PAPUA NEW GUINEA - AN ARCHIPELAGIC NATION UNDER ENVIRONMENTAL STRESS

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ABSTRACT

Papua New Guinea (PNG), an archipelagic nation with abundant natural resources and comparatively pristine environment is under threat. A major force behind this threat appears to be the socio-economic transformation produced by development. The economic and human activities of mining, logging and slash and burn agriculture are increasingly having a deleterious effect on the natural environment. The challenge facing the country is how to achieve the required social and economic development while ensuring at the same time that the natural resources are utilised and managed sustainably and the environment is protected. The paper highlights the threats to sustainable development and how to bring about desirable changes for sound management of resources and the environment.

Keywords: environmental sustainability, resource utilization, land degradation, national sustainable development strategy (NSDS).

Introduction

Lying barely south of the Equator, to the north of Australia, Papua New Guinea (PNG) is an archipelagic nation of some 600 islands scattered over 2 million km² of the South Pacific Ocean. Its mainland (New Guinea) in the west is a sub-continental island shared with Irian Jaya, which is a part of Indonesia. This mainland comprises 85 per cent of the country. Together with the provincial islands, the total land area is 463,000 km².The country's 1990 total population was 3.8, million growing at the rate of 2.3 per cent per annum. In 1995, the population was estimated at 4.3 million.

Geologically, the country is complex and lies upon at least three of the earth's main tectonic plates (Australian, Pacific and Solomon). Physiographically, the mainland is similar to Madagascar, with a massive rugged cordillera in the central core of the island, interspersed with wide intermontane valleys at altitudes of 1500 -1800 metres, flanked by low-lying coastal plains drained by numerous rivers. The chains of islands making up Manus, New Britain, New Ireland and North Solomons are characterised by steep rocky coastlines on tectonically active blocks, volcanic areas, rising coral reefs and minor depositional areas. In addition there are numerous reef-based low islands, and raised reef and atoll islands. Because of its latitudinal position, the country experiences a tropical climate with moderately high temperatures everywhere and little seasonal variability, except in the mountainous interior where due to the relief, temperatures are lower, giving rise to more equable climatic regimes. PNG is generally wet and humid except for pockets of semi-arid lands in the south west of Western Province, the Markham Valley, the lower Eastern Highlands and the area around the National Capital (Port Moresby).

PNG is also located at the crossroads of several major biogeographic provinces. Tropical rainforest covers most of the country. The remainder is covered mainly by savanna, grasslands and swamps. These factors have contributed to the country's rich terrestial and marine biodiversity. This biological and physical diversity is equally matched by the country's cultural diversity and this is reflected in the fact that there are well over 700 distinct language groups in the country, some spoken by as few as 20 people.

PNG's rich cultural heritage extends over at least 50,000 years with a history of agriculture dating to at least 9,000 years ago. The ancestral agricultural and hunter-gatherer societies especially in the high-

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land valleys have had a significant impact on the environment, progressively transforming large areas of forest into fire climax grasslands over the last few thousand years. Allen (1988) has pointed out the severe degradation caused by prehistoric agricultural land use in Enga and the Southern Highland Provinces. However, it is known that local people in several parts of PNG also practised traditional resource conservation.

PNG has a highly rich and divesified natural resource base. The country has been described as "a mountain of gold floating in a sea of oil" (UNISEARCH 1992). Besides gold and petroleum, the country has vast reserves of copper, silver, nickel, gas and timber. Until recently, the economy depended on copper, coffee, cocoa and copra. Since the mid-1980s, copper has been overtaken by gold, petroleum and timber as the leading export items. However, agriculture is still the mainstay of the economy with about 80 per cent of the population at least partially dependent on subsistence farming. Cash crops like coffee, cocoa, coconuts, rubber, oil palm and tea are grown in small holdings and plantations. About three-quarters of the country's land is forested, with some 10,000 species of flora, including as many as 1,500 tree species of which some 240 species are currently harvested for export.

The constraints to development and broad-based growth stem partly from the rugged mountain terrain and the spread of lands which divide the country into generally small separate regions among which population and production centres are widely dispersed (UNISEARCH 1992). The economy is fragmented and concentrated geographically around cores of activity, with few domestic linkages and with limitations of infrastructure and services.

Although much of PNG's natural environment is still comparatively pristine, the sustainability of the environment is under threat (Darkoh 1995). One of the forces behind this emerging "environmental crisis" appears to be the socio-economic transformation produced by development. The imperatives of modernisation, economic growth, resource utilisation, international trade, increasing consumption and population growth are putting more and more pressure on land and other natural resources in PNG. The challenge facing the country is how to achieve the required social and economic development while ensuring at the same time that the natural resources are managed sustainably and the environment is protected.

The Reality of Resource Development

It would seem from what has been outlined above that the greater part of the problem of achieving sustainable development in PNG relates to the overriding issue of achieving economic growth which arises out of the exploitation of natural resources and the associated and controlling structures which frequently operate as constraints to the achievement of long-term sustainable practices. This section highlights some of the major impacts of economic development on the environment in PNG. The aim is to outline the major threats to sustainable development and the underlying need for sound management to provide a firm foundation for sustainable development.

Minerals and petroleum are at present the largest export income earners in PNG and their importance is likely to grow in the future. In 1993, oil, gold and copper accounted for 72.4 percent of total exports and this contribution is projected to rise with the opening of the new gold mine at Lihir.

Mining and associated infrastructure development are having increasingly deleterious impact on environment in PNG. The greatest impact of mines stems from their current waste disposal practices. The mining activities of Ok Tedi, Misima, Hidden Valley, Porgera, Mt Kare, Wau, Mt Victor and Lakekamu (Table 1 & Fig. 1) use river and ocean dumping as the main means of disposing of mine wastes in PNG (Hughes and Sullivan 1989; Hayes and Mowbray 1994).

During the last one and a half decades, some 400 million tons of tailings have been dumped into the Empress Augusta Bay from the Bougainville copper mine (Asia Development Bank 1992). The tailings are estimated to have formed 7sq km delta and have affected 100 sq km of sea floor. The Jaba River which carries the tailings is biologically dead and fish populations are reduced in its tributaries.

