Applicability and Use of

Natural Resource Accounting

and **Environmental Economics**

in Small Island Developing States

by

Te'o Ian Fairbairn

and

Clem Tisdell

Applicability and Use of Natural Resource Accounting and Environmental Economics in Small Island Developing States

by

Te'o Ian Fairbairn
Fairbairn Pacific Consultants Pty Ltd,
Charlestown, NSW, Australia.

and

Clem Tisdell
Department of Economics,
University of Queensland,
Brisbane, Australia.

Acknowledgements

Foreword

The natural resources of the small island states of the Pacific are the basis for their economic development. Fisheries, agriculture, forests and mining sectors all depend on these resources. Pacific islanders also depend directly on these resources, as they provide food, building materials, medicines and drinking water for their own lives.
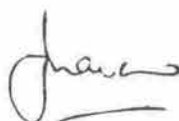
Sustainable development implies that these natural resources will be available for use by future generations of Pacific islanders. Current economic development and the government policies that drive development do, however, heavily influences whether these resources will be available.

The economic policies pursued by island governments are influenced by the information they receive, and how they then use this information to develop consistent and appropriate policies in keeping with their political aims.

The Rio Earth Summit in 1992, and the 1994 Small Islands Conference in Barbados, highlighted the commitment of small developing states to sustainable development, and to adapting their economic policies achieve this. This report discusses the fundamental issues in integrating environmental economics and sustainable development in this region, and how this could influence national economic policies in the region.

It comes at a critical time, as the region is seeking innovative financing arrangements for sustainable development - mechanisms that must be based on sound socio-economic criteria to truly achieve sustainable development.

The report discusses systems of natural resource accounting and environmental economics that are now being trialled and embraced around the world. This study recognises their value, but suggests that Pacific island governments should be careful in developing and using them for their own needs.

Vili A. Fuavao
Director

Contents

1. Introduction

The environmental needs of small island developing countries were given special attention at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in June 1992 as was the need to determine "how the new global framework for sustainable development can be put into action in island countries" (Miles, 1993, p. 34). The environment is a vital resource for all island developing states. Its special significance for the South Pacific islands was recently underlined by Vila A. Fuavao, Director of the South Pacific Regional Environment Programme (SPREP). He pointed out:

"The region is characterised by a high degree of ecosystem and species diversity, an extraordinary level of endemicity, a high degree of economic and cultural dependence on the natural environment, vulnerability to a wide range of natural disasters, a diversity of cultures and languages, and traditional practices and customs which are central to the close and special relationship of Pacific people with their environment" (Fuavao, 1993, p. 22).

In order to sustain their livelihoods and in most cases maintain their cultures, island people need to take special care of their environment. With growing levels of population and economic activity, this is becoming more difficult and requires greater effort than in the past. It is therefore appropriate to inquire about whether and how natural resource accounting (NRA) and environmental economics can help in this task.

NRA and other forms of environmental accounting are intended to address some of the limitations of traditional systems of national accounts. These accounts can transmit misleading signals as far as economic welfare and the state of the environment are concerned.

For example, GDP may rise but do so unsustainably because stocks of natural resources are being irreversibly depleted. In this case, the economy is in effect operating on borrowed time. Or GDP may rise because pollution or environmental deterioration leads to greater defensive expenditures e.g. more expenditure on health, to offset it. In both cases, traditional national accounts transmit misleading information if they are used as indicators of human welfare (Cf. Asafu-Adjaye, 1993, pp. 41-42).

Techniques of environmental accounting and economics have evolved in recent years to take greater account of the sustainability of welfare and to provide improved guidance for environmental policy. These may be of particular interest to small island states given their heavy dependence on the natural environment. However, they have been mostly developed in the context of the more developed market-economies of macro-states.

Given that the subsistence sector is still very significant in most small island developing states (SIDS) and that many still have important village social structures, it is likely that these techniques cannot be applied to the island states without some modification and qualification. Also SIDS often have to grapple with diseconomies in the collection of information, including environmental information, as well as a shortage of specialists, e.g., environmental specialists and statisticians. Therefore, special attention needs to be given to these issues as far as SIDS are concerned.

Let us consider natural resource and environmental accounting generally and then discuss the scope for applying and using it in SIDS and subsequently complete a similar exercise for environmental economics. Because both fields of study are very extensive, this paper can only provide a sketch of the most important issues.

2. Limitations of Standard Systems of National Accounts and the Need for Environmental Accounts and Statistics

As mentioned earlier, standard systems of national accounts such as the United Nations System of National Accounts (SNA), are inadequate as indicators of human welfare or sustainable development. This is not surprising because they were not designed with this purpose in mind. It is always useful to see economic concepts and techniques in their historical context.

National income and expenditure accounts arose originally to assist governments in market economies in achieving full employment and achieving a desired degree of macroeconomic stabilisation. They are a direct outcome of the economic analysis of Lord Keynes (1936) which links the level of aggregate employment and activity in a nation in the short run to the level of national expenditure (Tisdell, 1990, Ch. 2). The uses of these accounts were subsequently extended to growth theory and policy formulation and for the analysis of deflationary and of inflationary gaps. These accounts were never regarded as giving an accurate measures of human welfare but many people have come to rely on GDP and related national income aggregates particularly expressed in per capita values, as indicators of levels of welfare.

Interest in sustainable development and the state of the environment has brought home the dangers of doing this. For example, the level attained by GDP at any given time may be associated with

- the running down of standing stocks of natural resources such as timber, elimination of fish stocks, mineral extraction; or,

- an increase in defensive expenditures to counteract environmental degradation. However, this rise may mask a reduction in the sustainability of economic welfare (the likely situation in circumstance 1 above) and a reduction in current welfare (the possible situation in circumstance 2 above).

At this stage, there are probably two questions worth considering for SIDS:

- Is SNA likely to be less relevant to them than to most other economies and more deficient as an indicator of welfare or sustainable welfare?

- Does it follow that NRA or other forms of environmental accounting will be particularly useful for SIDS, especially some of the forms of it that are now being developed such as the System of Integrated Environmental Economic Accounting (SEEA) of United Nations Statistical Office (UNSO).

On the first question, the SNA would appear to be less useful to SIDS for policy purposes and as an indicator of human welfare and its sustainability than for more developed market economies. Reasons include :

- the SNA records only exchanges in the market system and government outlays. It ignores the subsistence sector or if it is integrated into these accounts, the data used are frequently highly deficient. This is a major problem because the contribution of the subsistence sector to GDP in SIDS is generally quite large, accounting for a third or more of the output of agriculture, forestry and fishing (Davis, 1993a). This sector is also usually the major sector for employment in Pacific SIDS (Davis, 1993a).

- A large segment of these economies, the most important segment culturally - the subsistence sector, is outside the market/monetary sector of the economy, even though it is not completely isolated from it. Thus SNA can only provide a partial snapshot of the economy and so SNA is less valuable as a guide for macroeconomic policies than in larger market economies.

- The Pacific islands region has been criticised (e.g., by the World Bank 1991; Asian Development Bank 1990, 1992) for not putting more emphasis on macroeconomic analysis and management. However, in part the lack of emphasis of the region on macroeconomic analysis and management may reflect the limited usefulness of traditional policy approaches based SNA in the region.

