6 FINDINGS - KLIAS PENINSULA IN GENERAL

6.1 VALUING WETLANDS IN LAND USE DECISIONS

> *Wetlands are defined as land where water is the dominant factor determining the nature of soil development and the type of plant and animal communities living in the soil and on its surface. Alternatively, wetlands may also be defined as land having the water-table at, near or above the land surface or land which is saturated for a long enough period to promote wetland and aquatic processes. (Stone 1991)*

Historically, wetlands have tended to be regarded as swampy wastelands with few productive uses. This perception has led to the loss of many wetland habitats throughout Southeast Asia. However, in recent years natural wetlands are increasingly being valued for the many important economic and environmental benefits they provide.

Tropical wetlands are among the most biologically diverse and productive ecosystems on earth. Plants and animals associated with wetland habitats are also integral to many food chains and life-support systems. Because wetlands are closely inter-connected with water resources and groundwater, rivers, streams and tidal areas, they form part of local and regional hydrological systems. In addition to direct benefits from the natural resources supported by the wetland environment, wetlands provide valuable services and functions to the human population, many of which are not normally valued in traditional accounting systems.

In recognition of their importance, a National Wetland Policy is being developed in Malaysia to guide the sustainable use and management of wetlands in order to protect the environment and promote economic growth. The Policy seeks to build wetland conservation into future land development plans.

Central to this objective is the need to properly understand the value of the overall wetland environment so that important resources, functions and benefits are not foregone in the rush to convert wetlands to other uses. The following table provides a brief summary of some of the Functions, Values and Attributes associated with wetlands.

Table 7 A Summary of Functions, Values and Attributes of Wetlands

(A) Functions

The interactions of physical, biological and chemical components of a wetland such as soils, water, plants and animals, enable the wetland to perform certain functions for example:

- water storage
- storm protection and flood mitigation
- shoreline stabilisation and erosion control
- groundwater recharge - the movement of water from the wetland down into the aquifer
- groundwater discharge - the movement of water upward to become surface water in a wetland
- water purification
- retention of nutrients
- retention of sediments
- retention of pollutants
- stabilisation of local climate conditions, particularly rainfall and temperature

(B) Values

Wetlands provide tremendous economic benefits, e.g:

- water supply - maintenance of quality and quantity
- fisheries
- agriculture - through the maintenance of water tables
- grazing timber production
- energy resources, such as peat and plant matter
- wildlife resources
- transport
- recreation and tourism opportunities

(C) Attributes

In addition wetlands have special attributes:

- biological diversity: wetlands support concentrations of birds, mammals, reptiles, amphibians, fish and invertebrate species, as well as countless plants.
- cultural heritage: e.g. open landscapes, wildlife, local traditions

(Source: The Ramsar Convention Manual 1994)

6.1.1 Total Economic Valuation of Wetlands

Wetland conversion projects have traditionally gone ahead because the financial *benefits* were perceived to be greater than the financial *costs*. However, the environmental *costs* associated with wetland modification are usually not enumerated. In many cases these impacts exert a high social and financial cost. Previous cases have demonstrated that the true cost of proposed actions is understated if the value of the wetland environment and resources are not included in the analysis. Options to preserve wetlands are also undervalued if wetland values are not well-represented. Such values may be substantial. A detailed New Zealand study estimated that non-market values of wetlands could represent as much as 70 percent of the total wetland value (Stone 1991).

Total Economic Valuation (TEV) is an analytical tool used to better represent the complete range of values linked to specific natural environments. Although it is impossible to represent in monetary terms the true value of nature, using a variety of approaches, economists are able to put monetary values on resources, functions and benefits that are normally taken for granted. This approach also demonstrates that the modification of wetlands is not 'costless'. By assigning comparable values to development options, TEV facilitates rational decision-making by land use managers by portraying more realistically the costs and benefits of any decision to modify or exploit wetlands. With this approach, "the fundamental purpose for valuing the environment is to facilitate social choice, rather than value the environment for the sake of it (Stone 1991)."

