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1 Introduction

Improving the quality of life for people in Sabah is a prime consideration in the work of the State Government. The Structure Plan plays an important part in this by setting out a long term 'vision' for new development whilst maintaining the environment as a desirable and pleasant place to live and work in, and to visit for current and future generations.

The Structure Plan is a statement of strategic policies for the protection of the environment and the control of development over the next 20 years or so. It provides a basis for investment decisions by local authorities, businesses and individuals, and for the plans and programmes of other organisations. The Plan also plays a key role in delivering environmentally sustainable development strategies by providing a framework for the systematic appraisal of development trends and environmental pressures.

The Plan in turn then provides a strategic context for Local Plans, mostly prepared by District Councils, setting out detailed policies and site-specific proposals on a larger scale map base (e.g. 1:5,000). It is important to recognize that thereafter, local Plans are required to conform generally to the Structure Plan.

Overall the Plan will set out the strategic framework for the use of land and show the scale and direction of development required to meet the needs of the State for jobs, houses and services, in a manner that safeguards and enhances the environment.

This environmental review comes at a time of increasing national and international concern over the impact we all have on the world environment. This has been most clearly seen through the Earth Summit at Rio de Janeiro in 1992, where the concept of sustainability was formally embraced - and more recent international conferences on global climate change. Increasingly Sabah will need to address these global concepts while at the same time accommodating local needs for housing, employment, leisure and the use of natural resources.

The balance between providing for growth and protecting environmental quality is not an easy one and as far as possible it should be sought to reconcile potential conflicts and provide a framework for sustainable change.

The policies aim to build on what is distinctive and good about Sabah. The policies may shape ideas for tourism, resource and mineral extraction and land use planning – particularly in relation to the distribution and ownership of land.

Although much of the information presented here will remain pertinent, new issues will continue to emerge and will have to be addressed so that the environmental priority areas are not degraded. For example, environmental pressures in and around urban areas will have to be addressed including reducing the need to travel and promoting greater use of public transport.

The Structure plan will reflect the current and future interests of the State mainly by addressing the following objectives:

- Providing a framework for allowing continued but sustainable development of the economy of the State
- Closer integration with international policy
- Maintaining and improving the environment in Sabah

How the environmental input to the structure plan is prepared?

The first step is to identify the key issues that need to be addressed. This requires a good knowledge and understanding of how and why the environment in Sabah is changing and what the future might bring. It requires the collection and analysis of a wide range of information, on population, economic growth, urbanisation and the environment to name but a few topics. This is presented in chapters 2 and 3 of the report: ‘State of the Environment in Sabah’ and ‘Society’s Impact on the Environment’.

The next step has been to outline the framework and policies for environmental management in Sabah - chapters 4 and 5.

The final step is to make recommendations, based largely on the preceding chapters, for further developing and improving the available environmental management tools in Sabah. This has been done in chapter 6.

2 State of the environment in Sabah

Throughout Southeast Asia, biological resources are currently being exploited at a rapid rate. Earlier in history similar processes driven by population expansion took place in Europe and North America, altering the environment and landscape forever. In Southeast Asia, it remains to be seen what the final consequences of a compressed but similar process of biological resource depletion will be. Will the present protected area system provide sufficient refuge for the increasingly threatened fauna and flora of the region while maintaining the basic functioning of the environment?

Throughout the region up until the First World War, environmental change was largely driven by agriculture, particularly by colonial administered plantations, rather than commercial forestry. However, during the late 1950s, the demand for timber was driven by the continued development of the market for tropical logs, to provide raw materials to reconstruct the recovering post-war economies of the world. As a consequence, the tropical forests that once cloaked the State began to fragment and disappear. While physical impacts to the environment are amongst the most noticeable of degradation processes affecting long-term resource sustainability, the fauna and flora that comprise the forest habitat, are equally impacted.

Sabah falls within the Indo-Malayan faunal realm, which contains some of the world's richest concentrations of terrestrial and marine biodiversity, with much of this biodiversity being concentrated in the lowland rain forests and offshore reefs. For example, it has been estimated that 81 per cent of the mammals of Malaysia were restricted to below 660 m.

It is now clearly evident that land use change has left little in the way of untouched forests outside of the protected area system. Present estimates of forest cover provide falsely optimistic information on the state of the environment due to the difficulty in defining 'deforestation'. Changes in forest cover do not reflect forest cover degradation due to selective logging and such forests may constitute important and extensive tracts. Today production forests comprise the most significant remaining areas of forested land and the continued survival of much of the regional biodiversity is dependent upon them, as indeed is a portion of national economic revenue. The fate of production forests following timber extraction is important as this will determine the passage and rate of environmental change locally and eventually at a regional level. Regenerating forest stands are laid vulnerable and susceptible to a number of pressures in-

cluding fire hazard, which may ultimately lead to the continued degradation of the stand and environmental change.

As regions of 'megadiversity' the responsibility placed upon countries such as Malaysia is enormous particularly as a number of the Sabah's larger mammals, which are particularly hard to conserve, are threatened with extinction. These include the two horned Sumatran Rhino (*Dicerorhinus sumatrensis*) and clouded leopard (*Neofelis nebulosa*).

Today, protected areas are usually blocks of land gazetted by law from the existing national land use resource inventory and are therefore exempted from the usual array of land alienation pressures. National Park status and other categories of protected area, although universally accepted as a means of managing land for conservation, do not necessarily mean that the objectives of conservation are met as most areas remain under pressure, particularly from the adjacent land users.

Expansion of human populations requires further land use change and associated pollution impacts. Given this current rate of expansion it is unrealistic to expect large areas of pristine habitat to be maintained. Therefore the fate of these protected areas and the environmental integrity of the State will be uncertain without clear policy and commitment to guide an environmentally sound development process to ensure our future.

Landmarks

Realizing the importance of environmental conservation and protection in the early 1970s, the State Government established an Environment Unit under the purview of the then Ministry of Manpower and Environmental Development in 1976. In 1987, the enforcement of the Environmental Quality Act 1974 was extended to Sabah and administered by the Federal Department of Environment. In 1991, Sabah commissioned the World Wide Fund for Nature - Malaysia to prepare the Sabah Conservation Strategy with funding from the United Nations Development Programme. The report was completed in April 1992 and approved by the State Government in 1995 as a guideline for planning. In 1996, the Sabah Biodiversity Conservation Project was initiated with support from the Danish Cooperation for Environment and Development (DANCED), with the objective to improve and sustain biological resources.

Other landmarks include the Tourism Master Plan that provides the State with a nature-based source of income and the Shoreline Management Plan, (1998) that was conducted and endorsed in order to avoid ribbon developments along the West Coast of Sabah. The Integrated Coastal Zone Management in Sabah project (DANCED) was initiated in September 1996 with the long-term objective of ensuring the sustainable development of the State's coastal areas. The State Environmental Conservation Department was established in 1998 and the Capacity Building of the Environmental Conservation Department Project (DANCED) initiated in 1999.

Key environmental areas

The following sections describe in brief the environmental status concerning the key environmental areas of interest: inland and marine waters, biodiversity

(flora and fauna), and the air. The descriptions are based on available data collected by the Environmental Conservation Department.

2.1 The inland waters

Water is a vital resource, the availability of which often determines the rate of economic development and also sets its limit. Rivers, streams, lakes, man-made reservoirs, underground aquifers and wetlands constitute the inland water resource, which are essential for agriculture, industry, human settlements and energy production.

Today in Sabah, inland waters are being polluted by both point and non-point sources of pollution. Industries, including mining, and human settlements are major point sources of pollution. Forestry and agricultural run-off containing fertilizers, pesticides and eroded soil are the major non-point sources of pollution. Eroded soil primarily originates from deforested hill areas, sloping agricultural land and poorly designed roads and construction sites.

Surface water

Introduction

Surface water is the major source of freshwater supply in the State. Surface water can be classified as either flowing water such as rivers and streams, or standing water such as lakes including man-made reservoirs. There are altogether about 19 river basins in Sabah. Of these, the Kinabatangan river basin on the East Coast is the largest covering an area of about 15,385 km². The Padas river basin on the West Coast covers an area of about 8,726 km². Most of the other basins cover comparatively smaller areas.

Water quality in both flowing and standing water can be determined by measuring parameters such as the concentration of Dissolved Oxygen (DO), the Biological Oxygen Demand (BOD), the Total Suspended Solids (TSS), pH and the Faecal Coliform Bacteria count.

Impacts and Status

Surface water quality in Sabah is adversely affected by various types of pollutants that enter water bodies.

Run-off from Land-use Activities. The greatest pollution problem in most river basins in Sabah is the high load of suspended solids as a result of sediment pollution from poor soil conservation practices during logging, agricultural development, mining and construction activities; and from natural erosion. Recent findings from the Kinabatangan river estimated soil loss at 7.8 million tons per year.

Chemical pollutants such as biocide residues originating from pesticides, insecticides, herbicides and fertilizers applied in agricultural activities are potential threats to water quality in the waterways and river basins of Sabah. The Sabah Water Resources Master Plan 1994 reported that the water supply in Ranau has been affected by pesticides and herbicides being washed from vegetable growing areas near Kundasang.

The Environmental Quality Report 1990 published by the Department of Environment reported that 12 of the 17, or 65%, of the rivers monitored in Sabah were heavily polluted with suspended solids and that 12 rivers were polluted with NH₃-N (ammonical nitrogen) due to livestock farming and domestic waste in 1997. Six rivers were polluted with suspended solids due mainly to earthworks and land clearing activities. On BOD, there was no pollution reported in Sabah. The Environmental Quality Report 1998 reported that seven rivers in Sabah had been found to be polluted in terms of suspended solids, BOD and NH₃-N.

Domestic Sewage. Municipal wastewater discharges, especially of untreated sewage, constitute an important source of pollution for inland waters in Sabah. Sewage poses a threat not only to human health, but also increases the load of nutrients and consequently biomass in water, which uses up oxygen during decomposition. The more oxygen is consumed, the more aquatic life is impaired. In certain instances, conditions may become anaerobic, resulting in the mortality of aquatic life. Recent studies have found that the level of coliforms found in selected rivers and estuaries of Sabah clearly indicates a high degree of sewage contamination along the coast of major towns in Sabah. These include the Inanam, Moyog, Tawau, Sembulan and Likas rivers.

Mining. Mining activities either directly release pollutants such as heavy metals into rivers, reservoirs and ponds, or contribute to groundwater pollution through the leaching of mine tailings. The Environmental Quality Report 1994 reported the presence of heavy metal at the Damit/Tuaran River that exceeded water quality standards observed for other rivers in the country. There is indication of heavy metal pollution in the Liwagu river but the source is unclear although there is speculation that it originates from the Mamut Copper Mine. Continuous monitoring of water quality is therefore essential to provide data for the formulation of appropriate rehabilitation measures. Research should also be conducted into biological indicators such as fish species/communities to further support the monitoring programme.

River Sand and Gravel Extraction. There is a concern on the adverse impacts of river sand and gravel extraction such as erosion of riverbanks and increased turbidity downstream, particularly during low flows as fine material is distributed by excavation work.

Groundwater

Introduction

Groundwater supply in Sabah is utilised largely as a supplementary supply and is confined to nine water supply systems in the State. Several potential groundwater storages have been identified (Natural Resource Office, 1994). Groundwater storage sites include beach, alluvial and coral deposits, and sedimentary and igneous rocks. Storage volumes for each of these different aquifers varies considerably depending on the thickness of the aquifer and the type of deposit.

Impacts and Status

The quality of groundwater is increasingly under threat due to the leaching of chemicals or the seepage of oil spills into groundwater storage. Pollutants include biocides and fertilizers residues from agricultural farms; organic wastes

from animal farms; heavy metals from mining wastes, rock tailings, and industrial wastes. A national groundwater quality monitoring programme has recently been initiated.

Wetlands

Introduction

Swamps, marshes and other wetlands once regarded as obstacles to agricultural and industrial development are now recognized for their great values in recycling chemical and biological materials and especially for their rich biological diversity. Wetlands filter pollutants, act as reservoirs of nutrients in food chains, produce forage for domestic animals and fuel for humans, provide aesthetics, recreational and cultural benefits to society and are habitats for thousands of unique species of plants and animals.

Impacts and Status

In Malaysia the number of known sites of significance is estimated to be 37, of which 86 % are regarded to be moderately to highly threatened (United Nation, 1990), the highest in South-East Asia. The main threat to wetlands are drainage to create land for crops, conversion to aquaculture, pollution by toxic materials from agricultural and industrial wastes, eutrophication caused by run-off water loaded with fertilizers and wastes, flood protection schemes and housing developments, commercial logging, hunting and fishing.

