshore waters and shell fish and freshwater lenses. The continuation of pig farming in urban areas, and adjacent to lagoons, also contributes to the problems of inshore water contamination. The task at hand in modifying traditional waste disposal activities has been highlighted in the case of South Tarawa, Kiribati:

Improved sanitation infrastructure, practices and safe water supply supplemented by community education programmes are key measures needed to reduce the incidence of diarrhea and improve community health. It is of major concern that since the cholera outbreak in 1977, three reticulated sewage systems have been put in place in the main urban areas but beach defecation and other

³ James Wangi, Chief Epidemiologist, Health Department, Papua New Guinea, personal communication.

adverse community health practices have increased substantially over that time (Kiribati Ministry of Home Affairs and Rural Development , 1995, p. 16).

While the provision of composting toilets may seem to be a perfectly good solution in such situations it should be borne in mind that Pacific Islanders reject the use of animal or human wastes on gardens.

Small island developing states have limited sustainable development opportunities. It has been suggested that tourism industries have great potential on atolls and small islands (Temu, 1996). However, it should be recognised that the accumulation of wastes in urban areas and the dangerous state of lagoon and inshore waters are likely to be constraints on the development of tourist industries.

One of the major characteristics of PICs is the predominance of communal or customary tenure (CT) over land and inshore areas. CT is particularly marked in Melanesia and in fact is enshrined in the constitutions of both Papua New Guinea and the Solomons, while in Fiji traditionally-owned land and state land (together 70%) cannot be sold. The fact that land tenure has not been documented and that titles do not exist, does not mean that tenure is weak but it does mean that the registration of landowners is a difficult and expensive task.

The fact that most land and inshore waters is under the ownership and control of local communities has a great consequences for environmental management and conservation.

In the case of biodiversity conservation and of stocks of timber and fish the customary owners as a group need to agree to a conservation policy. In some instances, as demonstrated by case studies in this publication, customary tenure needs to be reinforced in order to allow the traditional owners to exclude non-owners. The lack of acknowledgement of the existence of divergent views among groups of landowners can spell the costly demise of conservation projects as illustrated in the section Financial Instruments.

The implications of customary tenure may also be severe for the charging of services to households and for the organisation of urban services such as sewerage and water supply. For example the lack of titles to land, either because it is communally owned or because it is inhabited by squatters, mean that notices cannot be effectively served to individual house owners/consumers. Instead, notices may need to be served, through village leaders, on a community for its total consumption. Again, the acquisition of land for sanitary land fill or water supply systems may be subject to difficulties and to claims by traditional owners for compensation.

In other cases property rights may be vested in governments but the weak exercise of rights may lead to 'open access' to resources and environmental degradation (see the case study on Property Rights on Atolls).

Financial resources

The lack of appreciation of the dearth of resources at the disposal of communities in Pacific island countries can lead to the failure of Western designed environmental infrastructure. Low charge levels or low levels of recoupment of charges tend to limit the level of funds available for the

adoption of maintenance programmes.⁴ The provision of sewage systems or piped water supply systems that require pumping devices assumes that extra money for parts will be found, and moreover, that the paid expertise exists for undertaking the maintenance work.⁵ The sewage system of South Tarawa is infrastructure in disrepair due to the lack of maintenance funding and disputes over maintenance: See the case study under Charge Systems.

Nevertheless, there appears to be scope for governments and municipalities to adopt user pays policies that recoup larger proportions of the costs of environmental services and can increase maintenance and operating budgets, as illustrated in some case studies.

If economic instruments are indeed more cost-effective than command and control or regulatory measures, then restraints on budgetary and human resource deployment make the design and implementation of economic instruments all the more relevant to the region.

While it has been suggested that charges are often inadequate to fund environmental services, there are now some examples of reform. In Kiribati on South Tarawa there appears to be an adequate fee structure in place for solid waste collection (Morrison and Munroe, 1997).

And in Papua New Guinea the introduction of “environmental levies” covering a wide range of government costs in environmental management was proposed by the Papua New Guinea Department of Environment and Conservation (1993). The report recommended the application of the following instruments:

Charges to cover administration and management costs including the evaluation of proposals that affect the environment and the conduct of public hearings.

Performance bonds to encourage compliance with permit conditions, and to cover the costs of clean-up of spills of oil or toxic substances.

Charges to cover the full cost of monitoring and regulation of users of hazardous wastes, such as toxic chemicals and oil.

Charges, as a percentage of total development costs, to enable the provision of public goods such as local infrastructure in the form of schools and aid posts or nature conservation areas.

While the Papua New Guinea cabinet endorsed the setting up of a trust fund to receive the monies collected from such charges, the application of charges (as envisaged in the policy) has not proceeded because of resistance by industry and the Ministries that promote development. This paper argues that the application of economic instruments should be revisited in Papua New Guinea, and elsewhere considered as new instruments.

⁴ In the National Capital District of Papua New Guinea the proportion of charges collected, as against charges invoiced, is 55% (Wilbur Smith and Associates, 1996, p. ?).

⁵ The criticism of development funding can be extended to much aid that places heavy demands on the recurrent budgets of recipient countries. Aid donors tend to favour infrastructure projects such as sewage systems, patrol boats and roads while ignoring the downstream increase in maintenance and running costs that may be prohibitive.

A TYPOLOGY OF INSTRUMENTS AND CASE STUDIES

The discussion to date suggests that economic instruments have the following broad characteristics:

- a) they generate incentives to change production and consumption patterns (through cost internalisation);
- b) they raise funds either for the implementation of management or conservation measures and/or for the augmentation of consolidated revenue.

The paper now turns to a description of the main instruments within this classification, the typology follows Panayotou (1995). Table 1 summarises the typologies and indicates instruments that have been identified as being applied in the South Pacific. A description of types is in some cases augmented by case studies from the region.

Table 1: PRESENTLY APPLIED ECONOMIC INSTRUMENTS IN THE SOUTH PACIFIC

	PROPERTY RIGHTS	MARKET CREATION	FISCAL	CHARGES	FINANCIAL	LIABILITY SYSTEMS	BONDS AND DEPOSIT REFUND SYSTEMS
LAND AND SOILS	customary tenure		negative taxes (subsidies)			mining	
FRESH WATER RESOURCES	customary tenure			pricing		mining	
OCEAN AND SEA RESOURCES	EEZs; customary tenure	individual transferable quotas (ITQs)	export tax; licensing	access fees	differential pricing		
FORESTS	customary tenure; royalties		taxes				
MINERALS	customary tenure; royalties		taxes				
WILDLIFE			taxes	access fees			
BIODIVERSITY				access fees	GEF; trust funds; carbon offsets; co-financing; self-financing		
WATER POLLUTION	urban property rights			water/sewage pricing			
AIR POLLUTION							
SOLID WASTE			goods and services tax; littering fines	collection charges;			deposit-refund systems
HAZARDOUS WASTE							
TOXIC CHEMICALS							
HUMAN SETTLEMENT: LAND USE CONGESTION							
GLOBAL CLIMATE					GEF; carbon offsets		

Property rights

The existence of well-defined and enforced property rights are a key to the prevention of resource degradation. The rights to property are the rights to the stream of benefits flowing from the property. Where property rights are absent, the benefits stream is available to anyone; in other words there is 'open access'.

The existence of weak property rights or their absence encourages the short term exploitation of resources. The resource users do not have rights to future income from the resource and are therefore interested in maximising only present benefits. The maximisation of present benefits may incur an opportunity cost (user or depletion cost) in that the future benefit stream is reduced. In the absence of property rights the exploiters do not bear depletion costs which become externalities. (Temporal externalities to be borne by future generations.) However, where property rights are defined, depletion costs are internalised and borne by the owners, thus the level of use of the resource tend to fall.

Property rights must also be enforced, however, if open access it to be avoided.

In the South Pacific, most land tend to be in the hands of customary owners under customary tenure. Some of the implications of this for development and the environment drawn out in the section Social and Cultural Context.

There is a great debate on customary land tenure and its affect on development in the South Pacific and in Papua New Gunea in particular. On the one hand it is suggested that investment and economic development depend upon more secure access to land (Chand and Duncan, 1997) while others question whether there would be any increase in efficiency gains from agricultural land mobilisation (Kalit and Young, 1997). Ballard meanwhile suggests there is little likelihood of a centrally-planned mobilisation program being implemented in PNG (Ballard, 1997).

The focus of this report will be to examine the tenure situation with respect to environmental conservation and management initiatives, particularly those falling into the classs of economic instruments, rather than development *per se*. This will be done through cognisance of the theory and an examination of relevant case studies form the region.

Property rights and oceanic resources

The South Pacific is the most productive of regions, in terms of tuna harvest, due mainly to its abundant skipjack resource and contributes some 40% of the total tuna supplied for canning. The region also supplies a substantial proportion of Japan's sashimi imports.

One way of indicating the importance of fishing sectors is to express fishing revenue received by Pacific island governments as a proportion of total government revenue. In the case of Kiribati and Tuvalu the proportion is between 30% and 50%, mostly from tuna; it is also high in the Federated States of Micronesia and the Marshall Islands. These countries receive significant licence fees from foreign tuna vessels that fish their vast tuna resources. If we measure fishing by share of GDP, we find that it is 9-10% in Solomon Islands, Kiribati and Tuvalu but only 1.5% in Fiji. The latter

economy is diversified and fishing is just one of several important sectors. The formal employment associated with the export canneries of both the Solomons and Fiji is another consequence of large tuna stocks. While the importance to PICs of the income from tuna can easily be demonstrated (they manage to capture directly and indirectly only about 10% of the total annual value of the fishery, which is some US\$1.5 billion (Hunt, 1997b, p.).

The declaration of the 200 nautical mile Exclusive Economic Zones (EEZs) the Pacific (supported by the United Nations Convention on the Law of the Sea (UNCLOS), ratified in 1994) strengthens sovereign rights over marine resources. PICs control access to their marine resources and apply charges or 'access fees' on the marine resource rent earners and apply fiscal instruments, in the form of license fees, to recoup the costs of EEZ administration (Hunt, 1997b). Charges in the tuna industry are dealt with in detail in a case study in the Charges section.

Against a background of great increases in tuna catches, particularly skipjack and yellowfin important policy issues are the maintenance of stocks and the maximisation of the economic benefits flowing to PICs from those stocks. The creation for a market for rights to Pacific tuna stocks through the allocation of individual transferable quotas is dealt with under the section Market Creation.

Inshore resources

There are several factors which are tending to break down customary marine tenure (CMT) that has been important in the conservation of inshore (as opposed to offshore) marine resources. The introduction of cash benefits in exchange for access by industrial or commercial fisheries is one of these factors, evident in Papua New Guinea, the Solomon Islands, the Marshall Islands and Fiji. Narrow groups or spokespersons, not fully representative of the traditional descent groups, have been able to appropriate rents for their own use (Crocombe, 1994; Turner, 1994; Hviding, 1996).

There is a large body of literature describing the customary marine tenure (CMT) in the South Pacific. CMT is often under threat from commercialised fishing and resource development projects (Johannes, 1978). There are strong advocates for the strengthening of CMT, rather than a substitution other systems of rights (Hviding and Ruddle, 1991; Doulman, 1993). Given that coastal communities often have a tradition of, and an interest in, sustainable marine resource management, the reinforcement of their traditional tenure (through, for example, management plans) may be the best policy for central governments in the South Pacific (Hunt, 1996b; 1997a).

While it is acknowledged that CMT may present impediments to governments in undertaking industrial fisheries development, it is argued that strengthening CMT, rather than weakening it, should often be the preferred policy. The reasons are threefold.

First, in many countries subsistence fishing dominates and the local communities that are dependent on the resources for their livelihoods should be in a position to manage those resources. Second, the development and resilience of management and conservation plans for commercial resources by governments in cooperation with communities is facilitated by clear access rights. Third, where commercial exploitation of local resources is a possibility, for example in the cases of trochus or bêche-de-mer, strengthened CMT puts the local communities in a more advantageous position in negotiating with traders. In some PICs, CMT is already reinforced by central governments. For

example, local rights are recognised by the Fiji Fisheries Commission (Cook, 1994), and in the Solomon Islands (over both land and fisheries) through the Provincial Government Act of 1971 (Crocombe, 1994: Pulea, 1993).

Central governments have been prone to ignore the difficult process of clarifying CMT and carrying out development or conservation through 'top down' approaches. However, the resilience of any development or conservation arrangements is heavily dependent, in the Pacific, on local people being involved in decision processes and receiving rents from any arrangement.⁶

Case Study: Strengthening of customary marine tenure in Vanuatu

In moving forward, the thrust should not be so much in the documentation of CMT but in its definition and strengthening so that it can be effective in developing local arrangements, and can integrate more effectively with planning and policy, for marine resource management and conservation, of central governments (Hyndman, 1993).

