PROJECT BRIEF

1. Identifiers:

Project Title:	**Conservation of Biological Diversity Through Improved Forest Planning Tools**
PIMS NO:	1370
Duration:	5 years
GEF Implementing Agency:	UNDP
Executing Agency:	Ministry of Primary Industries
Requesting Country:	Malaysia
Eligibility:	Malaysia ratified the Convention on Biological Diversity on 24 June 1994
GEF Focal Areas:	Biodiversity
Operational Programme:	OP 3 Forestry
Strategic Priority:	IV Generation and Dissemination of Best Practices for Addressing Current and Emerging Biodiversity Issues

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2. **SUMMARY**

Tropical forests are the most complex and diverse ecosystems on earth. In addition to having extremely rich and diverse plant and animal life, these forests also play a significant role in the socio-economic development of the countries that harbour them. These countries also value the forests for their roles in the maintenance of soil and water resources, stabilising climate and the conservation of biological diversity. However, current forest management practices in many topical countries tend to maximise timber production goals and are deficient in certain critical aspects that threaten sustainability and conservation of biological diversity. The procedures for identifying forest areas that should be protected within the permanent forest areas and within individual forest concessions do not give sufficient consideration for biodiversity conservation. It is also now generally accepted that effective biodiversity conservation strategies must include not only a system of protected areas but also the integration of biodiversity considerations into the management of timber production forests—especially production forests that are adjacent to protected areas or include assemblages of species that are not well-represented elsewhere. The proposed targeted research project addresses these issues by developing tools that will enable forest planners to assess the adequacy of existing protected areas for biodiversity conservation and, if there is a need to establish additional

areas, to determine how large they should be and where they should be located. This approach fits directly into GEF's Strategic Priority II on mainstreaming biodiversity on production landscapes and sectors.

The proposed project will develop biodiversity assessment tools and economic valuation tools which will be integrated into a computer-based forest-planning model.

The biodiversity assessment tools will take spatial scale and habitat heterogeneity into account. They will make feasible rapid biodiversity assessments—both qualitative and quantitative—at the landscape and stand levels. The assessments will provide information on not simply the number of species present in a region, but also the presence of ecological communities that are not well represented elsewhere. They will enable forest planners to predict how the allocation of forest lands between protection and production categories, and the retention of unlogged areas within production forests, affect biodiversity. This again fulfils GEF's Strategic Priority II approach of integrating biodiversity conservation needs under a production landscape. The ecological research required to develop these tools will entail the establishment and periodic measurement of permanent sample plots in logged and unlogged forests, in the context of an experimental design that involves varying the proportions of logged and unlogged areas in timber concessions.

The economics research will adapt existing non-market valuation methods, which have mainly been applied to temperate forests in high-income countries, to the valuation of the benefits of protecting biologically rich tropical forests. It will encompass both direct use values like traditional non-timber products, nature-based recreation, and watershed services, and non-use values like existence values.

The biodiversity assessment and economic valuation tools will be integrated into a computer-based forest-planning model. This model will be designed to assist forest planners with practical decision-making. Based on the characteristics of forests in a planning region, an expert system could recommend how to allocate those forests between production and protection categories while prescribing an optimal balance between biodiversity conservation and timber production. The system could also predict how changes in timber management goals would affect biodiversity conservation.

The project will complement efforts to promote sustainable forest management. Although the tools it generates will be developed in a Malaysian context, they will be applicable to forests throughout Southeast Asia and in other tropical countries. To ensure that the global benefits of the research are maximized, the project will include a variety of training and dissemination activities. This is relevant to GEF's Strategic Priority Area IV on Generation and dissemination of Best Practices for addressing current and emerging biodiversity issues.

3. COSTS AND FINANCING (USD million):

GEF: Project	**$ 2,261,000**
PDF B	$ 0.196,350
Sub-total GEF:	$ 2,457,350
Co-financing:	
Government of Malaysia	$ 2,307,000
Private sector	$ 0.047,000
Universities	$ 0.530,000
ITTO (to be confirmed)	$ 0.558,000
Sub-total co-financing:	$ 3,443,000
Total Project Cost: (including PDF B)	**$ 5,900,000**

Abbreviations

DID	Drainage and Irrigation Department
EPU	Economic Planning Unit
FRIM	Forest Research Institute Malaysia
GEF	Global Environment Facility
Ha	Hectares
IRPA	Intensified Research Priority Area
ITTO	International Tropical Timber Organisation
KPU	Ministry of Primary Industries
MNS	Malaysian Nature Society
NGO	Non-government Organisation
NSC	National Steering Committee
NTFP	Non-timber Forest Product
PDF	Project Development Fund
PITC	Perak Integrated Timber Complex
PRF	Permanent Reserved Forest
RIL	Reduced Impact Logging
TWC	Technical Working Committee
UKM	Universiti Kebangsaan Malaysia
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UPM	University Putra Malaysia
VJR	Virgin Jungle Reserve
WWF	World Wide Fund for Nature

Background: biodiversity conservation in landscapes with timber production forests
Efforts to protect globally important biological diversity in tropical rainforests have historically emphasized the identification of habitats for "charismatic megafauna" (elephants, rhinos, orangutans, etc.) and the demarcation of those habitats as protected areas, where logging and other extractive uses are prohibited. The effectiveness of this approach is often limited by the small size of many protected areas, encroachment (including illegal logging), and the omission of ecosystems that lack "superstar" species but are nonetheless unique in evolutionary terms. Equally important, a reliance on protected areas is bound to have limited success because it ignores the substantial biodiversity that often exists in timber production forests. It is now generally accepted that effective biodiversity conservation strategies must include not only a system of protected areas but also the integration of biodiversity considerations into the management of timber production forests—especially production forests that are adjacent to protected areas or include assemblages of species that are not well-represented elsewhere.