- Some of the smallest states because of lack of resources find it difficult or impossible to compile national accounts on a regular basis.

SIDS show a large 'direct' dependence on use of natural resource stocks such as in agriculture, fisheries and forestry, to generate their income, including income from exports, than do high-income market economies. Their primary sector accounts for a high proportion of GDP (typically around one-third) and accounts for the majority of their exports. It accounts for a much higher proportion of employment (particularly if the subsistence sector is included) than its relative contribution to GDP. (In most Pacific island countries, those dependent in some significant degree on the subsistence sector for their livelihood comprise around 60-70 per cent of the total population.)

If foreign aid and remittances were to be excluded as a source of income and employment, the relative importance of natural resource-based industries would loom very large indeed in most SIDS.

Thus the substantial importance of the natural resource-base for the economies of SIDS is easily established from the above (see also McKee and Tisdell, 1990). This resource base is, in addition, extremely important to those island economies which have developed natural resource-based tourism.

Many small island economies rely heavily on their natural resources for direct household use, e.g., water for the household and firewood; and supplies of these are generally fragile or precarious on some islands. For example, underground water supplies face risks of contamination from sewage and rubbish disposal or from intrusion of saltwater due to excessive drawing off of freshwater on islands dependent on water lenses.

Pollution, e.g., water pollution, poses serious health risks when people are so heavily dependent on local produce. For example, if a marine lagoon or a major river, e.g., the Fly River in PNG or the Rewa River in Fiji is polluted, those with villages on its banks may be at great risk healthwise or may suffer as a result of reduced productivity of the natural system. The health risk is great since subsistence-people typically draw much of their food from their immediate locality.

Reduced natural productivity as a result of pollution could add to the cost of villagers making a living or could result in malnutrition or food shortages. This can threaten the sustainability of the village community.

In general, villagers have a sense of kinship with their locality and unlike in Western market economies, they tend to be less mobile within the economy. Thus sustainability is of special importance to people in developing countries (Tisdell, 1990, p. 13).

Thus from many perspectives, particular account needs to be taken of the environment in SIDS. On this, there is likely to be little disagreement. The best way of doing it is however, likely to be more controversial. For example, is some type of macroeconomic natural resource accounting best? Of the various environmental accounting systems which exist which ones or one is likely to be best?

3. Different Approaches to Natural Resource and Environmental Accounting

No neat classification of approaches to environm-ental and resource accounting is available although several writers have provided some classification (Peskin, 1991). There is certainly room for improvement on the taxonomy of approaches. One possibility might be classify them according to whether they use (1) monetary valuation or not (2) the degree of aggregation which they involve and (3) the comprehensiveness of their coverage.

Thus we may have:

1) **Value** based systems;

2) **Physical** (non-monetised) indicators; and,

3) Systems with **value and physical** indicators.

Environmental accounts may be highly aggregated as in the case of most national accounts or desegregated e.g:, by sectors or by major industries. They may cover the whole economy or environment or only a part of it. In principle, there is a wide choice of approaches. The literature has, up till now, concentrated on just a few of the possibilities.

Three major possibilities were identified:

1) Proposals to adjust estimates of GDP or Net National Product (NNP) to reflect welfare or sustainable welfare more accurately taking particular account of environmental considerations.

2) Physical resource and environmental accounting systems such as those used in Norway.

3) Systems involving both valuation on physical entities such as that proposed by Peskin (1991), and that suggested by UNSO System of Integrated Environmental-Economic Accounting.

Each of these approaches is considered in this section.

3.1 Adjustments to national income aggregates for changes in environmental/natural resource conditions

To reflect changing environmental conditions and variations in natural resource stocks, one proposal is to make adjustments to national income aggregates such as GDP and NNP. By making appropriate adjustments, it is believed that the resulting money value will provide a better indicator of human welfare and its sustainability.

Two types of adjustment have been proposed to allow for environmental change:

1) Deduction of expenditure on protecting against adverse environmental change or defensive environmental expenditure; and,

2) Deduction of a sum to allow for the using up of natural resource stocks, namely a sum of money to allow for the net depreciation or depletion of these stocks.

However, calculating the *appropriate* deduction is not always straightforward.

Consider defensive environmental expenditure. Total expenditure on environmental improvement or maintenance needs to be determined and the proportion of this considered to be defensive must be estimated.

This is not always straightforward. For example, while air conditioning involves a local environmental change only a small portion of this expenditure may be defensive, e.g., a defense against outside air pollution or temperature increase in urban setting. Deducting expenditures for such items as the cost of sewage treatment are also problematic. What one really needs to consider is the net benefit of such treatment as compared to non-treatment.

In addition, some non-defensive environmental costs should be considered for deduction. These include lost earnings resulting from greater morbidity due to greater pollution, lost earnings and leisure-time due to greater traffic congestion, reduced amenity values due to environmental deterioration.

Regarding natural resource depletion, in relation to SNA, it is generally argued that National Domestic Product (NDP) is a better indicator of welfare than GDP. NDP equals GDP less an allowance for the depreciation of man-made capital. However, no similar allowance is made for the depreciation or depletion of natural resource stocks, that is capital-like assets provided by nature. Income earned from the depletion of such assets, however, is included in GDP.

It has been argued that this asymmetric treatment of man-made capital and natural resource stocks in the existing national accounts should be removed. Two different methods of depreciating natural capital have been proposed. These are:

* the 'user-cost' method suggested by El Serafy (1989); and,

* the 'net price' approach recommended by Repetto and others (1989).

Details of these methods are given in Bartelmus *et al.*, (1993) and will not be repeated here. However, some observations are in order.

Both methods are designed for application to those natural resources which produce commercial products such as mineral resources and forest harvested for saleable timber. They make use of a neoclassical economics framework for estimation purposes and assume the existence of perfectly competitive industry and perfect capital markets. In fact numerous assumptions are required in practice to make these depreciation estimates (Bartelmus *et al.*, 1993, p. 127) so their reliability in practice is open to uncertainty.

While there can be little doubt that GDP and NDP are not suitable measures of economic welfare, one can also question whether deductions for defensive environmental costs and depreciation of natural resource stocks are adequate. GDP does not for example include values for free services provided by the environment, work provided without payment in the home or leisure-time. In effect, this suggests that monetisation needs to be extended to reflect the value of goods and services available to a community.

At the same time, some reformers have suggested that additional deductions from GDP or NDP are needed beyond those for environmental costs to get a better measure of welfare. For example, since some writers believe that most expenditure on advertising or product promotion is wasteful, this expenditure ought to be deducted. The same is often argued about defense expenditure. The view is that at least it should be regarded as a cost not as a net benefit to society. Some writers even believe that a large part of expenditure on education is defensive and suggested deductions on that account (Daly and Cobb, 1989).

These observations underline the problems inherent in adjusting SNA to give a more accurate measure of aggregate welfare. Certainly the philosophical basis for such welfare adjustments needs a lot more consideration before it would be advisable to make such adjustments routinely (Cf. Young, 1992, p. 125). The question should also be raised of whether it is sensible to tamper with a set of accounts which were basically set up for short-term demand and employment management in market economies to make it perform a task or a purpose for which it was never designed or intended. If measuring welfare or sustainability is the prime task, then new sets of accounts may be needed and may need to be designed from the ground up.