6.1.2 Benefits and functions of the Klias Wetlands

Under the IPPA studies, Total Economic Valuation was applied to the Klias wetlands to conduct a cost-benefit analysis of land use choices in Klias in order to make informed decisions for the sustainable use of these wetlands. The econometric analysis of the Klias wetlands is contained within the Economic Assessment that covered three main areas of the Klias Peninsula - (1) the Bukau-Api-api area, (2) the Padang Taratak area and (3) the Klias river-Kg. Gramma area. These provide conservative estimates of the total wetland values; the overall value of the wetlands would undoubtedly be much higher.

It is noteworthy that this study is not the first to state the value of the Klias wetlands and rivers. Numerous reports and publications by a state agencies and departments have already highlighted the importance of these areas and the need for their conservation. (See extracts from the Sabah Water Resources Master Plan, 1994 in Table 8.)

Much of the Klias Peninsula is within the Padas River water catchment. This is the largest catchment in west Sabah and one of the ten priority river basins in need of Water Catchment Plans in the Sabah Water Resources Master Plan (see *Appendix 4*).

Table 8 Rivers and sites in the Klias Peninsula named among the Wetlands, Rivers and Estuaries of High Value in the Sabah Water Resources Master Plan.

Areas	Description	Source
Klias Peninsula and Sg. Padas estuary wetlands	Very important migratory wader bird habitat.	Sabah Wildlife Department
Sg. Padas outer estuary and Brunei Bay	Single most significant prawn and fish near-shore resource in Sabah.	Sabah Wildlife Department
Sg. Padas and Sg. Kinabatangan	The consumption of fresh water fish from these two rivers is very significant since the rivers are large and the human populations along them are also large.	Department of Fisheries
Sg. Klias and other blackwater rivers of the Klias Peninsula draining peat swamps	Highly productive for estuarine prawn production.	Sabah Museum Department
Rivers in parks, virgin jungle reserves, other reserves and sanctuaries (relevant to Klias – Padas Damit, Gramma)	Representative of undisturbed aquatic and riparian ecosystems.	Sabah Parks, Water dept., Dept. of Medical Services and Health, DID, Forestry Dept, Soil Conservation Strategy (Folland 1982)

(Source: Sabah Water Resources Master Plan 1994)

6.1.3 Valuation of Klias wetlands

The main aim of the Klias economic valuation has been to assess the value of goods and services obtained by local communities from the wetland habitat and waterways; to assess the financial impact of conversion, degradation and drainage; and explore the economic potential for sustainable uses of the area.

I DIRECT USE VALUES

Direct Use Values refer to the productive and consumptive uses of wetland resources. The most significant direct benefit of wetlands is the harvest of wetland resources of fish, prawns and shellfish from the estuary and bay as well as forest resources of timber, mangrove poles, fruits, medicinal plants, forest foods and other useful materials. As discussed in sections 4 and 5, these resources make a major contribution to local households. As an indication of the scale of reliance on these direct benefits, the average gross harvest of fisheries resources (inclusive of personal consumption) in Weston totalled RM1182 per household monthly. Multiplied by the number of fishing households, the estimated total value was RM176,760 monthly or RM1.2 million per annum. In Kg. Pulaimanang, the gross direct use value was RM33,660 per year. The estimated direct use value from villages in the Padang Taratak area was placed at RM163,536 per annum.

From the analysis of direct use values, it is possible to surmise that any impact on the environment quality of the waterways, or removal of mangrove and wetland habitat would be likely to undermine the productivity and sustainability of the fisheries resource as well as ease of access to other renewable wetland resources. The maintenance of these resources should therefore be factored into development considerations.

II INDIRECT USE VALUES

Indirect Use Values are more difficult to quantify as they are not exchanged in the market place. These include the value of ecological services such as flood mitigation, sediment and nutrient retention, coastal stabilisation, regulation of climate and carbon sequestration.

The role of the Klias wetlands in providing some of these functions is explored briefly below. Because of the lack of detailed studies of wetland environments in general and PSF in particular, the full spectrum of wetland functions have yet to be considered.

(i) Flood mitigation

Based on the geomorphology of the Klias Peninsula, it has been theorised that the Klias PSF occurs in a depressional backswamp that may have once been the original course of the Padas river. Tectonic movements are thought to have shifted the alignment of the river to its present course.