This emerging landscape-oriented approach involves decisions that are more complex and whose implications are not well understood. For example, it requires careful consideration of not only the location of protected areas but also the location and timing of logging operations in production forests. Even in a completely homogeneous forest, which tropical rainforests most certainly are not, the spatial and temporal allocation of logging has a strong impact on the nature of the disturbance to plant and animal communities. Picture the large-scale but infrequent logging of half of a production forest every 50 years versus the smaller-scale but continual logging of 1% of the forest every year. Although the latter is popularly regarded as environmentally more friendly, it might in fact be more deleterious to the populations of certain taxa.

Decisions must also be made as to the desirability of leaving unlogged refugia within production forests and modifying logging methods in the remainder of the production forest area. These decisions, and also ones related to the location of protected areas and the location and timing of logging operations, involve both ecological and economic considerations. For example, a single large protected area might have more conservation value for some taxa than an equivalent aggregate area comprised of a smaller protected area and several small refugia distributed throughout neighbouring production forests. The opposite might be true for other taxa. Spatial allocations affect the direct and indirect economic benefits that flow from the conservation of biologically rich forests. For example, the size of protected areas affects their attractiveness as sites for ecotourism (obtaining a "wilderness" experience is impossible in an area of just a few hundred hectares); their location relative to forest-dependent communities affects their value as a source of nontimber forest products (NTFPs); and their topographical features (slopes vs. flatlands), as well as their location relative to human settlements and infrastructure, affects their value as a source of hydrological services. The effects of spatial allocations

are not independent, in either ecological or economic terms, of the characteristics of logging methods employed in production forests. For example, to achieve a given level of biodiversity conservation, the combined area of protected forests and refugia can probably be reduced if logging methods are modified to be less destructive. On the other hand, if the modifications entail large increases in logging costs, then a more cost-effective approach to biodiversity conservation could be to eschew modifications to logging methods but to increase the aggregate area of protected forests and refugia.

Targeted Research To Support Biodiversity Conservation at a Landscape Level

The discussion above suggests that three categories of information are required to manage biodiversity more effectively, in both ecological and economic terms, in landscapes that include timber production forests:

1. ***information on the impacts of changes in total forest area and changes in the allocation of forests among different use categories (protection, production, etc.) on biodiversity;***

2. information on the direct and indirect economic benefits that result from enhanced biodiversity conservation;

3. information on the costs of biodiversity conservation, in particular the opportunity cost associated with forgone logging activity.

Generating this information and the tools needed to integrate it into forest planning processes requires a multi-year, multidisciplinary research effort. This document describes a targeted research project, to be funded jointly by GEF and other national and international sources, aimed at filling this information gap. Specifically, the project will develop:

1. improved tools for rapidly assessing the biodiversity in tropical rainforests;

2. improved tools for estimating the economic value of goods and services associated with biodiversity in tropical rainforests;

3. improved models for predicting the biodiversity impacts, and associated economic benefits and costs, of alternative allocations of forests among different use categories at a landscape level.

By "tools," we do not mean 'quick-and-dirty' short-cut guides. Instead, the project will develop and evaluate a range of procedures—"tools"—for: (i) assessing biodiversity, (ii) valuing goods and services associated with biodiversity, and (iii) evaluating spatial tradeoffs between timber production and biodiversity conservation. For example, in the case of biodiversity assessment, we will develop and evaluate new sampling methods for estimating the biodiversity in a region from a small number of forest inventory plots.

This system will include guidelines for establishing the plots and statistically analyzing data from them. Because it is recognized that not all tropical countries have the resources to implement the "Rolls Royce" version of this system, we will also evaluate simpler versions that entail the use of less data. At the extreme, we will evaluate versions that do indeed amount to 'quick and dirty' guidelines. But note that the project is proposing a hierarchy of tools, from the more complex (and more data- and human-resource demanding) to the simpler. The research will aim at quantifying the amount of accuracy and precision that is lost when one uses the simpler methods. In effect, we are aiming at answering the question implicit in the reviewer's comment: are short-cut guides attainable?

We will develop a similar hierarchical set of tools for (ii) and (iii). The objective of the project is not to generate a single "tool" that works everywhere, but rather to assemble a "toolbox" of procedures whose reliability has been carefully evaluated. In view of the variation that exists across tropical developing countries in terms of forest characteristics, available ecological and economic data, and forest planning and management procedures and capacity, the output of the project will not be a single set of "best" methods and models. Instead, the project will develop and test a range of methods and models, and it will evaluate how their performance (accuracy and precision) is affected by data quantity and quality and, for models, number of variables and computational requirements. For example, on the ecological side the project will compare the statistical efficiency of alternate sample survey procedures for estimating the number of plant and animal species in large forest areas, while on the on the economics side it will accuracy of different methods for estimating the quantity of NTFPs collected by forest-dependent communities. Similarly, it will compare the performance of "benchmark" models to simpler approximations in, among other cases, relating measures of biodiversity to forest characteristics and forest-related values to socio-economic factors. As a result of the project, forestry departments and conservation organisations will thus have not only a larger menu of tools available for practical use but, equally important, information on the reliability of those tools.

This project fits under the GEF **Strategic Priority #4 on the Generation and Dissemination of Best Practices for Addressing Current and Emerging Biodiversity Issues**. In addition, the tools developed under the project will be disseminated for broader application to **Strategic Priority #2 on Mainstreaming Biodiversity in Production Landscapes and Sectors.**

The research activities for the project will be conducted in Malaysia, which has high levels of biodiversity and the wide range of socioeconomic conditions necessary for development and testing the biodiversity assessment and economic valuation methods. In addition, Malaysia has a long history of forestry research and this offers ample existing data useful for the project. The Perak Timber Integrated Complex (PITC) concession and the state of Perak, as a whole, will act as a laboratory for the development of tools. In addition, the proposed research activities will also draw upon data from other sites in Malaysia, in particular Virgin Jungle Reserves (VJR) and logged-over forests

surrounding the VJRs, as well as the rich data from the Pasoh Forest Reserve, as a comparative test site.