In measuring 'aggregate' welfare, a number of quality of life indicators and indices have been developed (Doessel and Gounder, 1991). These include indicators such as GDP or NDP per capita, expected length of life, access to education, various environmental indicators and so on. There may be argument about what variables should be included in the quality of life index and how much *weight* should be placed upon each if it is intended to derive a single index value, for example for the purpose of comparisons between countries.

Since the collection of statistics and the keeping of accounts for any purpose is costly, it is necessary to be clear about the purpose of these before embarking on the exercise, and to assess whether for procedure to be followed the benefits will exceed the costs. As discussed before, some type of benefit-cost analysis is required. However, before this can begin, the purpose of the accounting must be clearly articulated. This does not seem to be the case at present with natural resource accounting, particularly, those methods that rely on adjustment to SNA aggregates.

3.2 Physical resource accounting

Physical (real) changes in natural resources and the environment underlie monetary accounts designed to reflect these changes. Given the difficulties of assigning accurate monetary values to such changes, some systems of natural resource accounting concentrate only on the real or physical changes using 'satellite' accounts. This approach has been adopted in France and Norway, but also prominent in current efforts by Australia to establish NRA in the longer term (see Box 1).

Ideally, these separate or 'satellite' accounts to SNA would describe flows of resources, materials (including pollutants), and energy that underlie any economic system, so that the physical counterpart to the economic circular flow is fully described and measured.

As Peskin (1991, p. 180), points out: "The accounts show an initial stock (or 'opening balance') of a resource, its diminution through use and degradation, its augmentation through discovery or, in the case of renewable resources, through natural growth, and, finally, the total stock at the end of the accounting period (or 'closing balance').

Thus, in principle, such accounts show the depletion of natural resources and also their transformation into goods and materials, some of which may find their way back to the environment in the form of pollutants. The material or energy accounts can be linked to the conventional economic accounts through the use of ratios (or input-output coefficients) that express units of energy or material use per unit of production or sales." However, no country has specified all these relationships fully.

Even if a comprehensive set of physical accounts is not completed, it can be useful to do accounts for natural resources and environmental conditions of special economic or social interest to a country. SIDS, as discussed below, might consider such a selective approach, e.g., prepare accounts for only a limited number of vital natural resources such as freshwater, forests, fishery stocks, wildlife stocks, agricultural land, water quality.

In carrying out the above exercise consideration can easily be given to putting these statistics into the UNSO Framework for the Development of Environment Statistics (FDES). This framework provides a comprehensive coverage of environmental characteristics. The basic framework is shown in Table 1, and the categories are further subdivided by UNSO to provide greater guidance (United Nations 1984, 1991).

Table 1.: Format of the framework for the development of environment statistics.

Source: United Nations (1991) Concepts and Methods of Environment Statistics: Statistics of the Natural
Environment ST/ESA/STAT/SER F/57, New York, p. 138.

Components of the environment	Information categories			
	Social and economic activities, natural events	Environmental impacts of activities, events	Responses to environmental impacts	Stocks, inventories and background conditions
Flora				
Fauna				
Atmosphere				
Water				
(a) Freshwater				
(b) Marine water				
Land/Soil				
(a) Surface				
(b) Sub-surface				
Human settlements				

3.3 Integrated natural resource/economic accounts

The most comprehensive form of natural resource/environmental accounting is that which specifies physical characteristics, places valuations on these and links them to SNA. The United Nations Statistical Division has prepared a framework for such integration and, in the South Pacific context, a case study was completed in Papua New Guinea to pilot its application (Bartelmus *et al.*, 1993).

The process involves linking FDES data bases to NRA which in turn is linked to SNA. The basic framework is indicated in Figure 1 (United Nations, 1991, p. 137).

To complete such a fully integrated set of accounts is a large task. The case study of Bartelmus *et al.*, (1993) shows that considerable progress can be made in doing this. Nevertheless, they could not be entirely satisfied with the accuracy of their estimates because they lacked accurate physical data on stocks of several types of natural resources and on defensive environmental expenditures. As they pointed out:

> *"the lack of data on environmental expenditures is one of the weak points of PNG's environmental data basis. Similarly, the lack of physical resource accounts, with the notable exception of mineral resources, made it difficult to estimate scarcities in other renewable and non-renewable resources"* (Bartelmus *et al.*, 1993, p. 126).
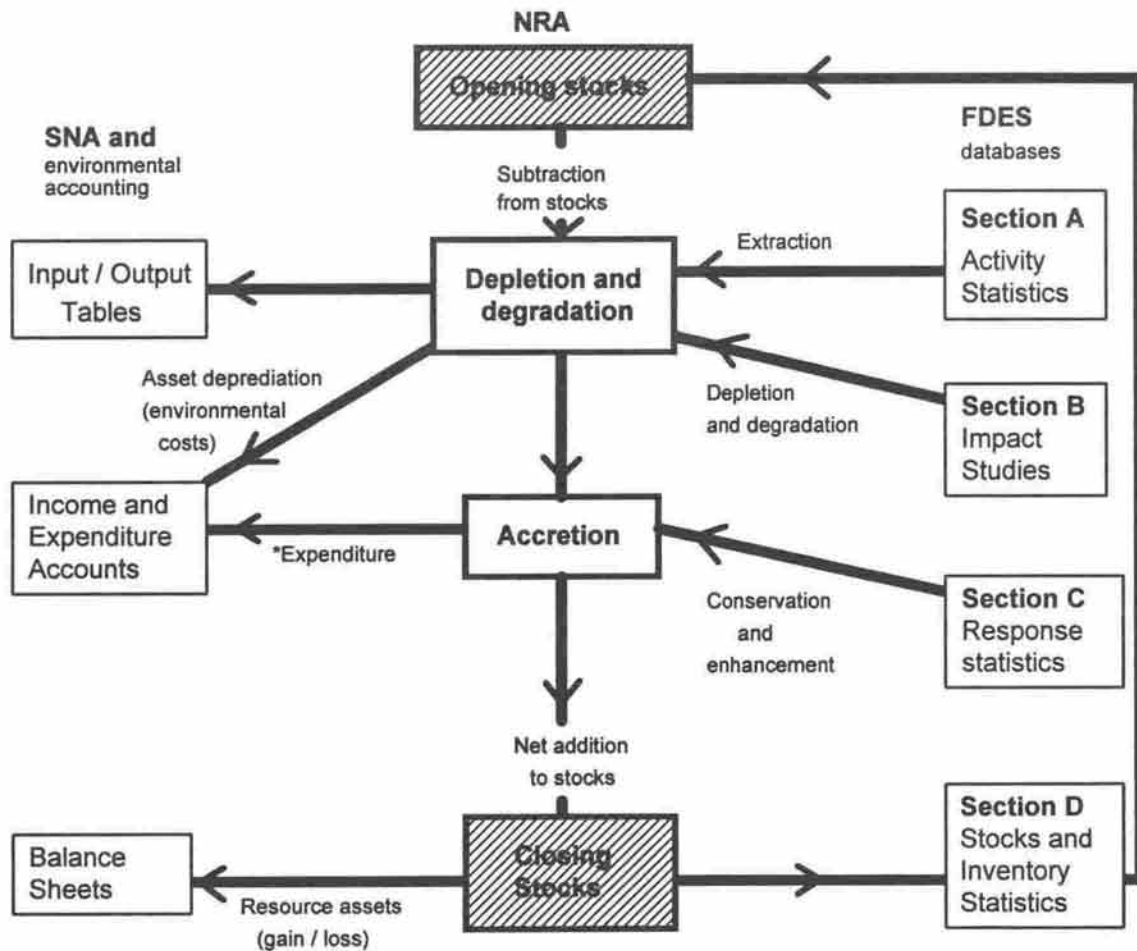
Fig. 1:   *Data linkages between FDES, NRA and the SNA.*

Source: United Nations (1991) Concepts and Methods of Environment Statistics: Statistics of the Natural Environment ST/ESA/STAT/SER F/57, New York, p. 138.