The potential chemical and biological impact of the gigantic OK Tedi gold and copper mine on the Fly River ecosystem has been extensively studied (Jackson 1982; Jackson *et al.* 1995; Rosenbaun and Krockenberger 1993; Eagle 1994). Dissolved manganese copper, particulate copper, and suspended sediment levels remain significantly higher than the background levels 190km below the junction of the OK Tedi and Fly Rivers. Some 600km further, the Strickland River adds waste to the Fly River system from a new gold mine at Porgera. The waste flows

Figure 1. **Major mine sites of Papua New Guinea.**

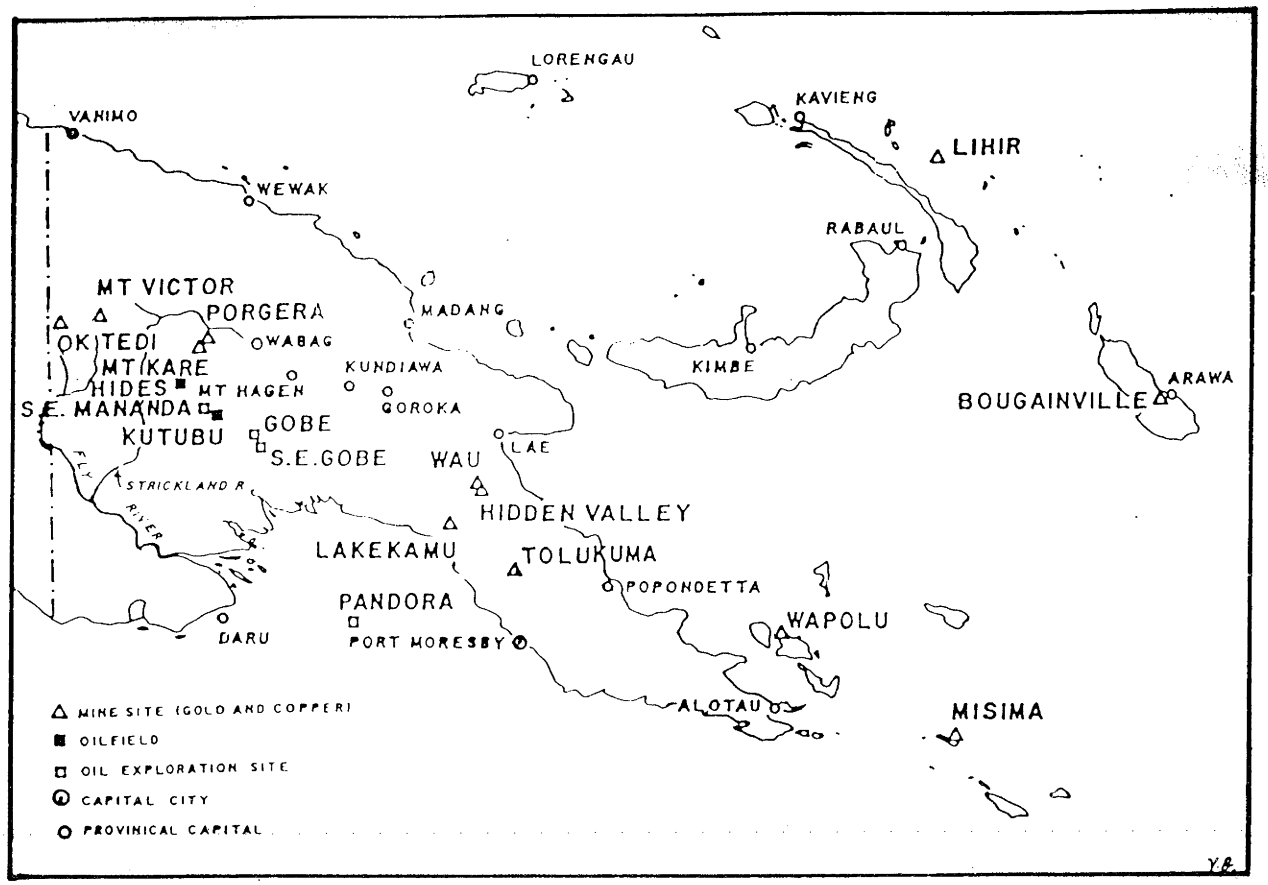


Figure 2. **Timber right purchase areas and local forest areas.** Source: **Department of Forestry, 1988.**