Perak Integrated Timber Complex Sdn Bhd (PITC)

The general management objectives of PITC include developing a sustainable vertically integrated timber-based industry, managing the concession for timber production and to ensure that all other uses, functions and services whether economic, ecological, or social are continuously improved and safeguarded, improving processing of timber resources and enhancing the value of downstream activities and promoting the export of high value added forest products.

PITC practices Selection Management System (SMS) which allows for a more flexible timber-harvesting regime that is consistent with the need to safeguard the environment. The average sustainable yield for the 30-year harvesting cycle for PITC concession areas has been estimated at about 108m3/ha gross.

Several potential areas of High Value Conservation Forest include unique habitats harboring rare or endemic plants, or known areas where the congregation of animals in search of food or minerals occurs. From the field audit carried out under the Forest Management Certification Evaluation in May 2001, it was felt that the forested areas around salt licks, which protect many large mammals, should be classified as HCVF. Groups of plants with economic potential as high quality timber or pharmaceutical resources should also be considered for protection so as to provide a source of generic material useful for future improvement through selective breeding. (Source: The Forest Management Certification Evaluation on the Forest Concession Area of Perak Integrated Timber Complex (Perak ITC), SCS, May 2002)

As for the legal and customary use-rights in PITC, there is no *orang asli* community in PITC concession, except for about ten families, which have been employed by PITC to work in the logging operations within PITC. As of last year, PITC has allowed these *orang asli* to establish a village inside the concession area.

There are nine villages of indigenous communities scattered outside the concession area. These local communities around the concession consists of around 700 people. These local communities are traditionally dependent on the forest for their livelihood, with hunting and collection of non-timber forest products as the main activities.

The villagers continue to depend on the nearby forest for their livelihood, as not much agriculture land has been developed, besides small areas planted with hill paddy, maize, tapioca and yam. In addition, the Jahai community moves from place to place, unlike the other local communities, called the Temiar and Semai, which do practise some agriculture for subsistence. Around 50% of the villagers are involved in rattan harvesting or fruit harvesting from the forest. Harvesting rattan for cash income is the main income-

The Perak Integrated Timber Complex Sdn Bhd (PITC) is a subsidiary of the Perak State Government's economic arm called the State Economic Development Cooperation (SEDC) The concession area consist of rich and highly diverse tropical rain forest, although some parts of it has been logged in the past. As of 1st July 2002 Scientific Certification Systems (SCS) certified PITC under the FSC scheme.

generating economic activity of the villagers.

Under the project, activities have been planned to generate data necessary for comparing alternate methods of quantifying the amounts of NTFPs collected by the indigenous *orang asli* households. It will also generate data necessary for constructing models that relate NTFP collection to household characteristics (age, income, education, proximity to markets and wage employment, etc.). This data will feed into the economic valuation models that will be developed.

Reasons for selecting Malaysia as the location for the targeted research project

The targeted research project will be conducted in Peninsular Malaysia, with many activities concentrated in the state of Perak. Malaysia, and these parts of Malaysia in particular, is an ideal location for a globally relevant targeted research project for the following reasons:

Malaysia is a Mega Diverse Centre

Malaysia has long been recognised as a global and regional centre for biodiversity. In addition to being acknowledged as a mega diverse centre, a study in 1994 has ranked Malaysia as 14 in a group of 25 countries with the highest levels of species and endemism in the world. Considering that Malaysia is only a very small country, the actual ranking diversity relative to size should be much higher. The flora of Malaysia is reported to contain about 12,500 species of flowering plants and 1,100 species of ferns and its allies. In Peninsular Malaysia well over 26% of tree species are endemic. Higher endemism is expected in the herbaceous plants with some of the larger genera being almost 80% endemic.

There is even greater diversity in the fauna within Malaysia. In the vertebrates, there are about 300 species of mammals, 750 species of birds, 350 species of reptiles, 165 species of amphibians and more than 300 species of freshwater fish. While there are about 13000 species of butterflies and moths, there is very little known of other groups. A conservative estimate is that there are more than 100,000 species of invertebrates.

Due to its high biodiversity, Malaysia is a good site for ecological research aimed at generating improved methods for assessing biodiversity.

Signatory to the Convention on Biological Diversity

Malaysia is one of the signatories to the Convention on Biological Diversity as well as the United Nations Framework Convention on Climate Change at Rio. To strengthen the conservation of biodiversity and to ensure the equitable sharing of benefits from the utilisation of forest genetic resources, a National Committee on the Convention of Biological Diversity was established to implement actions required under the Convention. Malaysia has already formulated a National Biological Diversity Strategy

and initiated action for an effective conservation and sustainable use of all natural ecosystems. The present proposal aims to provide research and development support for achieving the biological diversity conservation goals of the Malaysian Government and serve as a model to other countries of the region in fulfilling their commitments in respect of the Convention on Biological Diversity.

Wide range of socio-economic groups

Malaysia, especially Peninsular Malaysia, includes a wide range of socioeconomic groups, from poor rural communities that depend heavily on goods collected from the forest to middle-class urban households who value forests primarily for recreation and, as suggested by their contributions to environmental groups, passive use. Hence, it is a good site for economics research aimed at generating improved methods for assessing a variety of forest-related nontimber values. The scope of the research would be forced to be narrower if the project were conducted in a poorer tropical developing country without a sizeable middle-class or a richer country with few remaining forest-dependent communities. The former is especially important: to the extent other tropical developing countries are headed toward wealthier and more urbanized futures, Peninsular Malaysia provides a preview of forest-related values that forestry departments in those countries will increasingly need to consider in planning and management decisions.