In Sabah, the Kinabatangan floodplain is one of Malaysia's most treasured wetlands. The wetland ecosystem provides the varied vegetation types that are home to a diverse concentration of wildlife. The Kinabatangan river is the source of water supply for villages and Sandakan town and also an important mode of transportation for the local settlements as well as the agriculture sector. However, much of the wetland has been destroyed by unsustainable logging practices and land conversion for agricultural expansion, and contaminated by pesticides and discharge of industrial effluents. Realising the importance of this area, the State Government of Sabah in 1999, declared its commitment to fully gazette and protect this area of 27, 000 hectares as a wildlife sanctuary.

Mangroves

A special type of wetland that deserves individual attention in the Sabah context are mangroves as the ecological importance of these areas can hardly be overestimated; they form the feeding and nursery grounds for prawns, fish and other invertebrate species and mangrove vegetation protects coastal areas from erosion and acts as a buffer zone against tidal currents, floods and storms. Mangrove forests are also important to many local communities in Sabah with products ranging from firewood and fishing stakes, to the construction of small structures.

Impacts and Status

The main threat to mangrove areas is alienation for various development purposes. The depletion of mangrove forests is primarily associated with its exploitation for its timber products, land reclamation and aquaculture activities. Examples of such activities are to be found along the west coast region of Sabah where areas of mangroves have already been turned over to coastal resorts (including golf courses) and brackish water fish and shrimp farming.

Presently, mangrove timber harvest and aquaculture activities do not pose a significant threat to mangrove areas. Mangrove timber harvesting in Sabah is localised and is carried out on a small scale. The conversion of mangrove forest to aquaculture ponds is also a minor activity. The increasing marketing problems anticipated in cultured shrimps (environmental groups in importing countries are advocating consumer boycott on shrimps grown in mangrove areas) coupled with the unsuitability of mangrove areas as shrimp farms (due to poor soils and pond drainage difficulties), has led to a limited aquaculture development within mangrove areas.

However, the rapidly decreasing yields of wood available from dry land forests in Sabah and the increasing human population and declines in wild fish catches, might lead to extended use and conversion of mangrove forests for forest produce and aquaculture purposes.

About 317,000 hectares of the mangrove areas in Sabah have been constituted as Mangrove Forest Reserve. Like other reserves, any land use decision requiring excision of land from Mangrove Forest Reserves would require approval from the State Cabinet. However, land use not requiring excision (e.g., to allow logging or not) are taken at an administrative level.

2.2 The marine environment

The marine environment comprises coastal waters, estuaries and the high seas. It includes the water, seabed and a vast range of flora and fauna, which constitute an invaluable source of food. The marine environment constitutes a major component of the natural environment and has many dynamic interactions with other components such as air, coastal land and inland water.

Marine water quality

Introduction	Data on marine water quality in Sabah are limited, and normally only confined to those areas where development is ongoing and where environmental impact assessment studies have been carried out.
Impacts and Status	<p>All types of contaminants found in rivers and streams will finally be discharged into marine waters. These includes the following:</p> <p><i>Suspended Sediments.</i> Suspended sediment loading from rivers is one of the most severe threats to the natural nearshore habitats around the coastline of Sabah, and in particular the West Coast region. Suspended sediment affects the light and sedimentation conditions over static marine habitats such as corals and sea grasses affecting factors such as growth rates and respiration. The sediment loading can also cause problems with fish spawning as deposited silts provide unfavourable conditions for adhesive eggs, and can cause an out migration of fish, crustaceans and invertebrates from affected areas due to respiration problems. Suspended sediment cannot be addressed as a shoreline issue but must be tackled at source.</p>

Bacterial Pollution. Bacterial pollution is presently not a major problem due to the relatively low level of loading at the immediate mouths of the main rivers compared to the rate of dispersion and decay. However, in isolated areas, hygienic water quality problems are encountered and this trend will increase in future due to increased domestic and other loading. For instance, the water in Likas Bay, in the immediate vicinity of the City of Kota Kinabalu, has been found to have a high level of *Escheri coli*, exceeding the standards set by the Department of Environment. Combating this problem requires an integrated approach, which includes tackling the problem at source and relocating dwellings that directly discharge wastes into coastal areas and riverine areas.

Floatables. The most visible of the water quality issues are the floatables such as plastics, cans, bottles and a host of other solid wastes, which are commonly found in the coastal and riverine areas. Not only do floatables have a direct impact on soft bottom communities, coral reefs and other static habitats, they also have a serious effect upon marine beach aesthetics, which is directly related to the tourism industry. The issue of floatables can be tackled through the use of debris collectors along coastal areas and at the mouth of the major rivers. Debris collection is, however, an expensive intervention, which has to be borne by the Government through the Local Authorities. An integrated approach to reduce the loading is therefore preferable which may include for instance imposing environmental tax on plastic bags; building more low cost houses for the relocation of squatters away from water ways; and conducting environmental education and awareness programs.

Coral reefs

Introduction

Coral reefs are extremely fragile ecosystems. They are breeding and feeding grounds for a high diversity of specialist coral reef fishes and invertebrates. They are also important economically for the tourism and recreational sector. Coral reefs also prevent coastal erosion by acting as wave breakers. Sabah has established a number of marine parks, reserves and sanctuaries to prevent exploitation and to provide protection to marine life and resources.

Impacts and Status

The major threats to the coral reef ecosystems in Sabah are unplanned and *ad hoc* development activities along coastal areas and reclamation activities. Other threats include coral mining for construction materials; destructive fishing methods such as fish bombing and cyanide fishing; and marine pollution. Several reports have revealed that eutrophication through discharge of sewage has led to a profusion of algae overgrowing and killing the corals. It has also been reported that sediment erosion from improper development activities, and sediment discharge from rivers has caused coral mortality from turbidity and burial.

There are indications that nearshore aquatic life is now threatened. Sand mining in the sea, sediments from the rivers and bombing of fish constitute a serious threat along the 1600-kilometer long coastline of Sabah (Figure 2.1). Surveys and monitoring of coral reefs conducted by Universiti Malaysia, Sabah, Unimas and Sabah Parks revealed that most reefs along the coast of Sabah are in good condition but are seriously threatened by destructive fishing methods, excessive

sedimentation and over fishing. Another study by the same institutions proved that fish bombing is a fundamental factor in the destruction of coral reefs in Sabah. A total of 762 cases of fish bombing were reported between the years 1990-1999 and 444 persons were detained. In 1999 alone, 32 persons were caught and detained (Fisheries Department, Sabah, 1999).

The State of Sabah through its agency, Sabah Parks, has identified new marine areas that merit protection. Apart from Tunku Abdul Rahman Park, Pulau Tiga State Park and the Turtle Islands Park (a combined area of 20, 622 ha of coral reef), Semporna Islands has been proposed for protection.

Coastal erosion

Introduction In Malaysia it is estimated that 27 % of the shoreline is subject to erosion, while the Department of Irrigation and Drainage has identified 53 areas where coastal erosion is threatening important facilities. Erosion has destroyed beaches, damaged coastal roads and houses and posed danger to beach resorts and buildings.

Impact and Status Coastal erosion on a regional scale has been reported not to be a serious issue in Sabah at the moment. Although the existing situation is not serious, the trend is, however, clearly towards increased erosion due to the human impact, both directly due to construction on the coastal areas and indirectly due to hinterland activities. Coastal erosion may also occur as a natural process.

The Shoreline Management Plan report (1999) indicates that approximately 63 km of the 1600 km coastline of Sabah is eroding at a significant rate. The coastline areas in Papar and Kimanis on the West Coast, and in Sandakan on the East Coast have been found to suffer moderate to severe coastal erosion.

2.3 Biodiversity

Introduction Biodiversity incorporates the full complement of plants and animals, both individually as species and collectively as components of ecosystems. The existence of biodiversity is a symbol of ecological balance, which serves humanity in a variety of ways. Plant and animal life directly provide a sizable fraction of the human diet, and moreover, the utility of a diverse range of species is increasing, not only as a source of materials, but also as a new genetic resource that can contribute towards the improvement of breeds and to the development of biotechnology.

Impacts and Status Reduced biodiversity or the loss of species is the most graphic indicator of the plight of wild plants and animals. However, measuring changes in biodiversity is not easy.

Man is the main agent of extinction, causing it by altering habitats, overexploitation and by introducing exotic species which either prey on or out-compete native species. Habitat degradation, loss or modification is the most comprehensive indicator of the predicament of wild flora and fauna. This is a key area

of concern in the humid tropics as species diversity and endemism are unusually high.

Habitat Degradation and Loss. The heavy intensity of logging and conversion of land to agricultural plantations is the major contributing factor to the rising loss of both plant and animal species in Sabah. Four large mammals are under serious threat in Sabah and are potentially endangered with extinction on a world basis. These animals are: Asian elephant (>1000), Asian two-horned rhinoceros (a few tens), orang-utan (between 10, 000 - 20, 000) and tembadau or wild cattle (status is incompletely known).

Habitat Fragmentation. As forested lands are cleared to make way for plantations and other development activities, areas of continuous forest are often fragmented into smaller units. In Sabah, there have been reports of elephants attacking and destroying substantial areas of oil palm plantations. This is probably attributed to the fact that animal species, in particular large mammals, require large territories to sustain their food supply and to survive in the wild. It is also believed that through forest fragmentation, sexually mature and actively breeding populations gradually become isolated. Prolonged isolation in the reproductive process may ultimately result in sterility, which may also lead to extinction of the species.

2.4 The air

Introduction

Air pollution sources can be categorised as: (i) stationary sources, (ii) mobile sources, and (iii) open burning activities. Among these, emission from motor vehicles is the most persistent contributor in Sabah. There are only three automated air quality monitoring stations, two in Kota Kinabalu and another in Tawau. Another two manual air quality-monitoring stations are located around the Kota Kinabalu area.

Impacts and Status

In general, the air quality standard in Sabah is good except during periodic haze episodes related to the outbreak of forest fires which contribute towards high concentrations of particulate matter (PM10). Concentrations of sulphur dioxide (SO₂), nitrogen dioxide (NO₂) and ambient lead remain relatively low, (Air Pollution Index readings), throughout the year.

In 1997 Sabah experienced serious haze mainly due to the forest and land fires in plantations in Kalimantan and Sumatra, Indonesia. In 1998, the total area burnt in Sabah was estimated as being between 130,000 - 150,000 hectares, resulting in substantial ecological and economic losses, and contributing to the haze problems in the region.

There were 291,472 motor vehicles registered in 1997 in Sabah and a total of 1,177 stationary sources of air pollution were recorded. Complaints of air pollution resulting from tailing dust being blown by wind at the site of the Mamut copper mine at Lohan, Ranau have been reported.

3 The impact of society on the environment

The focus of this chapter is society – and based on a number of themes and sectors - describes the relationships between the technological and economic development and the resultant pressures on nature and the environment. The descriptions are based on available data collected by the Environmental Conservation Department.

It is likely that the following four key issues will set the agenda for society's impact on nature and the environment in Sabah in the near future:

- The high population growth rates
- The high economic growth rates
- Substantial changes in the land use patterns
- Continued and increased rates of urbanisation

A short overview of the key sectors in Sabah impacting nature and the environment in Sabah, namely forestry, agriculture, tourism and fisheries, is provided in sections 3.5-3.8.

3.1 Population growth

Population growth and increases in population density will substantially influence the availability, quality and sustainability of the natural resource base in Sabah. High population growth places continuous pressure on agricultural land and drives the conversion of forests for agricultural purposes. High population growth rates results in increased consumption and subsequent generation of wastes. Population growth and urbanisation increases the demand for domestic and industrial water, which further supports the need for sustainable water catchment management.

The population of Sabah is expected to grow from approximately 1 million in 1980 to 3.3 million in 2006 (Table 3.1). The growth rate from 1991-95 was 6.2 % annually, which is among the highest population growth rates in the world. At this rate of growth the population will double every 12.5 years. The population density per sq km in 1991 was 25, while the predicted density in 2006 is 115; an increase of around 460 %.

Table 3.1. Population and growth rates.(7th Malaysian Plan) 2000

Year	1980	1991	1995	2006
Population	1,055	1,867	2,389	3,343
Growth rate	80-91: 5.2 %		91-95: 6.2 %	

3.2 Socio-economic development

Even though the rate of socio-economic development in Sabah has remained slightly below that of the rest of the country, the rate of growth can still be considered high when compared with other regions and countries in the world. It can also be expected that such high growth rates will be maintained during the coming decades.

As with population growth, high rates of socio-economic growth sets the agenda for the availability, sustainability and quality of almost all natural resources in Sabah. High socio-economic growth rates places continuous pressure on land use, urbanisation rates, consumption rates, waste generating rates and demand for domestic and industrial water, and energy.