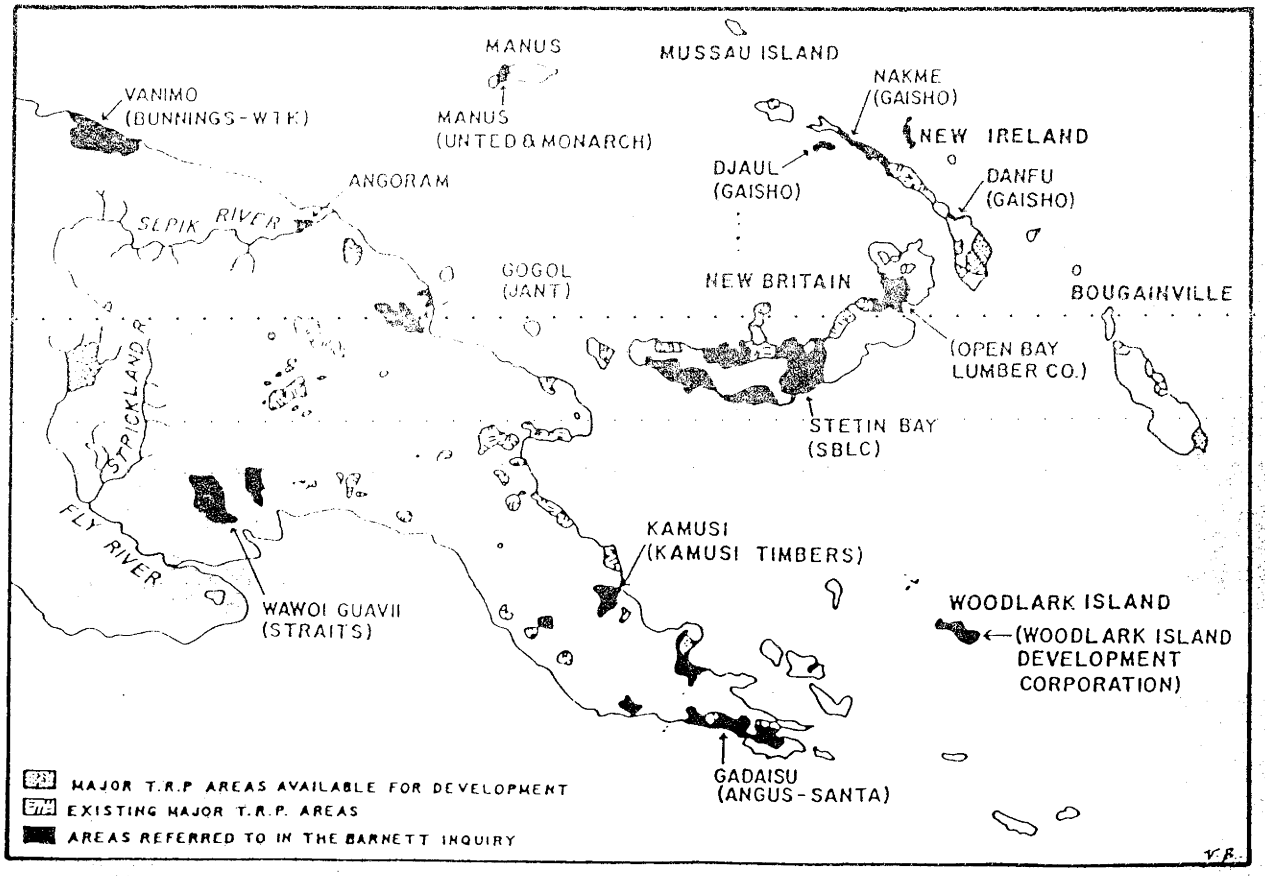


Table 1. **Disposal of tailings from mines in Papua New Guinea**

Mine	Tailings produced (tonnes per day)	Mine life (in years)	Disposal method
Bougainville*	35,000	30	Into river
Ok Tedi	80,000	30	Into river. (More than10,000 t/ day of fine waste rock also enters river
Misima	15,000	10	Deep ocean via submarine pipeline. (10,000 t/day also dumped directly into ocean)
Hidden Valley	10,000	10	Storage in tailing dam
Porgera	9,000	18	Into river
Mt Kare	300	3	Into river
Wau	1,400	9	Into river
Mt Victor	400	2	Storage in sealed limestone sink hole
Lakekamu	0	15	Virtually all rock wastes contained within dredging area

*Ceased operations in 1989 due to civil war, partly over environmental damage

Source: Hughes and Sullivan (1989)

another 385 km to the Gulf of Papua.

All gold and copper mining operations in PNG are on an open cast basis. It is less the total area of forest cleared that warrants concern than the absolute devastation caused at these sites. Most gold operations involve high pressure water blasting of the mountain side and then dredging the rivers below.

The resultant visible scars produce strong responses from the people. The miners have stripped the whole mountain side down to bare earth and deliberately eroded them inorder to wash the gold they hope is there into the river bed where they can sluice for it. What is surprising is that despite the conflict arising from the Boungainville Copper Mine and the A$4 billion compensation claim from landowners at the OK Tedi gold mine, the Government of Papua New Guinea has given its approval to ocean dumping for the new Lihir gold mine.

The environmental impacts of oil extraction are so far minimal but it may perhaps be too early to speculate on the long-term effects. In PNG in general, there appears to be a great impetus to exploit natural resources without regard to longer-term damage.

Environmental and social impacts of logging (Fig. 2) operation in Papua New Guinea have been well-documented in the 1989 Barnett Inquiry Report (Barnett 1989), in which no company was found to have complied with the environmental standards required of them by the Department of Environment

Table 2. **Estimated annual rates of forest disturbance or destruction ca 1990**

Activity	Type	Rate (ha per year)
Logging		
Clear felling	Deforestation	6,000
Selective	Mainly disturbance	70,000
Agriculture		
Subsistence	Mainly disturbance	200,000
Commercial	Deforestation	10,000
Other activities		
Mining	Mainly deforestation	1,000
Firewood	Mainly disturbance	2,000
Infrastructure	Deforestation	2,000
Resettlement	Mainly deforestation	5,000
Total		296,000

*Some of this clearance may be of secondary forest or grasslands.

Source: Papua New Guinea National Report, Unisearch 1992, p.44

and Conservation (and the relevant Environmental Planning Act 1978). The Report found that the forests were being mined for short-term gains rather than being managed on a sustained yield basis.

PNG is one of the seventeen most important countries in the world listed by the FAO that still have vast areas of their landmasses forested (FAO. 1992). PNG's forest estate covers over 36 million hectares (approximately 78 per cent of the country's total land area of 46.5 million hectares.) The World Bank (1990) estimates that the operable (commercial) forest area is 15 million hectares and the inoperable area 20 million hectares. It further estimates that the net annual deforestation rate averaged 22000 hectares per annum during 1981 - 85 while logging operations covered 70,000 hectares per annum over the same period. Table 2 gives the annual rates of forest disturbance or destruction in PNG.

The logging industry in PNG is controlled by foreign multinationals, with Malaysian, Japanese, Korean, Australian, Singaporean and Philippino interests represented among others. However, Japanese and Malaysian multinationals are dominant. In 1990, companies which were known to be Japanese - owned or Japanese - controlled held logging permits over 1 million ha - about half of the area then being logged. One Malaysian family-owned logging company, Rimbunan Hijau (Green Forest), based in Sarawak, now controls 80 percent of all PNG log exports.

Logging in Papua New Guinea (Fig 2) has been described as an operation that involves removal of all currently saleable timber, leaving a relic stand consisting of unsaleable timber species, defectives and small trees (Nadarajah 1993). Such stands do not tend to regenerate adequately for further cutting within an acceptable period of time and are usually converted to agricultural land by customary landowners (Sargent and Burgess 1988).

The logging practices in PNG are not sensitive to the forest ecology, thus the chances of natural regeneration are generally reduced or impeded (Nadarajah 1994). The majority of loggers do not maintain the required 50 metre buffers along rivers; often log slopes that are greater than 30 degrees, damage river and creek banks, and block and pollute rivers and creeks with debris. Felling direction of

trees is not taken into consideration in the preharvesting activities of loggers; thus felling causes extensive damage to the residual stocks. Extensive damage is also caused by the wide snig tracks and roads along which logs are dragged out.

Environmental clauses in the logging permits are usually the bare minimum believed to ensure a second harvest of the forest and are quite inadequate for maintaining the biological integrity of the forests (Marshall 1990). The Barnett Report found that any area of the forest that is rich in commercial species is effectively clearfelled with little heed paid to the importance of maintaining even those values that are so important to the landowners - in particular stocks of animals and birds for hunting and trees used by the local people for canoe building.The Report emphasised that environmental clauses were breached extensively, which goes to show that logging activities in PNG are inadequately monitored in terms of their logging practices.
The Barnett Report shows graphically the role played by graft in the logging business. It found that the problem was particularly severe in New Ireland, where "bribery, corruption and the buying of support have become so widespread that they have become a major social sickness" (Barnett Interim Report No.4, Vol 1: 67). Most of the logging companies used transfer pricing as a mechanism for secretly transfering profits off-shore. Between 1986 and 1987, transfer pricing on log sales averaged US$5 -10 per cubic metre, causing the loss of up to US$27.5 million in foreign currency earnings. In the same period, the government lost up to US$4.27 million in company tax on the hidden profits (Marshall 1990).