Forestry is an Important Sector

Malaysia is still endowed with relatively large areas of natural tropical forests, which continue to play a significant role in the socio-economic development of the nation. Malaysia realises that it would be to her advantage to manage the resource on a sustainable basis to ensure that the nation continues to enjoy the myriad of benefits accrued from the forests in perpetuity. Towards this end, Malaysia had set aside relatively sizeable areas of forest as permanent reserved forests (PRF). About 20.1 million hactares or about 60 % or of the country with a landmass of 32.8 million ha., is covered by natural forests. Out of this, 14.4 million ha.; consisting 3.84 million ha. of protection forests and 10.56 million ha. of production forest; are gazetted as PRF.. In addition, 1.8 million ha. outside the PRF are also designated as national parks and wildlife sanctuaries. Perak where the project site is located has a total forest area of 1.10 million ha covering 48% of the state

Reliable Data Available

Malaysia offers a great amount of existing data pertinent to the proposed research. Hence, the research can be jump-started and can make substantial progress within the relatively short time frame (from a forestry standpoint) of 5 years. This is especially the case for the ecological research. For example, the existing and computerized forest census (i.e., individual tree) data from the 50-ha forest demography plots at Pasoh Forest Reserve (Peninsular Malaysia), Lambir Hills (Sarawak), and Khao Chong (Thailand, but near Perak) will enable the research team to test alternate forest sampling procedures

cheaply on the computer, thus minimizing the need for baseline data collection. On the economics side, Malaysia's (human) population census is generally regarded as one of the highest quality in the developing world. This will facilitate the surveying of a large sample of households for estimating forest-related economic values. As in the case of the forest demography data, once these data have been collected, the research team will be able to evaluate the loss of accuracy and precision that would enter into the value estimates if such surveys were conducted in countries where there was more uncertainty about the sample frame or sample sizes needed to be smaller.

Increased Efforts Towards Sustainable Forest Management

Sustainable management and conservation of the forests have been accorded a high priority by the Government. Efforts are being advanced to ensure the flora and fauna is conserved for future generations. Such efforts are reflected by the fact that Malaysia played a leading role at the World Summit in Rio and was the first Chairman of the *Commission on Sustainable Development* that monitors the implementation of Agenda 21. Malaysia has launched her own National Policy on Biological Diversity. The policy aims 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. Included in the policy is an Action Plan that outlines the strategies to be adopted to conserve biological diversity. Strategies being adopted for conservation of biological diversity, which is in line with the project include:

- Protected areas delineated by functional and ecological zones of adequate size to conserve biological diversity in a holistic manner;
- Multiple use natural forests to meet the local and national needs at the same time serve as habitat for diverse species of plants, animals and micro-organisms;

Globalisation has also affected forest policies in Malaysia. The most relevant is the International Tropical Timber Organisation (ITTO) Year 2000 Objective which requires all tropical timber products traded in the international market to be sourced only from sustainably managed forests. The attainment of this Objective will be amongst the greatest challenges to Malaysia in the near future. In this regard, Malaysia has already taken several concrete steps through the establishment of a National Committee on Sustainable Forest Management with representation from various forestry agencies. There will also be greater understanding, cooperation and commitment from both the government and private sectors towards sustainable forest management goals which includes the conservation of biological diversity.

Support of Stakeholders

Malaysian stakeholders—in particular, federal and state governments, environmental NGOs, and, perhaps most importantly, the PITC concession—strongly support the research. Hence, the project has a high level of co-financing, will have ready access to

key data, and will be able to include experimental protocols that would be impossible in many other potential host countries. Co-financing is discussed in detail in the incremental cost section of this project brief. During the PDF-B phase, the project team enjoyed unrestricted access to data necessary for the project and unrestricted access to relevant field sites. The principal project site is the PITC concession in Temenggor Forest Reserve. The license-holder has agreed to allow the researchers to establish permanent sample plots in both logged and unlogged areas of the concession and to propose alternate logging patterns which he will then follow (e.g., leaving refugia of different sizes to test their biodiversity conservation value; harvesting portions of the forest in ways that permit testing the importance of maintaining a contiguous canopy and the 3-dimensional structure of the forest).

Strong Research Institution

Malaysia has a long history of forest research, substantial research capacity, and the ability to attract international research support as needed. Hence, there is reason to be confident that the project team will be able to act on the advantages listed in points 1-4 above. Moreover, the history of forest research in Malaysia, which is approaching a century, provides evidence that permanent study sites established in Malaysia will indeed be permanent. Specific evidence includes the country's system of Virgin Jungle Reserves (VJRs), many of which remain intact despite being in forests logged decades ago. The leading center for forestry research in Malaysia is the Forest Research Institute Malaysia (FRIM), which will be the lead implementing agency for the project. FRIM has successfully implemented research projects of a scale comparable to this one in the past, and it has a demonstrated ability to involve leading researchers from other Malaysian organizations and from overseas.

Strong Policies and Legislation:

Forestry in Malaysia is predominantly a state matter and the thirteen state governments have complete jurisdiction over their forest resources. The federal government provides technical advice on forest management and development of wood-based industries and trade. However, a close relationship between the states and federal government is essential regarding all land and forestry issues. The National Forestry Council (NFC), established by the National Land Council (NLC) in 1971, facilitates the adoption of a co-ordinated and common approach to forestry issues, including planned rational and effective management and utilisation of forest resources.

In this regard a National Forestry Policy was adopted in 1978. Some of the salient points relevant to this project include: -

- to dedicate areas of land as Permanent Forest Estate for production, protection, amenity and research purposes;
- to manage the PFE with the object of maximising social, economic and environmental benefits in accordance with the principles of sound forest management;

- to provide for the preservation of biological diversity and the conservation of areas with unique species of flora and fauna
- to undertake and support a comprehensive programme of forestry training.