The discussion suggests that the cooperative approach between communities, acting in their local interests, and governments, acting in the national or public interest, has much to offer. Strengthened CMT and local resource management arrangements, albeit based of necessity on customary practices rather than scientific fisheries management principles, can assist the central government in its overall policy of conservation of marine resources (as set out, for example, in National Environmental Management Strategies).

An example of where the strengthening of CMT has assisted the declaration of a protected area is provided by the work of Tacconi under an Australian Council for International Agricultural Research project in Vanuatu.

A very significant step in biodiversity conservation in Vanuatu is the development of provincial legislation, under the national constitution, enabling local groups to strengthen their property rights and hence their ability to protect and to manage their natural resources. This step was the direct result of actions of Tacconi in negotiating with the Attorney General's department and using a draft by-law (obtained from Santa Ysabel province, Solomon Islands) as a model.⁷ Such legislation has been adopted in principle by the local government councils of Santo and Malekula, and has been enacted in Efate (Bennett, 1996).

In 1994 the local government region of MALAPA which includes Malekula was empowered to create protected areas by the passage through the Vanuatu Parliament of the *Bill for Decentralisation and Local Government Regions, Act No. 1, of 1994*. MALAPA was now able to introduce by-laws that "outline create and draw up

⁶ In the PNG bait fishery the allocation of part of the rents to a trust fund and to the provincial government, rather than to local groups, became a bone of contention (Turner, 1994).

⁷ Awareness of the potential for local management of marine resources had already been raised by an education programme conducted by the Vanuatu Fisheries Department and the Environment Unit.

regulations governing the environmental protection zones (natural parks, natural reserves or tourist-attraction areas in the national interest” (Act 1, Section 20 (9)). Tacconi subsequently assisted MALAPA in drawing up a by-law that facilitates planning by local ni-Vanuatu (Tacconi, 1995a).

Features of the by-laws are summarised as follows:

Box: Feature of protected areas under by-laws, Vanuatu

Areas are protected on the basis of custom, and amenity and livelihood provision.

The regional council by-laws (under national legislation) strengthen customary tenure by making it an offence to contravene the rules governing a protected area.

The term of the by-law is specified by the landowners.

Amendments may be made by landowners to a by-law at any time.

For every declared protected area a committee of management is set up, representative of both landowner interests and community interests (through chiefly representation).

An important feature of the by-law legislation is that it is distinct from, but complements, the *National Parks Act, No. 7 of 1993*. This latter act is designed to protect unique ecosystems, habitats of threatened species or areas possessing outstanding features. The by-law, in contrast, allows the protection of natural areas that are significant in the support and maintenance of livelihoods (Tacconi, 1995a).

Conservation of marine or forested areas *per se* neglects the interface. An important characteristic of the protected areas that have arisen under by-laws is that they often incorporate several different ecosystems. At the same time they may stipulate degrees of conservation, given that livelihoods must still be derived from the protected areas. For example, in the case of the declared protected area of the Wiawi coastal community on Malekula, the forest is protected but the forest zone also includes plantation and garden, while protection straddles the coastal zone, conserving turtle as well as reef zone resources (Tacconi, 1995b). The 8km of protected coast is currently subject to bans on the collections of trochus and green snail and to closure to fishing on six days a week.⁸

Other conservation arrangements of note that depend on local jurisdictions exercising their customary rights include that of a Cook Island Council enforcing limited trochus harvesting. The arrangement features individual transferable quotas and inspections upon landing (World Bank, 1995). In the Solomon Islands, the maintenance of the Arnavaon Marine Conservation Area depends on the cooperation, and coordination through the provision of rangers, of three village councils on Choisel and Ysabel (with the support of governments and NGOs) to enforce bans on the harvesting of turtle eggs.

⁸Chief Timothy Nehapi, Wiawi Community, Malekula, Vanuatu, personal communication.

In closing, it is as well to be reminded that such inshore conservation regimes are most applicable in rural areas (rather than peri-urban areas), where traditional authority is still strong. And the communities must be able to substitute alternative sources of subsistence and cash income during closures (World Bank, 1995).

Property rights and environmental management

The lack of property rights or their enforcement have also been identified as major impediments to waste minimisation and disposal in countries of the South Pacific.

In Kiribati there is a proliferation of squatter households in unzoned urban areas. The lack of title to land by householders prevents the planning and delivery of urban services such as water and sewerage and the charging for those services (Kiribati Ministry of Home Affairs and Rural Development, 1995).

Similarly, in PNG's National Capital District, the lack of title by households in the Motu villages hampers the delivery of services and the collection of charges (Wilbur Smith, 1996). Practical solutions in this situation have included the collection of charges from village heads rather than from each individual household (ref. engineering study re sewage, Hanuabada).

Case Study: Property rights and environmental management on Pacific atolls

There are two main economic factors which are contributing to the unsustainability of present resource use on Kiribati and Tuvalu. The first is the lack of designated rights over the use of resources, resulting in 'open access'. Unregulated access without rules or responsibilities is an underlying cause of most resource degradation (Hunt, 1996b, p. 221).

The second factor is the lack of enforcement of rights, both of government-created rights, for example on lands leased by government from traditional owners, and of traditional rights, for example concerning local fish resources. The regulations that have been put in place by governments to cope with the environmental abuse are not being enforced. The full costs of mismanagement are passed on to the public. These costs include an increase in disease incidence and a reduction in aesthetic values (p. 221).

The Government has power to declare any area a water reserve. However, squatters construct toilets and put down wells in reserves with impunity. The main source of household water (49%) is wells that directly tap the lenses. Rainwater tanks contribute the balance of supplies on South Tarawa (35%) (p. 223). If a sustainable potable water supply to the whole population is to be the goal in Kiribati then open access to lenses through wells must be phased out, drawdowns from safe lenses must be managed to avoid salinity problems and a plan for supplementary rainwater collection developed. In the case of the lenses it is probably administratively most efficient to vest all rights to water lenses in the Government, or local

councils, and to compensate any private owners. Governments would need to enforce bans on all unofficial wells. For bans on wells to be successful, however, there would need to be provision of adequate reticulated supply or rainwater tanks to those now reliant on wells (p. 227).

In Kiribati, the ownership of all marine resources is vested in the state. This means, in practice, that effort in Island fisheries is uncontrolled~~an~~ situation in contrast with the strict regimes exercised under traditional management. The transition from careful management under strongly-held traditional property rights, to open access fisheries, is described by Teiwaki (1988, p. 41) (p. 228).

In the case of the reef and lagoon fisheries of outer atolls and islands, the logical entity for the vesting of fishing rights is the local community which exploits the resource. It is argued that even though there are collective action problems associated with community management this arrangement would be superior to the holding of rights by a central government, which faces prohibitive costs of enforcement.⁹ The island council or body could exercise its control over marine resources using a variety of methods. It could limit the numbers of fishers, or restrict used. In the latter case it could, for example, restrict the use of outboard motors on fishing vessels. Fish nursery areas and other areas of great significance for the maintenance of fish stocks would come under the purview of the groups holding the rights to the inshore fisheries. In practice, the management system adopted by Councils would be influenced by considerations of culture, equity and pragmatism (p. 228).

At the present time no effort restrictions or management plans are being applied anywhere to any fishery by the Fisheries Department of Kiribati, except through size of nets used on Tarawa lagoon.¹⁰ On the densely-populated atolls, such as Tarawa, the fishing effort is high and regulations of the central government will be required to ensure the enforcement of controls within inshore management strategies. Meanwhile, islands are developing their commercial fishing to supply the urban areas. There is bound to be competition between subsistence fishers and commercial fishers. The risk of resource depletion and potential conflict can only be resolved by Councils exercising their rights to control total fishing effort in their waters (p. 229).

Land tenure and conservation

Customary land tenure is dominant in Papua New Guinea where about 97% of land is strongly held under clan rather than individual ownership. While customary tenure is well-defined, and enforced, enabling groups to extract royalties from logging companies, *in situ* environmental degradation still arises because of ignorance on behalf of the resource owners of the costs to be borne as a result of

⁹For examples of self-government of common property resources see Ostrom (1990).

^Senior Fisheries Officer, Department of Fisheries, Government of Kiribati, South Tarawa, personal communication.

deforestation. Moreover, explicit land tenure does nothing to prevent the generation of downstream externalities from logging and mining operations. In Papua New Guinea these externalities are commonly internalised *ex post* through bargaining and the payment of compensation by the mining companies to downstream landowners. (More efficient would be the internalisation of externalities *ex ante* through the use of economic instruments such as performance bonds.)

Case Study: Customary land tenure and biodiversity conservation, Papua New Guinea

Unclear rights to land can prejudice the success of conservation projects in Papua New Guinea; claims to land by disparate tribes and language groups cause conflict and court challenges (Department of Environment and Conservation(DEC)/United Nations Development Programme(UNDP),1995).

The Integrated Conservation and Development (ICAD) process requires the identification of landowners and the setting of boundaries because landowners are the beneficiaries of development projects associated with ICADs. In the case of The Kikori River Basin ICAD, for example, the groups owning land where development incomes are realised receive 50% of revenues generated while other groups receive 12.5% (DEC/UNDP, 1995, p. 40).

While land ownership in other biodiversity projects in Melanesia may be more easily determined, the issues of usufructory rights may still need to be addressed by the conservation initiatives (see the case study below of the Vanuatu Biodiversity Trust Fund).

Case Study: Customary land tenure and land degradation, Fiji

In contrast to the rest of Melanesia much of the Fiji's agricultural land is under lease. An underlying cause of the failure of sugar growers to implement soil conservation works is the uncertainty of property rights in agriculture. This uncertainty leads to the erosion cost becoming an externality rather than being internalised and minimised as a user cost.

A high proportion of leases are due for renegotiation in 2000-20001, but only 60 per cent of landowners have indicated that they will renew leases, opting to grow sugar themselves. The social costs of the displacement of a high number of the Indo-Fijians community could be exacerbated by any price adjustments to sugar that take place at the same time. The twin imperatives required to secure the future of the sugar industry are ensuring that correct price signals are sent to the growers of sugar, and securing the property rights of growers (Hunt and Chandra, 1995).

A contributory factor to land degradation on sugar farms is the distorted price signal being sent to sugar growers: see the Fiscal Instruments section for a case study that examines the effect of price distortions on Fijian sugar.

Market creation

Markets can be created for the rights to pollute (for example, through tradeable pollution permits) or for the rights to exploit resources (for example, through individual transferrable quotas for fish).

While tradeable permits and quotas are efficient instruments, and the latter have been proposed for the tuna fishery in the South Pacific (Temu, 1997), they involve heavy transaction costs in monitoring and enforcement, and in the administration of markets. Such costs may make them presently unattractive in the South Pacific (Hunt, 1997b).

The case study below illustrates the practical difficulties of implementing a quota market mechanism for the management of tuna stocks in the South Pacific

Case Study: A market for tuna quotas in the South Pacific

The indifferent performance of input controls ie; vessels numbers and/or gear configuration, in the limitation of fishing effort, has thrown the spotlight on to output controls. Quotas, a form of property right, are a preferred method of output control. TACs are set for fisheries or EEZs and individual quotas (IQs) are allocated to vessels or groups of vessels within the TACs. Markets for quota allow efficient vessels to acquire additional quota and inefficient ones to divest quota. Individual transferable quotas (ITQs) are thus an attractive concept and have been implemented in several major fisheries. Needless to say, the monitoring of catches and enforcement of quotas are essential ingredients of successful IQ systems (Hunt, 1997b , p.167, p.168).

A review of the performance of output systems based on TAC/IQ suggest that they have not fulfilled their promise. In the North Sea fisheries of the European Union they have failed to achieve their principal aim of conserving fish stocks. There is only limited compliance and catches consistently overshoot TACs while landings are decreasing. Moreover, the discrepancies between reported catches and actual catches are wide (Karagiannakos, 1996). Concerns have been expressed that these difficulties will be encountered in the Australia's multi-species South East fishery (Lal and Brown, 1994). At the heart of the difficulties with IQs are the inherent economic and regulatory incentives that encourage the discarding of fish, both target and by-catch (Crean and Symes, 1995). These can be summarised as follows

- a) species caught is under management by quota but no quota is held by the vessel,*
- b) fish size is below regulation,*
- c) species caught is not under quota but is of low value (by-catch),*
- d) species is a target species but is of lower value than other target species (high-grading),*
- e) the species is within quota, but size is sub-optimal or the fish is damaged (high grading) (p. 168).*

In both Australian and New Zealand ITQ systems have failed to achieve their objectives. In Australia's southern bluefin tuna fishery, TACs and IQs have been in force for 10 years and yet there is still uncertainty whether the depleted fishery will recover under present catch levels (Bureau of Resource Economics, 1994). The task of adhering to TACs is made more difficult by industry. For example, in New Zealand there are a number of stressed fisheries under quotas but an attempt to implement realistic TACs by the government resulted in heavy political and judicial pressure being exerted by the fishing industry (Wallace, 1995). Likewise, in Australia, Japanese vessels boycotted Australian ports because they were dissatisfied with the level of southern bluefin tuna quota allocated to them (The Australian, 1995.)(p. 168).