They were also concerned about the assumptions and simplifications which they had to make to get results. For example, both methods of depreciating natural resource stocks (user costs and net price) were considered to be theoretical simplifications. There are also wider conceptual problems (some of which have been raised above) to be solved about the value of 'environmentally' modified SNAs as a measure of welfare and as a guide to policy formulation and implementation.

While there is scope for improved environmental accounts and statistics, the desirable extent and nature of these improvements will vary from country to country. Many, particularly SIDS, will not find it worthwhile to set up *macro-type* integrated environmental and economic accounts. At least, they should defer doing so until more research is done along the lines suggested by Bartelmus *et al.*, (1993, p. 127) who point out:

"Considerably more research is required regarding the actual use of modified accounts and accounting indicators in macroeconomic and sectoral planning and policies".

The above approaches dominate current efforts to account for the environmental and natural resource factors in GDP. However, another possibly useful methodology for measuring the contribution of major resource sectors to GDP has been advanced, and is of some interest. This methodology has been developed under the auspices of UNEP, and has been applied experimentally to the GDPs of Tanzania and Zambia in an attempt to measure the contribution of the ocean sector to total GDP (UNEP n.d.). In principle the suggested approach can be applied to any major resource sector.

This methodology involves the allocation of the portion of GDP - arranged by major industry or business establishment - that originates from the ocean/coastal sector. The relevant ocean products are those that either utilise an ocean resource in a productive process (i.e. on the supply side) or exist because the demand for the final output is due to some attribute of the ocean (demand side). Among the major ocean resources contributing to GDP are fisheries, marine mining and coastal tourism.

The approach is based on an analysis of GDP, by industrial components, to determine value added from ocean resources, and results in a two-sector economy, namely ocean and non-ocean sectors.

This innovative approach may have considerable interest for SIDS with their usually extensive coastal and marine areas. However, its application may be restricted where there is a lack of detailed national income data needed to distinguish sources of value added. There may also be a lack of skills needed to identify and assess the contribution of particular groups of ocean resources to GDP.

4. Natural Resource / Environmental Accounting in SIDS

Given the current stage of development of integrated environmental-economic accounting SIDS need to be cautious in applying it because of the costs involved in the preparation of these accounts, problems with their accuracy, limits to their application for policy purposes and philosophical issues (such as their value as indicators of welfare) which yet have to be resolved.

However, this is not to say that SIDS should neglect environmental / natural resource data collection. In fact, it is important that they give greater attention to this from a policy and sustainability point of view. See Box 2 for an update on the application of NRA and GDP compilation among the SIDS of the South Pacific.

The purpose for which environmental/natural resource data are being collected should be specified and any system or framework for this collection should be assessed in terms of this purpose. As for *macro* integrated environmental-economic accounts and *macro* natural resource accounts, their purpose is not well specified at present, and it is not clear that such accounts will result in timely policy decisions. Data may be gathered well after the event and be too aggregated to pin-point areas requiring policy intervention. In particular they may be of limited value for anticipatory policy - policy designed to avoid an unwanted situation developing.

Given the costs and benefits involved SIDS may at this time find it more worthwhile to concentrate on systems of partial environmental-economic data gathering and accounting such as FDES. It is clear from the Papua New Guinea study by Bartelmus *et al.* (1993) that significant gaps exist in basic knowledge in many less developed countries about natural resource stocks and variations in them as well as other items specified in FDES. It may be wise for SIDS to concentrate on filling the main gaps in their FDES before going on to specify natural resource accounts in monetary terms. It may even be difficult for SIDS to complete FDES comprehensively.

Box 2:

National income accounting and NRA among Pacific Island Countries

Very few Pacific island countries (PICs) presently compile national income regularly. They include the Cook Islands, Fiji, Kiribati, Papua New Guinea and Tonga. Except for Kiribati, which has its own national income specialist, these countries rely heavily on outside experts, notably from Australia and New Zealand.

No PIC has successfully applied NRA, although Papua New Guinea was the subject of a case study in applying NRA by the World Bank and the UN Statistical Division. It may be noted however, that Fiji (and 5 Asian countries) has received ADB support to apply NRA experimentally.

It also appears that no PIC has been able to systematically develop environmental indicators. However, in almost all cases, considerable data and information on selected aspects of the environment and natural resources have been collected and published. These include data on land use; forestry resources; inshore fish catches; and water and coastal pollution.

There is a growing recognition among PICs of the need to develop meaningful environmental and natural resource indicators as a basis for sound decision-making. Of interest is an upcoming (September 1994) meeting of regional statisticians which, among other things, will discuss the need for environmental indicators and effective ways for setting them up nationally. The organiser, the South Pacific Commission, has asked SPREP to identify environmental indicators deserving priority. The meeting will also discuss training requirements for establishing key environmental indicators.

It is therefore clear that PICs have a long way to go in establishing adequate databases in relation to natural resources and the environment, not to mention NRA systems and related aggregates. In these fields, these countries will need continuing external assistance - from regional and international agencies - especially for technical assistance, training and institutional strengthening.

There is, therefore, a need for sectors and areas to be identified which should be given priority. Priority areas could differ significantly between countries. For example, the forest sector (or the commercial forest sector) may be of little or no importance to small coral islands such as Tuvalu and Kiribati, but very important to larger countries including Papua New Guinea, Solomon Islands and Fiji. However, one would expect the fisheries or marine sector will be of great importance to all SIDS.

A special effort should be made to target the subsistence sector given its cultural and economic importance throughout the South Pacific islands. Its sustainability can be undermined by environmental and natural resource depletion or deterioration. In many SIDS the bulk of the population is still employed in subsistence activities. It can be argued that this sector provides long-term social and economic security for many island states (Tisdell and Fairbairn, 1984). While many SIDS benefit considerably from foreign aid and remittances (Bertram, 1986) this so call rent-income may not be secure in the long term. There can also be considerable insecurity in commercial exports not to mention the long-term lack of sustainability of mining.

To obtain adequate data sets on natural resource/environmental conditions in the subsistence sector may in itself be a substantial exercise. For policy purposes, it may also be desirable to specify the data spatially e.g., in very small states, by villages. Attention should be given to local community involvement in such data collection.

A number of environmental/natural resource problems have to be addressed at the village or local community level. In many Pacific islands, effective traditional institutions of local government exist. However, if these institutions are to work well, local communities must be provided with appropriate information e.g., on their changing environment and its consequences. In this regard a partnership is necessary between local communities and those outside the community who possess special skills for environmental/natural resource assessment.