3.3 Land use

Nature, environment and land use development patterns in Sabah are closely linked to its geographical attributes (Figure 3.1 insert the 3D tin of Sabah).

In Sabah, the pace of converting land (largely forest) to state and alienated land, has occurred at a slower pace compared to other Malaysian states and countries in the region. With only 25.6 % of all land alienated, and large areas of land still maintained under forest reserve, it can only be expected that substantial areas of land will be alienated in the coming decades. With continued development there will be increased competition for land for primary economic activities such as agriculture, mining, industry and an increased demand for housing. Therefore land use patterns will undoubtedly undergo dramatic changes in the coming decades, substantially changing the nature of the environment in Sabah. Habitat loss or modification is regarded as the primary cause of biodiversity loss in Sabah as elsewhere.

The most important land cover systems in Sabah are the forests and croplands. Land use change in Sabah is characterised by deforestation and the expansion of cropland.

Out of the total land area of 7.37 million hectares, about 3.9 million hectares are classified as reserved land (forest reserves, parks and wildlife sanctuary), 3.2 million hectares have been alienated, and about 0.3 million hectares remain as State Land.

Forest reserves (protective forest, commercial forest, domestic forest and other forest areas) constitutes 48.8 % of the total land area, alienated land

25.6 %, other reserves 15.3 %, mining prospecting areas 3.8 % and State land 6.5 %.

3.4 Urbanisation

The urban environment is characterized by high concentrations of the population and a high intensity of human activity. The relative economic, political and social importance of urban areas can hardly be overemphasized. Urbanization, however, also creates a number of environmental problems, including encroachment into rich agricultural land, deforestation, production of solid wastes, heavy pollution of urban rivers, air pollution and increased risks associated with chemical and hazardous wastes.

Urbanisation and land. The *conversion of natural and agricultural ecosystems* to provide urban infrastructures, such as houses, roads and factories characterises land use change near urban areas. In Sabah, considerable alteration and deterioration of the landscape in and around urban areas has taken place through hill cutting, road construction, quarrying, land clearance and industrial and housing developments.

Many urban areas in Sabah, particularly Kota Kinabalu and Sandakan, suffer from the spread of slums and marginal and illegal settlements. These marginal settlements are characterized by the absence or severe lack of basic infrastructure and environmental services such as water supply, solid waste collection, sewerage and drainage, which all contribute towards additional stress on the environment, particularly in the form of river pollution and disposal of solid waste.

Case study: Steeplands around Kota Kinabalu and the District of Penampang

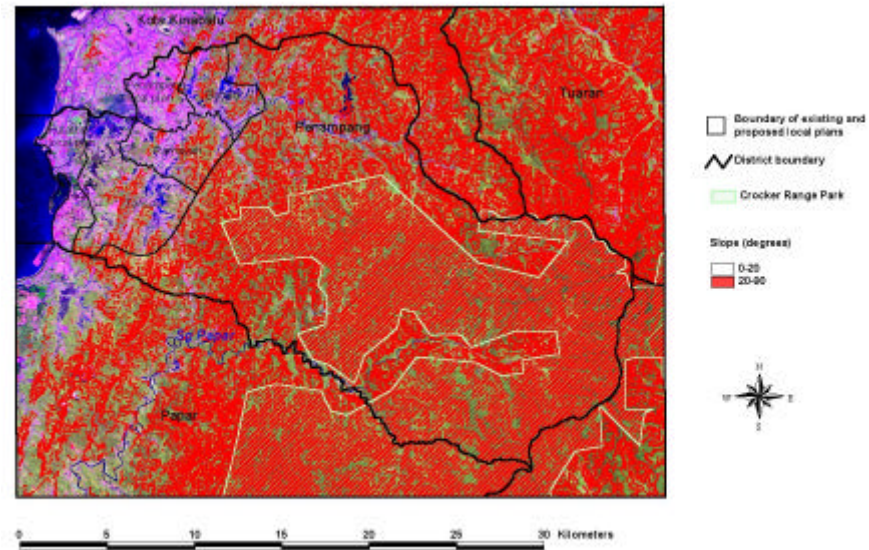


Figure 3.2 Slopes over 20 degrees – Kota Kinabalu and the Crocker Range, Sabah

The remotely sensed image illustrates the restriction posed by terrain in and around Kota Kinabalu and along the west coast of Sabah. The eastern three-quarters of the District (465 km²) falls on the steep and hilly terrain of the Crocker Range while the remainder, extending west to the coastline, has a predominantly low relief and comprises of broad alluvial plains with isolated outcrops of low hills. This provides two general classes of terrain; either flat floodplain land or steep hill slopes, thus placing severe restrictions on development opportunities in the future. For example, in the Sungai Moyog catchment, which comprises 295 km² of the District, only two per cent of the lands have gentle slopes considered ideal for development, the remaining lands are either too steep or flat lying and flood prone. As a result of these constraints most of the population is concentrated on the coastal strip and inland along the river floodplains and lower hill ridges.

These physical characteristics are the driving pressure for the large amount of cutting and filling in the lower catchment areas within the District (DID, 1998). The physical constraints must also be considered alongside the demographic trends along the West Coast of Sabah in and around Kota Kinabalu. In 1997, five per cent (133,190) of the total population of Sabah lived in Penampang District while the surrounding areas of Tuaran, Kota Kinabalu and Papar account for a further 19.2 %. The lowest population projection for the year 2015 estimates an increase of 157 per cent in the overall population in the combined areas - which remains daunting as this almost trebles the population to 1 654 855 (DID, 1998). The implications for water demand water quality and overall land degradation are huge. More cutting and filling of the slopes and floodplains will occur to accommodate the growing population. Agricultural lands

will fall under continued pressure to be converted to urban uses with the further loss of rice growing areas. With further industrial development, mixed industrial areas will continue to spread out and in-land from Kota Kinabalu. Discharge of pollutants to the drainage systems will continue to increase and the remaining forested areas of the Crocker Range will be further encroached upon.

Many of the areas faced with the greatest development pressures due to population growth and land use change are steep and require careful planning if the land is to be developed sustainably (Figure 3.3 insert slope diagram)

Solid Waste Disposal. Solid waste disposal is found to be a major problem in most districts in Sabah. The City of Kota Kinabalu is the only local authority that operates a solid waste disposal facility based on the sanitary landfill system, situated at Kayu Madang, Telipok. The remaining districts operate open-space dumping where accumulated wastes are normally buried with soil. Open-space dumping grounds not only emit a foul smell and cause a nuisance to nearby residents but they also provide operating centres for scavengers and breeding grounds for rodents and other pests that could be potential disease carriers. There is also a danger of toxic leachate from these dumping sites spilling into rivers and streams or seeping into the ground water storage system. Indiscriminate dumping of waste by residents both in towns and villages is rampant. The problem is further aggravated due to the limited rating areas in some districts resulting in indiscriminate waste disposal in places such as roadsides and in waterways. Another contributing factor to the waste disposal problem is the lack of awareness on the importance of maintaining a clean environment for healthy living.

Air pollution. The deterioration in air quality in urban areas is mainly the result of increases in manufacturing and industrial activities and in the number of motor vehicles.

Water pollution. Urban rivers typically become heavily polluted with domestic sewage, industrial effluents and solid wastes, mainly in terms of phosphates, biochemical oxygen demand (BOD), coliform, alkalinity and turbidity.

Industrial, toxic and hazardous waste. In Sabah, the majority of industries are located in and around urban areas and consequently most environmental problems related to effluents and emissions are more likely to have a greater impact on urban populations. Only limited data on toxic and hazardous waste in Sabah (for example acid wastes, asbestos dust sludge, alkaline wastes, mineral oil, hydrocarbon wastes, paint sludge, photographic wastes) exists today.

Noise pollution. Urban noise and traffic congestion are emerging problems in Sabah, however, it can be expected that as the standard of living improves, people will become more sensitive to the level of noise in the environment.

Asia encompasses some of the world's most urbanized countries. Compared to other parts of Malaysia, the urbanisation process in Sabah has lagged behind, however, it is likely that urbanisation in Sabah will increase considerably in the

coming decades. The majority of Sabah's population is still rural with a gradual but steady shift towards urbanisation (Table 3.2).

Table 3.2. Urbanisation rates in Malaysia (% of population)(MOSTE, 1997 and 7th Malaysia Plan)

	Peninsula			Sabah				Sarawak			
	'70	'80	'91	'70	'80	'91	'00	'70	'80	'91	'00
Urban	-	37	86	17	20	33	38	16	18	38	50

3.5 Sector impacts

Forestry

Overview

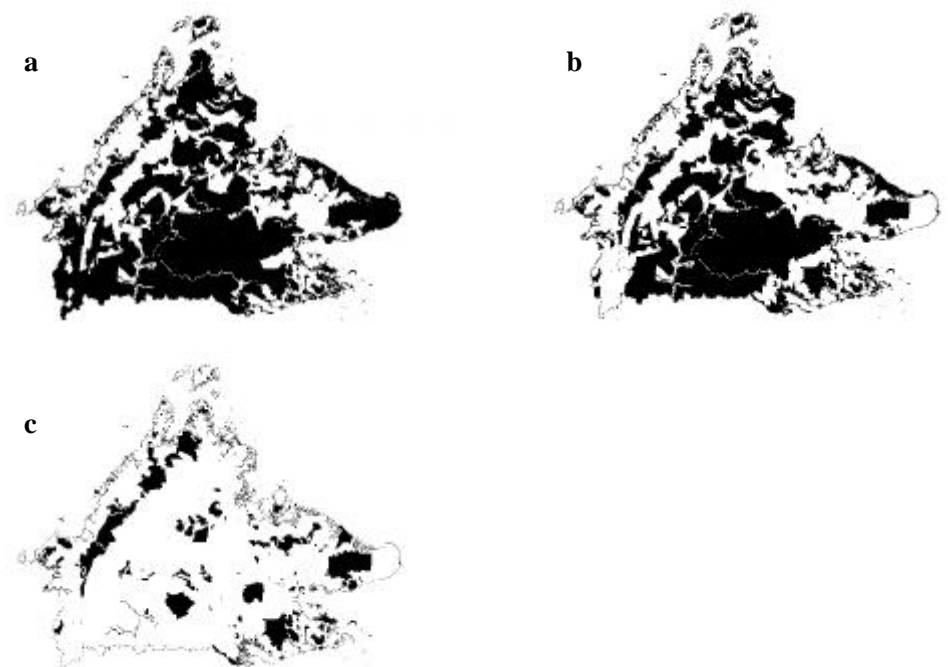
Since independence, Sabah has remained heavily dependent on forest resources for the generation of revenue. Forest resources provided between 40-50 % of the State revenue in the 1990's, compared to 60-70 % in the 1970s and 1980's. Logging has been carried out both on Commercial Forest Reserve and State Land Forests. About 2.744 million hectares of the total land area of Sabah have been constituted as Commercial Forest Reserve.

Figure 3.4 shows that from 1970 to 1996, virgin forest areas dwindled by 90 %. According to current projections, all virgin forest areas outside of the protected area system will be gone by the year 2010 (Sabah State Government, 1998). While it is frequently stated that about 60 per cent of Sabah remains under some form of forest cover, fully protected areas where logging is prohibited by law constitute only a fraction of this (Figure 3.5).

Figure 3.4. Virgin forest and logged disturbed forest 1970-95 (Sabah State Government, 1998)



Figure 3.5 Forest cover in Sabah – 2000 (a) Forest Reserves, Industrial Tree Plantations and Parks, (b) Legally gazetted natural forest, (c) Forests where logging is prohibited by law (Forestry Department, 2000).



The reduction in forest area has led to a serious reduction in industrial raw materials, with impacts on the future sectoral composition of the Sabah state economy. This also implies a reduction in the amount of resources available to local communities (e.g. rattan, wild game). Both selective logging and conversion to non-forest uses have increased the rates of soil erosion and therefore affected water supply, water quality and peak flows. The fragmentation of the existing forest into separate blocks has reduced biological diversity and fragmented wildlife populations. For example, populations of rhinoceros in Tabin Wildlife Reserve, Danum Valley and Kinabatangan are no longer in contact, reducing the viability of each such population. Reduction and fragmentation of forest and selective logging have increased fire risk and increased ease of access so that poaching and illegal encroachment are made more likely.

Conversely, forestry has had positive impacts in controlling use of forest resources, maintaining areas of forest that might otherwise have been lost, and protecting biological diversity in Protection Forests, Virgin Jungle Reserves and Wildlife Reserves. Forestry rules and guidelines are designed to control and mitigate impacts on soil, water, forest composition and biological diversity.