The characteristics of the South Pacific tuna industry would seem to make ITQs even less likely to deliver stock conservation in the region. Given the highly migratory nature of the tuna stocks, regional TACs would need to be agreed between the many PICs. However, as was mentioned above, some island states are implacably opposed to the loss of sovereignty over their fish stocks that the setting of regional TACs implies. The high seas areas would also need to be subject to these TACs, requiring the compliance of the powerful distant water nations, as specified in the Implementing Agreement. The difficulties of enforcement and monitoring in the region are further exacerbated by the great distances and vast EEZs that need to be policed in the face of financial constraints, the multi-species nature of the fishery and the fact that most of the catch is landed outside the region (p.168).

Nor do political realities auger well for a system of quotas. Major incentives for PICs to maintain bilateral access arrangements with the fleets of the wealthy fishing nations are the considerable level of aid that may directly or indirectly be attached to fishing access. For example, the amount of Japanese aid in the Pacific in support of fishing access agreements is said to have averaged \$US20 million a year between 1982 and 1992 while, in comparison, Japanese fishing fees were \$US14.5 million in 1992 (Bergin and Michaelis, 1996, p.55)(p.168, p.169).

It was suggested above that rents will increase in the South Pacific tuna industry in the medium term as a result of global rises in the value of tuna. The foreign fleets will be motivated to maximise their share of the rents and will be reluctant to reduce fishing effort. The offer of side benefits will always be available to the distant water nations to be used as a tool to discourage the implementation of restrictive regional TACs by the PICs (p.169).

Given that criteria for the allocation of quotas are always contentious it can be expected that political action will be taken by nations perceived to have been disadvantaged. While an auction system for quota has the potential to be equitable and transparent (Waugh, 1987; Morgan, 1995) central organisation of the auction and heavy policing of quotas would nevertheless still be necessary. Arrangements that provide more secure fishing rights could lessen the

monitoring and enforcement costs of ITQs but these have not been developed (Townsend, 1995) (p.169).

Fiscal instruments

A challenge for PICs has been in devising mechanisms by which they can recoup some of the benefits of resource exploitation and some of the profits of companies. In this they have been frustrated by the widespread problem of transfer pricing

Tax arrangements and access to natural resources

In Pacific countries one of the greatest policy dilemmas is how to frame fiscal policy that will capture a share of the resource rents of exploiting companies without discouraging investment. Typically, the forest and oceanic resources of PICs are exploited by foreign companies. If Pigouvian and other types of taxes are perceived to be high by investors then investment will be curtailed. At the same time company taxation has often been disappointing in raising tax revenues because of transfer pricing.

Company tax

Companies are motivated to minimise their company tax burden. They often do this in developing countries through transfer pricing. For example a logging company may sell logs to a parent company at an agreed (discounted) price rather than the market price. The agreed price will reduce the reported revenue of the logging company for the purposes of income tax (and in this instance, export tax).

A fish canning company may pay its parent firm a management fee or a marketing fee. Inflating the cost of these services reduces the reported income of the canning company (Hunt, 1997c).

The overseas parent companies that receive inflated profits through transfer pricing are beyond the reach of the tax department of the island government, and making adjustments to company tax returns to counter the effects of transfer pricing may well be beyond the capacity of tax departments. transfer pricing is not limited to multinational firms. Domestic firms may adopt the practice of double invoicing. This practice is believed to occur in both fisheries and forestry sectors (World Bank, 1995). (See the case study of transfer pricing in the South Pacific below.)

A response to transfer pricing has been to raise revenue by levying direct *ad valorem* export taxes or turnover taxes in lieu of company taxes.

Export taxes

Export taxes are anathema to exporters mainly because they are linked to the value of exports rather than the profitability of the enterprise and in addition their avoidance is difficult. Moreover, the rate of export tax can be changed by the stroke of the pen and can be a major source of uncertainty for resource exploiting companies. However, they do present a direct means of internalising environmental costs through full cost pricing.

Goods and services taxes

Goods and services taxes (GSTs) are an indirect means of full cost pricing. Once again they are not popular with companies because it unavoidably loads costs. However, the GST has an advantage in that it is already in place and can be varied easily. Their costs of collection are, however, relatively high and they tend to be regressive in that consumers pay tax on the necessities of life.

There is a goods and services tax of 3% in the National Capital District of Papua New Guinea designed to raise revenue for governance of the NCD, for instance for the financing of waste collection and disposal services. The level of reduction of consumption depends on the elasticity of demand for the taxed goods.

Once discriminatory taxation is employed against some consumer goods on environmental grounds an extra unwelcome administrative burden is created. In contrast to goods and services taxes, the usual company taxes and income taxes are very indirect.

Because of the resistance to taxation measures by resource firms and the various disadvantages and advantages of the different fiscal measures, we present Table 2 showing the advantages of each of the taxes considered from the point of view of both governments and firms. In so doing, it contrasts fiscal instruments with respect to their certainty and their incidence. The table suggests that the application of a mixture of fiscal instruments would perhaps be in the best interests of PICs in maximising receipts while at the same time retaining flexibility to incorporate full cost pricing.

Table 2: IMPLICATIONS OF TAX POLICIES FOR GOVERNMENTS AND FOR FIRMS IN NATURAL RESOURCE SECTORS

TAX POLICY	IMPLICATIONS FOR GOVERNMENT	IMPLICATIONS FOR BUSINESS
<i>levy company and personal tax</i>	<p>POSITIVE tax related to profit</p> <p>NEGATIVE high costs of collection; uncertain level of collection; low level of collection due to avoidance through, for example, transfer pricing.</p>	<p>NEGATIVE reduces cash flow.</p> <p>POSITIVE tax proportional to profit; profit minimised through concessions and transfer pricing; tax minimised through tax concessions.</p>
<i>levy export tax</i>	<p>POSITIVE ease of collection; certainty of level of collection; vehicle for full cost pricing.</p> <p>NEGATIVE disincentive to exporters.</p>	<p>NEGATIVE unrelated to profit; uncertainty on tax levels. disincentive to expand exports.</p> <p>POSITIVE</p>
<i>levy goods and services tax</i>	<p>POSITIVE broader base; unrelated to profit; increases with greater business activity; vehicle for full cost pricing.</p> <p>NEGATIVE high cost of collection; regressive.</p>	<p>NEGATIVE unrelated to profit; increases with level of business activity; compliance costs.</p> <p>POSITIVE unrelated to export volumes or value.</p>

Source: Hunt (1997d).

Case Study: Transfer pricing in the South Pacific

A joint venture was established in the early 1970s to produce and export frozen fish, canned fish and fish meal. The company has operated under a series of joint venture arrangements with the government. However, the company failed to earn a consistent profit making an operating profit on just 8 occasions to 1993 and a small profit in 1994 and tax payments to the government partner have been rare. Losses were enormous, a heavy burden of debt together with inflated management fees and sales commissions, absorbed a significant proportion of revenue. For example, the effective rate of sale commission paid on exports to the U.K. was nearly double that paid on canned tuna entering that market from other sources (World Bank, 1995, Box 4.3 page 60).

Negative taxes (subsidies)

Production subsidies on production are dealt with under this heading because subsidies are negative taxes. Full cost pricing and the attainment of a social optimum requires the removal of production subsidies that increased production and environmental damage associated with that production. There follows a case study of subsidisation of sugar production in Fiji.

Case Study: Sugar price subsidisation and land degradation in Fiji

Land degradation due to sugar cane growing on steep slopes is one of the major environmental concerns in Fiji and a focus of action in the National Environmental Strategy of Fiji (Fiji Government and IUCN, 1993; Drysdale, 1994; Seru, 1993).

A subsidy is paid to sugar growers in Fiji by the European Union. This boosts the price of 45% of sugar output by 2.5 to 3 times the world price. However, the price to the grower, and the price signal, is an average of the subsidised and the free market price which is around 18c per pound, compared to the world market price of around 12c per pound.

The price to the grower 'at the margin' should be 12c, not 18c. The distortion caused by price averaging encourages sugar producers to crop marginal land which would be unprofitable at the world price. It also prevents growers from diversifying into other niche markets. The expansion of area under sugar stimulated by subsidised prices has been accompanied by a decline in the amount of sugar extracted per tonne of cane. But price signals to growers that favoured quality sugar cane production and resulted in processing efficiency are also lacking.

Steep hillsides are being brought into production with consequent severe soil erosion. The need for soil conservation works is ignored and the agricultural potential of the marginal land is destroyed. The long-term costs are a loss of land productivity and river and inshore water sedimentation leading to reduced coral reef productivity, but

there is also a significant short-term cost in the dredging of rivers to keep them navigable and an increased incidence of flooding.

The effect of price distortion is exacerbated by insecure property rights in the Fiji agricultural sector - see Property Rights section.

Above there was a discussion of the pros and cons of various tax measures open to governments. While is not popular with exporters because it is not related to their performance or profitability it can be effective in raising funds to cover government costs. In the case of the crocodile export industry of Papua New Guinea the government attempts to recoup its heavy management costs through export taxes.

Case study: Taxes in the crocodile skin export industry of Papua New Guinea

Export income earned form the export of crocodile skins mainly to Japan is between K3 and K5 million annually.

To comply with its obligations under the CITES, and its own directives concerning sustainable resource use, a costly control and monitoring operation is mounted by the Department of Conservation. The Crocodile Monitoring Unit (CMU) cost K211,000 in 1994 and K431,000 in 1995.

Charges for entry into the industry to farm crocodiles, to trade, to buy, and to export skins, raised some K8,000 in 1994. More important were taxes on exports that raised K170,000, one third of which was captured by the DEC as a "management levy" the balance, an export tax under the Customs Act, returning to consolidated revenue.

It is argued by DEC that crocodile farmers, hunters and exporters should bear the full cost of the government's programme because they are the direct beneficiaries. It is recommended that a single export tax be levied (by amalgamation of the "management levy" and the export tax) and that this be increased by 12% per annum until full cost recovery is achieved. It is, however, recognised that the export tax will be unpopular with industry and may put some operators out of business and reduce total export income.

The other alternative proposed is the establishment of a trust fund so that funds generated by the industry through taxes can be earmarked for expenditure in the industry. It is argued that the existence of the fund would not only make higher taxes acceptable to the industry, knowing their taxes were being spent on the industry rather than disappearing into consolidated revenue, but it would also encourage donors to invest in sustainable crocodile harvesting and research.

The full cost recovery in this instance appears to be an appropriate policy given that external benefits are few. However, it could be argued that the maintenance of wild stocks of crocodiles is a public as well as a privet benefit and that the 'public' should contribute to conservation costs. While the existence of a trust fund would encourage donor contributions to conservation it should be noted (see Trust Funds section) that small trust funds are expensive to administer and a preferable arrangement may be for

the crocodile trust fund to be one part of a much larger trust fund set up to finance biodiversity conservation in Papua New Guinea in general.

In this discourse we deliberately ignore direct taxes on pollution as being inapplicable in the context of the Pacific islands for reasons of administrative difficulty, as discussed above. However, there is one direct pollution operating which is in the form of a tax on litter.

Case study: The On-the-spot Littering Fine of Port Moresby

A direct K5 on-the-spot littering fine is imposed by City Rangers in Port Moresby. The City Rangers are casual workers employed by the National Capital Development Commission. According to anecdotal evidence collected by the author the tax has been effective in tidying the streets of the City.

The fine is placed in the Fiscal category in Table 1 because it may be looked upon as a pollution tax for using the limited solid waste assimilative capacity of the city streets. Its contribution to the city's revenue is minor and its main justifications are that its imposition changes behaviour of litterers and its collection generates employment.

Charge systems

In the differentiation between charges and environmental taxes we follow Panayotou (1995) who defines charges as payments for use of resources infrastructure, and services, that are akin to market prices but are the prices for public goods or privately-provided goods. Fiscal instruments or taxes are, in contrast, a means of raising revenue or changing behaviour.

A common application of this instrument in the South Pacific is primarily with the objective of sharing in the benefits gained by private exploiters of the common tuna resources. For example, as detailed in Table 1, access fees are charges on mainly foreign tuna vessels according to expected fish catch and value, while licence fees are charged all fishing vessels, domestic and foreign. Access fees as an economic instrument in tuna resource exploitation are examined in the next section.

Access charges are also made for public goods such as national parks and the Port Moresby Botanical Gardens.

In the case of piped water, progressive charges are designed to reduce consumption as well as to raise revenue to cover operating and capital costs of both water and sewage systems. In the case of solid waste there is often an indirect flat charge made on households and businesses for collection and disposal.