It is apparent that government and landowners in PNG are forsaking economic rents to which they are entitled to logging contractors (World Bank 1995). The Barnett report found that logging companies are not interested in conservation: their aim is to make as much money as quickly as possible and they will go to any lengths to achieve this. "The industry is corrupt and corrupting" (Marshall 1990).

Forestry operations, particularly excessive logging, are a threat to the subsistence of rural residents through deforestation, causing soil erosion and contaminated water supplies as well as loss of biodiversity and non-timber forest resources. Other environmental impacts include loss of nutrients, disturbance of nutrient recycling process, changes in soil physical properties, drainage disturbance, reduction in the rate of regeneration process and significant changes in soil temperature light intensity. Saulei's (1990, 1991) research in the Gogol TRP clearly demonstrates some of these effects.

The current forest revenue and concession regime does not seem to protect either the ecosystem or the short-term financial interests of the landowners. What happens to the land after the loggers finish with it, appears to be nobody's concern (Nadarajah 1995). The current trend of establishing oil palm plantations on the deforested land is entirely unplanned and ad hoc. The use of agricultural chemicals in oil palm plantations is common. However, no studies yet have estimated the impacts of such agricultural activities on the environment.

At present, little information exists on the impact of firewood collection on deforestation in PNG. Most villagers and fuelwood collectors supplying towns or villages generally do not travel long distances to collect their woodfuel. Charcoal making is less known and consequently not common in PNG. It is therefore possible that fuelwood collection in general has had negligible impact on forest sustainability in PNG. The exceptions, of course, could be the high density areas such as the Highlands where anthropogenic disturbances have led to conversion of forests into grasslands. Firewood is a significant fuel in urban centres but surveys in Port Moresby have found that there is a decline in use intensity (Hedger and Levett (1991).

It would appear at present that environmental degradation is not caused on any large scale by pressure of population in PNG since total population (4.3 million), its growth rate (2.3 per cent) and density (8 persons per km 2), are comparatively low by African and Asian standards and also since the level of urbanisation (15 per cent) is relatively low. Neverthless, there is distinct evidence that where population densities are relatively high, as in the highlands (which comprise only 20% of the total land but 65% of the population), the practice of subsistence agriculture causes environmental degradation.

Traditional agriculture in PNG is based on the rotational bush fallow variant of the shifting cultivation system which is highly productive and sustainable, provided that population pressure does not lead to the shortening of fallow cycles. However, the intensification of commercialisation of agriculture, coupled with increasing population pressure in some parts of PNG (e.g. the Highlands, the Gazelle Peninsula in East New Britain and Losuia Island in Milne Bay Province), are threats to the environment and long-term sustainability of the PNG agricultural production systems.

Evidence seems to point that localised population pressure appears to be one of the factors leading to the gradual extension of slash and burn agriculture into forested areas, creating most risk of environmental degradation with the destruction of trees and seed sources. There is little doubt that shifting cultivation has been and still is one of the chief causes of deforestation in PNG. The Department of Forest (1991) has estimated that some 6 million hectares are used at any one time and altogether in the gardening fallow cycle in PNG. Most of the 200,000 hectares or so of forested land brought into subsistence cultivation each year is through conversion of secondary forest on a rotation system, but it is reasonable to assume that as much as 10 per cent of this, i.e. 20,000 hectares, is primary forest (UNISEARCH, 1992).

The land which is most at risk of land degradation is that which is cleared and subsequently utilised continually or where the period of fallow is inadequate for the recovery of its previous condition. Shortening of fallow cycles and frequent burn-offs have led to the conversion of primeval forests to secondary forests and ultimately to bush and grasslands in the upland areas. According to the Department of Forests (1991), shifting agriculture is principially responsible for the present day occurrence of anthropogenic grasslands over an area of 3.5 to 4.0 million ha in PNG.

More frequently, soil erosion is the result of land clearance by shifting cultivation. As illustrated by the example of Chimbu Province, traditional slash and burn practices in the upland areas of PNG can leave steep slopes open to heavy rains, spurring landslides, slumps, rapid loss of soil, decrease in fertility and land productivity (Humphries, 1984).

In the coastal areas, destruction of mangrove areas is a matter of concern while further inland in the area around the capital city, Port Moresby, shifting agriculture in the past has no doubt extended the eucalyptus savannas; it has replaced the mixed semi-deciduous **Bombax, Aleurites** and **Gyrocarpus** seasonal forest, although remnants of these trees still cling to the water courses. In the last two decades slash and burn agriculture and tree cutting have also left visible scars on the landscape of the Port Moresby hills. Eden (1993) has described the ecological aspects of traditional swidden cultivation in the coastal plain of southwest PNG, and Levett (1992) has made a comparative study of gardening systems in two mountainous areas in the Gulf Province.

Other factors affecting sustainability of resources in the coastal areas include "pesticide (DDT) and dynamite fishing" and commercial fishing for high value sedentary species. There is however, little reliable data on which one can make an assessment of the extent of damage caused to coastal resources. Tourism is underdeveloped in PNG and consequently has not had much impact on coastal beaches and corals.

Informal, unplanned peri-urban development and squatter settlements are some of the most visible and pressing urban and environmental issues in the coastal areas of PNG. In Lae, peri-urban development has occured on steep, unstable slopes, and erosion, landslides and flooding have become a serious problem. Around Port Moresby, peri-urban development and garbage disposal are acute problems.

As yet, there is no comprehensive data-base on PNG's environment. However, in terms of land use, some remarkable progress has been made recently with the establishment of the Papua New Guinea Information System (PNGRIS). To date, with financial and technical assistance from AusAid and CSIRO, PNGRIS has compiled a fairly comprehensive set of land use data including an update of the 1990 Population Census in various software programmes. This information from PNGRIS does not cover the whole country and there is presently no nationwide monitoring and data collection on key environmental variables. However, a land management project led by Bryant Allen of Australian National University is currently involved in mapping, describing and assessing the extent of environmental stress in all the varied agricultural systems of PNG.