Conversion of montane forest for agriculture. In the past, the cool and wet conditions of the Tropical Montane Cloud Forests were not readily exploitable by traditional people in Sabah and many of the montane forest area in Sabah have remained intact until recently. The traditional environment of the hill peoples in Sabah were restricted to upper lowland terrains, the highest being at about 1,200 – 1,400 m asl, corresponding to the lower limits of the lower montane forest where cloud cover descends daily and the daily minimum temperature is 18°C. Under these conditions, fruits of some important crops abort (e.g. bananas and coconuts); thus harvesting such crops is not possible. However, more recently, cultivation has rapidly invaded the upper montane forest zone. This invasion became possible through the combination of the introduction of temperate crops e.g. cabbage, asparagus and modern cultivation skills i.e. the use of fertilisers and pesticides and road accessibility. Consequently, temperate vegetation cultivation has now reached 2,100 m. In addition, other large-scale, modern exploitative activities have impacted this forest type including dairy farming, golf course development, unregulated tourism and the incursion of logging activities to the very limit of harvestable forest. Most areas in the cloud forest zone on Mount Kinabalu are protected but are under increasing pressure. However, cloud forests on other low-lying, unprotected mountains are increasingly threatened

Agriculture

The major environmental concerns associated with the agriculture sector are suspended solids from soil erosion as a result of extensive land clearance, and industrial effluent discharges from oil palm refineries, which can be harmful to

diverse life forms in the aquatic and marine environment. In addition, the application of biocide and fertilizers may spill into rivers and other water bodies, which can be detrimental to aquatic ecosystems and human life.

Continued conversions. The regional soil surveys for the State of Sabah indicate that about 29% or 2.2 million hectares of the total land area is suitable for agriculture and therefore continued conversion of land to agriculture can be expected in the coming decades (Table 3.3). Plantations will continue to supersede forests, especially along the east coast of Sabah.

The widespread use of monocropping will substantially influence and change the environment and species diversity in Sabah.

Agrochemicals. Gains in agricultural productivity are largely the result of using high yielding crop varieties requiring the intensive use of inputs such as irrigation water, chemical fertilisers and pesticides. Monocropping adds to the agrochemical problems, in that planting only one crop, season after season, gradually drains soil nutrients, which then requires the increased application of chemical fertilizers and use of pesticides to prevent and control outbreaks of diseases and pests. In Asia the use of fertilizer doubled from 1977 to 1987 (United Nations, 1990) and the rate of use has increased by 7.5 % per annum. Adverse impacts associated with the use of fertilizers include the accumulation of phosphates and heavy metals in soil, leaching of nitrates, phosphate and potassium into groundwater and surface run-off causing pollution of rivers. Pesticides used include insecticides, herbicides and fungicides. In Asia the use of pesticides increased by 57 % per annum in the 1980s (United Nation, 1990).

Shifting Cultivation. Shifting cultivation has caused some impact on the general landscape of Sabah. The process involves land clearing by burning the existing vegetation, and replanting with fast growing crops such as hill padi, maize, tapioca and various other types of fruit and vegetables. The crops produced are normally just sufficient to meet the annual needs of the farmers and their families. It is estimated that around one million hectares of land in Sabah have been subjected to some kind of shifting cultivation activities. Shifting cultivation is normally sustainable due to the long fallow period, which allows for the rejuvenation of soil. However, if practiced on steeper hillsides with shorter fallow periods, the problems of soil erosion and land degradation can be potentially serious.

Agricultural land use change. In 1992, agricultural land comprised only 12 % of the total land area (compared to 28 % for Sarawak), with oil palm plantations comprising 5.7 % of this total. Between 1970 and 1992, the annual growth rate for plantations has been about 10 % (Table 3.3). Further development between 1992-97 shows that by 1997, 843,952 hectares were planted with oil palm, almost double since 1992. Felda Oil Palm Plantations, located in the district of Lahad Datu, are managing about 638,000 hectares of plantations and is among the largest oil palm producers in the world. Cocoa on the contrary has decreased by almost 50 % to 94,331 hectares, while the area of land under rubber was maintained at approximately the same level with 86,109 hectares.

Table 3.3. Agricultural land use Sabah 1970-91 (MOSTE, 1997)

	1970 %	1985 %	1992 %	1992 ha
Oil palm	0.5	2.5	5.7	421,958
Cocoa	0.1	2.3	2.6	188,841
Rubber	1.4	1.2	1.2	88,022
Padi	0.6	0.5	0.9	62,284
Coconut	0.8	0.8	0.8	55,337
Other	0.1	0.1	0.7	47,640
Total agriculture	3.5	7.4	11.7	864,082
Non-agriculture	96.5	92.6	88.3	6,507,018
Total	100.0	100.0	100.0	7,371,100

Tourism

The impact of tourism on the environment is diverse. In general most of the tourism industry supports and encourages the conservation and protection of natural resources and the establishment of protected areas for tourism purposes. However, in the case of over-exploitation or unplanned tourism activities, damage to marine parks, corals and associated marine life, clearing of forested land for transport and access routes and buildings, increased solid waste, adverse effects on wildlife, removal of mangrove trees for construction of boardwalks and littering can be experienced. Over-exploitation of some of the most attractive islands in Sabah has been reported.

Since the 1980s, tourism has become an increasingly important industry both worldwide and in Sabah. Tourism is the world's largest and most dynamic industry with 10.7 % of world's GDP, and the industry's gross output is predicted to double from 1995 to 2005. In 1995, 1996 and 1999 approximately 7.5 million tourists visited Malaysia each year, while 1997 and 1998 experienced a drop in visitors to 6.2 and 5.5 million respectively. According to the Sabah Tourism Masterplan approximately 100,000 tourists visited Sabah yearly from 1980-94. The increase in tourist arrivals was less in Sabah compared to the rest of Malaysia, but still remained high. Arrivals to Sabah increased by 29 % from 1980-94, as opposed to Malaysia's 220% growth in the same period (Ministry of Tourism and Environmental Development, 1995). The tourist revenue estimated for 1994 was MR 187 million.

Sabah, with a number of world class tourism destinations such as Mt Kinabalu, and activities such as nature and wildlife viewing, a range of soft and tough adventure activities such as diving, snorkelling, rafting, and jungle trekking, ethnic cultural experiences, beaches and golfing, has in the last 5 years experienced a rapid investment growth in the tourism industry and today has 255 hotels with more than 10,000 rooms. Approximately 9,000 people were employed in the industry by year 2000.

With tourism playing an every important role in the State's economy, landscape issues will increasingly need to be considered. For example, major tourist corridors will need to be maintained and improved so that the level of visual amenity when viewed from major transport routes is acceptable. This normally takes the form of giving due consideration to the impact of building/structure set backs, advertising signs and landscaping along major tourist routes so as to maintain a quality of visual appearance along the such tourist corridors.

Fisheries

Environmental problems faced by the fisheries industry include destruction of important breeding and feeding areas, destruction of aquatic habitats and the degradation of the aquatic environment. Wetlands, including mangrove forest, are increasingly being cleared for agriculture, aquaculture and other purposes and degraded by pollution or the diversion of drainage water. Coastal areas are threatened by coastal erosion. Effluents from industrial and domestic discharges, land reclamation, illegal dumping and the accidental spillage of oil wastes all contribute to the degradation of the aquatic environment. Other problems include over-exploitation; unsustainable fishing practices e.g. the use of spear guns, fish poisons and fish bombing.

The total *fisheries production* of Sabah in 1994 was approximately 170,000 tonnes with marine fisheries contributing 161,000 tonnes or 95 % and aquaculture 9,000 tonnes or 5 % (Fisheries Department, 1996) Fisheries production experienced an annual growth rate of around 6.6 between 1990-94. Difficulties in maintaining these growth rates - sustainable yields – have been experienced in recent years. Approximately 22,000 full-time fishermen are employed in the fisheries industry.

Fish bombing. Studies by Universiti Malaysia Sabah, e.g. a study in 1998 on the status of the coral reefs of Darval Bay offshore from Lahad Datu, has shown that fish bombing activities in Sabah have resulted in serious damage to coral reefs, resulting in declining fish catches. Work by the Institute of Biodiversity and Environmental Conservation of UniMas revealed that on average, 2 ½ blasts of fish bombing were recorded per hour from the islands of Mabul, Ligitan, Silam, Kunak, Mantanani and Sipadan, off the coast of Semporna.

According to the Fisheries Department, from 1996 to 2000 there has been an overall reduction in fishing by blasting with explosives. In 1999, 91 cases of fish bombing in the 16 districts of Sabah were reported, and 15 of these cases were brought to court.

4 Environmental policies

A number of environmental policies already exists that can provide support for the Sabah Structure Plan 2020. The policies are categorized below into international, national and state level. Since a detailed description of each of the management frameworks is beyond the scope of this report, only a few of the strategies and policies have been described here while others are listed as a reference.

4.1 International treaties

Convention on Biological Diversity 1992 (Rio de Janeiro) Rio Declaration on Environment and Development (27 Principles)

The United Nations Conference on Environment and Development was held in Rio de Janeiro in 1992. Heads of State, their representatives and other national delegates agreed on a non-binding Declaration on Environment and Development, known as the Rio Declaration. The relevant principles outlined are:

- *Principle 4.* In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it
- *Principle 10.* Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making process. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided
- *Principle 11.* States shall enact effective environmental legislation. Environmental standards, management objectives and priorities should reflect the environmental and development context to which they apply. Standards applied by some countries may be inappropriate and of unwarranted economic and social cost to other countries, particularly developing countries

- *Principle 15.* In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation
- *Principle 16.* National authorities should endeavour to promote the internalisation of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment
- *Principle 17.* Environment impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.

Global Convention on Wetlands (RAMSAR) (1975) - The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

Agenda 21

Following the United Nations Conference on Environment and Development mentioned above, a much fuller document was produced, setting out an agenda for actions during the 21st Century. Known as Agenda 21, it contains much material relevant to environmental management.

Langkawi Declaration of Environment 1992

Commitment by Heads of Government of the Commonwealth to implement 16 programmes of action.

Convention on Climate Change 1993

Combating deforestation and protection of oceans and freshwater resources.

International Tropical Timber Agreement (ITTA) 1983

Sustainable Forest Management - objective year 2000.

Convention Concerning the Protection of the World Culture and Natural Heritage (1975)

4.2 National level

At the national level, environmental frameworks include for example:

Malaysian National Conservation Strategy 1992

This conservation strategies was intended to set out plans and suggestions to be used to (i) integrate fully the many existing efforts toward natural resource management for conservation and development, (ii) build on the strengths of existing institutions and mechanism, and (iii) incorporate additional future efforts into the process of conservation as a key to successful developments.

National Policy on Biological Biodiversity 1998

This policy is formulated with the aim to conserve Malaysia's biological diversity and to ensure that its components are utilised in a sustainable manner for the continued progress and socio-economic development of the nation. This policy has outlined six objectives to be achieved through the eleven outlined policy principles.

National Environmental Policies (Draft) 1998

The National Environmental Policy is still under draft.

National Wetlands Policy (Draft) – compiled by Wetlands International Asia Pacific).

4.3 State level

At the State Level, there are several reference works of environmental policy recommendations of relevance, including:

Sabah Conservation Strategy 1992

The Sabah Conservation Strategy was prepared under the auspices of the then Ministry of Tourism and Environmental Development (now the Ministry of Tourism, Environment, Science and Technology). The three volumes provide a thorough guide to environmental policies and actions relevant to the environment. The document outlined several recommended strategies with regards to the environment, which are given in much greater detail in the original document. The guiding principles outlined are:

- Planning and implementation of all work concerned with natural resources must be holistic and multi-sectoral, emphasizing a proactive approach at macro and regional levels rather than a reactive approach at micro and specific levels. The cause of the environmental problems rather than the symptoms must be tackle
- The system for allocation of land use and tenure should shift during the next five years from being a piece-meal arrangement where private interests compete for land in the absence of a regional plan, to an integrated system where public interests and natural resource conservation take precedence in the context of regional plans
- The target level of the annual expenditure of the State Government should be reduced from MR 1,500 million typical of recent years, ideally to not

more than MR 1,000 million, a level which is still much higher than that of State Governments in Peninsular Malaysia, and which will reduce the pressure for continued high levels of logging of natural forest.

The recommended policies are grouped here under Land Policy, Water and Coastal Policy, and Forest Policy.

Land Policy. These recommendations are based on intensive consultation between all levels of government.

Action Strategy 1: Institutional Strengthening. There must be an upgrading of the capacity of the State Government to manage allocation of natural resources and the natural environment generally, and to protect environmental quality.