Case Study: Charges policy in oceanic fisheries

The typical method by which PICs derive access fees from foreign fishing companies, exploiting the tuna resources of the EEZs of PICs, is through bilateral negotiations. A charge or fee for access is negotiated by each individual country with each distant water fishing fleet. The access fee is a method of extracting rents from fishing fleets that has

practical advantages over a royalty (Hunt, 1997c). The access fees for foreign fishing vessels is around 5% of the value of canning tuna.

What is in contention here is not the access fee instrument itself but the negotiation method by which access fees are raised. The method of negotiation has implications for both level of access fee and the management of the common tuna stocks. A cooperative approach to the extraction of fees has been advocated, rather than a bilateral approach, on the grounds that cooperation among PICs would yield higher fees through greater bargaining power and at the same time enable the adoption of regional controls on fishing effort (Hunt, 1997a; 1997c).

However, given the resistance, among some PICs, to a cooperative or multilateral approach to access fee negotiation, it is necessary to do more than simply advocate it as a policy. Hence, the advantages and disadvantages are systematised in order to throw light on the reasons for dissent by some PICs and by the opposing distant water fishing nations. Table 3 attempts to capture the negative and positive aspects of bilateral, as against multilateral, arrangements for the fixing of access from the point of view of both Pacific island governments and distant water fleets.

Table 3: ACCESS CHARGES POLICY IN THE SOUTH PACIFIC TUNA FISHERY

ACCESS CHARGES POLICY	IMPLICATIONS FOR PACIFIC ISLAND GOVERNMENT	IMPLICATIONS FOR DISTANT WATER FISHING FLEETS
<i>bilateral arrangement</i>	<p>POSITIVE</p> <p>facilitates aid flow associated with tuna access; facilitates joint ventures; sovereignty over EEZ maintained; certainty of access fees</p> <p>NEGATIVE</p> <p>precludes regional approach;</p>	<p>NEGATIVE</p> <p>high negotiating costs.</p> <p>POSITIVE</p> <p>high leverage in negotiations; access arrangements confidential; no constraint on catch.</p>
<i>multilateral arrangement</i>	<p>POSITIVE</p> <p>facilitates regional management plan for tuna; facilitates the control of tuna fishing effort in the region;</p> <p>NEGATIVE</p> <p>loss of aid attached to bilateral access arrangements; loss of sovereignty over EEZ; less certainty on fees.</p>	<p>NEGATIVE</p> <p>relative negotiating power of PICs increased; regional access uncertain; access arrangements transparent; possible restraints on regional tuna catch.</p> <p>POSITIVE</p> <p>lower negotiating costs; regional access guaranteed.</p>

Source: Hunt (1997d).

Case Study: Charges and the Tarawa sewage system, Kiribati

The consequences of the installation of infrastructure that requires high maintenance costs in a situation where there is an acute shortage of maintenance funds is illustrated in this example. The denial of responsibility for maintenance of the sewage system by the two institutions could be seen as a direct result of underfunding, itself a symptom of failure to charge for services.

As with the water supply system, the sewerage system is under increasing strain and is already operating above capacity. The system is in a precarious position and deteriorating rapidly with the three sea water pumping stations and their network of smaller pumps requiring continual maintenance and repair. Mainline blockages between pumping stations are common and the PUB [Public Utilities Board] have little or no maintenance tools for repair. The communal toilet blocks are in a state of disrepair having been vandalised or just let run down with salt water pipe leakages, structures collapsing and an estimated 70% of cisterns broken. Responsibility for the maintenance of the toilets in public areas is disputed, with neither the TUC or BTC prepared to accept local responsibility. There is no public charge for sewerage use and the Government provides only a small subsidy to the PUB for operating and maintenance costs - in 1995 this was \$60,000 (Kiribati Ministry of Home Affairs and Rural Development, 1995, p. 16).

Case Study: Charges for piped water in Tarawa, Kiribati

A 'user pays' policy, as advocated by McMaster and Pollard (1993), with respect to water supply would, in theory, enable the recoupage of capital and operation costs of the universal provision of reticulated and tank water. But given that it appears that one of the main reasons for people resorting to wells is the costs of reticulated water, full cost recovery through pro rata charges, such as applies at present, would deter households from closing their now-illegal wells (Hunt, 1996, p. 227).

A preferable recoupage policy may be a two-part tariff in the form of an annual rate charged to households to cover capital costs, accompanied by a modest pro rata charge for water delivered. Detailed water policies will vary depending on particular endowments of atolls, rainfall, and actual and projected population density and distribution (p. 227).

The box below provides a more comprehensive analysis of water supply and charges for water on atolls.

Box: Fresh Water pricing on Atolls

A characteristic of many atolls, including those which make up Tuvalu and Kiribati, is the presence of a fresh water lens, just below ground level, on the larger islands. The lenses are a

renewable resource in that they are recharged by rainfall. Given the absence of rivers or fresh water lakes, the only other source of fresh water is collected rainwater.

As the density of the human population above a lens increases, the supply of potable water can be jeopardised both by drawing down water at a rate faster than replenishment, and by pollution via the very permeable overlying soils. There are severe penalties for pollution of the water supply but they are not enforced (Gangaiya, 1994).

The majority of households in Tuvalu, where rainfall is relatively higher and more reliable, have been fitted with rainwater tanks, metal roofing, plastic guttering and downpipes under a UNDP project. Such substitution of polluted ground-water supplies is one of the keys to the prevention of water-borne disease and other health threats posed by lens contamination by bacteria, viruses, and dissolved nitrogen.

The fresh water lenses at Betio and Bairiki on South Tarawa presently provide an extraction rate of 1,250 cubic metres per day to some 3,500 connections (out of about 4,000 households in total) but the supply is only available for 1 to 2 hours for three periods of the day (Kiribati Ministry of Home Affairs and Rural Development, 1995:14). The main source of water on South Tarawa for half of the households is wells that directly tap the lenses, while rainwater tanks are a main source for a third of households.

The following illustrates the unsustainability of existing exploitation of the fresh water lenses:

- a) the supply of reticulated water from lenses in Buota and Teoraereke was discontinued due to their pollution—they are subject to uncontrolled use by squatters; and
- b) drawdown on lenses at Betio and Bairiki of 1,250 m³ per day exceeds the estimated sustainable yield of 1,000 cubic metres per day (Kiribati Ministry of Home Affairs and Rural Development, 1995:15.), salt water intrusion is thus a possibility.

The Kiribati Public Utilities Board is responsible for the operation and management of the reticulated water supply. While there is a charge of \$1.00 per m³, orderly supply of reticulated water and cost recovery is hampered by a failure to read meters, tampering with meters and illegal connections. Moreover, leakages reduce supply by between 10 and 20 per cent (Kiribati, Ministry of Home Affairs and Rural Development, 1995).

The supply of fresh water to the increasing population of South Tarawa, and to islands with growing populations, such as Kirimitati, is a major development issue. While untapped lenses at Tenaitku Bight and on Abatao and Tabiteuca can be utilised, lens supply is limited. It appears as though heavier supplementation by collected rainwater will eventually be necessary. However, the collection of rainwater will probably be an expensive option on South Tarawa given the atoll's relatively low and erratic rainfall. (continued)

While the cost recovery of reticulated water supply is in theory an advisable policy through *pro rata* charges, the charges should not be such as to encourage the continued use of 'free' well water. Gangaiya (1994) suggests that the high frequency of well use is a function of the charge on reticulated water. If sustainable potable water supply to the whole population is to be the goal, then open access to lenses must be phased out, drawdowns from safe lenses must be managed and a plan for rainwater collection developed. Individual strategies for the development of sustainable water supplies will be required on the outer islands of Kiribati; strategies will vary depending on island size, rainfall, and on actual and projected population density and distribution.

Financial instruments

Financial instruments are currently being employed to effect environmental conservation. They include trust funds, international and bilateral environment funds, debt for nature swaps and carbon offset arrangements.¹¹ These instruments appear to have much to offer if they can:

- a) reconcile the public interest in conservation with private interests through financial compensation for the opportunity costs of forest and biodiversity conservation,
- b) allow the international community to bear a substantial part of the opportunity costs of logging and at the same time redistribute income from the industrialised countries to developing countries,
- c) allow the establishment of protected areas in the face of the fact that sustainable forestry appears to be an impossibility in practice,
- d) enable financial compensation to be channelled directly to the participating landowners (Hunt, 1992).

UNCED, and the entry into force of the Convention on Biodiversity in December 1993 manifested international concern for the loss of biodiversity. One result has been an increase in financial flows through instruments such as the multilateral Global Environmental Facility and bilateral trust funds.

In Papua New Guinea financial instruments have also been developed whereby conservation is effected through transfer of funds to local landowners who are affected by resource development projects. NGOs such as the WWF act as facilitating agents for the financial transfers.

A review of three financial instruments that have been applied in the region follows: a GEF project in Papua New Guinea, a trust fund development in Vanuatu and a carbon offset scheme in Papua New Guinea.

Trust Funds

There are already several trust funds operating in the South Pacific for the purpose of managing capital funds generated by resource exploitation (for example in the case of Nauru) or that facilitate the management of funds contributed to from various sources including aid (in the case of Kiribati and Tuvalu) (Duncan, Larmour and Hunt, 1996). These PICs possess limited domestic development opportunities but can achieve an assured return from offshore investments. While environmental conservation is not the objective of these perpetual funds they nevertheless provide (in the case of Kiribati and Tuvalu) useful models for the structure and management of conservation trust funds in the region.

In these atoll states the building of capacity to improve environmental management practices and to carry out conservation programmes is dependent on an increase in government revenues (Hunt, 1996a). Aid donors are likely to continue to prefer to fund infrastructure rather than provide budgetary support. However, government infrastructure requires maintenance, and increased government capacity often requires growth in the appropriation for public servants' salaries. The trust funds of Kiribati and Tuvalu have been generating increasing revenues available for governments and have therefore been seen as suitable mechanisms for financing the increase in recurrent expenditure associated with environmental programmes (Duncan Larmour and Hunt, 1996; Hunt, 1996a)).

¹¹ Carbon offset arrangements are means by which power utilities or companies offset carbon dioxide production against conservation of carbon in biomass. Such projects often involve natural forest conservation that have implications for biodiversity conservation.

Trust funds for biodiversity conservation

A trust fund may be in the form of a sinking fund designed to generate a stream of income from interest and capital for a set period, or to generate a stream of income indefinitely (a perpetual fund). The latter is the more appropriate funding instrument for long-term conservation projects and is particularly appropriate for facilitating regular payments under long term lease arrangements. Perpetual funds are also suitable to meet the long term funding required by integrated regional development plans that may be associated with conservation projects. Fund capital may be sourced bilaterally, multilaterally or domestically, or from a combination of sources.

Important structural and management criteria for their successful operation of trust funds include:

- a) freedom from political influence,
- b) subject to external audits,
- c) subject to evaluation of performance,
- d) transparency of audits and reviews,
- e) management by competent agents,
- f) governance should be participatory and reflect the stakeholder interest (Lovei, 1995, cited by Tacconi, 1997a, p. 7).

Issues of importance in the management of funds are:

- a) the inflation rate, which can reduce the real value of the capital and of interest,
- b) the exchange rate, which can influence the value of capital injections by donors,
- c) and the tax status of the fund.

The latter two issues determine the location of the fund.

Economies of scale are present because of the high administrative costs of trust funds. Relatively small funds may be more viable under an umbrella administration that spreads overheads but at the same time allows the stakeholders to be intimately involved in the decision-making with the respect to trust fund management.

Governments are unhappy about the diversion of government revenues to trust funds and away from consolidated revenue. Their argument is that efficiency and equity considerations dictate that governments should be free to allocate revenues to areas that display the highest marginal social benefits.

A counter argument is that spending by governments on environmental protection is often well below the social optimum because the linkage between health of the population and environmental quality is not made, or because governments are not interested in funding conservation which has benefits in the long term rather than in the short term.¹²

Perhaps the most important contribution of trust funds is in the area of biodiversity conservation where investment by private donors, particularly from rich countries, is secure, and the proceeds are

¹² A short but engaging discussion of the pros and cons of earmarking can be found in Serageldin and Martin-Brown (1995, p.28, p.29).

directed at specific objectives and at the same time available to local property right holders who need outside support for their management and conservation efforts.

Case study: The Vanuatu Biodiversity Conservation Trust Fund

This fund, administered by the Pacific International Trust Company of Vanuatu, is designed to generate lease payments to landowners of the Erromango Kauri Protected Area who have foregone their opportunity to log the area. The sinking fund arrangement, begun in 1995, has a five year life but may be further extended by the landowners through a perpetual fund under a 75 year lease.

A prior assessment of the area by Tacconi (Tacconi and Bennett, 1997) calculated the lease payment which was the annuity equivalent of the revenue foregone from logging.