The value of information gathering must also be related to the presence of institutions for taking advantage of the information gathered. Data needs to be gathered with existing institutions in mind. On occasions also consideration might be given to changing or adding to institutions to make greater use of data being gathered. Environmental accounting and statistical data collection should not exist in a social vacuum. Social and political institutions and property rights have important implications for sustainable resource-use and this should always be kept in mind.

Some SIDS do have substantial commercial sectors and a disaggregated approach to collection of environmental/natural resource data should cover the most important of these sectors. Consideration should be given to devising criteria for the selection of those sectors to be given particular attention. The central government or public sector plays a major role in most SIDS and it would seem desirable that this sector be included in most practical assessments of environmental/natural resource conditions and changes.

While developments in integrated environmental and economic resource accounting and natural resource accounting do highlight important issues, it seems wise for SIDS at this time to concentrate on less ambitious types of a gathering and processing and to take a more disaggregated approach. The process should be linked to the structure of their economies and reflect their institutions, particularly their local institutions. As a result the information is likely to be more valuable and to obtain greater application. Thus new environmental data frameworks should be developed for SIDS and should allow for diversity of socio-economic structures and natural resource conditions encountered between SIDS.

5. Applicability of Environmental Economics to Small Island Developing States

Environmental economics has developed as a readily identifiable body of thought in recent years. The first text books on this subject were produced in the United States in the 1970s. Frequently, the coverage of such texts includes environmental and natural resource economics e.g. Tietenberg (1992) since these subjects can overlap to a considerable extent.

Environmental economics can involve both microeconomic and macroeconomic models. As the subject has developed, microeconomic modelling is, as a rule, heavily dependent on neoclassical economic theory and market-failure variations to it. The techniques of analysis and policy prescriptions are usually of greatest relevance to large market economies. This is not surprising since it is within such economies that the bulk of this analysis has been developed.

Environmental economic models involving macro-variables are frequently closely related to theories of economic growth and development or use aggregate analysis to model the whole economy such as input-output analysis with a waste-disposal and absorption sectors added. The former is generally concerned with the evolution of economic systems and the latter with the modelling of such systems in a more complete fashion than in the past, e.g. by extending models of general equilibrium economic as for example is done by Kneese *et al.*, (1970) and Isard (1979).

Environmental economics has been developed mainly with large market economies in mind and implicitly assuming the presence of Western institutions and types of socio-economic behaviour. To some extent it is culture-specific and this limits its application to many SIDS (Cf. Tisdell, 1993a). However, this does not mean that there is no scope for applying environmental economic analysis to SIDS.

One must be selective however, in its application and alter it as required to take account of local institutions and conditions. For example, in most SIDS environmental economics needs to take account of the role of local subsistence communities and the particular types of property rights which exist at the village-level. Privatisation of resources at this level is, for instance, not normally a socially acceptable possibility.

There are a number of environmental economic concepts which are relevant to SIDS and which would benefit from some discussion. These include economic concepts of environmental externalities or spillovers, the role of property rights in the protection of the environment, sustainability of resource use and problems of knowledge and the use of the environment. Let us consider these aspects.

5.1 Environmental Externalities

A large portion of environmental economies is concerned with the exploration of environmental externalities - why they occur, whether they are significant and how can they be corrected, particularly in the context of market systems. Environmental externalities (or spillovers) occur when one party or set of parties obtains benefits or is damaged by the action of another party or set of parties in using resources, *and* the beneficiary does not pay the originator of the benefit for it, or the victim is not compensated by the originator for the damage caused. Reciprocal exchange is not present and so externalities are often said to be one source of market failure.

However, in market systems, this failure occurs because markets have not been extended completely enough. Theoretically, universal extension of perfect markets would eliminate all externalities but there are often limits to which extension of markets (and associated property rights) is economical and practical.

As is clear from the above, environmental externalities may either be favourable or unfavourable. In the former case, the gains to a person or set of persons carrying out some action are less than the benefit to the whole society. Social benefits exceed private benefits.

For example, a community re-afforesting a hilly area, say in Fiji, may confer benefits on villagers downstream because the severity and frequency of flooding is reduced. Or a coastal community setting aside a small protected marine reserve for encouraging breeding of fish may benefit other nearby coastal communities to some extent by raising the stock of fish in the general area.

In the case of unfavourable externalities, private costs (or costs to a small group) are less than social costs - costs to the wider community. Because the former group does not pay the full cost of using the environment, they are liable to engage in socially inappropriate behaviour.

Examples of unfavourable externalities include private companies releasing industrial pollutants into streams and the leaking of heavy metals and pollutants from tailing dumps created by mining companies so reducing fish populations and endangering human health. To take another example, commercial logging can result in adverse externalities e.g. loss of corals due to increased freshwater surges and greater sediment. Again underground water supplies may become polluted due to spillage of dangerous chemicals or leaking of chemicals from private stockpiles of raw materials. Many other examples could be quoted.

It should be clear from the above that the environmental externalities will be of considerable concern to village communities. They can both be affected by them and give rise to them. Furthermore, they may occur in the village itself, e.g., due to the action of a particular family. However, within the village they must normally be corrected by communal action since there is limited scope for the operation of markets or market-related mechanisms within many villages.

A variety of methods have been suggested for correcting adverse externalities. These include taxes, tradeable environmental-use rights, regulation and improved assignment of property rights. There is not room to explore here the limits to the use of such instruments in SIDS. A wider study examining this aspect would be worthwhile. Within the market sector of SIDS scope for using most of these instruments may exist but the size of markets may limit the application of tradeable environmental-use rights.

5.2 Property Rights and Market-Making

Extension and clearer determination of private property rights is often suggested by Western environmental economists as a means of dealing with externalities. However, there are limits to the economics of this process and in many SIDS in the Pacific social custom restricts the creation of such rights, e.g. in reef areas or forested areas. Nevertheless, this does not mean that property rights issues are irrelevant.

Communal management of resources can be relatively efficient and can provide social security at the village level. However, titles of the local community need to be definite and settled and there may be a need to improve communal or village governance of local resource management. Once the titles of local communities become definite this should also establish a legal responsibility for the use of these resources. For example, a village may be held to be liable for adverse environmental spillovers on other villages caused by its activities and compensation or penalties may be imposed or if favourable externality is created by the village be eligible for reward. Furthermore, within the village greater consideration should be given to the rights and responsibilities of resource-users.

In many cases, village leaders would benefit from more accurate information about environmental changes and risks in their local area as well as its possible impacts on other communities. Negotiated intercommunity settlement of issues of mutual concern, such as impacts of environmental spillovers, should be encouraged.

While there may be significant social limits to market-making in many SIDS, there is scope to explore application of tradeable permits for environmental use to a greater extent there hitherto. Furthermore, account must be taken of the fact that foreign investors will as a rule require secure titles in order to undertake direct investment.

An important issue for nearly all SIDS is the management of their exclusive fishing zone. The inshore or near coastal strip is generally intensively utilised by local people whereas, as a rule, the remaining area is utilised by distant water fishing nations.