Other legislation which is considered of major importance to the forestry sector includes: the Water Enactment Act (1935); the Land Conservation Act (1960); the National Land Code (1965); the Protection of Wild Life Act (1972); the Malaysian Timber Industry Board Act (1973); the Environmental Quality Act (1974); the National Park Act (1980); and the Malaysian Forestry Research and Development Act (1985).

In the light of the UNCED Conference in 1992, the discussions and agreements reached within ITTO and new research findings, both the National Forestry Policy and the National Forestry Act were reviewed and amended in 1993. New measures instituted in the National Forestry (Amendment) Act are primarily aimed at improving and strengthening capacity in forest management, and biodiversity conservation in Malaysia. At the same time, the government has allocated significant financial resources towards the management of forest resources which includes more than $US 5 million in related research and development activities.

Causes and Threats to Globally-significant Biodiversity

In the course of the project preparatory process, a number of threats have been identified through local consultative workshop involving major stakeholder that includes the forestry departments and other relevant government agencies, non-governmental organisations, universities, private forestry enterprises, tourism operators, local councils and local communities. Being a targeted research project focusing on the conservation of biological diversity, the project received strong support from the major stakeholders.

Some of the major causes and threats that were identified include:

- Poor planning and implementation of forestry operations especially in the past, such as harvesting have resulted in many detrimental impacts to the residual forest such as loss of undisturbed forests, fragmentation of habitat, soil erosion and compaction, siltation, poor stand recovery, change in species composition. Some of the consequences of this is the fragmentation of habitats, loss ecotourism, loss of future harvest, reduction of indigenous people livelihood, genetic degradation and migration of wildlife. The impacts of these operations on biodiversity, need to be better assessed taking into consideration spatial and temporal influences.

- Management of the resource and enforcement that was not adequate has also been raised as a major threat to the conservation of biodiversity. Some of damaging activities that could result include encroachment of illegal settlers, poaching and unsupervised logging. Here again such activities could bring about the loss of habitat, unfavourable changes in species composition, lost of productivity of the future crop and degradation of orang asli (aborigines) welfare.

- Policies, such as awarding of small sized (80-100 ha) forest parcel and short duration period for logging could serve as an incentive for loggers to maximise benefits at the expense of the forest environment.

- Poor planning in the allocation of production and protection areas and the lack of information on the status of biodiversity as well as their economic value often results in management decisions that are unfavourable to biodiversity consideration.

- Current allocation of protection areas such as the national parks and riparian buffers, steep slopes as well as high elevation areas within the permanent reserved forests are allocated based on topographical features, sensitivity to disturbances and also historical factors. Insufficient consideration has been given to biodiversity conservation factors.

The stakeholders also discussed the management options to address these threats. Some of the options suggested include enhancing the capacity of researchers, managers and private forestry operators on good forest management practices according the conservation of biodiversity a high priority. There is also a need to have better planning procedures in place that promotes the holistic management of the forest resources. Long term concessions should be encouraged and forest certification be promoted as an incentive for good practices. Greater emphasis needs to be given to forest conservation and steps should be taken to integrate biodiversity policy forest management planning and implementation. Greater community involvement is required in the forest management planning and community welfare should be considered in the harvesting approach adopted. At the same time greater research input are required to develop sound forest policies and strategies while long-term goals of enhancing public awareness on the need for biodiversity conservation is pursued.

Fragmentation of habitats is a major global environmental change occurring today and the one most likely to devastate biodiversity and ecological processes in the near future. Loss of habitat, change in their quality and high levels of fragmentation are the main reasons why many species are being included in the endangered and threatened list. Consequently better planning is required in the identification and demarcation of critical habitats to optimise biodiversity conservation. In this respect capacity to identify and map such habitats will have to be enhanced and their socio-economic implications needs to be determined. The tropical rainforests can be distinguished broadly to a number of unique habitats such as inland forests, peat swamps and mangroves. However, this stratification needs to be further refined and mapping of these habitats need to go beyond the vegetation maps done in 1962. The forest vegetation maps produced by the Forestry Departments are mainly classified based on commercial timber value.

Registration of distinct habitat represents an important management tool. There is an urgent need to improve the classification based on strictly ecological criteria to enable proper evaluation be undertaken on intact areas and remaining fragments of forests so

that biodiversity considerations are fully integrated into relevant strategies in forestry planning and management. This requirement fits directly into GEF's Strategic Priority II on mainstreaming biodiversity on production landscape and sectors.

Replicability of the project outputs

Although the research will be conducted in Malaysia, the tools developed by the project will be applicable to forests throughout Southeast Asia and in other tropical countries. The project will not produce a single set of "best" models, instead, it will develop and test a range of models and it will evaluate how their performance is affected by data quantity and quality. As a result of the project, forestry departments will this have not only a larger set of tools available for practical use but also thorough information on the reliability of those tools.

To ensure that potential users of these tools are informed of their availability and trained in their use, the project will include a variety of dissemination and capacity building activities. There will be opportunities for cross-project learning among relevant GEF OP#3 projects in tropical countries. A strategy for replication has been included in the project under the 4th immediate objective of the project, building on the awareness and dissemination activities. In addition, the international dissemination of the tools developed by the project and the lessons learnt from it will be ensured by the project's International Advisory Panel.

The replication strategy complements the awareness component by focuses on learning-by-doing approach, and hence includes, for example, Activity 4.1.3 on scientific exchange programmes, Activities 4.15 and 4.1.6 on cross project learning visits. In addition, the proposed project has an output (output 2.2) on the production of manuals, including data sets and software that explain how to implement the valuation methods developed and tested. This output would be an input into the replication strategy.