Noteworthy features of the arrangement are:

- a) the availability of an interested donor (in this case the European Union),
- b) the relative simplicity of negotiations between the stakeholders (compared with, for example, Papua New Guinea where there would have been many more traditional owners of an area of 3,000 hectares),¹³
- c) the existence of a local trust company,
- d) the work of Tacconi in facilitating negotiations, concluding in a trust deed. Of importance is the retention of the right of the landowners to obtain subsistence form or to develop other projects in the protected area.

It remains to be seen whether tensions that have arisen between local villagers and the landowners will be a serious threat to the viability of the scheme.¹⁴

The Global Environmental Facility

The Global Environment Facility (GEF) is a financial mechanism that provides grant and concessional funds to augment projects and activities in developing countries that aim to protect the global environment. Global problems addressed are climate change, biodiversity loss, international waters pollution and ozone layer depletion. In 1994, \$US 2 billion was pledged by June 1997, by 31 countries, to the GEF trust fund in the World Bank.

¹³ Tacconi and Bennett (1994) suggest that there is a fundamental difference between the pattern of land tenure between Vanuatu, where land is held by individuals or families, and Papua new Guinea and the Solomon Islands where land is held by clans. Nevertheless, the reduction in the population of Erromango due to diseases introduced by white sandalwood traders () appears to explain the large individual holdings

¹⁴ Disputes have arisen between the landowners and the adjacent villagers. The villagers derive no financial benefit from the lease and resent restrictions placed on their access to the leased area (personal observations of the author).

Implementation is through the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP) which are charged with identifying projects, providing associated technical and scientific assistance and capacity-building.

The South Pacific had receive substantial assistance from the facility up to March 1996. The bulk of the assistance (\$US15 million) was for biodiversity conservation in the South Pacific and of this, \$US10 was allocated to Papua New Guinea (AusAID, 1996, p. 6).¹⁵

The paper turns to an analysis the Lak Pilot Integrated Conservation and Development (ICAD) project in Papua New Guinea that received GEF funding.

Case Study: The Lak Conservation Area ICAD Project

The allocation of \$US 5 million by the GEF in support of a biodiversity conservation programme implemented by the Department of Environment and Conservation (DEC) jointly with UNDP and funded by GEF. As well as institutional strengthening, the project was charged with identifying and establishing two Integrated Conservation and Development (ICAD) projects the first of which was at Lak on the southern tip of New Ireland. The ICAD was to conserve relatively large areas (at least 80,000 hectares) in cooperation with resource owners. The basis of the compact between landowners and the institutions is that socio-economic development benefits are delivered on the condition that the conservation programme is implemented (UNDP, 1993, p.4).

The key criteria and components for the establishment of ICAD areas are:

1. A large area of land or marine coastal area should be capable of being zoned for conservation and development objectives.
2. A negotiated package of social and economic benefits for the inhabitants is linked to the conservation programme.
3. Social organisations are developed in the local communities to enable collective decision-making and management.
4. Institutional support is maintained to achieve 2. and 3 (DEC/UNDP, 1995, p. 8).

Southern New Ireland was assigned a very high priority for protection in 1992 (Alcorn and Beehler, 1993, cited by McCallum and Sekhran, 1996). The Lak community, numbered some 2130 in 1990, comprised of 67 clans in small coastal villages.

¹⁵ Commitments made to the South Pacific from the GEF include:

- a) Papua New Guinea \$US 15 million for biodiversity conservation (and AusAID is providing cofinancing of \$A5 million from its commitment of \$A30 million to the GEF pilot phase);
- b) Papua New Guinea \$US 250,000 for community based projects;
- c) PICs \$US2.5 to facilitate reporting under the framework Convention on Climate Change;
- d) PICs \$US2 to implement the Climate Change Convention.
- e) Other initiatives in the planning stage are covered in AusAID (1996).

In 1991 the resource owners through their local company, the Metlak Development Corporation (MDC), had obtained a timber permit from the National Forestry Authority to remove from the Lak Timber Rights Purchase Area (80,500 ha) up to 100,000m³ of timber per annum for 10 years. Logging was undertaken by Niugini Lumber merchants, a subsidiary of Rimbuan Hijau, on behalf of MDC. However, in order to implement the ICAD project the landowners agreed to terminate their logging agreement at a joint meeting with UNDP and the Government of Papua New Guinea in 1994.

According to Macallum and Sekhran (1996) the landowners expected substantial 'development' or material benefits to flow from the ICAD project. However, there were few development opportunities in the area. In fact only one project, sustainable forestry, was found to be feasible and an internationally-certified low impact timber harvesting, processing and marketing enterprise, owned by the landowners and supported with technical assistance by UNDP, was begun.

Economic analysis

An economic analysis of the sustainable forestry project (DEC, 1995, Annex Table 10, p. 15) shows that an internal rate of return of 34%, an NPV (8% interest and a period of 16 years) of K2.8million, and a net undiscounted cash benefit to the community, after loan servicing, of K73,000 in year 1, K158,000 in year 2, rising to K234,000 in years 3, 4 and 5. And, apart from a negative income in year 9, the project promised to yield net benefits for many years. The project was to have cost up to K1.9 million of which K450,000 was to be sourced from GEF and the balance from other donors or commercial sources; a carbon offset investor (see section below) was sought to take advantage of the reduction in CO₂ emissions resulting from the project.

By contrast, the cash income from logging by the landowners over each of the first 5 years (it was estimated that the timber resource would have been exhausted after 7 years) has been estimated to be about K1 m annually (royalty share 0.33m and landowner company share 0.59m.) (Income foregone by the national government was estimated to be K5 m and net profit to the logging company after harvest costs and taxes, royalties and the social infrastructure levy, some K5 million.) Landowner income represents 6% of the gross of K16.7 million.¹⁶

The landowners were thus to be faced with a substantial short term opportunity cost if they had chosen to forego logging in favour of sustainable forestry.

In the UNDP/GEF budget for the ICAD sustainable forestry project the cost of international experts far exceeded the benefits to be received by the landowners, rising from \$US 217,000 in the first year to \$US 697,000 in the third year and falling to \$US 58,000 in the fifth, and the undiscounted total of GEF funds to be spent on all experts

¹⁶ Confirmation of the proportion of income received by landowners and of net profits of loggers is provided by Sekhran (1996, p.30) who suggested that 6.8% of gross was captured by the landowners while the logging company netted 29% of gross.

over the five years was \$US 2.8 million. The undiscounted total funds to be committed to the project was \$US 5 million (UNDP, 1993). It should be noted that no funds were allocated to compensate the landowners for income foregone. Moreover, DEC warned that the local communities were concerned that the delay between the cessation of industrial logging and the onset of project interventions would mean financial hardship (DEC, 1995).

The failure of the community to implement their resolutions to terminate industrial logging operations led to the forest resource being diminished to an amount below the required by the ICAD project. This, together with tensions among landowners, and between landowners who wanted logging to continue and the project sponsors, prompted the DEC and UNDP to withdraw their support from the project in August 1996 (McCallum and Sekhran, 1996). According to the National Forestry Authority (NFA, 1996, cited by McCallum and Sekhran, 1996, p. 8) the accessible Lak forest resource will be exhausted in 1997. Meanwhile the social benefits attributed to logging operations such as community buildings and roads and bridges are in disrepair, as are the gardens, the local people having switched to imported produce ((McCallum and Sekhran, 1996).

Commentary

It is difficult to avoid the conclusion that the sponsors overestimated the benefits that landowners would attach to sustainable forestry. If a landowner perspective rather than a sponsor perspective is taken of the choice between sustainable forestry and logging then the decision to continue logging would seem to be a rational one. From the landowner point of view future incomes from sustainable forestry would be more uncertain than those from logging given the increase in the number of variables associated with such a project, heavily dependent as it was on international experts. And despite the landowner awareness campaigns by project staff it is unlikely that the landowners would have placed a value on biodiversity anywhere near that placed on it by the international sponsors.

We come back to the proposition that if conservation proposals entail large opportunity costs for communities, then communities may need to be fully compensated. There appear to be an increasing number of cases where communities themselves decide to conserve their resources rather than exploit them and this is to be encouraged (Tacconi and Bennett, 1997). However, in the case of Lak there was already a lucrative logging project in full swing when the sustainable forestry project was promulgated; hence the opportunity costs would have been sizeable and immediate to the landowners.

Case study: The Kikori River Basin ICAD project

Begun in 1994, the World Wildlife Fund (WWF) implements the project in partnership with the Kutubu joint venture partners in the Kutubu oilfield development. The Kikori ICAD area of 2.2 million hectares, straddling Gulf and Southern Highlands Provinces and containing wetland and montane ecosystems, is by far the largest of the six in PNG and has a population of 15,000, made up of 380 landowning clans and 7 language

groups. A geneological study was begun in 1991 and land tenure documentation continues. While hunting pressure on wildlife is low, the major threats to biodiversity are logging, oil fields and inward migration (see Appendix Table 1-forthcoming).

Of special interest is the initiative to identify land boundaries and ownership necessary for incorporation of landowner groups through Lands Department certification.

Five Incorporated Landowner Groups (IGLs) have so far been certified enabling the distribution of benefits. (The financial arrangements operating under the auspices of the Kutibu joint venture are yet to be determined for this study.)

Co-financing

An example of the joint funding of a conservation initiative by many donors follows:

Case study: Co-financing of marine conservation in the Solomon Islands

A case where the conservation initiative is co-financed by a mixture of external sources is the Arnavon Marine Conservation Area in the Solomons.

The uninhabited Arnavon Islands are one of the most important rookeries in the Western Pacific for the endangered Hawksbill turtle. There is also a high diversity in terrestrial fauna for a small island group, with 41 species of birds (8 endemic to the area). The island affords a key nesting ground for the Sanford's Sea Eagle, Brahmay Kite, ospreys, megapodes, two species of pigeon and many species of sea birds. In addition there are six species of bats and at least seven species of terrestrial reptiles.

The three villages situated on Choiseul and Isabel that claimed to be traditional owners were subjecting the marine resources of the Arnavons to considerable pressure. The Nature Conservancy along with Government Departments of the Solomons have established a participatory management regime based on a management plan under Isabel Province legislation. A management committee represents the communities and hires conservation officers from each village who reside at the Arnavons field station. The project's external benefits of extending conservation initiatives, training Conservation Officers and cooperation between villages are important.

The economic pressures that had led to the overexploitation of the marine resources of the island remain. A more recent phase of the project has been to provide compensatory development for the villages in the form of financially viable fisheries enterprises that serve the Honiara market.

While the conservation project is very much in the hands of the villagers, external finance is still required for the purposes of organising meetings of the Management Committee, paying the Conservation Officers, meeting costs of supplies of fuel and equipment and of monitoring and research.

The possibilities for revenue generation from other sources such as tourism is being assessed but meanwhile annual running costs of some \$US 10,000 is contributed by a host of donors¹⁷ at the behest of the Nature Conservancy and Solomons Government. Also being investigated is the feasibility of the establishment of a trust fund of some \$US 200,000.¹⁸

The project once more illustrates the need to compensate communities for undertaking projects that are in the public interest. As in the case of the Lak sustainable forestry project, the benefits of conservation at the Arnavons are uncertain and are very much in the future, and as such they do little to meet the immediate requirements of the local people for income.

Carbon offsets

‘Carbon offsets’ are financial instruments by which generators of greenhouse gases can offset their increase in emissions by purchasing carbon in biomass. The increase in carbon may be in growing plantations or it may be sequestered in natural forest that would otherwise have been cleared or logged.

While there is no binding international agreement on greenhouse gas reductions, industrialised nations are nevertheless encouraging private firms to achieve sustainability through a policy of carbon offsets. Private firms, such as power utilities, seek carbon at the lowest possible price. The cheapest carbon is found in developing countries. Developing countries stand to reap external benefits from the flow of funds for the establishment of plantations or for forest conservation. Conservationists are particularly interested in the biodiversity conservation benefits of the carbon offset instruments.¹⁹

Case Study: Carbon offsets in Papua New Guinea

In Papua New Guinea the Lak Integrated Conservation and Development Project (ICAD), was funded mainly by the Global Environment Facility and implemented jointly by the Department of Environment and Conservation of PNG and the United Nations Development Programme. The ICAD project and the Nature Conservancy entered into a partnership with COPEC, a Los Angeles-based carbon offset consultancy and brokerage firm, to seek investors in greenhouse gas mitigation at Lak. Subsequently a formal submission was prepared under the Activities Implemented Jointly (AIJ) scheme (under which cooperative projects between parties in two countries are

¹⁷ The South Pacific Regional Environment Programme, The Nature Conservancy, the Government of Japan, Jusco Corporation, the Australian Centre for International Agricultural Research, ICLARM, USAID, The MacArthur Foundation and the Ford Foundation.