Action Strategy 2: Land Allocation and Management.

a) Guidelines for land allocation:

- Government agencies involved in the processes of land allocation must recognize the problems associated with the now-typical patterns of rural land use in Sabah, and guidelines provided in the Sabah Conservation Strategy should be followed.

b) Land reservation

- Land, which is unsuitable or of limited suitability for permanent agriculture, and which is likely to become degraded or idle if deforested, will be reserved by Government
- Government will reserve land, which is subject to competing, and difficult-to-resolve claims
- Priority must be given to halting unnecessary deforestation on ridge tops and hill tops which occur on State land and alienated land
- Adequate land under natural forest will be reserved in rural areas for exclusive use by local communities for purposes of obtaining traditional forest products
- Rural communities whose members wish to continue to cultivate hill rice (i.e. to practice stable shifting agriculture) will be allocated specific, communally managed land areas, which will be reserved for this purpose.

c) Land alienation

- Government will make efforts to reduce the confusion and abuse which has arisen from the liberal system of land distribution
- State land will be alienated for agriculture only if the land is truly suitable for permanent agriculture and likely to be developed and well managed. State land should not be alienated for agriculture on the basis of native customary rights alone
- Where land which is unsuitable or of limited suitability for permanent agriculture has been alienated or has been approved for alienation, every effort will be made to prevent degradation of the land
- Government will entertain applications for land to be retained under natural forest cover, either entirely or partially, up to a maximum of 50 acres per holding, for purposes of sustainable wood or rattan production, ecotourism, or other purposes which can be justified by the applicant.

d) Erosion

- Prevailing levels and extent of soil erosion must be greatly reduced.

e) Slope limits

- Future alienation for agriculture of land mainly or entirely above 25° slope will be prohibited
- Government will adopt and announce a policy that land above 25° slope is not recommended for agriculture. Furthermore that all existing conditions of land title whereby alienated land, which is still not developed will be waived for land above 25° slope.

f) Sloping agricultural land technology (SALT)

- SALT will be promoted by all Government agencies involved in use of land of greater than about 15° slope for agricultural, agro-forestry or animal husbandry purposes.

g) Idle land

- Alienated land, which is clearly idle (i.e. predominantly under scrub or grass which is not used as grazing land, but not land under regenerating natural forest) will continue to be subject to fines for non-fulfillment of land title conditions.

h) Plantation forests

- The development of plantation forests will be carried out with the following concurrent objectives to support the goal of reducing levels of timber cut in natural forests: (i) to support the goal of developing Sabah's domestic forest-based industry; (ii) to make use of idle land, especially that unsuitable for agriculture or farming; (iii) to promote a form of land use which is environmentally and socially appropriate for many of the rural areas of Sabah, and (iv) to assist in reducing the risk of fire in natural forests
- Existing plans to convert Forest Reserves to plantation forests will be abandoned and, instead, means and incentives will be provided to utilise alienated land and any deforested land, which is of limited suitability for agriculture, for wood production through plantation forests
- New proposals for plantation forests within Forests Reserves may be generated for sites which were severely degraded through logging and fire prior to 1992, subject to a process of justification and objection.

i) Database

- Government will assist the Lands and Surveys Department to develop a central database on land applications, land ownership and land use.

Action Strategy 11: Environmental Planning and Management Procedures. Land use plans generated on a regional or District basis will form the basis for land allocation in all rural areas throughout Sabah. Guidelines must be developed rapidly and used to aid decision-making on land allocation. Land, which has been reserved by law for protection or management of natural resources (e.g. Forest Reserve, Park, Nature Reserve, and water supply area), must be surveyed and demarcated on the ground in a way that will be recognized in a

court of law. The potential for use of remote sensing and Environmental Impact Assessments in planning should be more fully explored and utilized.

Water and Coastal Policy. The following recommendations would strengthen Environmental Management through a combination of safeguarding catchment areas, improving water quality and supply in the coastal zone, and reducing impacts of polluted flows into marine areas.

Action Strategy 3: Conservation of Freshwater Resources.

a) State-wide

- The needs associated with the protection of freshwater supplies will be given priority over all other sectors when allocating land and making decisions on activities that affect land.

b) Water catchment areas

- Important water catchment areas will be identified on a state-wide basis and given adequate statutory protection
- Responsibility for each important water catchment area, including implementation of protective measures, lies with the relevant agency.

c) Edges of watercourses

- The banks of watercourses must be protected to minimize erosion and to limit entry of human-generated pollutants
- Retention of river reserves, following the guidelines already used by Government, will be strictly observed during land alienation and development processes. River reserves should always be marked both on the title or lease and on the ground during the survey
- Reserves of at least 100 m must be retained along sections of large rivers, which are clearly, and naturally changing course, except where either existing land titles or well-established, long-standing native customary rights are held.

d) Freshwater fish

- Natural freshwater fisheries will be conserved by protecting the freshwater and estuarine environment, and by taking steps to identify and reduce main sources of pollutants. Natural waterways will be 'restocked' only with native fish species unless there are special reasons to do otherwise in particular circumstances.

e) Hydro-electric power (HEP)

- The development of HEP in Sabah should proceed, but with priority given projects which result in inundation of small land areas which can be shown to be unimportant for biodiversity conservation, and which cause minimal disruption of human communities
- All HEP proposals will be subjected to Environmental Impact Assessment.

Action Strategy 6: Management of Coastal and Marine Resources. Mangrove and nipah forests will be managed integrally and sustainable for both fisheries and forest products, with priority given to fisheries. There will be a reduction in trawling as a method of fishing in inshore waters. Continued efforts will be

made to reduce the amount of illegal bombing and all forms of damage to coral reefs.

Forest Policy. The following shall maintain the integrity of forested areas, reduce erosion, safeguard water quality, and improve economic sustainability:

Action Strategy 4: Conservation of Natural Forests. The management of natural forests must be based primarily on their protective functions (especially relating to water, biodiversity and prevention of adverse off-site effects likely to result from severe disturbance) and secondarily on their productive functions (including products other than timber). The rationale for the wood production component of natural forest management must rapidly become the annual harvesting of volumes of wood, which are sustainable in the long-term, and not the supply of revenue to the State Government.

Natural forest conservation will be tackled primarily through: (a) prevention of unnecessary deforestation, (b) improved management of all natural forests, and (c) increased allocation and use of land outside existing reserved forests for forest-based purposes. Natural forest cover should be maintained on all land except where specific areas are likely to be used more productively, and without significant adverse environmental effects, under alternative uses. Special attention must be given to maintaining the integrity of reserved forests. Precedents must not be allowed to be set which will permit uncontrollable long-term encroachment and degradation. Government should facilitate public support for the Sabah Forestry Department's ongoing efforts to stop illegal logging. Levels of logging damage must be reduced by implementing (short-term) financial penalties on license-holders, based on actual amounts of damage done during logging and (long-term) a new system of awarding logging licenses, which improves the incentive for license-holders to minimize damage.

Action Strategy 5: Conservation of Biodiversity. The fullest possible array of Sabah's natural biodiversity must be conserved *in situ*. As a long-term goal, at least 10% of Sabah's land area must be retained as totally protected forest habitat and the total extent of natural forest should never be reduced to less than 50% of the land area. Support will also be given, especially to the Department of Agriculture, Sabah Forestry Department and Wildlife Department, for *ex situ* protection of biodiversity.

Action Strategy 10: Support for Development of Forest-based Industry. Efforts to develop a sustainable, integrated forest-based industry in Sabah must be broadened and accelerated, but the wood requirements of the industry must be very much less than is presently the case. Activities carried out to support forest-based industry must always support sustainable management of natural forests. Natural forests (including secondary and degraded forests) will be managed for wood and rattan production wherever possible in preference to clearance and replacement with plantation forests.

Action Strategy 12: Prevention of Forest Fires. Concerted efforts must be made to prevent forest fires, whether localized or widespread.

Sabah Tourism Master Plan 1996

Tourism in Sabah is very much influenced by the management issues of natural resources. Therefore, the Natural Resource Policy outlined in the 6th Malaysia Plan (1991-95) was an important consideration in the preparation of the Sabah Tourism Master Plan (1996). This policy is aimed to:

- Promote nature conservation by establishing additional protected areas like national parks, marine parks, wildlife sanctuaries and nature reserves
- Promote nature and conservation education
- Promote forest recreation
- Promote tourism through national parks and protected areas
- Carry out scientific research.

5 Environmental management

Institutions that deal with environmental issues at present are of two levels, the Federal and the State level.

At the Federal level, the institutions that deal with environmental issues include DOE under the Ministry of Science Technology and the Environment (MOSTE), DID, the Malaysian Institute of Maritime Affairs, the Malaysian Meteorological Service and the Marine Department.

At the State level, the Federal Department of Environment (DOE) is responsible for enforcing the Environmental Quality Act 1974 (EQA). The Environmental Conservation Department (ECD) under the Ministry of Tourism, Environment and Science and Technology has recently been formed and provides advice on development of land and natural resources. The Natural Resources Office and the Lands and Surveys Department under the Chief Minister's Department, the Department of Drainage and Irrigation (for, rivers, coastal erosion and engineering), Water Department, Department of Industrial Development and Research (industrial development planning) the Ministry of Local Government and Housing, Local Authorities (the Municipal councils), and Town and Regional Planning Department (planning at town and district level) are also involved directly in environmental issues. Other departments involved are: Forestry Department, Fisheries Department, Wildlife Department, and Sabah Parks, Ports and Harbour Department and Agriculture Department. With such a range of departments involved, each individual approach is based on an individual sector basis and departmental jurisdiction often overlaps.

Three key environmental management tools exists, namely:

- Establishment of protected areas
- Integrating environmental issues into regional land use planning
- Environmental protection and monitoring.

Each of these management tools is described below in brief.

5.1 Establishment of protected areas

In recognising the importance of forests and other natural resources in Sabah, conservation efforts have been placed under the direct responsibility of the Government and implemented by departments such as the State Forestry De-

partment, Sabah Parks, Wildlife Department, Fisheries Department, Yayasan Sabah and the Environmental Conservation Department.

The key towards conservation of biodiversity of both flora and fauna is to create totally protected areas in key habitat where exploitation and destruction and disturbance is prohibited. In general it is considered that approximately 10 % of a nation's land area has to be conserved in order to provide sufficient protection of habitats and biodiversity. In Sabah, land gazetted as Parks, Protection Forest Reserves and Virgin Jungle Reserves amount to approximately 5.8% of the land area (Table 5.1 & Figure 5.1 insert figure of existing protected areas).

Table 5.1. Protected Areas 1991. Million ha. (MOSTE, 1997)

	National Parks	Wildlife/bird sanctuary	Total
Sabah	0.25	0.14	0.39
Sarawak	0.08	0.18	0.26
Peninsular Malaysia	0.43	0.31	0.74
Total	0.76	0.63	1.39

Direct benefits of protected areas

Direct benefits of protected areas are those with tangible, immediate and measurable. They can include:

- Protecting renewable harvestable resources
- Supporting nature related recreation and tourism
- Protecting wild species

Indirect benefits of protected areas

Protected areas provide a number of indirect benefits in the form of services which depend on intact ecosystems. These can include:

- Stabilising hydrological regimes
- Contributing to climatic stability
- Protecting soils
- Contribution to the natural balance of the surrounding environment
- Providing facilities for scientific research and education

The following conservation areas are crucial components of Sabah's protected areas system. For most of them, critical issues are the proper demarcation of boundaries; the question of adjacent land use so as to form effective buffer zones; and the avoidance of impacts from other land uses.

Under the jurisdiction of Sabah Parks:

- Pulau Tiga
- Tunku Abdul Rahman Park
- Turtle Islands Park

- Kinabalu Park
- Crocker Range Park
- Tawau Hills Park.

Under the jurisdiction of the Sabah Wildlife Department:

- Mantanani BS (1933)
- Sipadan BS (1933)
- Lankayan Conservation Area (2000)
- Likas BS (1997).

Under the jurisdiction of Forest Department, managed by Sabah Wildlife Department:

- Tabin Wildlife Reserve
- Kulamba Wildlife Reserve
- Gomantong Forest Reserve.

Under the jurisdiction of Sabah Foundation:

- Danum Valley Conservation Area
- Maliau Basin Conservation Area.

5.2 Integration of environmental issues into regional planning

The EIA system and environmental comments on land applications and development plans are commonly used methods for the integration of environmental concerns into the development process. However, the environmental assessment of development projects in isolation, or on a case-by-case basis alone does not always amount to sufficient environmental planning. Such environmental assessments are for example, limited by the fact that they primarily apply to the assessment of larger, more formal development projects. Smaller and informal developments, however, often have a cumulative effect, which may amount to an overall significant impact. The present assessment procedures may bypass such developments.

Most environmental land use planning methodologies and technologies now available are based on the experience of industrialised countries. There is therefore a need to modify these approaches to make the process compatible with the realities presently confronting newly industrialising countries i.e. high population growth rates, rapid resource depletion and environmental pollution.

Regional planning usually takes place at both the national and regional levels. The physical plans produced as part of the planning process at this level normally range in map scale from 1:50,000 to 1:25,000.