At present, floods are a highly disruptive annual occurrence in Beaufort District. This is due to the high rainfall which averages 3,000 to 3,500 mm per annum and the large catchment area of approximately 8,800 km^2. Floods occur between 2 - 6 times a year but are more prevalent in years with heavy rainfall (in 1996 when rainfall exceeded

4,000 mm, there were 12 major floods). The sharp descent of the Padas River at the Padas Gorge sends large volumes of water into this low-lying area which cannot be discharged quickly into the sea. Floods in Beaufort and the Klias Peninsula incur heavy damages to agriculture and public infrastructure. In 1996, these amounted to RM9.65 million in losses. Flood mitigation is also an unproductive drain on Sabah's resources. As much as RM4.76 million is budgeted under the Seventh Malaysia Plan to support these efforts.

Because the Klias wetlands are low-lying they are able to absorb and retain floodwaters spilled over from the rivers. In this way, the PSF and inland wetlands play an important role in flood attenuation, although this role tends to diminish in areas closer to the coast. Although flood events are heavily influenced by rainfall and river catchment management, any modification to the floodplain wetlands that undermines their role in floodwater attenuation could contribute towards floods being more serious and pervasive.

(ii) Pollution control - nutrient and sediment retention

Wetlands tend to reduce the velocity of water flowing into them from streams and rivers. This causes the deposition of the sediment load and pollutants before the water is discharged into the estuary and the bay area. As the Bukau and Padas catchments have high levels of land use activity, the amount of silt, agricultural chemicals and heavy metals carried by surface run-off is significant. The wetland clays and mud provide a sink for toxins and pollutants, and prevent adverse effects on aquatic life and fisheries resources.

Drainage canals that rapidly channel urban and agricultural run-off directly into the sea, or any other modifications that impair the ability of wetlands to play this function could cause coastal pollution and negatively impact local livelihoods.

(iii) Preventing subsidence and saline intrusion

PSF provides a buffering function between the saltwater and freshwater systems. This creates a productive brackishwater environment that is important to some organisms at certain stages in their life-cycle. It also ensures that saline waters do not flow into and degrade agricultural lands. The drainage of freshwater has the capacity to draw in water from the coast, particularly during dry weather. As discussed in section 4.3.2, draining peat soils potentially causes **subsidence** when the added weight of dry peat compresses underwater layers of soil leading to a drop in the level of the land. This destabilises the land and upsets this freshwater-saltwater balance and increases the likelihood of **saline intrusion**, a problem which is very difficult to reverse.

In view of these problems, any proposed drainage works in support of flood alleviation and agricultural development should consider and address the possible impact of saline intrusion and subsidence on their project.

(iv) Preventing forest fires

In their natural state, the peat soils of PSF are waterlogged and do not present a fire risk. Wetlands have the potential to retard the spread of fire into agricultural lands. However, once drained the natural vegetation and the soils themselves are highly combustible. Peat fires are especially destructive as they are difficult to control. In addition to the destruction of crops and property, the fires also cause harmful levels of air pollution with impacts on human health and economic productivity.

The danger of peat fires has already been demonstrated by destructive fires in Kalimantan and in the Klias Peninsula itself, where forests, crops and property were destroyed. More than 10,000 hectares of dried out PSF in Forest Reserves were destroyed in the Klias Peninsula. The impacts to the local economy from lost productivity due to ill-health related to the resulting haze is among the costs of inappropriate wetland development.

(v) Tourism potential

Related to the natural attributes of the area is the inherent potential for the area to support nature tourism. A preliminary assessment of tourism potential in the Klias Peninsula has found it to be strategically located to attract both domestic and foreign visitors (*Background paper 8*, section 6.7). The Klias wetlands combine rare biodiversity and wilderness values, recreational opportunities, and cultural experiences. This potential has yet to be tapped.

Tourism has the capacity to bring new money/foreign exchange into the area which will have multiplier effects on local business activity. Because the natural setting is the main attraction to tourists, tourism development does not require substantial investment into environmental improvement and may be considered a development option that is compatible with biodiversity conservation and the retention of renewable natural resources in Klias.