¹⁸ Peter Thomas, The Nature Conservancy, Auckland, personal communication.

¹⁹ The introduction of reduced impact logging that reduces the greenhouse gas emissions compared with conventional logging (and conserves soils and biodiversity) qualifies as a carbon offset policy.

encouraged, monitored and certified and submitted to the United States Initiative on Joint Implementation (USJI) in July, 1995.²⁰

The USJI responded that the monitoring plan in the submission was an area of concern. Nevertheless, in other respects the proposal was favourably received and may have eventually received approval as an AIJ initiative. However, before this could eventuate the overall project was terminated because of insurmountable problems concerning, principally, the lack of commitment of landowners to conservation and development initiatives. But doubt that the project would ever have been certified is raised by the comment “the proponents recognised it was unlikely that the on-the-ground difficulties with the project could be adequately resolved” (Stuart and Sekhran, 1997, p. 44).

In hindsight it is clear that the Lak project was deficient in several respects in addition to the fundamental flaw of lacking community support. For example, complicated land ownership patterns increased transaction costs. These two deficiencies increased the risk that destructive commercial logging would have been resumed in the conservation area. This lack of security, together with the high costs of comprehensively monitoring the project, would have reduced the attractiveness of the Lak project to investors, who have no reason other than commercial ones to invest in carbon offsets in Papua New Guinea.

Customary land tenure adds a dimension to forest conservation that must be fully recognised and understood by the international agencies involved if projects are to be successful. The failure of lack suggest that alternative models of forest conservation based on manifest community support are more likely to succeed. In Vanuatu two main models of conservation were explored under an ACIAR project. These were trust funds whereby landowners leased their forested land to the government in exchange for an annual lease funded from a trust set up initially by international donors. The second type of landowner-initiated conservation schemes is less dependent on financial transfers to landowners to secure conservation. There is presently insufficient space to detail the models and financial instruments explored in the ACIAR Vanuatu Forest Conservation Project (Tacconi and Bennett, 1996) but the authors suggest that such models have much to offer in other Melanesian countries.

Case study: Self financing - The Wiawi Conservation Area

A conservation initiative by landowners on the west coast of the island of Malekula in Vanuatu is reported by Tacconi (1995a). (See also the Case Study: Strengthening of customary marine tenure in Vanuatu.)

²⁰ While it should be noted that no formal crediting of carbon offsets occurs under AIJ it is still a useful strategy for companies in complying with domestic requirements to mitigate greenhouse emissions.

The owners decided to protect a designated area of forest. In this area there would be no gardening, logging of any form, lighting of fires or earthworks. Hunting is permitted but only with permission of the landowners.

On the 8 km length of foreshore area the landowners decided to enforce fishing regulations prohibiting the collection of turtle eggs and to protect nesting turtles. Fish, trochus and other marine resources are permitted to be collected only with the approval of the landowners.

The conservation initiative was not conditional on the receipt of funds to compensate for the opportunity costs of conservation. The landowners perceived that the benefits of conservation would be greater than the internalised costs.

Differential pricing

Included in this section on financial instruments is the differential pricing of product with the aim of conserving a resource. The pricing mechanism can be used as a disincentive to catch undersized fish and other undersized marine resources, such as trochus and greensnail. In the case study below a fish marketing centre in Papua New Guinea discourages the taking of undersized specimens by setting the price of undersized fish and other marine products to zero.

Case Study: The pricing of marine products and resource conservation, Papua New Guinea

There are two communities involved in a fish marketing and supply development on Siassi Island, Papua New Guinea, a landowner group which has formed a company to organise logging and investment of the proceeds of logging, and a group of island fisherfolk that catches and supplies fish to the fish marketing centre set up by the landowners. The project was initiated by the landowner company to contribute to meeting its need for a long term source of cash income. The landowner company also recognised that a fishing enterprise would allow adjacent small island communities, whose natural resources are mainly marine resources, to reap an indirect cash benefit from the exploitation of Siassi forest resources. At the same time the artisanal fishers were seeking market outlets for fish catches, in excess of subsistence needs, and for bêche-de-mer and trochus. Coincidental was the appointment of a District Programme Manager Fisheries (DPMF) to the Siassi district who disseminates the information required for fish processing and marketing. The project was initiated, and is operating, without any direct financial assistance from provincial or national governments or aid donors. (In this respect the project is in contrast to the many fisheries development projects in the South Pacific that have been initiated from outside and have relied heavily on aid and expatriate expertise.)

Basic fish conservation measures are in place that reduce the effects of fishing on stocks (such as minimum fish size and gill net specifications.²¹ The minimum fish size

²¹ Under the Fisheries Act, Government Papua New Guinea (1995), licensing guidelines specify methods of fishing and types and quantities of equipment that may be used (Section 4.1 p.19) and

regulations are complemented by a nonpayment policy on undersized fish presented for sale at DPMF. Prices are set to zero for undersized bêche-de-mer and trochus as well as to scale fish.

Liability systems

Making polluters or damagers liable for the damage they cause *ex post* is an incentive present in common law countries such as Papua New Guinea. The problems of costs of enforcement through the courts and the proof of damage are issues that tend to be ignored by advocates.

Nevertheless, there are distinct advantages in this approach where information on which to base *ex ante* Pigouvian-type arrangements is scarce, for example in cases where the prospective damages of a mines cannot be estimated. (Where damages can be estimated with some degree of certainty, then performance bonds can be raised against the liability.)

In Papua New Guinea the unstable nature of the terrain makes tailing dams associated with mines very expensive. Consequently mines have been allowed to discharge wastes into rivers or the ocean. However, the *ex post* costs of discharges to downstream landowners became apparent in the case of Ok Tedi. In this case the landowners were able to prove the connection between the damage and the mine operations, and value the damage.

Such compensation claims have no doubt forced mining companies to take some action to mitigate downstream damage. However, as far as is known, no tailing dams have been constructed for major mines in Papua New Guinea.

The difficulties of hiring legal advice and the making a case against transnational companies should not be underestimated. Another disadvantages of the liability system is its encouragement of compensation-seeking behaviour and consequential stultifying effects on development. Moreover, environmental damage may be very great and may be irreversible. No amount of compensation may suffice to reimburse future generations

Bonds and deposit refund systems

Performance Bonds

In the case of performance bonds there is a charge on the potential polluter or environmental damager at the outset at the commencement of a project which is calculated to be equal to the present value of the cost of clean-up. The potential injurer may be allowed to transfer the liability to pay the net tax/deposit if the conditions for a subsidy/refund are not met, to a third party such as a bank or insurance company which may attract a premium.

may, by Gazetted notice, prohibit the taking of fish less than a specified size (Section 52, p. 25).
“Fish” in the Act is any water-dwelling aquatic or marine animal or plant (p. 3).

Common (1995) notes that the advantage claimed for the instrument are in terms of the incentives it creates for the firm to undertake research to investigate environmental impact and means to reduce it. The potential loss of the bond by the potential injurer is an incentive for internalisation of social costs. The smaller the damage the greater the proportion of the bond refunded. Moreover, the burden of proof on the extent of damage at the completion of the project is with the developer who must satisfy the authorities that damage costs are minimal in order to retrieve the deposit.

Raising a performance bonds reduces a firm's liquidity. Given that the extent of environmental damage is subject to great uncertainty, insurance companies find difficulty in indemnifying firms against environmental claims (Shogren, Herriges and Govidasamy, 1993).

Other potential problems of this method particularly in countries such as Papua New Guinea, where subsistence is still the rule rather than the exception, is the difficulty of costing non-market effects of environmental damage.

A case study of the application of performance bonds is the Great Barrier Reef Marine Park Authority of Australia. This instrument has potential for application in the mining and tourism industry where it can shift the onus on to operators to comply with environmental standards and environmental agreements. The experience of GRMPA is valuable in assessing the applicability of the instruments in the South Pacific.

Case Study: Performance bonds: the experience of the Great Barrier Reef Marine Park Authority²²

Environmental rehabilitation work is often required after a project is completed or abandoned. Rehabilitation is in the interests of the public but there is little incentive for the developers to invest in and carry out such work. Indeed the developer may not be in a financial position to carry out work in the case of bankruptcy or financial failure.

The government, in ensuring that rehabilitation work is undertaken and in minimising its own risk, can institute a mandatory requirement for performance bonds to be lodged to ensure that sufficient funds are available for rehabilitation. The need to post a performance bond before the project proceeds also has the effect of forcing the developer to consider management of the project to minimise rehabilitation costs.

Since 1987, the Great Barrier Reef Marine Park Authority (GBRMPA) of Australia has required performance bonds to be posted for semi-permanent or temporary structures on the Reef. The bond constitutes part of a permit issued by the Authority, setting out the type of activity allowed and the location of that activity. For example, the permit may allow charter boat operations, tourism or waste disposal.

Up to 1993 there were 33 instances where performance bonds had been required as a condition of permits. They ranged from \$1,000 to \$1 million. They are set on the basis of the expected costs of site rehabilitation. The larger bonds are adjusted annually in line with movements in the consumer price index.

²² Sources: Lal and Brown (1996); Whitehouse (1993).

Access of Performance Bonds or Bank Guarantees by GBRMPA

Magnetic Quays, Magnetic Island. A receiver was appointed in December 1990. Approximately \$A100,000, out of the \$A500,000 bank guarantee, was used to cover renewal of insurance premiums and undertake minor site maintenance and stabilisation work.

Fantasy Island. A tourist pontoon broke up and sank while being towed in 1988. The developer failed to remove the wreckage and the Authority drew on the security bond and a bank guarantee to the value of \$A210,000 to allow a salvage contractor to complete the work.

Australian Pearl Management. Pearl culture operations on Arlington Reef were abandoned in 1989. Moorings and 10 tonnes of miscellaneous gear were removed from the Park using \$A 13,000 from a bank guarantee.

Pacific Pearls. A pearl culture operation was abandoned in 1990 following damage by cyclone Joy. Culture equipment was removed from the Park using all of the \$A7,000 bank guarantee.

Deed of Agreement

Where there is risk of negative environmental impacts the permit is augmented with a deed of agreement that may be accompanied by an environmental monitoring programme. The deed of agreement, a legally binding document, sets out the terms and conditions pertaining to the development (removal of facilities and cleaning up; environmental monitoring or implementing a code of environmental practice; insurance coverage required to cover clean-up and removal of structures, and the lodgement of performance bonds and rehabilitation of the site. The bond may cover the cost of maintaining insurance cover for the duration of the deed after the permit has expired.

Insurance

Insurance companies are willing to agree to insurance cover when the probability of rehabilitation and expected costs can be estimated. The cover is therefore usually limited to natural disasters, for example cyclone damage.

Effectiveness

The Authority stipulates that the level of rehabilitation be done to a standard not exceeding that at the time of commencement. The method of rehabilitation is not stipulated, allowing the most efficient approach to be adopted. However, in practice, nature may be allowed to rehabilitate, for example in the case of coral, rather than requiring rehabilitation by the permittee.

The size of the bond is important. If it is too small then it may fail to cover rehabilitation's costs and the government will need to bear a proportion of

rehabilitation costs. On the other hand, if it is too large then the operators will bear an unnecessarily high financial cost of maintaining the bond. It is important therefore that rehabilitation costs are thoroughly considered *ex ante*. (See the training exercise on Performance Bonds.)

While cash bonds are placed in an interest bearing account with interest accruing to developers, they nevertheless may still incur an opportunity cost to the developer and a large bond relative to the size of the firm may weaken the firm's overall creditworthiness. The less costly bank guarantee is an alternative to a cash bond. However, guarantees may only be available to large operators.

Deposit refunds

In the case of deposit-refund systems the potential polluter/environmental damager is subject to a tax (deposit) in the amount of the potential damage and receives a subsidy (refund), equally large in terms of present value, if certain conditions are met (for example proof that damage has not occurred). The tax is a price for the right to pollute or inflict detrimental effects on the environment, and a negative tax or price is exacted if the right is not exercised.

The value to the producer of returned items may be such that the refund is sufficient to generate a high proportion of recycling or reuse. Where non-return imposes social costs, mandatory deposits may be imposed by industries themselves for certain types of items. Alternatively, government may introduce a tax/deposit-subsidy/refund system. Administration may be by industry or by government. The optimal tax is where the social costs of traditional disposal equals the social cost of the return alternative.

It is important to note the incidence and benefits and costs of such schemes. The price increase occasioned by the tax will reduce sales. Consumers for whom the deposit is less than the cost of traditional disposal will also incur a net cost. However, scavengers that take advantage of the deposit on non-returned items will be beneficiaries, as will taxpayers, to the extent that total deposits exceed total refunds plus administration costs.