The choice of PITC as a test site would not restrict the potential of replicability of the tools. It is not the empirical relationships in the statistical models that will be applicable elsewhere, but rather the generic form of those relationships and the procedures for quantifying variables and parameters included in them.

The sites on which the research will be tested on are hill dipterocarp forest, which is the principal type of forest subject to logging in South East Asia, therefore from a policy standpoint, the test site is representative. This enhances the replicability of the tools.

Protection of Biological Resources and Intellectual Property Rights

In the implementation of projects involving external inputs, it is necessary that steps be taken to ensure proper protection is provided to biological resources and that, issues concerning international property rights are addressed. In this respect, research activities being undertaken within the study area must only be those stated and agreed in the project proposal. Foreign researchers working in the study area, must be accompanied by officers, employee or staff from local government agencies involved in the project. The collection of field data from inventory and/or experimental plots must only be undertaken within the study area. Any additional data collection from areas outside the study area will require the permission of the Perak State Government.

The research being undertaken should not be involved in any bio-prospecting activities that involve the removal of biological specimens from the research site. In this respect the collection or removal of biological resources from the forest for this purpose is prohibited. The Perak State Government holds all rights to the forest resources within the State. No person shall claim or be entitled to any copyrights, patent or intellectual property rights over any discovery of biological resources from the research being undertaken. Any application for patents, copyrights or intellectual property rights pertaining to such discovery shall only be made with the consent of the Perak State Government. If necessary the Perak State Government will request the Implementing Agency for the project to sign an agreement with respect to the protection of biological resources and property rights.

On-going Externally Assisted Projects:

Malaysia through FRIM as the implementing agency, is currently undertaking a major GEF project MAL/99/G31 – Conservation and Sustainable Use of Tropical Peat Swamp Forests and Associated Wetland Ecosystems. This is a 5-year project that began its implementation in January 2002. Its primary objective is to develop and implement plans and to encourage processes that will ensure the conservation and sustainable use of globally significant genetic, species and ecosystem diversity within tropical peat swamp forests in Malaysia. The project will ensure conservation and sustainable use at three sites, as well as demonstrating what is required for the adoption of a multi-sectoral approach to peat swamp forest management throughout Malaysia. The total funding allocated for the project amounts to US$13.67 million as follows:

UNDP/GEF	-	$5.99 million
Malaysia	-	$5.28 million
DANCED	-	$1.60 million
Netherlands	-	$0.80 million

This project focuses in the aspects of management and conservation of peat swamp forest, which is a unique and important forest ecosystem. It does not cover the inland dipterocarp forest, which forms the bulk of the forest in Malaysia covering about 90 % of the total forest land.

Project rationale

Development Goal

The development goal of the project is to conserve biological diversity of tropical forest ecosystems through the improved forest planning procedures. The project will contribute towards realisation of goals and strategies stated in the National Forest Policy and National Policy on Biological Diversity with emphasis on improvement of the knowledge base, strengthening of institutional framework, and integration of biological diversity considerations into sectoral planning.

Global Environmental Objectives:

The project will enable the conservation of globally significant biodiversity through the development of tools for assessing and valuing biological diversity in a landscape that includes timber production forests. The project will also develop models to assist planners and managers to allocate those forests between production and protection categories by prescribing an optimal balance between biodiversity conservation and timber production. The tools and models although developed in Malaysia can also be adopted and adapted by other tropical countries and thus promote the conservation of biodiversity not only in Malaysia but also globally.

Immediate project objectives:

The proposed targeted research has four immediate objectives namely:

1. To develop tools for ecological assessment of biodiversity in tropical forests are improved;
2. To develop tools for economic valuation of goods and services associated with biodiversity in tropical forests are improved;
3. To develop tools for integrating ecological and economic aspects of biodiversity into forest planning decisions at a landscape level are improved; and
4. To enhance and disseminate the knowledge and capacity in assessment and economic valuation of biodiversity.

Project Strategy

The project will develop tools that will enable forest planners to assess the adequacy of existing protected areas for biodiversity conservation and, if there is a need to establish additional areas, to determine how large they should be and where they should be located. The project activities will contribute towards the improvement of knowledge of biodiversity assessment, economic valuation of forests, impact of harvesting activities and the recovery of the ecosystem. Using the baseline information, models will be developed which will provide the tools for incorporating biodiversity conservation in forest management systems. If such tools are not available, assessment of impacts on biodiversity will not be possible, planning capacity to include biodiversity consideration will be hampered and loss of biodiversity in production forest would persist. In fact, it would also be difficult to indicate if the existing biodiversity in the protected forests is adequate and are representative of total existing biodiversity.

Despite past work, species-area relations remain an extremely active area of research and debate. In particular, we do not yet know in detail how to assess the species diversity of a large tropical forest region on the basis of a small number of small samples distributed within the region.

Accomplishing this task would be of enormous practical value, and is proposed as one of the central objectives for the project. The project proposes research that aims at devising efficient methods for estimating biodiversity at a macro level from inventories of selected taxa at a micro level.

Recently, we have made several advances in learning how to extrapolate from small-scale samples to predict tree diversity in large tropical forest regions (Plotkin et al., *PNAS* 2000); we have also begun to understand how to assess the rate of tropical tree species turnover with distance (Plotkin et al., *Ecology* 2002). But these results only serve as preliminary steps toward the larger goal of making biodiversity assessments from small samples operational.