Before UNICLOS (the *UN International Convention on the Law of the Sea*) there was open-access to fishing-resources beyond the inshore area. How best to manage the inshore and offshore fisheries sustainably and for maximum economic benefit is a major issue facing most SIDS. This is made more difficult because many fish species, particularly in offshore areas, are fugitive resources. Thus co-operation in this management between different communities, island and countries is often called for to obtain the best result.

Especially in relation to their offshore fisheries involving distant water fishing nations greater use of market mechanisms may be possible in allocating fishing rights. A considerable amount of literature in environmental/natural resource economic deals with this subject.

5.3 Mechanisms for Sustainability of Resource-Users

Sustainability of resource-use has become a major issue in the literature on environmental economics and the discussion has ranged across both microeconomic and macroeconomic issues. The microeconomic discussion is concerned with matters such as: Do actual markets ensure sustainability of resource-use? Would perfect markets ensure such sustainability? To what extent can and should market or actual economic systems be modified to improve their sustainability characteristics?

On the macroeconomic side discussions have been concerned with issues such as the following: What does sustainability mean and is it possible? How do macroeconomic policies effect sustainability? Are population growth and rising levels of per capita consumption a problem for attaining economic sustainability or sustainable development? Are they a problem in principle? Will self-correcting mechanisms come into play which will avert a major problem? For example, will population growth soon attain a stationary state due to 'natural' developments?

Consider the microeconomic perspective. Many environmental economists argue that private property rights or well defined systems of property rights are the key to sustainability. Up to a point this is true and we have already indicated the possible relevance of property rights to SIDS and pointed out, however, that social constraints prevent extensive reliance on private property rights at the village level in many SIDS.

Nevertheless, systems or rights and mechanisms for resolving disputes about rights do have important implications for sustainability in SIDS and is worthy of deeper investigation.

Some economists have argued that basically sustainable economic development requires the maintenance (sustainable use) of the environmental/natural resource stock and only in special circumstances can the depletion of this stock be justified. Clearly to maintain the stock of non-renewable resources (e.g. minerals) while making use of them is impossible but it is possible to use renewable resources, such as fisheries, sustainably. This view introduces a cautionary note into the economic growth debate.

It suggests that one should not deplete natural resource or environmental stocks without being relatively sure that sustainable benefits can be achieved by making use of the gains obtained from the depletion. One is warned that investment in man-made physical capital is unlikely to achieve sustainability because of the impermanence of such capital but investment to achieve extension of productive **knowledge** can have permanent benefits.

This approach has led some economists to suggest that project evaluation should include a sustainability criterion or test (see Tisdell, 1993b, Ch. 8). Pearce *et al.* (1989) have recommended that social cost-benefit analyses should be undertaken subject to a constraint that the level of natural resource / environmental capital be maintained. This view has been used to support environmental offset policies. A project, for example, which depletes environmental capital at one location may be allowed if it is compensated for by another adding suitably to environmental capital elsewhere. There is scope for exploring the possible use of environmental offset policies in SIDS.

The concept of sustainability is also sometimes linked to the precautionary principle. This principle indicates that in relation to environmental use or depletion it may be wise to err on the conservative side given that several types of resource depletion are irreversible.

In practice, an important source of lack of sustainability in relation to economic production can be the presence of externalities and the inappropriate use of shared resources due to defects in the property rights system, e.g., the presence of open access. In addition, environmental goods with the characteristics of pure public goods exist can be a source of market failure and a lack of sustainability.

Even in case where private property rights can be fully established and enforced doubts have been expressed about the ability of actual market systems to ensure desired levels of economic sustainability. It is often argued that private discount rates (or the market rate of interest) is too high to guide the use of capital investment and use of natural resource stock.

Lower rates of interest tends to favour projects with more sustainable compared to immediate returns and may favour a greater level of conservation of environmental resources (Tisdell, 1991, Ch. 3). Supporters of this view see the need for the government or community to intervene to moderate private demands to deplete environmental or natural resources. It can be argued that at least a modified form of discounting of the future support sustainability considerations (Kula, 1992).

Environmental risks or hazards are also an important issue. Companies engaging in environmentally risky activities may be required to deposit bonds against the risk. This may induce them to take greater care and improve sustainability prospects. Particularly those SIDS where mining or other risky commercial activity is being undertaken may find the growing economics literature on this subject to be relevant.

At a macroeconomic level an important issue is how can a country which is not in a sustainable development mode, get into this mode? The Brundtland Report (WCED, 1987) suggests that such a transition will be impossible in less developed countries unless poverty can be eliminated. However, will it be possible to eliminate poverty in all countries without jeopardising sustainability? If so, what is the best way to approach the task?

These are questions of global importance to which we do not have ready answers by they are not irrelevant to SIDS. For example, will the economic growth of China and India (say, to reduce poverty) add significantly to carbon dioxide and greenhouse gas emissions hastening possible sea-level rises and thereby effect economic sustainability (Tisdell, 1994)?

As one can see, the subject matter of environmental economics is broad. Clearly much of environmental economic analysis can be applied to small island developing states *provided* care is taken to allow for the special customs and institutions of such states. However, 'off-the hook' application is likely to result in a serious misfit. This suggests that it would be desirable to build up a set of suitably modified environmental economic analysis so as to make it more readily applicable to SIDS.

6. Strengthening Environmental and Natural Resource Accounting Capabilities among PICs

As noted earlier, the proper integration of environmental concerns in development planning among SIDS is a vital requisite for achieving sustainable development.

Similarly, it was pointed out that among SIDS in the South Pacific, the capacity to carry out this task is very limited. Indeed, the capacity to construct national income accounts on a regular basis, not to mention basic environmental indicators, remains very much at the elementary stage. A vital challenge is to remedy these defects and to take the necessary steps towards preparing the statistical basis required to produce meaningful indicators and, in the case of the larger PICs, to possibly eventually venture into NRA.

For PICs, the most promising approach - at least during the initial stages - would appear to be to examine the present situation with particular reference to the availability of information on particular aspects of the environment and natural resources, with a view to establishing meaningful indicators on a systematic basis.

An additional task is to strengthen local capabilities for the regular compilation of national income accounts and undertake in-depth studies of key areas of the physical environment and how they interact with economic, demographic and social factors. These steps are vital in laying the basic groundwork for the possible future application of NRA or variants thereof.

For most PICs, the adoption of fully integrated environmental economic accounting does not appear to be warranted. The costs of doing so in relation to the benefits are likely to be too high and most PICs would find it difficult enough to complete SNA at present because of lack of qualified staff. It is, furthermore, not yet clear how well these accounts can be used in development planning.

Adjustments to national income aggregates such as GDP and NNP may be possible in some SIDS to allow for environmental / natural resource changes but are likely to be rough-and-ready and of little practical value. The best that might be expected from them is to sound a note of warning about falling natural resource stocks and deteriorating environmental condition.

It might be noted that this view also accords with that of the Australian Bureau of Statistics. According to Paul McCarthy (1993, p.7), who provides a useful overview of 'green' accounting and the problems involved with it, the Bureau has questioned the priority that should be given at this time to investigating a 'green GDP' given the amount of statistical development required (relative to other environmental indicators). The view that further development of physical indicators is required before values can be placed on environmental factors is shared by national accountants and environmental statisticians in most countries'.