Deposit-refund systems may be superior to alternative instruments in that:

- a) they work when the act of environmental degradation is not directly observable or when the potential injurers are numerous or mobile;
- b) they simplify the proof of compliance;
- c) they specify the maximum economic consequences of non-compliance;
- d) actual or expected damages are covered in principle by actual payments;
- e) they may have income redistribution effects.

Deposit refund systems also have properties that make them more attractive than taxes or subsidies from a politician's viewpoint. While taxes may be regressive deposit-refunds are neutral and may distribute income. And while subsidies need to be financed by government, deposit refunds are self-financing (Bohm and Russell, 1985).

Deposit refund systems for bottles are applied effectively by the soft drink industry in PNG. The rate of return of aluminium cans is also high in Port Moresby. The case studies that follow shows how responsive small businesses can be to deposits.

Case Study: Deposit refunds and reuse and recycling in Port Moresby²³

The high consumption of bottled and canned drinks generates a large volume of solid waste. Table 1 indicated that deposit refund systems are being applied in the South Pacific. In Papua New Guinea the market demand for used drink bottles and cans enables bottle and can refunds to be paid by industry. The result is a high level of reuse and recycling.

Bottle reuse:

The price paid for used drink bottles is an incentive for collectors in the informal sector.

The table below shows the prices paid and the quantities purchased on a weekly basis in May 1997.

Table 4: WEEKLY THROUGHPUT AND PRICES PAID BY PNG BOTTLE INDUSTRY PTY LTD

Empty Bottles	Quantity (ctns of 24)	Refund offered by PNG Bottle Industry Pty Ltd	Buying price of bottler
COKE (285ml)	15 500	K1.50	K1.70
PEPSI (285ml)	12 500	K1.70	K1.80
SPBeer (all brands)	35 000	K1.20	K1.35

Source: PNG Bottle Industry Pty Ltd

When allowing for the cost of handling, transport and cleaning, the use of returnable bottles is cheaper in economic (and energetic) terms than non-returnable bottles or cans. In the case of SP Holdings, a large bottling company, the cost of importing one new bottle is K0.27 whereas one returnable bottles costs K0.10 (cost of purchase plus washing). Therefore it pays PNG Bottle Industry to offer a refund.

The average returnable rate for bottles is about 85% within the country, while in Port Moresby it can be as high as 90% ie; the same bottle is reused about 9 times.

Recycling Aluminium Cans

²³ The source of this case study is Dzuali, Hunt and Mano (1997).

Aluminium cans cannot be re-used but the raw material, aluminium, is valuable. The strength of the overseas market for aluminium enables recycling companies to pay a price which acts as a sufficient incentive for the collection of a high proportion of drink cans.

Table 5: RECYCLING ALUMINIUM CANS, PORT MORESBY

Refund per kg	Overseas Selling Price per kg
K 0.65	\$US 1.05

Source: SP Holdings, PNG Recycling Pty Ltd

According to preliminary data, more than 75% of aluminium cans are recycled in Port Moresby.²⁴

Case Study: Can and bottle recycling in selected countries

Government policy can generate or eliminate economic incentives for recycling as is illustrated below.

The Kiribati Government taxed the export of discarded aluminium drink cans and virtually brought to a halt their export. Large mounds of cans were observed by the author in 1995 waiting for a change in government policy that would allow their compactions and shipping via container. The tax has now been lifted.

In Tonga the limited volume of cans was sufficient for one operator to make a profit. However, the collection of cans for recycling has ceased because of entry of additional operators; And in Western Samoa where Coca Cola bottles are subject to a deposit refund and hence reused, the government has allowed the establishment of a Pepsi plant that distributes in plastic bottles that are added to the waste stream (Morrison and Munroe, 1997).

Case Study: Solid waste collection in Port Moresby

In these traditional Motu coastal villages aof the National Capital District of Pupua New Gunea, there is a continuous disposal of household solid wastes to village areas in general and to the tidal zone beneath dwellings in particular. Plastic constitutes 90% of the waste at villages (Kinhill Kramer, 1997, p. 4), reflecting the fact that used plastic, unlike non-ferrous metals and bottles, has no market value.²⁵ The accumulated rubbish

²⁴ PNG recycling also has a thriving business in recycling aluminium which it melts down and exports as ingots, and in car batteries which are containerised and shipped to Japan.

²⁵ A fairly large percentage of the plastic would appear to be in the form of plastic bags that originate at supermarket checkouts. The low level of organic matter in the waste may simply reflect its biodegradability.

poses a threat to public health both through the provision of habitat for disease-carrying vectors and the harbouring of bacteria-infested organic matter.

The lack of official solid waste collection in and disposal services from the villages is illustrated by the case of one of the larger villages, Hanuabada, with a population of some 10,000. The waste generated by Hanuabada would total some 1.4 tonnes daily. However, the amount disposed of at official dumps is only 0.1 tonnes daily, suggesting that 1.3 tonnes per day of solid waste is disposed of 'informally' into the environment (Wilbur Smith Associates, 1996, p. 30; Table 15-7, p. 31).

Informal interviews with village leaders and villagers suggest that the following are contributory factors to the *in situ* disposal of wastes (Dzuali, Hunt and Mano, 1997).

- a) the entrenched habits among villagers of disposal of wastes to the tidal zone;
- b) irregular and insufficient payment of youths and women's groups contracted to collect waste from the village areas;
- c) lack of sufficient funds for education campaigns;
- d) lack of sufficient waste disposal points in villages;
- e) lack of enforcement of anti-littering regulations.

The following instruments suggest themselves as having a place in reducing the level of wastes.

1. The imposition of differentiated taxes on plastic-wrapped food items and plastic bags.

2. Economic incentives to householders to collect waste.

There would no doubt be resistance from supermarket and store owners and consumers to an increase in the price of plastic-wrapped goods. There may also be difficulty in administering a differentiated goods and services tax. Moreover, the effectiveness of such a tax in reducing the consumption of plastic-wrapped goods is by no means assured given that effectiveness would depend on the elasticity of demand for such goods.

Taxes impose a cost on the polluter while subsidies impose a cost on the taxpayer. Subsidies for pollution control in industry tend to attract new entrants and to increase overall pollution levels. However, they may have a place in inducing behavioural change where taxes have undesirable side effects. For example, a tax on toxic waste collection may encourage tax avoidance by means of random disposal of the waste into the environment. In this case, a subsidy to encourage proper disposal may be warranted because of high social costs associated with random toxic waste disposal. The burden on taxpayers can be reduced by raising a deposit or a tax on the purchase of the toxic substances.

The introduction of financial incentives to collect waste appears to be a promising option. The subsidy could be in the form of a deposit refund system, whereby plastic waste is remunerated by weight at specified collection points in villages, would provide

an incentive to collect waste rather than dispose of it beneath houses in the tidal zone or randomly into the village environment.

Such an incentive on waste collection would tend to provide an incentive for waste production given that it effectively lowers the price of consumer goods associated with the waste. However this price effect is likely to be small. The subsidy effect could be balanced by a small increase across the board in the goods and services tax that already applies in the National Capital District.

DISCUSSION

The adoption of economic instruments for environmental conservation and management is an innovative approach that should be applicable in developing countries in general and in the South Pacific in particular. The paper shows that economic instruments are already being applied in the South Pacific. A analysis of the case studies suggests preconditions for thier successful application.

Given that this research is very much in the work in progress stage, the discussion will be confined to major issues that seem to have emerged in the foregoing sections.

The documentation of tenure appears to be very important for effective application of financial instruments such as ICAD projects, GEF and carbon offset projects and trust funds. It is difficult to see how rewards for conservation of natural assets can be equitably distributed through these mechanisms unless the owners of the natural assets can be identified.

However, efforts to mobilise land in Papua New Guinea have been met with hostility. Registration of customary land has been seen as meeting the interests of outside investors through the disempowering of the people. It is expected therefore that registration will need to proceed on a project by project basis. But registration will add to transactions costs of the application of these instruments. In the cases where the instruments are international ones that seek least-cost investments in ecosystem and biodiversity conservation, the increase in transaction costs may make Paua New Guinea uncompetitive.

In the case of the conservation initiative at Wiawi in Vanuatu it was illustrated that strengthening customary tenure allowed owners to draw up and enforce local management rules. Even though this process did not involve the registration of landowners it nevertheless still required the identification of landowners and the boundaries of their customary-held land and coastal resources.

In urban environments of the region it was found that the lack of individual property rights was an impediment to the charging for water and other environmental services such as waste removal and sewerage. In the case of group ownership of urban land the group can be charged for services. However, the discussion raises the whole question of whether and how services should be delivered to the squatter settlements of, for example, Tarawa and Port Moresby.

Also touched on was the need for governments to enforcement property rights and to reduce open access to public lands and public water supplies. The reduced aesthetic appeal of islands and the disease risk associated with improper waste disposal are disincentives to tourism.

The declaration of Exclusive Economic Zones has effectively transferred property rights over vast marine resources to the island states. In theory, the tuna-rich states could generate a market for their abundant and valuable tuna resources and at the same time manage the resource through controls on catch quota. It was argued, however, that transaction costs of organising the market through the device of transferable quotas were prohibitive and that this strategy is unlikely to be adopted. This leaves open the question of how the PICs will begin to manage their valuable regional tuna resource. Of particular concern is the need for management of the depleted species of tuna, namely big eye and albacore, and by-catch species.

In the absence of market creation for tuna, the method of exploitation of the region's resources is through access charges. Each country bargains individually with the major foreign fishing fleets. This method allows the fishing nations to bid down charge levels. A concerted approach by the PICs would, it is suggested, deliver higher charges.

In turning to fiscal instruments and their ability to raise revenue for environmental management and conservation, a mixture of taxation instruments may be the most effective.

In most cases it is not feasible to monitor pollution from individual sources. Therefore while the application of direct taxes to point sources is efficient in theory it needs to be proven in practice. And while product taxes may not reduce pollution to optimal levels they are effective in raising funds for the management or clean-up operations.

Company taxes tend to be easily avoided in the South Pacific. Export taxes are therefore an attractive revenue raising alternative to governments. However, as the chart comparing the various tax measures from both government and investor point of view showed, export taxes are anathema to investors.

The issue of leaded petrol needs to be addressed in the region. The role of economic instruments in the phasing out of leaded petrol, such as differential taxation, is an area of future study.

There are a great range of financial instruments employed in the region at present. Some offer great promise for biodiversity and natural resource conservation, such as the GEF, trust funds and carbon offsets. But they are all relatively new and will need to be monitored and evaluated. While this study has attempted to bring together and analyse financial instruments being applied there is a notable lack of economic analysis which would allow a more comprehensive review. In particular there is a dearth of data on the ICAD projects in Papua New Guinea. However, it is already noteworthy that significant failures seem to have occurred because of the lack of full support for projects from affected parties (a criterion that was suggested would be important earlier in this report).

The registration of ownership of resource owners, and the cost involved as suggested above, seems to be the greatest impediment to adoption. Another criterion suggested earlier to be important in assessing the applicability of instruments was the capacity of institutions to monitor conservation projects. A lack of expertise and financial resources may preclude the widespread adoption of these instruments in the region.

An area that has not so far been pursued in this study is that of compensatory projects, an instrument in the same stable as carbon offsets. Compensation is effected through projects in one

location that offset the environmental or resource damage in another location. Such projects may be applicable in mining and forestry .

The case study of mining at Ok Tedi (forthcoming), under Liability Systems, illustrated the mechanism whereby environmental damage is compensated after the event through the courts. These systems will probably continue to play a role because of the difficulty in identifying the costs and risks of environmental degradation associated with mining projects. While performance bonds, an *ex ante* rather than an *ex post* approach, would appear to have a greater role to play, particularly in mining, it was pointed out in the performance bond case study that significant resources are necessary to administer this instrument. These included resources to assess the project for its impacts, to detail the rehabilitation required, to monitor performance and the need to be able to uphold the conditions of the bond through the legal system.

The deposit refund system would appear to have a large number of applications. An important finding here was that individuals and small business respond very positively to the presence of small incentives. (In the earlier sections it had been suggested that refundable deposits would be effective in countries with high unemployment and without unemployment benefits.) In Port Moresby there are a large number of bottle collectors and scavengers and returnable deposits are functioning as an income redistribution mechanism.

The Port Moresby case study was confined to market driven deposit refund systems. Other PICs have higher freight costs than PNG and at the same time generate smaller volumes of bottles and cans and other non-ferrous metals. Market incentives such as those applying in the case of PNG bottles and cans are therefore absent. However, refundable deposits on cans and bottles can be applied by government as well as industry.

A challenge is to apply economic instrument to the recycling of other wastes. This may be done by facilitating markets for materials, for example by separating the elements in the waste stream, or by creating markets that do not presently exist.

There appear to be significant costs to the public in generation and disposal of waste with no market value. An attractive proposition seems to be the introduction of deposits on plastics, the collection and disposal funded by a small tax on the products that generate the plastic, or through a small increase in the goods and services taxes. Such schemes may be replicable throughout the Pacific.