Research methodology

The project will utilize existing information on demographics of tree species that have been extensively collected within 50-ha plot in Peninsular Malaysia, Brunei and Thailand. The information gathered from these plots will provide invaluable inputs to developing an efficient but statistically sound sampling techniques for collecting additional information on biodiversity in different locations. These sampling techniques will be applied in the Temenggor Forest Reserve, Lower Belum Forest Reserves and around a number of VJR plots within the country. This ecological information, supplemented by economic valuation of forest goods and services will provide critical inputs to developing improved tools and models in assessing biodiversity in tropical forests. The tool will be used by the forest planners in prescribing an optimal balance between biodiversity conservation and timber production. Therefore forest planners will address the issue of "landscape permeability" as raised by the review panel at the implementation stage. The project was not designed to implement specific logging practices but it will examine the impact of experimental logging techniques that seek to maintain the three dimensional structures of the forest.

The flowchart below (Figure 1) shows the expected relationship between the inputs and outputs of the proposed model for integrating ecological and economic aspects of biodiversity into forest planning decisions at a landscape level.

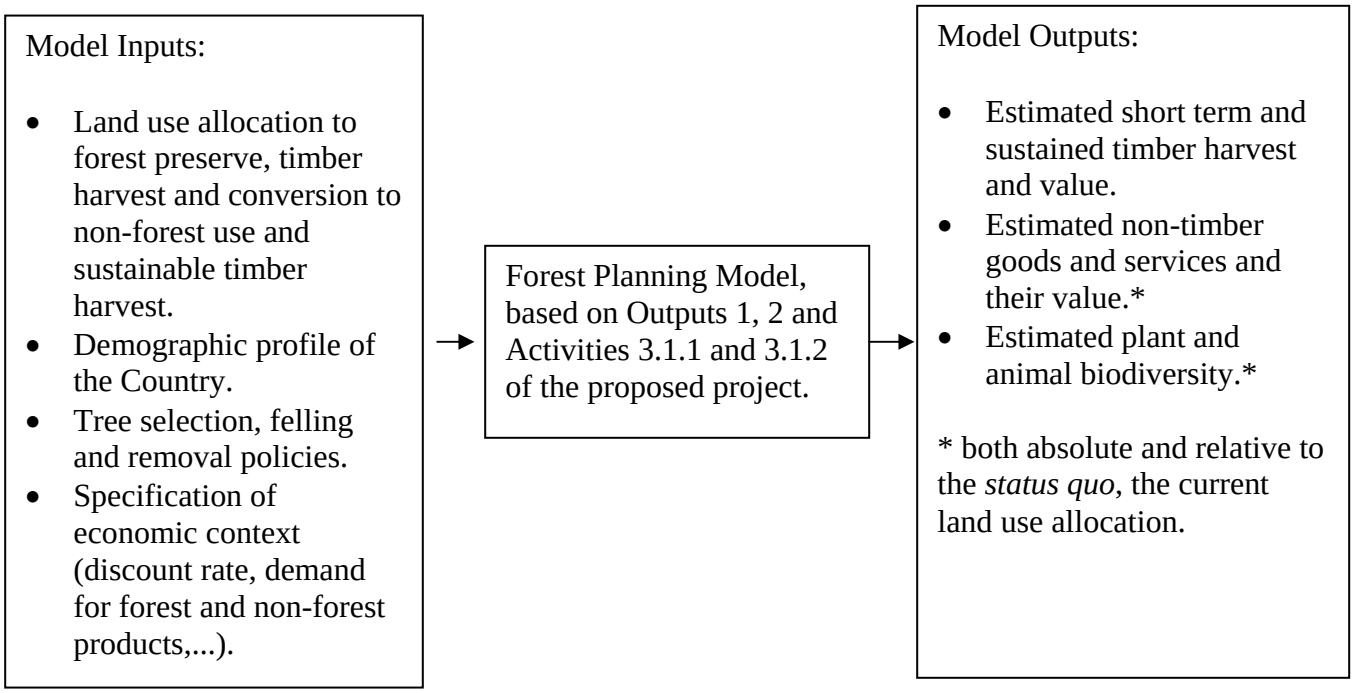


Figure 1: Inputs and Outputs of the forest planning model

The proposed targeted research project will be an integral part of the Government of Malaysia's broader effort to promote sustainable forest management and is expected to last 5 years. Several approaches can be adopted to complete the project, with the proposed results. Of them one would be to break up the project into its separate components, engage consultants to undertake each of the modules and piece together the results for application. This has several disadvantages, chief among which is the high degree of interdependence of the components. Having separate consultants will lack coordination and focus and will not be effective in timely achieving the expected results. The results of one activity feed into the other and several cross linkages exist among them, as demonstrated in Figure 2 below. They cannot be treated as individual and discrete activities.