Adequate support from regional and international agencies will most certainly be needed if PICs are to succeed in strengthening their capacities to properly integrate environmental factors in development planning and decision-making. Financial and technical assistance is needed to augment efforts at the national level, including those related to institutional strengthening and the building up of skills and the preparation of appropriate strategies and policies.

Regional organisations, notably SPREP and SPC, have a vital role to play, especially in providing advisory inputs, training facilities, technical assistance, and presenting regional positions on the environment at international fora. International organisations also have an crucial role to play in providing financial assistance - both to national and regional parties - and in supporting training, regional conferences, scientific studies of the environment, and natural resources.

Specific areas of need which deserve to be addressed if PICs are to succeed in achieving a better integration of environmental / natural resource and economic development are listed below. These areas should be considered as having priority in the development of a proposal - or set of proposals - to external organisations seeking assistance for PICs.

They involve measures of assistance designed to:

- *Evaluate existing information on the environment and stocks of natural resources and submit proposals for designing and establishing a more systematic and comprehensive set of environmental statistics and indicators;*

- *Assess the merits and possible procedures for the adoption of FDES approaches as a basis for organising environmental data and as an interim system pending the possible establish-ment of NRA in the longer term;*

- *For individual PICs, identify key environmental / natural resource areas that need to be addressed as a matter of priority in terms of integrated development planning and possibly the application of NRA in the future;*

- *Strengthen national capacities to prepare standard national income accounting on a regular basis, the acquisition of such skills being an essential prerequisite to NRA accounting should it become a feasible and practicable option*

- *Undertake a detailed study of how NRA could be applied (and modified) in the context of small PICs, and identify possible benefits and costs likely to flow from such a system;*

- *Undertake an in-depth analysis of the relevance for PICs of environmental economics as it has developed to date, taking into account the special features of the economies of these countries, notably the large role played by subsistence production, communal-based organisations, and the prevalence of traditional and cultural institutions and practices;*

- *Give strong support for well directed training initiatives, both at the country and regional levels - aimed at promoting indigenous skills in environmental statistics and accounting, cost-benefit analysis of natural resource projects, and environmental economics in general;*

- *Undertake a detailed study of the dynamics of the subsistence sector as currently operating among PICs, with particular reference to the question of resource management and its significance in the overall economic process; and,*

- *Carry out further analysis of selected economic and environmental issues that bear upon sustainable resource usage, including the investigation of environmental externalities and the use of environmental 'offset' policies.*

In tackling the above major issues, as the leading regional agency in this field, SPREP can be expected to play a key role in providing advice, mobilising funding and technical assistance, and in coordinating the overall effort. For the further development of national income and statistical indicators, the SPC - through its statistical unit - can be expected to take the major responsibility.

SPREP and SPC should be heavily involved in training activities, both in-country and regionally, supported by interested international agencies such as UNEP and UNDP. The regional facilities of ADB and EPOC / ESCAP can also play an active role in these areas.

7. Concluding Comments

NRA was developed because of existing deficiencies of existing systems of national accounts in allowing for the costs of environmental deterioration and for the depletion of natural resource. These deficiencies of SNAs are not surprising because these accounts were originally devised as means of measuring aggregate market demand, an important determinant of the level of aggregate employment of labour in the short and medium term in market economies. Later these accounts came to be used by many as indicators of economic growth and to give crude measures of welfare.

In the 1970s, but commencing in the late 1960s, increasing dissatisfaction came to be experienced about this practice. Some economists argued that the costs of economic growth were not being fully accounted for, e.g., Mishan (1967) and the question of the sustainability of economic growth and development was increasingly raised. Thus the seeds for the development of accounting for natural resource use and environmental change were already present (Cf. Tisdell, 1991, sec. 1.4).

Various methods of dealing with the problem have been suggested - adjustments to national income aggregates to allow for changes in environmental and natural resource conditions, physical indicators of variations in the status of the environment and natural resources, and integrated environmental (national resource) and economic accounting.

However, there are still a number of conceptional problems to be resolved and limitations of aggregate monetary accounts allowing for changes in environmental conditions and attractions in the levels of natural resource stocks. Some of these problems arise because the aim is to use accounts of flows to capture changes in stocks. It is doubtful if this can ever be a complete success. Nevertheless, sustainability and environmental issues are important and they need to be taken in to account by SIDS.

It has been argued in this report that the application of a fully-fledged (and unmodified) system of NRA is somewhat premature. It is suggested that the most promising path for SIDS to follow is to concentrate on the FDES approach, collecting basic statistics and indicators for those information categories and sectors of most importance to their own economies. In may cases, SIDS have considerable gaps in basic information on natural resources and the environment.

Without the basic data from FDES more sophisticated natural resource accounts will not have a firm foundation. One would expect in most SIDS that the subsistence (village) sectors and marine sector would be given priority for coverage. Some systematic method, however, of selecting sectors for coverage would be useful. Research into this matter is recommended.

The data should be disaggregated to a level where it can result in practical decisions. In many SIDS this will require, it to be disaggregated to the village or local community level. Accounting must be related to the possibilities for decision-making and be structured to the social patterns of decision-making in SIDS.

Environmental economics has undergone substantial development in the last two decades and has considerable potential for application in SIDS even though it requires modifications and further development for worthwhile application. For example, account needs to be taken of communal structures, restrictions on private property rights and the nature of communal property. However, it is still the case that SIDS have to grapple with environmental externalities, property-rights issues and failures of the socio-economic system to ensure economic sustainability. Careful study of environmental economics and its sympathetic adaptation can do much to address these issues in SIDS.

Both NRA and environmental economics do have applicability and can be used in small island developing states. However, there are limits to their applicability and usefulness as pointed out above. Research into their limits should be encouraged and a body of environmental economic analysis based on the institutions and cultural settings of SIDS needs to be developed.

It is recommended that foreign aid donors provide funds for the systematic development of this latter body of knowledge because it will be of considerable benefit to SIDS in achieving sustainable development and improving the quality of life of islanders.

To conclude - donors, both regional and international, can play a crucial role in building up the capacity of SIDS to develop suitable sets of environmental and natural resource indicators, and to establish FDES. They can also be instrumental in strengthening national income capabilities of SIDS which, in the long term, and especially for the larger countries, can facilitate the adoption of NRA or variants thereof.

Key areas of possible assistance include:

1. a review of existing environmental data situation of SIDS and how to organise such data more systematically; and,

2. appropriate training programs in the fields of natural resource and environmental statistics, FDES concepts and techniques, national income accounting procedures, and environmental economics.

Because of their generally greater familiarity with local conditions, regional organisations (such as SPC and SPREP for South Pacific SIDS) can play a particularly active role, for example, in providing technical assistance and in mobilising resources, including those from interested international agencies.

References

Asafu-Adjaye, J. (1993) "Environmental Accounting in Papua New Guinea" *Pacific Economic Bulletin*, 8(2):42-49.

Asian Development Bank (1992) *Tonga Economic Report*, Asian Development Bank, Manila, Philippines.

Asian Development Bank (1990) *Economic Policies for Sustainable Development*, Asian Development Bank, Manila, The Philippines.