Other areas where governments could consider applying incentives for proper disposal include toxic chemicals, used motor oils and other hydrocarbons, spent car batteries, used tyres and car and truck bodies. The cost to governments of refundable deposits can be offset by higher import duties or purchase taxes.

The study has not yet ploughed important and potentially rich fields. The omissions that stand out are the economic instruments that apply in the forestry industry²⁶ and in the mining industry and also in the allocation and funding of piped water.

²⁶ Peter McCrae, Economist, Papua New Guinea Forest Authority, Port Moresby, personal communication.

REFERENCES

- Alcorn, J., and Beehler, B. eds. 1993. *Papua New Guinea conservation needs assessment*, Boroko, Papua New Guinea Department of Environment and Conservation, Boroko.
- AusAID, 1996. *The Global Environment Facility - Questions and Answers*, AusAID, Canberra.
- Ballard, C., 1997. "Its the land, stupid! The moral economy of resource ownership in Papua New Guinea", in P. Larmour (ed), *The governance of common property in the Pacific region*, National Centre for Development Studies/Resource Management in Asia Pacific Project, Australian National University, Canberra, pp. 47-66.
- Bennett, J., 1996. "Highlights for 1995-96 - an update of the 1994-95 Annual Report", ACIAR Project 9020, ACIAR, Canberra.
- Bergin, A and Michaelis, F., 1996. "Australia and the South Pacific; implementing the UNCED ocean agenda", *Marine Policy*, 1996, 20(1), pp. 47-62.
- Bernstein, J., 1993. *Alternative approaches to pollution control and waste management*, Urban Management Programme, World Bank, Washington, D.C.
- Bohm, P. and Russell, C., "Comparative analysis of alternative policy instruments", in Kneese, A. and Sweeney, J., (eds) *Handbook of natural resource and energy economics, Vol 1*, North Holland, New York, pp. 395-463.
- Bureau of Resource Economics*, 1995. *Fishery status reports 1994*, Australian Government Publishing Service, Canberra.
- Chand, D. and Duncan, R., 1997. "Resolving property issues as a precondition for growth: access to land in the Pacific islands", in P. Larmour (ed), *The governance of common property in the Pacific region*, National Centre for Development Studies/Resource Management in Asia Pacific Project, Australian National University, Canberra, pp. 33-46.
- Common, M., 1995. *Sustainability and policy*. Cambridge University Press, Cambridge, U.K.
- Connell, J. and Lea, J., 1993. *Planning the future: Melanesian cities in 2010*. Pacific Policy Paper 11, National Centre for Development Studies, Australian National University, Canberra.
- Connell, J. and Lea, J., 1995. *Urbanisation in Polynesia*. Pacific Policy Paper 14, National Centre for Development Studies, Australian National University, Canberra.
- Cook, A., 1994. "The quoliquoli of Fiji", MSc dissertation, University of Newcastle Upon Tyne.
- Crean and D. Symes, 1995. "The discards problem: towards a European solution", *Marine Policy*, 18 (4), pp. 422-434.
- Crocombe, R. 1994. "Overview", in R. South, D. Goulet, S. Tuquiri and M. Church (eds), *Proceeding of the international workshop on traditional marine tenure and sustainable*

management of marine resources in Asia and the Pacific, University of the South Pacific, Suva, pp. 291-300.

Department of Environment and Conservation, 1995. *Papua New Guinea: Lak Conservation Area Sustainable Forestry Project Proposal*, DEC, Waigani.

Doulman, D., 1993. "Community-based fishery management", *Marine Policy*, 17, pp. 108-117.

Drysdale, P., 1994. "Soil erosion: The hidden disaster in Fiji", A land Conservation Board Discussion Paper, unpublished.

Dzuali, R., Hunt, C., and Mano, S., 1997. "Economic instruments in environmental conservation", 8th Pacific Science Inter-congress 13-19 July, 1997, University of South Pacific, Suva, unpublished.

Gangaiya, P., 1994. *Land based pollution sources in Kiribati: a case study*, SPREP, Apia.

Higham, C., 1995. *Department of Environment and Conservation Institutional Strengthening Project, Papua New Guinea*, AusAID, Canberra.

Hunt, C., 1992. "Deforestation in Papua New Guinea: the role of economics in devising solutions", in R. Harding (ed), *Ecopolitics V Proceedings*, University of New South Wales, Kensington, pp 135-143.

Hunt, C., 1996a. "Tackling environmental threats on Pacific atolls", *Pacific Economic Bulletin*, 11 (2), National Centre for Development Studies, Australian National University, Canberra, pp. 58-69.

Hunt, C., 1996b. "Property rights and environmental management on Pacific atolls", *International Journal of Social Economics*, 23 (4/5/6), pp. 221-234.

Hunt, C. 1997a. "Cooperative arrangements for marine resource management in the South Pacific", in P. Larmour (ed), *The governance of common property in the Pacific region*, National Centre for Development Studies/Resource Management in Asia Pacific, Australian National University, Canberra.

Hunt, C., 1997b. "Mangement of the South Pacific tuna Fishery", *Marine Policy*, 21 (2), pp. 155-171.

Hunt, C. 1997c. "Rent equity and sustainability in the South Pacific tuna fishery", In *Environmental planning and development in small island states*, Proceedings of the 1996 Malta Conference (forthcoming).

Hunt, C. 1997d. "Maximising Pacific island country returns from investment in the South Pacific tuna industry", National Centre for Development Studies, Australian National University, Canberra, unpublished.

Hunt, C. and Chandra, R., 1995. "Current economic trends - Fiji", *Pacific Economic Bulletin*, 10 (2), National Centre for Development Studies, Australian National University, Canberra, pp. 13-18.

Hunt, C. and Marimbu, A. 1997. "The Siassi fish marketing and supply project", National Centre for Development Studies, Australian National University, unpublished.

Hviding, E., 1996. *Guardians of Marovo Lagoon: practice, place, and politics in maritime Melanesia*, University of Hawaii Press, Honolulu.

Hviding, E. and Ruddle, K., 1991. *A regional assessment of the potential role of Customary Marine Tenure in contemporary fisheries management in the South Pacific*, FFA Report 91/71, Forum Fisheries Agency, Honiara.

Hyndman, D., 1993. "Sea tenure and the management of living marine resources in PNG", *Pacific Studies*, 16 (4), pp. 99-114.

Industry Commission, 1997. *Role of economic instruments in managing the environment*, Staff Research Paper, Industry Commission, Canberra

Johannes, R., 1978. "Traditional marine conservation methods in Oceania and their demise", *Annual Review of Ecological Systems*, 9, pp. 349-364.

Kalit, K. and Young, E. 1997. "Common property conflict and resolution: Aboriginal Australia and Papua New Guinea", in P. Larmour (ed), *The governance of common property in the Pacific region*, National Centre for Development Studies/Resource Management in Asia Pacific Project, Australian National University, Canberra, pp. 183-208.

Karagiannakos, A., 1996. "Total allowable catch and quota management system in the European Union", *Marine Policy*, 20 (3), 1996, pp. 235-224.

Kinhill Kramer, 1997. *Report for Elavala Causeway Investigation*, National Capital District Commission, Port Moresby.

Kiribati Ministry of Home Affairs and Rural Development, 1995. *Urban Development Plan for South Tarawa*, Bairiki.

Lal, P. and Brown, D., 1994. "Individual transferable quotas in fisheries management", ABARE Conference Paper 94.40, Australian Bureau of Agricultural and Resource Economics, Canberra, 1994.

Lal, P. and Brown, D., 1996. "Using performance bonds as an environment management tool: The Great Barrier Reef Marine Park's Experience", *Australian Journal of Environmental Management*, 3 (2), pp. 86-97.

Lovei, M. 1995. "Worldwide experience with environmental funds and other earmarked environmental financing mechanisms", Environment Department, World Bank, Washington, D.C.

McCallum, R. and Sekhran, N., 1996. "Lessons learned through ICAD experimentation in Papua New Guinea", Paper to the United Nations South Pacific Forestry Development Programme, 23 September, 1996 Heads of Forestry Meeting, Port Vila, unpublished.

- Morgan, G. 1995. "Optimal fisheries quota allocation under a transferable (TQ) management system", *Marine Policy*, 19(5), 379-390.
- Morrison, J. and Munroe, A., 1997. "Overview of waste management in the small island developing states of the South Pacific", Proceedings of the Regional Workshop on Waste Management for Small Island Developing States in the South Pacific, 12-16 May, 1997, Anutech, Canberra, unpublished.
- National Forest Authority, 1996. *PNG National Forest Plan*, Boroko.
- Ostrom, E., 1990. *Governing the commons*, Cambridge University Press, Cambridge, UK.
- Panayotou, T., 1995. *Economic Instruments for environmental management and sustainable development*, Harvard Institute for International Development, Harvard.
- Papua New Guinea Government, 1994. *Fisheries Act 1995*, Port Moresby.
- Papua New Guinea Department of Environment and Conservation, 1993. "Environmental levies in Papua New Guinea: review discussion and recommendations", DEC, Waigani, unpublished.
- Pearce, D. and Turner, K., 1990. *Economics of natural resources and the environment*, Harvester Wheatsheaf, London.
- Pulea, M., 1993. *An overview of constitutional and legal provisions relevant to customary marine tenure and management systems in the South Pacific*. FFA Report No. 93/23. Forum Fisheries Agency, Honiara.
- Serageldin, I., and Martin-Brown, J., (Eds) *Servicing innovative financing of environmentally sustainable development*, The World Bank, Washington, D.C.
- Seru, V., 1993. "A need for soil conservation and watershed protection strategy for Fiji", Paper to the Watershed and Soil Conservation Seminar, Republic of China, Ministry of Agriculture, Fisheries and Forests, unpublished.
- Shogren, J., Herriges, J. and Govindasamy, R., 1993. "Limits to environmental bonds", *Ecological Economics*, 8, pp. 109-133.
- Tacconi, L., 1995a. *Participatory conservation in Malekula Island, Vanuatu*, Research Report No. 10, University of New South Wales University College, Canberra.
- Tacconi, L., 1995b. *Proposal for the establishment of the Nagha Mo Pineia Protected Area*, Research Report No. 11, University of New South Wales University College, Canberra.
- Tacconi, L. and Bennett, L., 1994. *The socio-economic assessment of the Erromango Kauri Protected Area*, Department of Economics and Management, University College of New South Wales, Canberra.
- Tacconi, L. and Bennett, J., 1997. *Protected area assessment and establishment in Vanuatu: a socio-economic approach*, Australian Centre for International Agricultural Research, Canberra.

Teiwaki, R., 1988. *Management of the marine resources in Kiribati*, Atoll Research Unit and Institute of Pacific Studies of the University of the South Pacific, Suva, Fiji.

Temu, I., 1996. *Recent economic developments in smaller South Pacific countries: Cook Islands, Kiribati, Tuvalu and new Caledonia*, Economics Division Working Paper 96/4, Research School of Pacific and Asian Studies, Australian National University, Canberra.

The Australian, 1995. 31 October, p. 5.

Thistlethwaite, R., and Davis, D., 1996. *A sustainable future for Melanesia? Natural resources, population and development*, Pacific Policy Paper 17, National Centre for Development Studies, Australian National University, Canberra.

Tietenberg, T. 1996. *Environmental and Natural Resource Economics*, Fourth Edition, Harper Collins, New York.

Townsend, R., 1995. "Transferable dynamic stock rights", *Marine Policy*, 19 (2), pp. 153-158.

Turner, J., 1994. "Sea change: Adapting customary marine tenure to commercial fishing: The case of the Papua New Guinea bait fishery", *Proceeding of the international workshop on traditional marine tenure and sustainable management of marine resources in Asia and the Pacific*, eds. R. South, D. Goulet, S. Tuquiri and M. Church, University of the South Pacific, Suva, pp. 141-154.

United Nations Development Programme, 1993. *Global Environment Facility: Papua New Guinea Biodiversity Conservation and Resource Management Programme*, UNDP, Port Moresby.

Wallace, C. 1995. "Managing resources in New Zealand", paper to the Inaugural Ecological Economics Conference, Coffs Harbour, Australia, unpublished.

Waugh, G., 1987. *The collection of rent in the South Pacific tuna fishery*, Islands/Australia working paper no. 87/3, National Centre for Development Studies, The Australian National University, Canberra

Wilbur Smith and Associates, 1996. *Urban development and services plan, Volume 4*, Report to National Capital District Commission, Port Moresby.

Whitehouse, J., 1993. *Managing multiple use in the coastal zone: A review of the Great Barrier Reef Marine Park Authority*, Australian Government Publishing Service, Canberra.

World Bank, 1995. *Pacific Island Economies: Building a Resilient Economic Base for the Twenty First Century*, World Bank, Washington DC.