From the national perspective, Regional planning is concerned with optimising the use of national space in the development process. A country is seen as a system of regions each of, which constitutes a distinct geographic, socio-economic, functional or administrative component of national space and each of which comprises a system of settlements and hinterland areas. The regional

planner at the national level often concentrates on the interregional implications of patterns of development in the different regions.

In Malaysia medium term national development plans are formulated for five-year periods. The five-year plans cover all sectors of the economy and include independent chapters on the environment and this explicit incorporation of environmental considerations into development activities reflects environmental commitment and concern at the highest government level. The five-year plans provide guidelines for the achievement of sustainable development and the enhancement of the environmental quality and should pave the way for the incorporation of environmental matters into development strategies.

From the regional perspective Regional planning is concerned with using regional resources in a way that maximises the benefits to the economy and population of the region. Regional planning is not a neatly defined discipline; it draws on perspectives from the broad fields of economics, geography, town-planning and organisational development. Integrated regional economic-cum-environmental development plans are not simply a compilation of separate economic and environmental plans. They should show the linkages between economic development, resource use and the production of residuals and impacts on environmental quality and communities. Any regional environmental development plan, even if it is not economic-cum-environmental in scope, should give attention to regional economic considerations so that all proposed environmental projects will be economically sound.

Regional planning potentially allows linkages between sectoral national planning and project planning and between physical and socio-economic and spatial linkages through which project impacts are expressed. Regional planning also allows the identification of the institutional arrangements necessary to ensure beneficial integration of projects into the economy of a sub-national area. An understanding of regional planning is essential for defining the role that environmental land use planning can play in regional development.

Environmental land use planning

Environmental land use planning is defined as a planning process through which environmental considerations are incorporated into socio-economic development. It is only through this type of planning that the integration of environmental matters into the development process can be achieved, thereby moving part way to securing sustainable development.

In terms of physical planning environmental concerns at the regional level are normally addressed by the following:

- Nature protection/conservation
- Landscape protection
- Water protection
- Location of EIA required activities
- Specific safety zones for high risk installations
- Restricted zoning for environmental parameters i.e. light, noise etc.

Although such an environmental land use plan will prioritise the environmental legislation of the Department, it may also incorporate other relevant environmental requirements e.g. water catchments and riparian reserves. Ideally the environmental land use plan should also incorporate other relevant environmental legislation e.g. the Sabah Water Resources Enactment (1998). By means of spatial analysis of environmental data, the environmental land use plan will further identify areas that are environmentally sensitive. It is therefore envisaged that the environmental land use plan will provide information that will support and assist decision-making concerning Land Applications and Development Plan approval. In the medium to long term, this would allow greater control over development activities and environmental planning and management at the local and district level.

At the environmental land use plan scale of planning (1:50,000), environmental decision-making is normally concerned with the following issues:

- Identifying sites for nature protection/conservation
- Landscape protection
- Water protection
- Location of EIA required activities

Locations that require restricted zoning for environmental parameters or risk e.g. high-risk installations, light, and noise.

The environmental land use plan should best represent the above environmental concerns by means of spatial zoning, thus providing guidance at an early level of the decision making process, as to the suitability of project location.

For the environmental land use plan to succeed the procedure needs to be responsive to the social context of any particular setting therefore the specific goals, administration and regular practices of the society must be well understood. This allows for the purpose, approaches and strategies for the environmental land use plan to be defined in ways that strengthen existing procedures. The environmental land use plan should make as much use as possible of the existing administrative resources and institutional arrangements.

Environmental land use planning should support regional planning as a fully integral component.

The most difficult aspect of the environmental land use plan is achieving and maintaining the multilevel co-ordination that is required to facilitate implementation. Resources, sectors, programmes, projects, administrative levels, participants in the planning and management process, sources of funding and so on are found in a unique variety and quantity at the regional level, where administrative ability to co-ordinate is often weakest.

In developing an approach to incorporate environmental considerations into planning procedures, it should be borne in mind that the traditionally environmental land use plan should include four primary elements:

- Assessment of the situation and preliminary identification of goals
- Information collection and analysis
- Co-ordinated policy formation (including integration into regional planning)
- Co-ordinated policy implementation.

Traditionally the basic activities for using environmental analysis to co-ordinate regional environmental programmes include:

- *Inventorizing regional environmental resources and hazards* in terms of their quantities, qualities, sources and spatial distribution, and documented in maps and text so as to be useful for regional planning purposes
- *Analysing regional environmental systems*. A region is a complex area of interlocking environmental systems. A common pattern is first for individual components of environmental systems to be analysed and inventoried, then for the systems to be analysed and documented and finally for the relationships among systems to be studied, e.g. deforestation in zone A will increase flood hazards in Zone B. The maps and accompanying text should be designed to be useful for an evaluation of interactions between regional environmental systems and other regional systems. Risk or sensitivity analysis performed should also be mapped (the results) and should be designed to be useful for formulation of regional environmental resource and hazard management strategies and for co-ordinating regional development programmes
- *Identifying regional environmental/development interactions*
- *Formulating resource/hazard management strategies*
- *Co-ordinating regional programmes.*

5.3 Environmental protection and monitoring

Environmental Impact Assessment (EIA)

Until 1998, the only legal tool used in addressing environmental issues was the Environmental Impact Assessment (EIA) which is a legal requirement under the Environmental Quality Act (EQA) 1974, as amended in 1985. The EQA is a legal framework to manage the environment and the most significant mechanism is the implementation of Environmental Impact Assessment (EIA). In Sabah, EIA is a mandatory requirement under Section 34A of the Environmental Quality Act, 1974 for activities prescribed in the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987.

Under the then Ministry of Tourism Development Environment and Culture, the Environmental Conservation Department (ECD) was formed in August 1998 and the Department is now responsible for enforcing the newly enacted Conservation of Environment Enactment 1996. In 1999 the *Conservation of Environment (Prescribed Activities) Order 1999* was gazetted, making Environmental Impact Assessment (EIA) a mandatory State requirement for Prescribed Activities. Any person intending to carry out any prescribed activity needs to submit an EIA report to the Director of the Environmental Conserva-

tion Department for examination. The overall objective of the Prescribed Activities Order is to regulate and mitigate activities associated with Section 5 of the Conservation of Environment Enactment 1996.

The Existing Process and Procedure of EIA in Sabah. A primary objective of ECD is to ensure responsible, effective and environmentally sound environmental management by implementing an EIA system. The EIA procedure contributes towards this objective by means of providing and examining development alternatives and the assessment of any associated adverse environmental impacts. The procedure culminates in an agreement upon and implementation of recommended mitigation measures and subsequent compliance and residual impact monitoring.

The objectives of the EIA procedure can be summarised as:

- To examine development options available and select the most appropriate
- To identify and predict the significance of any adverse environmental impact
- To identify and incorporate into the project appropriate mitigation measures
- To determine effective monitoring programmes of compliance and environmental impact.

A project that has been designed to suit the local environment is more likely to be completed on time and within budget and is more likely to avoid difficulties along the way.

ECD has chosen to implement an EIA procedure, which focuses on:

- Prioritisation and prediction of the most significant environmental impacts
- Identification of appropriate and cost-effective mitigating measures
- Recommendations on sufficient and realistic monitoring programmes for compliance and environmental impact.
- Focussed, appropriate and realistic Terms of Reference for the assessment. This will allow for a more flexible EIA procedure, that should vary in breadth, depth and type of analysis depending on the project
- Transparency and openness in all steps of the EIA procedure, from initiation to review and approval.

It is important to stress that the EIA procedure is primarily a tool to predict the environmental impacts of a development project and to suggest adequate mitigation measures and monitoring programmes. EIA should therefore be seen primarily as an *assessment and mitigation tool*.

EIA reports are regarded by ECD as *environmental information* supplied to the Department and/or the Review Panel in order to review the predicted environmental impacts of the proposed project and to prepare an Agreement of Environmental Conditions that will be co-signed by the project proponent and subsequently monitored by the Department. The Agreement of Environmental Conditions specifies the mitigation measures and monitoring programmes to be

implemented by the project proponent. This final stage is a key component of the EIA procedure in Sabah.

Role of ECD and DOE. The State ECD and Federal Department of Environment (DOE) jointly share the responsibility for administering the EIA system in Sabah. ECD is responsible for EIAs covered by the Conservation of Environment (Prescribed Activities) Order 1999. While the Department of Environment is responsible for EIAs covered by the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order, 1987, however, in Sabah, the order only applies to Prescribed Activities not listed in the Conservation of Environment (Prescribed Activities) Order 1999. Project proponents and EIA consultants are requested to contact the Departments for further clarification of responsibilities and specific procedures.

Involvement of other Departments. Many government departments are involved in the EIA process. The level of involvement varies depending on the nature of the development project. At the conclusion of the study, the EIA report is distributed to the relevant departments and agencies that are invited to sit on the review panel to review and assess the study.

The following departments are invited to sit as a review panel and give comments to all EIA reports submitted to the Department of Environment, Environmental Conservation Department, Department of Drainage and Irrigation, Public Works Department, Land and Survey Department and Natural Resources Office and Town and Regional Planning Department

The following departments are invited to give comments on EIA reports on projects relevant to the jurisdiction and function of the department. For example, the Minerals and Geosciences may be invited to sit in a review panel if the EIA report is for Quarry operation and may not be invited to sit in a panel for EIA on golf course development: Marine Department, Ports and Harbour Department, Port Authority, Minerals and Geosciences Department, Department of Agriculture, Local Authority, WWF and Forestry Department.

Limitation and gaps in the present EIA process as an environmental planning tool. There are several limitations in the present implementation of EIA in the state of Sabah. One of the most important limitations is the lack of awareness of the strength of EIA as a planning tool. This has led to a lack of co-operation from developers. Many perceive the EIA as a hindrance to development. This hindrance may be in the form of delay in project approval and implementation or the length of time taken in the EIA study and the delay in review process. Also, EIA studies are often carried out late in the planning process, after the final plan design is completed and approved, which leads to difficulty in changing the design.

An EIA study is only required if the project falls within the prescribed activities list and there is no legal requirement for those activities that are not subjected to EIA Order. However, Section 5A can be used under the Conservation of Environment Enactment 1996 for activities not listed under the Order. The prescribed activities lists are project and site specific that have not taken into a c-

count the cumulative effect of the activities that are outside of the prescribed activities. Often EIA studies are omitted when the size of the project does not fall in the prescribed activities although the project might be detrimental to the environment. A solution to this problem is the implementation of regional environmental planning in order to plan for possible cumulative impacts and incorporate environmental concerns within District or Regional plans.

Therefore in order to cope with the projected increase in land use pressure and maintain a good quality of life, environmental considerations should be incorporated into all matters related to land use development. Ideally good environmental management should not only respond to the problems now but will consider the effects of the increasing numbers and affluence of people on the natural resource base of the future.

Environmental Monitoring

Environmental monitoring are defined as a process for repeated observations and measurements of physical, chemical and or biological parameters of single or plural elements of the environment at specific places and intervals with particular objectives, supplemented with monitoring of socio-economic parameters. It is necessary to have access to consistent and accurate environmental data and information before any sensible actions can be formulated for environmental management. Constraints hampering monitoring generally include legislative and institutional arrangements, limitations of budgetary allocation, insufficient coverage of indicators to be measured, low frequency of monitoring, insufficient laboratory and equipment facilities and the lack of trained manpower.

Environmental monitoring activities may target ambient parameters e.g. water and air. Monitoring activities for other natural resources are not so well organised. The continued improved access to remote sensing, however, has considerably improved the situation in this respect, particularly for the monitoring of land use and land resources.

Presently several departments/agencies are involved in environmental data collection such as DID, DOE, ECD, JKR, Universiti Malaysia Sabah, Minerals and Geosciences Department, Department and Health Department. The parameters that are currently monitored by these departments are:

- Air quality especially in industrial areas
- Noise Level especially in industrial areas
- Water quality (fresh and marine water quality)
- Pesticides content in vegetables and food
- Available water resources
- Wastes.

Limitation identified in the current process of monitoring:

- The main environmental parameters or the criteria for their determination that should be used need to be identified and defined alongside sampling frequency, location and methods and agency
- Present monitoring is only carried out to meet a particular agency's requirements and does not provide sufficient data to establish an overview of the environment for the whole state of Sabah
- The data management and reporting system needs to be established
- At present there is no single agency with overall responsibility for environmental monitoring and reporting in Sabah
- No methods have been developed for monitoring biodiversity. Baseline data on ecological other natural resource parameters are still lacking
- The present monitoring for pesticides is only for pesticides in vegetables and no monitoring is done on pesticides that get into the water bodies. This lack of adequate monitoring applies also to other ecological toxins.