To obtain an overall picture of the impacts of the various human activities on the natural environment, Hayes and Mowbray (1994) have provided a qualitative assessment (Table 3). This Table shows that forestry and mining have the greatest impact and that the effects of population and agriculture rank lower. The greatest impact would appear to be on cultural values followed by forest habitat and water quality.

PNG's National Sustainable Development Strategy (NSDS)

In recent years increasing attention in the country appears to be focusing on the impacts of economic development and the issue of creating an environmentally sustainable economy and society.

Table 3. **Impact of human activities on environmental quality in Papua New Guinea: a synopsis.**

	Human activities associated with production and consumption							
Effects on	**Agriculture**	**Forestry**	**Fishery**	**Mining**	**Energy**	**Transport**	**Industrial pollution**	**Population density**
Water	1	1	1	1	1	1	1	1
-Fresh	2	3	1	4	2	2	2	2
-Marine	2	3	2	4	1	2	2	2
Land/soil	2	3	1	3	2	2	1	2
Air	1	1	1	1	1	2	2	1
Biota/habitats	1	1	1	1	1	1	1	1
-Marine	2	3	2	2	2	1	2	2
-Forest	2	4	1	3	2	3	1	2
Cultural Values	2	5	2	5	2	2	4	3

Source: After Hayes and Mowbray 1994.

No significant impact	1
Some local impact	2
Some widespread impact	3
Considerable local impact	4
Considerable widespread impact	5

The PNG Government in cooperation with non-governmental organisations has embarked on a programme of concurrent and interconnected activities for planning for sustainable development. Nadarajah (1995) has traced the history and reviewed some of the Government initiatives towards planning for sustainable development in PNG. She has discussed especially the voids in the National Sustainable Development Strategy (NSDS) or Yumi Wankain prepared by the United Nations Joint Inter-Agency Mission to Papua New Guinea (UNDP 1994). Because Yumi Wankain is currently the blueprint for PNG's sustainable development, this section focuses on it as a starting point for the major discussion on how PNG can bring about a change especially through the planning process to achieve sustainability in its management of natural resources.

Yumi Wankain

Unlike a developing country like Madagascar where the initiative towards sustainable development has largely come from within in response to a felt need to arrest an endemic problem (deforestation) and prevent the calamitous situation of soil erosion and irreversible decline in the country's exceptional biological diversity (World Bank 1989), in PNG planning for a national sustainable development strategy originated from a response to a global strategy - the UNCED '92 principles (Nadarajah 1995). While, arguably, the principles of sustainable development have been part of Melanesian culture and recognised by the National Constitution as one of the Five Stated Goals- integral human development; equality and participation; national sovereignty and self-reliance; conservation of natural resources for the collective benefit of all and for future generations; and Papua New Guinea ways of

social, political and economic organisation - meant to guide the development of the country, there has been a failure on the part of the PNG academic and political leadership since Independence to conscientise and/or develop the concept as a meaningful social theory which could have provided an ideological basis for development planning and resource management. Consequently, in PNG, it would seem that the issue of environmental consciousness and the need to develop a management machinery to protect the PNG environment have showed first among international organisations and not by internal pressures at local and national levels. This probably explains why, as yet, in PNG, with the possible exception of ICRAF (Individual and Community Rights Advocay Forum) the Churches and the media, there are no strong (endogenous) environmental lobbying groups.

According to Nadarajah (op. cit) it was a post - UNCED Seminar in November 1992 that gave birth to the formulation of a sustainable development strategy. It ought to be noted however that earlier on, in 1991, through the auspices of the United Nations Environment Programme and guidelines provided by SPREP in preparation for UNCED, the University of Papua New Guinea's UNISEARCH had produced the National Report on Papua New Guinea (UNISEARCH 1992).

This latter document would seem to be the first comprehensive study on the issue of environment and development and planning for sustainable development in PNG.It should be noted though that the World Bank in 1988 had also produced a study on Papua New Guinea : policies and prospects for sustainable growth and broad-based growth. Volume 1 the Main Report, & Volume II, the Annexes, World Bank, Washington D.C.

The post-UNCED Seminar in November 1992 alluded to above, was followed by two other major seminars, the Waigani Seminar on Environment and Development in 1993 and the Huon Seminar on management of resources in 1994. Both provided public fora for discussion of key sustainable development issues and recommendations for the development of a national sustainable development strategy (NSDS) for PNG. They were followed by a Biodiversity Country Workshop which also defined a workable conservation strategy for PNG.

Following the Government's endorsement in April 1994 of a proposal for the development of a NSDS for PNG, a National Steering Committee was appointed to coordinate the formulation of the NSDS through a nationwide participatory process. Subsequently, the Government requested UNDP to assist the NSDS Steering Committee formulate and implement a national sustainable development strategy. As a first step in providing this assistance, UNDP funded the Joint Inter-Agency Mission to provide an integrated package of policy advice to the PNG Government on sustainable development.

The joint inter-agency group comprised seven international consultants and three national consultants. Their mission lasted six weeks during which the group organised several working groups in various parts of PNG dealing with issues such as policy planning, enabling government, managing Papua New Guinea's assets and people's participation. The mission worked in close collaboration with national and provincial government agencies, the private sector, and NGOs to help ensure that "the package of policy advice was grounded in the knowledge and experience of PNG nationals and residents" (UNDP 1994).

Using the vision of sustainable human development contained in the "Five Goals of PNG's National Constitution" as the framework for its work, the Mission analysed the major environment and development issues facing PNG under three broad headings of enabling government, managing PNG's resources, and improvement of people for effective participation and integral human development. The agenda for action mapped out for the NSDS followed a similar framework.

Strategies recommended to provide a supportive legal and institutional policy framework for good governance include:

A workable and properly enforced legal system

Establishment of effective administrative procedures and supportive institutional (government) structures

Accountability and transparency in government; and

A national framework for a "bottom-up" approach to planning.

A set of three strategies and mechanisms were recommended for the sustainable management of PNG's renewable and non-renewable natural resources.

These strategies advocate investment of the benefits from mining, job creation, and a shift in priorities from urban to rural development. Proposed action programmes emphasise:

Accountability and the need to clearly ensure that revenue obtained from non-renewable resources are well-managed for the benefit of present and future generations.

An employment-led growth strategy rather than GDP - led growth strategy to provide meaningful employment for job seekers.

Development of the fisheries sector on a commercial basis and along sound sustainable management principles.
A sustainable agricultural development strategy to maintain agriculture sector's productive base, improving the competitiveness of the commerical sector and broadening the productive base through diversification.