Bartelmus, P., Lutz. E. and Schweinfest (1993) "Integrated Environmental and Economic Accounting: A Case Study for Papua New Guinea". Pp. 108-143 in E. Lutz, *Toward Improved Accounting for the Environment*, World Bank, Washington, D.C.

Bertram, I.G. (1986) "Sustainable Development in Pacific Microeconomies", *World Development*, 14(7): 809-992.

Daly, H.E. and Cobb, J.B. (1989) *For the Common Good: Redirecting the Economy Towards Community, the Environment and a Sustainable Future*, Beacon Press, Boston.

Davis, R. (1993) "Sustainable Development Environmental Accounts and Planning in Pacific Island Countries". ASAIHL Conference on Sustainable Development Challenges for the Asia-Pacific Region in the 21st Century, Griffith University, 6-8 July, 1993.

Doessel, D. and Gounder, R. (1991) "International Comparisons of Levels of Living and the Human Development Index: Some Empirical Results" *Department of Economics Discussion Paper No. 72*, University of Queensland, Brisbane, 4072, Australia.

El Serafy, S. (1989) "The Proper Calculation of Income from Depletable Natural Resources". In Y. Ahmad, S. El Serafy and E. Lutz, eds, *Environmental Accounting for Sustainable Development*, World Bank, Washington, D.C.

Fuavao, V.A. (1993) "South Pacific Regional Environmental Programme: Implications of Agenda 21 for the Pacific". *Pacific Economic Bulletin*, 8(2):22-31.

Isard, W. (1969) "Some Notes on the Linkage of the Ecologic and Economic Systems". Paper delivered to the Regional Science and Landscape Analysis Project, Department of Landscape Architecture, Harvard University, 27 March, 1969.

Keynes, J.M. (1936) *General Theory of Employment, Interest and Money*, Macmillan, London.

Kneese, A.V. Ayers, R.U. and d'Arge, R.G. (1970) *Economics and the Environment: A Material Balance Approach*, Resources for the Future, Washington, D.C.

Kula, E. (1992) *Economics of Natural Resources and the Environment*, Chapman and Hill, London.

McCarthy, P. (1993) "Problems and Prospects for 'Green' Gross Domestic Product (GDP) in the Australian National Accounts", Australian Bureau of Statistics, Canberra. A paper presented to the Environmental Economics Conference, Canberra, November, 1993.

McKee, D.W. and Tisdell, C.A. (1990) *Developmental Issues in Small Island Economies*, Praeger, New York.

Miles, G. (1993) "Progress since the Earth Summit". *Pacific Economic Bulletin*, 8(2):32-40.

Mishan, E.J. (1967) *Costs of Economic Growth*, Staples, London.

Pearce, D. Markandya A. and Barbier, E.B. 91989) *Blueprint for a Green Economy*, Earthscan Publication, London.

Peskin, H.M. (1991) "Alternative Environmental and Resource Accounting Approaches". Pp. 176-193 in R. Costanza, editor, *Ecological Economics: The Science and Management of Sustainability*, Columbia University Press, New York.

Repetto, R., Magrath, A., Wells, M., Beer, C. and Rossini, F. (1989 *Wasting Assets: Natural Resources in the National Income Accounts*, World Resources Institute, Washington, D.C.

Tietenberg, T. (1992) *Environmental and Natural Resource Economics*, 3rd edition, Collins Harper, New York.

Tisdell, C.A. (1990) *Natural Resources, Growth and Development*, Praeger, New York.

Tisdell, C.A. (1991) *Economics of Environmental Conservation*, Elsevier Science Publishers, Amsterdam.

Tisdell, C. (1993a) "Project Appraisal, the Environment and Sustainability for Small Islands" *World Development*, 21(2): 213-219.

Tisdell, C.A. (1993b) *Environmental Economics*, Edward Elgar, Aldershot, UK.

Tisdell, C.A. (1994) "The Environment and Asian-Pacific Economic Development, particularly East Asian Economic Development". Paper prepared for Western Economic Association International Pacific Rim Conference, Hong Kong, 8-13 January, 1994.

Tisdell, C.A. and Fairbairn, I.J. (1984) "Subsistence Economies and Unsustainable Development and Trade: Some Simple Theory" *Journal of Development Studies*, 20: 227-241.

UNEP (n.d.). "Contribution of the Ocean Sector to the GDP of Tanzania and Gambia: A Methodology", Nairobi.

United Nations (1984) *A Framework for the Development of Environment Statistics* ST/ESA/STAT/SER.M/78, United Nations, New York.

United Nations (1991) *Concepts and Methods of Environment Statistics: Statistics of the National Environment*, ST/ESA/SER.F/57, New York.

WCED (World Commission on the Environment and Development) (1987) *Our Common Future*, Oxford University Press, New York.

World Bank (1991) *Pacific Island Economies: Toward Higher Growth in the 1990s*. World Bank Country Study Series, Washington, D.C.

Young, M.D. (1992) *Sustainable Investment and Resource Use*, UNESCO, Paris and The Parthenon Publishing Group, Carnforth, UK.

Glossary

Aggregate employment

Total number of persons in the labour force in actual employment, usually applies to those employed in the formal non-subsistence sector.

Externalities (or spillovers)

Arise whenever the activities or enjoyment of any set of economic agent, or identities, are affected (favourably or adversely) by the activity of others, and the effect escapes being priced.

Framework for the Development of Environmental Statistics (FDES)

A framework developed by the UN Statistical Office to assist in the development, coordination and organisation of environmental statistics.

Gross Domestic Product (GDP)

Total market value of goods and services a country produces in a given period (usually a year); Net Domestic Product (NDP) equals GDP less an allowance for the depreciation of man-made capital.

Inflationary Gap

The amount by which actual private and government spending (GDP) exceeds the theoretical amount of spending adequate to absorb all the available goods and services without appreciably raising the price level.

Input-Output Coefficient

The ratio between the value of what an economic sector (or firm) purchases from and sells to other sectors (firms) in the process of production; derived from statistics of inter-industry tables of transactions (input-output tables).

Macroeconomics

The economy viewed as a whole or its basic subdivisions or aggregates, for example, government, households and business sectors, that make up the economy.

Microeconomics

Concerned with specific economic units - for example, an individual industry, a firm or a household - and considers the behaviour of these individuals units.

National Resource Accounting (NRA)

A system of accounting that complements standard national income accounting systems and designed to incorporate more fully environmental aspects of development, particularly resource depletion and environmental degradation.

Neoclassical economics

A school of thought assumes that consumers and producers are "rational", i.e. that consumers want maximum benefits from a product, and that producers want maximum profit. It highlights the importance of factor substitution and the allocative efficiency of free markets. forces.

Satellite Accounts

Environmental accounting statement separate from, but consistent with, the SNA and providing supplementary data to SNA.

Social Cost-Benefit Analysis

A procedure for attempting to measure the benefit and costs of projects or activities, taking into account externality effects

Sustainable Development

Describes a pattern of development that attempts to integrate economic growth with environmental protection and resource conservation (particularly non-renewable resources) for the benefit of present and future generations.

System of Integrated Environmental-Economic Accounting (SEED)

SNA accounting system modified to take into account environmental aspects.

System of National Accounts (SNA)

Standard system of national accounting as developed by the UN Statistical Office.