The tourism potential of the Klias wetlands leans heavily on the retention of the biodiversity values and scenic integrity. The loss of attractive tourism sites resulting from inappropriate development choices may be considered *opportunity costs* ***or lost value.***

6.1.4 Valuation conclusion

Using information on soil capability, hydrology as well as local socio-economy, an econometric analysis was conducted to compare the relative benefits of conversion of the Bukau-Api-api area to oil palm cultivation. The report concluded that when the economic returns from oil palm were calculated with the high financial investment of land modification and its impacts on the socio-economy of the area, the financial justification for plantation agriculture was greatly reduced.

The cost-benefit analysis found that the loss of benefits to the wider Klias community associated with agricultural conversion in the Bukau-Api-api area was sufficiently high to provide a stronger economic justification for retaining the area under natural conditions. Furthermore, the limitations of the Kranji and Klias soils of the area and the unpredictable element of hydrological change tend to reduce or negate any forecasted financial benefits of agricultural modification.

If the potential recreation and tourism benefits of the Klias area are factored into the analysis, the loss of habitat and biodiversity values arising from land clearing and conversion are likely to be substantial.

Overall, the economic assessment recommends that the Bukau-Api-api area and its adjacent natural areas ought to be conserved because the loss of benefits and resources by a large sector of society are expected to outweigh potential gains from forest conversion.

6.1.5 Socio-economic Impact of Conservation

The economic assessment also evaluated the economic impact of conservation areas on local communities.

i) Bukau - api-api area

Conservation of the Bukau-Api-api area is considered to offer some improvement to the community by protecting the quality of the wetland environment and its ability to sustain important living resources. In addition, conservation is seen by local people as having the capacity to generate additional benefits arising from the possible development of nature tourism.

ii) Padang Taratak-Padas Damit area

The establishment of a Wildlife Sanctuary in the Padang Taratak area, primarily for bird conservation, could be economically advantageous to the local communities as it serves to retain in natural conditions a communal area for fishing, grazing buffalo and the harvest of renewable forest resources. A potentially symbiotic situation is feasible with provision made for continued local access to resources on a sustainable basis. The potential for this area to support nature tourism has already been mentioned. If this sector is developed with local involvement, conservation would also have the potential to raise local income levels and create additional employment.

iii) *Sg. Gramma-Sg. Klias area*
The Gramma river flows through swamp forest that is already protected within the Padas Damit Amenity Forest Reserve. This area is densely forested and permanently inundated. In its natural state it supports fishing activities and the harvest of forest products mainly for domestic use. This area is considered one of the best areas in the Klias Peninsula to view proboscis monkeys and silvered langurs. Similar, to Padang Taratak, efforts to tap this tourism potential are likely to generate economic benefits to the local community which could supplement their household earnings.

6.2 ENVIRONMENTAL MANAGEMENT CONCERNS

The threats to wetland ecosystems associated with drainage have already been dealt with in section 4.#. This section highlights further environmental concerns that should be noted and addressed in planning and land use management.

6.2.1 Sedimentation

A great deal of sediment presently enters the river system from roadworks and forest clearing on slopes within agricultural estates. Silt carried in run-off impacts the utility of the waterways for transport and the health of the aquatic environment and fisheries resource. By reducing the depth of rivers and streams, sedimentation also exacerbates flooding problems in Beaufort District.

Appropriate land use management and soil conservation methods (revegetating exposed areas) within the Bukau and Padas catchments are the only ways to effectively control soil erosion and sedimentation. Integrated Catchment Management Plans should be considered a priority for both the Padas and Bukau river basins.

6.2.2 Nutrient loading

Nutrient loading is a problem that arises when the water drained directly from agricultural projects, carries fertilisers and pesticides into streams and other water bodies. This may cause eutrophication which is harmful to aquatic ecosystems.
The over-usage of agricultural chemicals should be discouraged as the bulk of the input ends up in surface run-off. Farmers should also be encouraged to limit the use of fertilisers and pesticides. More environment friendly methods of enhancing productivity and eliminating pests should be introduced.