A massive shift in government priority from urban to rural development to build the necessary infrastructure.

These initiatives would go together with activities aimed at empowerment of people in villages and communities through better education, training and awareness raising activities. Effective participation is dependent on people having the knowledge and skills to take part in decision making, on access to the relevant information, and on mechanisms that allow their involvement.

The Inter-Agency Report was published by UNDP in October 1994. Since the publication of the Report, there has been a change of Government in PNG and the implementation of the NSDS has been stalemated because of the bureaucratic problems of finding a suitable location for its secretariat within the governmental administrative structure. As a result, nothing much has been done about the NSDS, and planning for sustainable development in Papua New Guinea, unlike in Madagascar, for example, has gone no further than drawing up paper plans.

From theory to action : How to bring about change

While sustainable development is not unknown in Papua New Guinea and has received support and recognition since UNCED, planning for sustainable development is a new concept to most sectors of the economy and society. For most, the concept remains abstract and theoretical.

If sustainable development is to achieve its potential under the NSDS, it must be integrated into the planning and the measurement systems of individual and corporate activities in agriculture, forestry, fishing, mining, industry, commerce and other sectors of the economy as well as modes of livelihood in society. For that to happen, the NSDS Commission or Secretariat and the National Planning Office should translate Yumi Wankain into an operational action plan in terms familiar to business, government leaders, landowners, local communities and individual members of the general public, at national, provincial and local (district and village) levels.

To assist business leaders in applying the concept of sustainable development in their enterprises, the Canadian International Institute for Sustainable Development (IISD 1992:7) has recently proposed the following practical definition of the concept:

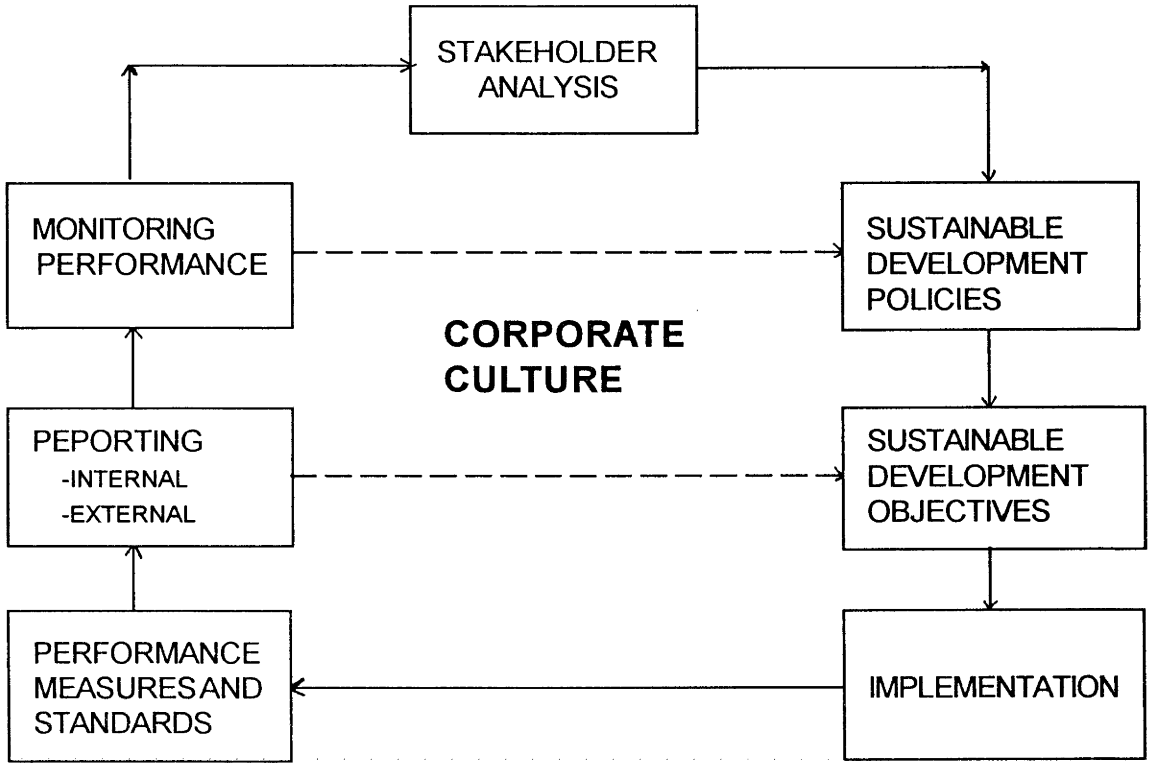
"For the business enterprise, sustainable development means adopting business strategies and activities that meet the needs of the enterprise and its stakeholders today while protecting, sustaining and enhancing the human and natural resources that will be needed in the future".

This definition captures the spirit of the concept proposed in the report of the World Commission on Environment and Development and focuses attention on areas of specific interest and concern to business enterprises. It recognises that economic development must meet the needs of the business enterprise and its stakeholders. The latter include shareholders, lenders, customers, employees, suppliers and communities who are affected (either positively or negatively) by the enterprises's business activities.

The definition also highlights the dependence of the enterprise's economic activities on human and natural resources, in addition to physical and financial capital. It emphasises that economic activity must not irreparably degrade or destroy these natural and human resources. Human resources refers to all people affected directly or indirectly by the enterprise's economic activities including employees and the public at large.

The power of any sustainable development strategy lies in both opening up new opportunities and avoiding the trap of trading off environmental goals against growth. In order to continue to prosper, business

Figure 3. **A model of a management system for sustainable development.**



Source: IISD (1992)

must play a vital role. Society should not allow it to be passive. A company that does not embrace these principles should in time be regulated into taking the actions it would not take voluntarily and efficiently.

Decisive actions are needed to stem and forestall the serious threats to the environment by such business activities as logging and mining which appear to be the main culprits of environmental unsustainability in PNG. The country's unique biological diversity is of long-term national and global concern and the NSDS Commission or Secretariat should follow the example of Madagascar by spelling out and implementing an action plan that aims at limiting deforestation, controlling logging activities, protecting PNG's unique biological patrimony, monitoring environmental trends, educating the population on environmental issues and curbing pollution through indiscriminate dumping of mining waste and tailings.