Environmental standards, rules and regulations

All environmental protection must be related to objectives that are stated in environmental standards, rules or regulations. These standards, rules or regulations are usually minimum quality of life values acceptable for human well-being.

Setting appropriate environmental standards, rules or regulations is complex requiring considerable expertise. It is recognised that standards, rules or regulations should be something that can actually be achieved within the existing system.

Sabah currently uses the standards for the monitoring of noise, water quality and air quality recommended by the Federal Department of Environment as a guideline. Only a few regulations have been developed.

Environmental databases

A systematic environmental information database is a valuable aid to decision-makers and planners in formulating and evaluating comprehensive and effective environmental policies, standards, rules or regulations. The system covers the natural as well as the man made environment including a wide range of human activities, natural events and environmental impacts. Significant progress has been made in database development in recent years with the increasing availability of GIS.

Environmental Auditing

Environmental audit provides the means by which existing environmental conditions can be defined and compared to provide a snapshot of environmental change set against a defined time frame. Environmental audit can be considered in two forms. In certain industries or resource exploitation processes, it is possible and increasingly more common; to demand an annual audit of the consumption of energy and raw materials, waste production, and waste treatment by the industry concerned. Such audits may form part of the licensing and

monitoring of these processes and serve also to maintain high standards of environmentally sound development. A more difficult audit is to establish the situation of the natural environment by an audit of natural resources and land use. Such an audit cannot accurately be done until substantial quantitative databases of natural resources are available. However, it is possible in all cases to develop qualitative analysis systems that can show the trend of change in natural systems while at the same time adding to the existing database. The current mechanisms for environmental auditing are:

- DOE generally carries periodical reporting on the state of environment
- Instant reporting are from project studies carried by DOE or other agencies
- Indirect environment assessment may be done based on other indicators.

6 Recommendations

The recommendations outlined below refer to the key environmental management tools described in chapter 5.

6.1 Establishment of new conservation areas

The Identification of Potential Protected Areas (IPPA) component of the Sabah Biodiversity Project (1998) focused on six areas previously identified as being potentially significant for biodiversity conservation. Management agencies and responsibilities have been clearly identified for all of the areas. It should be noted that since these recommendation were made, some of the areas are under pressure from neighboring land uses (Figures 6.1 (Indetified Potential Protected Areas & 6.2 Both IPPAs and existing PAs). All of the identified areas are under considerable pressure from surrounding land uses and it is therefore imperative that management options be implemented immediately.

Potential and recommended future conservation areas include:

Ulu Padas. Ulu Padas refers to the upper catchment of the Padas River, a highland areas at elevations of 3,000 to over, 6,000 ft above sea level. The area is mainly Commercial Forest Reserve and a village area comprising both State and titled land. The area contains forest types not found elsewhere in Sabah including exceedingly rare plants not found outside of Ulu Padas and the area is thought to be comparable to Kinabalu Park in terms of plant diversity and endism.

The high rainfall, dense network of streams and highly erodible soils indicate the importance of forest cover on the area's steep slopes to avoid negative impacts of flooding and erosion downstream. The forests in this area contain natural resources important for communal use by the Lun Dayeh community that resides in the villages of the Long Pasia and Long Miau.

The area is under immediate threat from ongoing commercial logging activities and although much of the area has been selectively logged or converted to industrial timber plantation, there is still scope for conservation action. This includes the re-designation of compartments previously designated for industrial timber plantation back to natural forest management; the set aside of small areas of kerangas (heath) forest rich in biological diversity; the protection of historical, cultural and archaeological sites; the maintenance of traditional walking

routes between Sabah, Kalimantan and Sarawak. The international Timber Organisation and the Sabah Forestry Department have begun looking at the possibility of setting aside 20,000 ha of the Ulu Padas Forest Reserve for biological diversity conservation.

Lower Segama. The lower Segama study site refers to the riverine strip sandwiched between two Wildlife Reserves in the east coast of Sabah: Kulamba Wildlife Reserve to the north and Tabin Wildlife Reserve to the south. Both these reserves are outstanding in that virtually all of Sabah's large animal species occur here. The lower Segama is covered in logged freshwater swamp forest and there is evidence of intensive large mammal, primate and bird life in the area, inkling footprints of the Sumatran rhinoceros. This provides evidence of the importance of the area as a forested corridor to facilitate the movement of wildlife between the two reserves. Most of this land is currently State land under application for title and is vulnerable to forest conversion, repeated logging and hunting unless steps are taken to assure its conversion. The forest is also important for nurturing local fisheries and the local Tidong communities rely predominantly on subsistence farming and the harvest fish and prawns for their livelihood.

Lower Sugut. Lower Sugut refers to the lowland floodplain forest along the Sugut River in northeastern Sabah. The area contains an array of forest types such as riverine, freshwater swamp forest, kapur forest, lowland dipterocarp forest and east coast peat swamp forest, many of which are disappearing fast in other parts of Sabah. Apart from its botanical diversity, this region is also rich with wildlife. Oxbow lakes and steep sandstone ridges add to the natural beauty of this region. Orang Sungai fishermen rely on the health of the freshwater swamps and waterways for fisheries resources. Without concerted efforts to conserve biodiversity in these areas many of these forest habitats are likely to be converted to plantations or become degraded by repeated logging.

Klias Peninsular. The Klias Peninsular is the largest remaining wetland area in the west coast of Sabah, located on the delta of the Padas and Bulau rivers. The area consists of several transitional wetland habitats comprising mangrove forest, *Gymnostoma* forest, nipah swamp, open swamp, riverine forest and mixed peat swamp forest (PSF). PSF is an especially rare habitat that is becoming endangered in Sabah. Especially as large areas of PSF in the Klias Peninsular were destroyed in the 1998 fires. These habitats provide a refuge for the endangered proboscis monkey, silvered leaf monkey and estuarine crocodile. The Klias Peninsula contains areas important for many species of resident wetland birds as well as a diversity of migratory birds, including large numbers of ducks and certain globally threatened species such as Storm's Stork.

The Klias Mangroves nurture the fisheries resources of Brunei Bay and many of the communities in the two study areas investigated under the IPPA rely on the fisheries as a main source of income or for personal consumption. The wetlands also play a role in flood mitigation and preventing coastal erosion. Although there are several forest reserves, large areas are rapidly being drained and converted to agriculture and other uses. As wetlands are hydrologically

linked, land use in adjacent areas must be planned in order not to damage these important wetland forests.

Crocker Range Foothills

Only the upper parts of the Crocker Range are contained within the Crocker Range Park (CRP). The foothills refers specifically to the hilly land from the base of the range to the CRP boundary. The Crocker Range is unique in Sabah in encompassing an undisturbed continuum of forest from true lowland dipterocarp forest below 500 feet altitude to montane forest above 4,000 feet. Some tree species are believed to be endemic to lowland and hill dipterocarp forests of north-western Borneo. It is believed that the area still harbours a breeding population of Orang-utan.

Many parts of the Crocker Range foothills were identified as significant water catchment areas. Over the years the land outside the CRP has been repeatedly logged or converted to oil palm plantation. The process of alienation is still ongoing and the forests of this area were badly damaged by the 1998 drought and fire. The upper catchments of the Membakut, Bongawan and Kimanis rivers are in danger of becoming irreversibly degraded due to repeated logging and fire. It is imperative that the importance of the foothills of the Crocker Range for biodiversity and water catchment protection be addressed in planning.

Nabawan. The Nabawan site was selected as it represents the only significant sites for kerangas or heath forest in Sabah and possibly the only significant sites for kerangas. Kerangas forest is a kind of low stature forest that occurs on nutrient-poor sandy podsol soils. The Nabawan kerangas forest are outstanding as they support rich and spectacular orchid flora. These forests have exceptional potential for biodiversity conservation and research, nature education and recreation and nature tourism. At the time of project completion only 1000 ha remained intact, and less than 20 percent of this occurs within protected areas. Wild meat is an important source of protein to the local Murut in this interior area. In addition to adjacent natural areas the kerangas forest serves as an accessible hunting area for local people, especially as forest areas become increasingly scarce in Sabah.

Semporna Islands Park. This area has been proposed to be conserved by Sabah Parks. A draft management plan exists with maps and proposed zoning. The residents of two islands (Pulau Selakan and Pulau Sibankat) have requested to be included within the proposed park area.

Kinabatangan Wildlife Sanctuary. The area has been proposed by Sabah Wildlife Department. A draft management plan exists and this has been updated by the department. Out of ten proposed sections, six have been gazetted as a bird sanctuary under the Land Ordinance (Cap.68). There is an urgent requirement to complete gazettement of the remaining four sections and to re-gazette all ten under the Wildlife Conservation Enactment (1997). The area owned by SAFODA and Borneo Samudra is an important forest connection between upriver and downriver sections of the sanctuary. Since the area is generally unsuitable for agriculture it should be maintained under natural forest.

There is a need to maintain a connection of natural forest downriver between sections 1 and 2 of the sanctuary and the nearby mangroves.

Sungai Imbak Reserve. The area proposed includes the narrow valley between the two existing ridge-top Virgin Jungle Reserves. Without the intervening valley, the function of the two VJRs would be seriously impaired. Preliminary surveys have been carried out by various scientists but as yet no overall management plan exists.

Other identified potential conservation areas include:

- Pulau Banggi/North Borneo/ Marudu Bay
- Pulau Jambongan
- Bukit Silam and Darvel Bay islands
- Binsuluk Forest Reserve. On the Klias Peninsula, this is one of the few remaining areas of peat swamp forest on the west coast.
- Darvel Bay. This area should include the mainland area up to and including Bukit Silam. This land area is very important for plant diversity. Being on ultrabasic rocks it is poorly suited to agriculture. Its protection will help to safeguard water quality in the bay. Sabah Parks has an existing proposal.
- Danum Valley to Maliau Basin. Sabah Wildlife Department has proposed a zone of forest to be protected, 5km wide on each side of the Kuamut River (i.e., totaling 10 km width).
- Wetlands in Sabah and in particular coastal wetlands are currently under-represented in the protected area inventory. Wetlands generally should be protected and that Sabah should aim to include at least one wetland site under the RAMSAR Convention.

6.2 Environmental issues into regional planning

It is strongly recommended, that

- Regional plans are developed and adhered to for all main development or environmental sensitive regions in Sabah
- Environmental issues are integrated into these regional plans.

These environmental regional land use plans, covering one to several catchment areas, should be generated on a regional or District basis and should form the basis for land allocation in all urban and rural areas in Sabah.

The reasons for the recommended increased focus on the development of regional or District plans are, amongst others, that while EIA may provide some solutions for environmental management on a project to project basis, the impact of the EIA tool remains limited in the light of limited regional planning.

It is furthermore recommended that environmental guidelines for regional planning, land zoning and alienation should be developed or improved.

The following general principles should be incorporated into Land Use Planning Schemes and/or local plans:

- Wherever possible large blocks of forest should be retained, they should not be fragmented, for example, by roads and agriculture. This will reduce fire risks, enhance their value to biological diversity and maintain the economic viability of forest blocks.
- Corridors should be maintained between forest patches.
- Agricultural and other development should be avoided on flood-prone and swampy areas, e.g. the floodplains of rivers such as the Segama, Kinabatangan, Labuk and Sugut rivers.
- Planning boundaries (boundaries between different land uses, water catchment areas, property boundaries) should where possible follow natural features such as watersheds and avoid cutting across steep hills, cliffs, rivers, etc
- Buffer zones should be retained around existing and potential protected areas
- River reserves should be retained wherever possible. When possible their width should be tailored to the natural hydrological functions of the river (e.g. flooding) above and beyond the existing guidelines.
- A minimum river reserve standard is that no construction, clearing or removal of vegetation should take place within 20 metres from a stream or river with a width of more than 3 metres is allowed
- Urban development and settlements should where possible be downstream of protected areas so that effluent, sediment and solid waste input to protected areas is minimized
- The expense of river straightening, canalization and dredging should be avoided (including by upstream catchment management and siting downstream developments outside the influence of floods).
- All existing protected areas (e.g. Class I Protection Forests, Class VI Virgin Jungle Reserves, Class VII Wildlife Reserves, Parks, Wildlife Sanctuaries etc.) should be retained
- Alienation and development on hill with slopes having a gradient of 20 degrees or more should requires additional assessment

Intended development plans/developers should also take into consideration the *Conservation of Environment (Prescribed Activities) Order 1999*, making Environmental Impact Assessment (EIA) a mandatory State requirement for Prescribed Activities.

6.3 Environmental protection and monitoring

Three recommendations are made in order to strengthen environmental protection and monitoring.