6.2.3 Long-term water monitoring

In order to ensure a compromise between continuing land development and conservation goals within the Klias Peninsula, the hydrology assessment (*Background Paper 4*) makes recommendations for long-term monitoring of (1) groundwater levels, (2) water levels, (3) streamflow and (4) water quality at several specific points along the Bukau-Api-api area so that any land use changes that threaten the natural environment may be addressed. Similar monitoring activities should be undertaken for the Klias, Padas Damit and Padas rivers by the Department of Irrigation and Drainage and the Sabah Forestry Department**.**

6.2.4 Sustainability of fisheries resources

The assessment of fisheries at the Klias IPPA study sites has identified the over-exploitation of fisheries resources as a factor that could seriously limit the resources available to local communities in the future. It recommends that the Fisheries Department evaluates the status of the resource and takes steps to ensure long-term sustainability such as enforcing minimum cast sizes, no fishing zones and limiting fishing rights to licensed resident fishermen. Unsustainable forms of fish exploitation such as explosives, electrical current and poisons should also be actively prevented, while ways of boosting the productivity of the resource should be investigated.

6.2.5 Fire prevention

Fire has been a particularly destructive force in the Klias Peninsula where fire damage was experienced in 1982-83, 1991 and 1998. In all events, water stress was a factor, but human influences sparked the outbreak of fire in almost all instances. The large areas of peat soil is another factor that increases fire risk. For these reasons, the Peninsula is classified as having moderate to high risk of fire.

The assessment of fire damage conducted by WWF Malaysia during and following the 1998 fires found that fires occurred as a culmination of weather conditions and land use practices (Davison 1998). Thus, human activities and land use practices are the only factors that can be controlled to prevent future fires.

Fire prevention and risk minimisation strategies that should be incorporated into district land use planning include -

(i) Avoiding forest fragmentation to minimise edge effects and susceptibility to drying
(ii) Making compulsory the construction of firebreaks when clearing land in agricultural land, be they plantations and small-holdings
(iii) Controlling forest degradation through illegal logging, clearing and drainage of waterlogged peat swamps.
(iv) Monitoring and controlling agricultural drainage to prevent impacts on Forest Reserves.

Readiness and rapid response to fires is essential to limit damage. A Fire Management and Response Plan, integrating the resources and efforts of the relevant government

agencies and large stakeholders should be developed. Public awareness should be also promoted to prevent fire risks and encourage vigilance in reporting outbreaks.

6.3 KLIAS COASTLINE PROTECTION

Much of the coastline of the Klias Peninsula is lined with mangroves. This is the largest area of mangrove and nipah swamp remaining in Sabah's west coast and serves as a major nurturing ground for fisheries resources of the Brunei Bay. Sections of the coastline mangroves are protected within the Menumbok Mangrove Forest Reserve and the Nabahan Forest Reserve, but a large section at the mouth of Padas river in between these two Reserves is presently not protected.

Sections of these mangroves have been observed in the past to be cut back by coastal erosion, stranding stands of *Bruguiera* at sea (Wells *et al* 1975). Although the mangrove species (*Rhizophora conjugata, R. mucronata, Avicennia sp.* and *Sonneratia sp*.) of this area are reasonably well-represented elsewhere, the natural vegetation along the entire stretch of coastline should be maintained to stem the erosive impact of the sea on the Klias coastline.

6.4 ROLE OF TOURISM IN ECONOMIC DIVERSIFICATION

Wetland environments the world over are increasingly gaining prominence as attractive recreation areas. The natural features of the Klias Peninsula make this area potentially appealing to both domestic and international tourists. In addition, it is strategically located close to Kota Kinabalu and Labuan and improvements to the road system will improve accessibility from Brunei and Sarawak.

The Klias Peninsula has attractions not found elsewhere in the west coast of Sabah, which include proboscis monkeys, fireflies and diverse birdlife. Although some of these may be viewed along the Kinabatangan and the east coast of Sabah, to some, travel to these areas is too time-consuming and prohibitively expensive.

Tourism may provide the impetus for development initiatives that utilise the natural vegetation and diversity of the area, providing economic diversification for an area where natural resources and land suitable for agriculture are becoming increasingly limited.

6.4.1 Proposed Nature Tourism Areas

Three main sites have been identified as potential as nature tourism destinations: the Padas Damit - Padang Teratak area, the Bukau - Api-Api area and the Klias-Gramma area (**Map 11**).