The price of effective sustainable development is eternal vigilance and surveillance. Sustainable development principles enunciated in the NSDS and those of Agenda 21 should become part and parcel of the new laws and regulation policies of the country and should be rigorously enforced. Too often, in PNG, there has been laxity in the enforcement of regulations and legislation relating to the Environmental Planning Act and the Environmental Contaminants Act since their passage in 1978. In the forestry sector in particular, lack of effective enforcement of regulations and legislation has led to flagrant abuses of laws and regulations by loggers. Such logging malpractices need to be kept in constant surveillance and severe penalties imposed to ensure compliance. Measures should be introduced to boost capacity for monitoring to ensure existing and new legislation are enforced by the relevant agencies and institutions. The development of the country's resources will continue in a haphazard and destructive manner unless the problems facing legislation and enforcement are addressed.

The concept of sustainable development must be integrated into business planning and management information and control systems and business executives should ensure that their business enterprises regularly provided appropriate reports that

compare actual performance to these strategies. Management should incorporate stakeholder expectations into a broad policy statement that set forth the organisation's mission with respect to sustainable development. This policy statement should guide the enterprise's planning and set forth values that management, employees and other groups such as suppliers are expected to strive to achieve.

Figure 3 provides a recommended management model for sustainable development. The model requires management to perform a stakeholder analysis; set sustainable development policies and objectives; design and execute an implementation plan; develop a supportive corporate culture; institute measures and standards of performance; prepare reports; and enhance internal monitoring processes. The diagram illustrates these seven steps which are required for managing an enterprise according to sustainable development principles and their interlinkages.

Government should develop policies that would harmonize corporate activities with the "common good" to motivate business to meet performance standards or to encourage them to report publicly on their performance. Policy makers should study industry or other private sector performance standards to assess their effectiveness and consistency with proposed government policies and to determine whether they can be incorporated (with or without amendment) into regulatory performance standards. All sectors of human and corporate activities should be closely and reguarly monitored.

The potential effects of development projects on local communities should also be considered. In addition to determining whether proposed policies will address their major concerns (such as reforestation, proper disposal of effluents and wildlife preservation) regulators should ascertain whether local communities will be significantly affected in other ways. Companies cannot perform consistently with society's sustainable goals unless there is open communication between them and the communities where they operate. People need to be part of the decisions and programmes that affect their lives.

It is also important for government to harmonize tax policies with environmental policies. Policy makers can encourage sound environmental behaviour and discourage activities and processes that are harmful to the environment through tax measures. Fiscal policies can also be applied to mining and logging companies so that they pay the real economic and social cost of the damage they cause to the environment and the minerals and timber they export. Measures such as environmental levies, if imposed, should have clear environmental objectives and take into account the full fiscal impact on development.

Landowners' Participation in the Planning Process

In PNG, unlike in most developing countries, most land is clan-owned under customary systems of tenure. Approximately 97 per cent of PNG's land is customary land held under traditional ownership arrangements. Land owners, therefore, have a significant stake in most business enterprises in both rural and urban areas in PNG even if they do not share in the profits. Business enterprises have a moral, if not legal accountability to landowners and the local communities in which their enterprises operate. These groups of stakeholders are beginning to recognise their right to communicate their concerns to management and government and to use the legal process to influence corporate behaviour.

The sustainability of production and, indeed, the security of the future of any development project or business enterprise depends on the level of landowners' participation in the whole process of planning and management. The Barnett Report (1989) on forestry in PNG states that the landowners are passive "bystanders of the whole forest resource development". This is the shortcoming of the Forest Policy itself, which is vague on this issue. Participatory management is the active involvement and hands-on interaction of the parties or stakeholders in the planning and implementation process.

Hitherto, in the context of forestry planning in PNG, participation has been understood as "soley equity participation", and not in terms of a dialectical process involving dialogue and interaction on organisational and management issues. An overall mechanism facilitating meaningful landholder participation in both private and public sector activities needs to be worked out. A major effort is also needed to provide a special form of community education required to give landowners and traditional community decision makers the technical and other knowledge they would need for effective interaction and management of environment and resources in a modern development context.

Concern with people participation, given the system of land tenure in Papua New Guinea, also raises

three broader issues:

1) -the need to determine the extent of government powers over Papua New Guinea's environment and natural resources;

2) - the need for a national policy for rural develop ment and human settlements; and

3) -the need for a landuse planning system with zoning on the basis of agro-ecological criteria.

Many of the environmental problems facing the country arise from the lack of a clear perspective on the extent of government powers over land resources and the lack of coordinated land use and human settlement policies. They also result from non-enforcement of environmental legislation as highlighted already, inadequacy of financial and human resources, lack of public awareness and cross-sectoral cooperation, absence of political will and general neglect of of economic assessment and planning procedures. There is clearly a need to explore more fully the costs of land degradation and the economic benefit of reclamation, rehabilitation and prevention.

The land tenure system in PNG also necessitates a major rethinking in the decision making process. Development is most unlikely unless a price is put on land. The lack of certainty over ownership or access to land and the lack of mechanisms to use land commercially will continue to impede development. Land reform is necessary to ensure security of tenure among landholders.

Eco-tourism and the informal sector : two untapped potentials in PNG

Finally, as has been pointed out, the power of sustainable development lies in opening up new opportunities without trading off environmental goals against growth. Tourism and the informal sector are two of the new areas in which opportunities exist for planning a sustainable employment-led growth strategy to provide meaningful work for job seekers in PNG. Currently in PNG, according to the Prime Minister Sir Julius Chan (1992), each year produces another 52,000 young school leavers all wanting to enter the labour market. Of this, estimates show that only 10,000 may be successful in being absorbed into the formal sector, with the remaining 42,000 relegated to finding productive work elsewhere in the informal sector. Crime and law and order problems are endemic and escalating as the unemployment situation in the country continues to worsen.

Experience in Fiji, Kenya, Reunion, Mauritius and elsewhere in the developing world shows that tourism can offer considerable opportunities for income creation (foreign exchange) and gainful employment of young school leavers as well as sustainable development through enhanced linkages with the environment. As Schoell (1994) has pointed out, much impetus could come from a well-defined eco-tourism as an industry. PNG could take a cue from Fiji where landowner tourism ventures based on "nonstandard" tourism resources appears to be highly successful. PNG has a diversified natural landscape, including scenic mountains and valleys, coastal islands, reefs and beaches, unique flora and fauna, which can make the country a real "paradise" for visitors with very special interest. Tourism based on natural resources, should be planned in such a way that local people resident in the area will benefit. Integration of the local people will help ensure environmental sustainability.