1. Development and implementation of protection and monitoring tools, as rules, regulations and standards

Establishment and implementation of standards, rules and regulations for environmental protection. This could for example be:

- Environmental regulations for pig farming

- Environmental regulations for construction on steep slopes
- Environmental regulations for oil palm plantations
- Regulations for establishment and operation of landfills
- Environmental regulations for sewerage discharge.

Furthermore it is recommended that an *environmental audit* of natural resources management and protection should be introduced and practiced in Sabah. New legislation and regulation should allow for environmental audits to be introduced, initially in a limited form to specific hotspot issues or areas. As a long-term objective, the following steps should be taken towards developing environmental audit:

- Developing a system of auditing natural resources management and protection as a condition of license based initially around prescribed activities and related to certain environmentally sensitive areas. This system may be broadened in scope over time
- Establishing an audit of change and trends in natural resources management and protection, using existing monitoring data and a space time frame of 3-5 years. This form of audit could also be initiated on an issue on spatial basis to take account of significant environmental factors. The natural resources to be monitored could be air, landscape, inland waters, marine waters and flora and fauna.

Finally it is recommended that a inter-departmental *Environmental Monitoring Committee* is formed to consider all aspects of monitoring with coordination between agencies concerned with monitoring is due to a single responsible agency.

2. Development of the application of the EIA tool

While it was earlier thought important to expand the number of prescribed activities covered by the EIA system, given the nature of the development process in Sabah, it is now considered that improvements in the environmental screening related to the land alienation and development plan procedures provides better opportunities for environmental planning. The above recommendation should be supported by improving regional planning, and environmental protection and monitoring procedures. This would reduce the number of EIAs required but improve the effectiveness of the tool overall. Currently EIAs are required for projects which are too small size. The EIA tool should only be required for larger environmental projects and issues that can and should be dealt with at an early stage - the planning level.

It is recommended to review the Prescribed Activities Order during 2002 and implement the proposed changes. It is also recommended to continue the development of EIA guidelines for key environmental impact areas, for example forestry, oil palm plantations, aquaculture and mining.

3. Development of specific policies and actions plans for environmental protection

Development of policies and action plans for specific environmental areas of concern. This could for example be:

- Protection of river reserves
- Protection of river water quality
- Protection of coral reefs
- Protection of steep hill slopes.

An example of a specific policy and action plan is provided below:

State Policy on protection of steep hillslopes

1. Vision

To maintain the integrity of the hillscape in Sabah by the application of effective legislation and enforcement, and regional land use planning schemes for all important hill areas.

2. Policy Statement

To ensure that development activities on hillslopes is carefully planned and implemented, thereby avoiding unnecessary detrimental impacts on the environment, landscape and surrounding settlements.

3. Principles

Hillslope Development activities shall be based on the following principles:

- Hills scenery constitute an important part of the cultural and physical landscape of Sabah and as such are an integral part of the State heritage, yielding benefits locally, nationally and internationally, both for the present and future.
- It is the responsibility of all sectors to maintain the hillscape of Sabah and ensure that it is prudently managed and developed
- Development on hillslopes must be planned and guided by the natural environmental setting - let the site influence the plan

4. Objectives

- To strengthen the present framework for control and management of development on hillslopes
- To ensure that all Government Agencies and the public are aware of and adhere to existing regulations, requirements and procedures
- To identify the key issues, geographical locations and stakeholders involved in hillslope development
- To prepare land use planning schemes and local plans for all important hill areas in the state
- To strengthen cooperation and management of hillslope development activities

5. Rationale

Overview

The terrain of Sabah is generally hilly and mountainous. The western part of Sabah is dominated by the 50 km wide, 1,200 to 1,800 m high Crocker Range, which stretches from the Sarawak border in the southwestern corner to the Kinabalu massif at its northern end in Mount Kinabalu (4,093.37 m). Between the Crocker Range and the sea on the west coast is an extensive, heavily populated coastal plain with hills reaching down to the sea in many places.

East of the Crocker Range are several less prominent ranges. In the south central and part of east Sabah, the topography is dominated by a series of circular to sub-circular basins ranging from 16 to 50 km across and are defined by curved ridges, up to 1,800 m high, and valleys.

The Lokan Penplain, 65 km wide and 180 to 300 m high occurs between Telupid and Sandakan. The southern part of the Sandakan Peninsula is hilly and terminates in a number of spectacular escarpments facing Sandakan harbour. The Semporna Peninsula is dominated by steep volcanic hills stretching parallel to the south coast. Inland from Tawau and Lahad Datu, the terrain is mountainous, with hills of more than 900 m high.

Five inter-montane plains are located along the west coast and interior.

Flat, non-swampy land available for development in Sabah is thus limited in extent compared to the hilly terrain, which constitutes most of Sabah. As pressures from population growth, economic activities and land use activities grow; it is inevitable that the hilly areas will be developed.

Construction on hillslopes is becoming increasingly evident in urban centres and hilly areas with tourism potential such as Kundasang and Gunung Emas in Penampang. The types of structures erected on such slopes range from residential houses to commercial condominiums/apartments and chalets; other structures include temples, water storage reservoirs and telecommunication/transmission towers.

It is anticipated that construction on hills will increase in the near future as pressures from population growth, economic activities and land use continue to increase.

Needs

Hills can have considerable development potential because of the views and attractive setting they provide. Historically, construction on hills had been conceived on short-term benefits with the rights of the individual prevailing. However, there are rising community expectations concerning the maintenance of visual values, natural habitat and biodiversity around urban and growth centres. Hillslopes are often prone to hazards such as soil erosion and landslide as is evident from past incidences, resulting in loss of lives and property. Development in these areas can compound such hazards and render them highly visible and costly to deal with.

There is, therefore, a need to better manage and control construction activities on hills to reduce environmental impacts and to reduce loss of lives and property.

Future management decisions on hillslope development should also be based on the principle of sustainable development because of the unique values associated with hillslopes, which makes them a natural resource in their own right. In this context, sustainable development means that resources should be used in ways that do not jeopardise future use of the resource. Strategic planning, which recognises visual, conservation and recreational values, can provide clearer directions for future uses and management.

The Policy on hillslope development will help to ensure that such management decisions are implemented on a statewide basis.

Legislation

The need for controlling development on hillslopes has been recognised for many years. It is reflected in a number of legislative controls administered by various government agencies, for example:

- City/Municipal/Local District Council- **Written Approval** of the Development Plan under Section 23 of Land Ordinance 1930 and Land Rule 3(2)
- The Central Town and Country Planning Board - for **approval to rezone** the land on which construction will be carried out under Part I, Section 3 of the Town and Country Planning Ordinance 1950
- Environmental Conservation Department (ECD), Sabah – **EIA Approval** to carry out construction activities on hills with slopes having gradient of 20 degrees or more from the Director of ECD under the *Conservation of Environment Enactment 1996* and the *Conservation of Environment (Prescribed Activities) Order 1999*. Construction of buildings for commercial purposes or buildings exceeding 4 storeys high for residential purposes on hills with slopes having gradient of 20 degrees or more and construction of parks, resorts or other recreational facilities or major roads on hills with slopes having gradient of 20 degrees are Prescribed Activities, which require an EIA approval prior to project commencement.

Most of the approvals for hillslope development are issued on a piecemeal basis and little attention has been given to the cumulative effects, which a number of existing or future operations may have on the hill environment as a whole.

Environmental Impacts

The major adverse environmental impacts of hillslope development are:

(a) *Slope erosion*. Site clearing during earthworks result in the removal of vegetation and the creation of cleared surfaces, which become vulnerable to the erosive action of rain and surface runoff. Erosion on exposed slopes starts with rain splash leading to sheet, rill and gully erosion creating badlands if the site is left exposed

for too long or abandoned altogether. Cuts and fills change the slope angle, often creating steeper slopes. The steeper the slope, the faster the surface runoff flows and the more force it will have to remove material downslope.

(b) Slope stability. Landforms are the product of the local balance between weathering, erosion and deposition and are continuously evolving. Natural slopes that have been stable for years may suddenly fail because of development activities on hills.

Changes to the terrain and hydrology through construction or earthworks may cause erosion, which create conditions conducive to mass movement if exposed surfaces are not protected within a short period. Exposed rocks will be weathered at a faster rate and the weathered material is susceptible to movement especially when saturated with water.

Over cutting the toe or over steepening of the slope gradient can induce instability. Slope cutting changes the slope topography and releases residual horizontal stresses and cause expansion of the slope. Joints or weak zones may be exposed along which sliding may occur. Placement of fill will also lead to increase in shear stresses acting on slopes and may lead to slope failure.

Drainage patterns of an existing terrain may be altered as a result of construction. The change in groundwater flow patterns may cause changes detrimental to the stability of the newly constructed slopes of the existing *in-situ* slopes that were stable prior to construction.

(c) Landscape impacts. The impact on landscape is the direct physical change to existing landscape features such as vegetation, topographical, geomorphological features and recreational facilities as well as buildings and structures. Visual impact is a change to the appearance of the landscape and the subsequent effect on the views of groups of people at particularly sensitive viewpoints. Visual impact can vary from overall improvement to degradation. Construction on hills will bring about a change in the landscape and will thus have a visual impact on landscape quality.

Other adverse environmental impacts of hillslope development include:

- Loss of ecological habitat
- Objectable noise levels from construction and transportation activities
- Vibration associated with piling, vehicular movement and blasting
- Dust and atmospheric pollutants from machinery and transport vehicles
- Wastewater and solid waste disposal.

6. Strategies and action plans

The Policy will be guided by the following strategies and action plans:

Strategy 1: Strengthen the present framework for control and management of construction on hillslopes (Development Plan level)

Action Plans:

- Enforce existing regulations and guidelines related to construction on hillslopes
- Strengthen the existing Town and Country Planning Ordinance by making it mandatory for land developers to follow guidelines for development in hilly areas when planning and submitting development plan proposals
- Strengthen the implementation of the Conservation of Environment (Prescribed Activities) Order and the accompanying guidelines for construction on hillslopes
- Promote co-ordination in the implementation of hill resources management between the different units managing, controlling and enforcing regulations on construction activities on hillslopes at district and state levels
- Conduct seminars and other relevant information dissemination activities for all relevant Government agencies personnel on regulations, requirements, procedures and criteria when processing and approving development plan proposals.

Strategy 2: Enhance awareness on the present regulations, requirements and procedures for development on hillslopes

Action Plans:

- Conduct seminars and road shows and use mass media, pamphlets, booklets etc. to inform land developers and the public on the regulations, requirements and procedures when planning and submitting development plan proposals for approval
- Create awareness among land developers that construction on hillslopes might have adverse downstream effects and that they must do their part in reducing the negative impacts downstream and on adjacent land users. Land developers and the public should be made aware of the need that construction on hillslopes should be implemented without destroying the unique characteristics of the hills. The policy of 'let the site influence the plan' shall be adopted.

Strategy 3: Improve the knowledge database

Action Plans:

- Conduct studies to (i) document existing construction on hillslopes and their impacts on the environment, including slope stability, erosion and landscape impacts, (ii) cut and fill activities, (iii) agricultural activities– both shifting and permanent (iv) identify catchment areas or hills with high ecological and

landscape values where current or past development are/had taken place and take immediate action to conserve these areas, and (v) determine the development capacities of hills which are currently being developed; if the carrying capacities have been exceeded, take immediate action to restrict and control new constructions

- Promote international, national and local collaboration on issues related to hillslope development.

Strategy 4: Prepare land use planning schemes and local plans for all important hill areas (planning – zoning - level)

Action Plans:

- Review existing land use planning schemes and local plans covering critical hill areas and update accordingly to be in line with the Policy
- Prepare new land use planning schemes and local plans for all hill areas with priority given to hills, which have potential to be developed. Land use planning schemes and local plans for hill areas have to be evolved with an area basis perspective, shall take into consideration the water catchment basis and must be prepared using an integrated approach taking into account conservation issues vis-à-vis development needs, thereby ensuring compatibility between conservation of hill natural resources and construction activities on hillslopes. The planning of hill areas shall be carried out in an integrated and coordinated manner between all agencies involved
- Secure that the land use planning schemes and local plans prepared are fully implemented and enforced
- Take action to gazette hill areas which have been identified to be conserved
- Amend or enact new regulations to manage and control construction activities on hills where necessary, for example legislation that specifies type of construction allowed and low-impact facilities, forbids high-rise structures on hills, limits density, demarcates sensitive hill areas that requires Special EIA, makes developers put down a good behaviour bond to ensure that they take adequate care of the environment and make good any damage the development causes.

Strategy 5: Strengthen institutional implementation framework (implementation level)

Action Plans:

- Set up an inter-agency working group for hill development. This working group will be responsible for integrating all resource planning and setting state priorities

- Identify the potential for reallocation of resources and seek new and additional sources for the implementation of the strategies of the Policy on hillslope development.