I PADAS DAMIT - PADANG TERATAK AREA

Primarily a marshy grassland with sections of mixed swamp forest and nipah adjacent to the Padas Damit Amenity Forest Reserve. An important site for resident and migratory birds, including flocks of ducks and egrets that use this wetland as a wintering site (November to January). Parts of the area are also said to provide refuge for the estuarine crocodile. The area is traditionally used by local communities for buffalo grazing and fishing.

Nearby villages: Kg. Padas Damit, Kg. Bintuka/Siak, Kg. Masikuan/Taratak, Kg. Taguna, Kg. Kukut, Kg. Bengkalakak, Kg. Mentulud
Nature attractions: birdlife; proboscis monkeys; silvered langurs; crocodiles (night eye-spotting); unique setting: marshes, mudflats, mangroves, nipah
Recreational potential: fishing in rivers, estuary or ponds; good game fish - barramundi, snapper, grouper are attractive to sports anglers.
Cultural features: traditional fishing activities; buffalo grazing

II BUKAU - API-API AREA

The Api-Api river is a blackwater river which flows alongside the Klias Forest Reserve. It joins the Bukau river near Kg. Pulaimanang which then meets the sea at Weston. The area showcases the transition of wetland habitats from the inland peat swamps to coastal mangroves. This is one of the last places in Sabah where peat swamp forest may be viewed. The natural flora and setting are the main attractions, although it is also possible to see silvered langurs, proboscis monkeys, otters and wetland birdlife at dawn and dusk.

Nearby villages: Kg. Pulaimanang, Kg. Bukau, Kg. Weston Laut/Tengah/ Hilir, Kg. Lingkungan
Nature attractions: Api-Api river: silvered langur; birdlife; rare peat swamp forest; unique transition of wetland habitats; Weston: wide estuary; mangroves and nipah swamp; waterbirds; proboscis monkey; long-tailed macaques; fireflies at night near Kg. Nabahan; crocodile eye-spotting and otters at night; Lubok road panoramic lookout point.
Recreational potential: rowing, angling etc.
Cultural features: Weston: local fishing activities (riverine and coastal); 'water village' lifestyle (potential for a Homestay Programme); boat-making; nipah/rattan handicraft (baskets and mats); preparation and sale of saltfish and dried shrimp; local foods and sweets; weekly markets; festive periods.

III KLIAS-GRAMMA RIVER

The Klias river flows through the largely undisturbed riverine and mangrove swamp forest of the Padas Damit Amenity Forest Reserve. At Kg. Kota Klias, local boats may be hired. Residents of this area use narrow canals as short-cuts between river meanders to access the narrow Gramma river. Here there is a good chance of viewing proboscis monkeys, silvered langurs, long-tailed

macaques and birdlife. An alternative route to the Gramma river is by boat from Kg. Gramma which is located off the road to Kg. Bintuka.

Nearby villages: Kg. Kota Klias, Kg. Nukohan, Kg. Gramma **Nature attractions**: mangroves, mixed swamp setting; proboscis monkeys; silvered langurs; long-tailed macaques; birdlife **Recreational potential**: boating; angling etc. **Cultural features**: local fishing activities; relaxed kampung lifestyle

6.2.2 Conclusion

The wetland areas of the Klias Peninsula have potential for tourism and recreation development. Historic and cultural elements also add interest to the area. Local communities consulted are receptive to tourism as a means of stimulating new non-traditional sources of income in this area. In its natural state, the Klias wetlands provide valuable resources to local people and crucial habitat to native wildlife. Tourism seems to offer a sustainable alternative use of the wetlands while enabling it to continue to support local economic and subsistence needs and ecological/ hydrological benefits.

In developing this tourism potential, careful attention must first be paid toward:
(1) protecting and managing important habitats and wildlife, and minimising damage to the environment from tourist infrastructure and numbers;
(2) coordinating efforts among the district and State government agencies, local stakeholders and the tourism sector, and
(3) ensuring the participation of local communities and the equitable distribution of benefits. Local people should also be assisted in acquiring skills required for the tourism sector.