Apart from tourism, the informal sector itself, hitherto neglected, warrants development attention, because experience in most developing countries shows that this sector is and can be a relatively efficient part of the domestic economy. Experience of ASEAN countries such as Indonesia and the Philippines shows that the non-agricultural informal sector - cottage industries, handicrafts, appropriate technology, etc - can play a dynamic role in providing income-earning opportunities and serving the demand of the low income population for inexpensive manufactures. Appropriate training and institutional support should create an enabling environment for this sector as well as the formal small and medium scale enterprises to absorb the unemployed school leavers as well as those affected by retrenchment under the structural adjustment programme which has been imposed by the World Bank and the IMF.

Disscussion and Conclusions

The planning process of the NSDS in PNG has been facilitated by the international agencies. It is time for a real initiative and commitment from Papua New Guinea itself to address the issues of sustainable development by translating the NSDS into an action plan and embarking on the implementation process. While implementation initiatives at the national level are halting, the country's natural resources are dwindling and the social and environmental impacts of resource development show signs of despair.

There are sufficient laws which can serve as a workable basis for initiating action for sustainable development. These should be 'field tested' now and new legislation be designed to complement or revamp the old and the moribund. Whatever the governmental agency for planning and implementation (the National Planning Office, or NSDS Commission), it is important that all stakeholders have a clear perception of sustainable development, which has as much to do with the environment as it has with all sectors of society. Effective environmental management requires an integrated land-use planning, which demands that policies, programmes and land management practices governing the development of one resource are formulated with due consideration of the requirements for effective management of other resources.

The ultimate success of environmental management in PNG depends to a large extent on people participation and initiatives. PNG has experienced many rural development programmes with varying degrees of success. Some of the reasons for the failure of rural development projects appear to be the "top-down manner" in which such projects are implemented and the lack of the necessary involvement of people in the planning process (Hayes and Mowbray 1994). Efforts to improve the environment in PNG requires awareness, acceptance and responsibilities by citizens and local communities and by enterprise and institutions at every level, all sharing in the common effort in ensuring environmental sustainability.

Important lessons can be learnt from Manus regarding community-based "bottom up" approach, emphasising village initiatives in resource and environmental management. The policy approach adopted in this province encourages communities to identify their own basic minimum needs and to take responsibility for managing, developing and conserving their own resources. Empowerment of local communities is one way of approaching the issue of environmental management. The time has come to begin to think seriously and find more innovative ways of managing the environment and solving the "environmental crisis".

In finding new and more effective ways of resolving and/ or mitigating the land degradation problem caused by prevailing agricultural practices, the initiative should first focus on the need for better economic assessment of land degradation, rehabilitation and prevention and their role in decision making. It should pursue the problem within the context of overall development planning.

Due attention should be paid to research and the role indigenous (local) knowledge can play in sustainable resource management. Indigenous knowledge, as it relates to land degradation, comprises a wide range of accumulated local experience about natural resource use and management techniques, institutional and organisational arrangements as well as beliefs and values. This traditional knowledge can certainly enhance and be enhanced by modern scientific knowledge to the benefit of sustainable development. The challenge is to evolve and infuse the right mix between the two. Hence given the importance of successfully combining traditional and modern knowledge systems in the Papua New Guinea context, research should be carried out on how best to achieve this aim.

Of all factor inputs pertinent to combating environmental degradation, human resources appear to be the most important, followed by technology. So far, in PNG too great an emphasis has been placed on the mobilization of financial aid and not enough on the real factor inputs and the special conditions in PNG. In planning the NSDS for example, it appears as if PNG has been the subject of experiments of a somewhat benevolent academic research character, with local participation as an extra dimension thrown in rather belatedly. The problems of PNG cannot be realistically and successfully treated other than through understanding and initiatives of PNG people themselves. There is an urgent need to develop national capabilities (training) for land-use planning in a wide range of scientific and managenal disciplines to meet the specialized manpower needs.

Population growth is a key factor in the population-resources-development-environment equation and must be taken into account in the long-term planning for development, land degradation control and other aspects of environmental conservation. PNG has recently adopted a population policy with a general goal of maintaining a growth rate that will not pose a threat to the country's economic objectives. Halting land degradation requires restoring the balance between man and land - between population size and available resources and environment. Development and improved technology through making better use of resources can help in relieving pressures and restoring this equilibrium. But in the long-term, population growth must be brought into line with the realities of the resources, development and the environment. There is, therefore, a need to integrate population planning into macroeconomic planning at

national, provincial, and local levels.

In an era in which Structural Adjustment Programme (SAP) has been imposed on PNG by the World Bank and the IMF, the prospects of higher levels of damage to the environment could be high. Sustainable development in this context, requires greater use of economic instruments such as the "polluter pays" and "user pays" principles to complement regulation and control measures. These could both increase revenue and improve environmental protection. Because poverty contributes to environmental damage as the poor are often forced to act unsustainably in order to live, SAP policies should include an employment-led growth strategy to provide meaningful employment for job seekers. They should also include access to credit and lower interest rates for small farmers, and businesses. This will enable such small scale enterprises to expand, diversify, and increase their employment and productive capacities.Other measures such as secure property rights are also required. Poverty tends to increase during the early stages of SAP, and this could have an adverse effect on sustainable development. However, it must be admitted that the policies being advocated are not easy to adopt during SAP.

In addition to SAP, increasing unemployment, law and order problems are currently significant impediments to sustainable development and political stability in PNG. These would seem to emphasise all the more the need for the adoption of an employment-led growth strategy which opens up new opportunities without trading off environmental goals against growth. Such opportunities would seem to exist in the area of tourism and also in the informal sector of PNG economy. Eco-and landowner-tourism ventures would seem to provide a leeway, while in the informal sector, attention is needed in offering appropriate training and support to make the sector an efficient part of the domestic economy.

Education and public awareness programmes are the vehicles for conveying correct environmental messages on pollution control and resource misuse and for changing false environmental perceptions and ensuring that the community or society behaves responsibly and in an environmentally sensitive manner. There is an urgent need to reform the education sector by making it more responsive to employment and sustainability of resources in the country. Information and administration also need to be effectively coordinated.

In conclusion, the harsh truth is that PNG, today, is confronted with an emerging environmental crisis. The combined effects of modernisation, economic development, population growth, international trade and consumption are pushing both the State and individuals within PNG to meet their needs by causing environmental damage with much wider social impact. Degradation from ineffective control of deforestation, mining and agricultural activities and land use pressures are leading to the loss of essential reserves of seeds and nutrients, the genetic storehouse that has been the heritage of PNG for ages. It is time a real commitment is made by Papua New Guineans themselves to arrest this ominous catastrophe that looms like damocle's sword that can turn the otherwise pristine PNG environment into a desert for posterity.

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