Developing this potential will also rely on the involvement of agencies and individuals with the necessary expertise to assist in creatively planning, packaging and promoting tourism products to the various target groups.

6.2.3 Tourism recommendations

i) Important biodiversity areas and historical sites in Klias Peninsula not currently within protected areas to be conserved under the appropriate legislation (Forestry Enactment, Wildlife Enactment, Cultural Heritage Enactment).

ii) No further alienation of State land should be permitted within the proposed Padang Taratak Wildlife Sanctuary and the proposed Bukau-Api-Api Forest Reserve extension. Provision may be made to guide the sustainable use of new conservation areas by local communities.

iii) A conservation management and tourism development plan should be drawn up for important conservation areas, existing Forest Reserves and sites with tourism potential. The plan should involve the Sabah Forestry Department, Sabah Wildlife Department, Beaufort District Office, local stakeholders and relevant tourism organisations.

iv) Local communities should be consulted and given opportunities to participate in habitat and wildlife protection, rehabilitation of certain areas and the development of tourism infrastructure and services.

v) Important wildlife habitat for proboscis monkeys, silvered langurs, flying foxes, estuarine crocodiles and migratory birds should be made priority areas for monitoring by the Sabah Wildlife Department.

vi) Environmental education programmes should be conducted in the Klias area to highlight the importance of the wetlands for the conservation of threatened species, fisheries resources and other important hydrological processes. Illegal hunting and harmful fishing practices should be discouraged.

vii) Potential alternative uses of natural and semi-natural areas in Klias should be investigated to stimulate economic benefits.

6.5 PROBOSCIS MONKEY CONSERVATION

The Klias Peninsula is the only area of wetland habitat in the western part of Sabah that provides habitat for the proboscis monkey. Throughout most of its limited range in Borneo, this Bornean endemic is threatened by logging and agricultural conversion, and more recently, forest fires (Bennett and Gombek 1993; see Map 9). This species is also threatened by casual hunting.

A 1996 study of the distribution and abundance of the Klias proboscis monkeys found the density of monkeys to be an estimated 0.19 groups/km^2 or 1.14 individuals/km^2 (Bernard 1996). Four study areas were featured: (1) Sg. Gramma (through the Padas Damit Amenity FR), (2) Sg. Sinapokan (close to the mouth of the Klias River), (3) Weston (mouth of the Bukau River, Hindian and Nabahan FRs) and (4) the general Padang Taratak area. A total of 21 groups, comprising 126 individuals were observed. Although the proboscis monkey population in Klias is smaller and more scattered in comparison to other sites in Borneo, based on the current rate of habitat loss in Boneo, the wetland habitats of the Klias Peninsula could play a critical role in the survival of this species.

Overall, the monkeys were found to be most abundant close to, or along rivers running through Forest Reserves, indicating the significance of extensive areas of good quality habitat to the species. Ecologists believe that proboscis monkey populations could be strengthened by effectively preventing hunting, protecting stretches of continuous habitat and possibly planting degraded areas with the monkeys' preferred food sources (Lim 1996, Bennett 1998 pers. comm). Proboscis monkeys are selective feeders and must range over wide areas to find their main foods of young shoots and seeds. They are severely threatened when habitats shrink or become fragmented. The isolation of population groups impedes genetic variation which may affect their long-term species survival (Bernard 1996).

The proboscis monkey has exceptional potential to stimulate nature tourism and has done so in several areas: the lower Kinabatangan river in east Sabah, Bako National Park in Sarawak and in Tanjung Puting National Parks in Kalimantan (Bennett and Gombek 1993). Although the proboscis monkeys in Klias are wary of people because of previous hunting pressure, this behaviour has been known to change under different conditions. In areas where hunting has ceased, such as Bako National Park, the monkeys have gradually become more at ease with humans (Bennett 1998, pers. comm.). This suggests that the proboscis monkeys of Klias may over time, become more amenable to nature tourism activities if they are adequately protected within a conservation area.

In order for the Klias Peninsula to make a significant contribution to proboscis monkey conservation, larger areas of contiguous wetland habitat should be given protection. Active enforcement and education programmes to discourage hunting should be carried out. The rehabilitation of degraded wetlands with suitable food species should also be explored as an approach to strengthen the existing population.