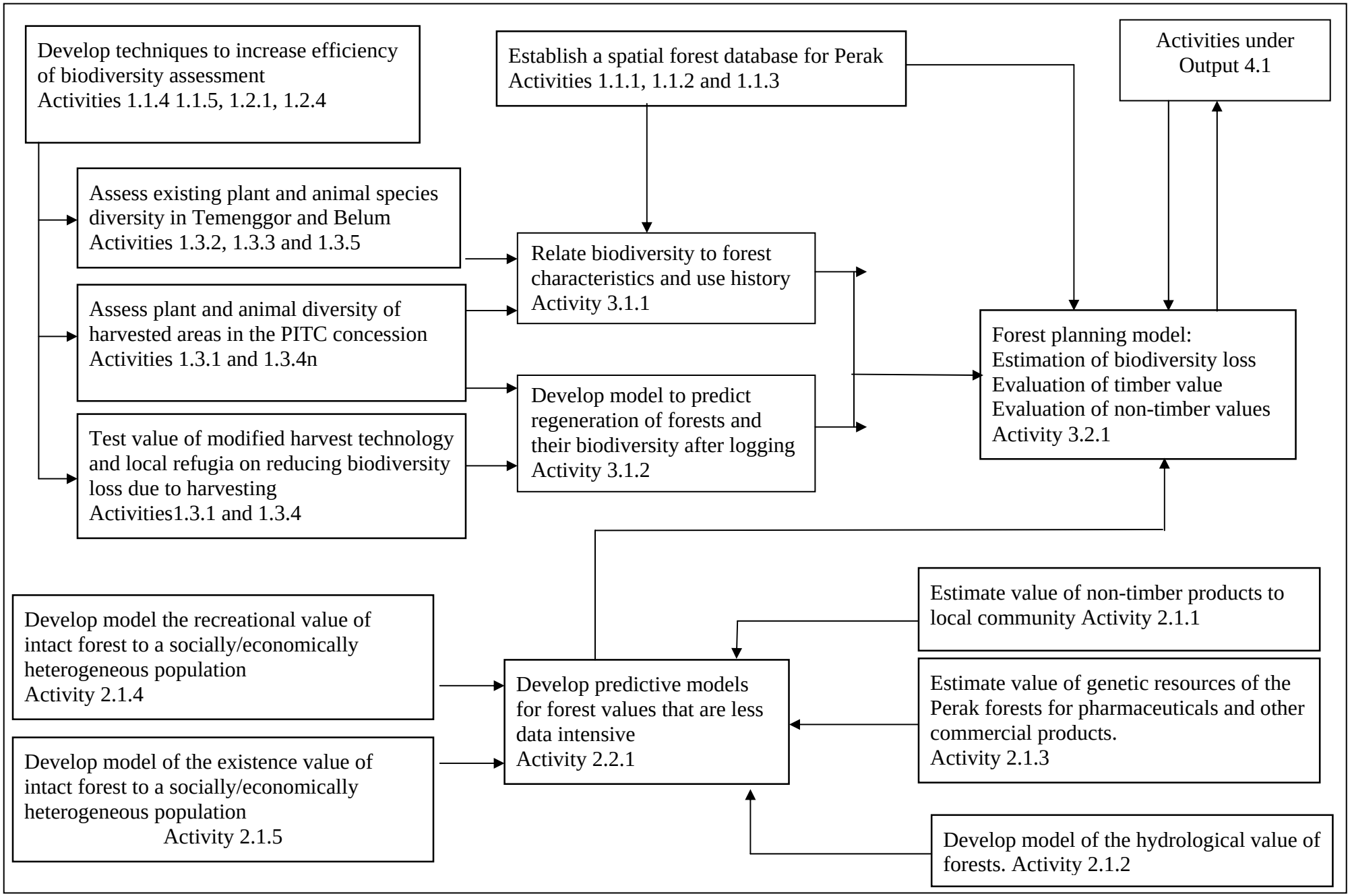


Figure 2: Flowchart of Project Activities

The alternative, and the more efficient approach is to have a multi-disciplinary group of experts, agencies and stakeholders jointly undertaking this work. Briefly the approach is as follows:

i) FRIM would act as the coordinating agency and would also conduct all field surveys, baseline data collection, testing the derived models for veracity, and conducting the training for the transfer of technology to forest managers.

ii) International consultants familiar with the project requirements and having a good understanding of the local culture and environment will be contracted to assist in the formulation of methods and analysis of the data and development of the ecological and economic models. These consultants selected will be highly respected and competent in their fields. They will have wide working experience in tropical forests and in Malaysia. If possible they should come from one or two institutions with multi disciplinary skills, and as such will be able work together as a team. Coordination of their work would also be easier for FRIM. FRIM will also collaborate with experts involved with relevant on-going projects that may be similar to the activities in this proposal to avoid duplication of efforts and develop synergy with other efforts and therefore reduce costs.

iii) Fieldwork for the project will be carried out primarily in Temenggor Forest Reserve, Perak. This forest reserve is rich in biodiversity and is part of the largest remaining block of natural forest in Peninsular Malaysia. The dipterocarp forest here represents a unique association of Malaysian and Thai-Burmese floristic elements, resulting in high endemism The fieldwork will be conducted in cooperation with the Perak State Forestry Office and the Perak Integrated Timber Complex Sdn. Bhd. (PITC), which is a subsidiary of the Perak State Economic Development Corporation.

iv) The project will be implemented in Perak State (map appended as Annex VII) in collaboration with the Forestry Department. The entire permanent forest estate in Perak will be considered for analyses that require considerations at a large scale. The state of Perak has been selected because of the support and interest shown in collaborating in the project.

v) The Concessionaire, PITC would collaborate with direct inputs of field staff and machinery available. The forest concessionaire is forward looking and interested in collaborating in the research. There is also better infrastructure and quality baseline data are already available which the project can use.

In this approach, there are several advantages:

i) With the close cooperation of specialists in the fields of GIS, modeling, quantitative ecology, programmers from internationally recognised agencies, there is direct transfer of technology and know-how.

ii) The consultants to be employed for the project should be familiar with FRIM and Malaysia and thus would easily fit into local cultural and working environment and will able to adjust to requirements of FRIM and other local counterparts. It would be

preferable that these consultants be from a multi-disciplinary agency, so as to be able to source the best expertise available and to be able to work well as team.

iii) FRIM being the coordinating agency, with newly acquired skills, will be able to train forest managers and field workers in the methodologies. This would be economical and efficient. FRIM would also achieve higher levels of technical skills and capacity.

iv) By working with the Forestry Department and PITC, many inputs of personnel time would be made available at minimal costs. In addition, this would indeed ensure that the models and tools developed are practical, simple and easily applicable.

v) Overall, the cost of undertaking this work in this integrated manner would be kept low, and the results timely.

The Forest Research Institute of Malaysia (FRIM) is in a good position to head and implement the project efficiently. It is the national R&D Institution and has a pool of skilled multi-disciplinary staff. FRIM is also committed and has identified a team of scientists to implement the project in Perak. The Ministries of Primary Industries and Science, Technology and Environment are in support of the Project. Besides all the above, the Federal Government is committed to sustainable forest management practices, and has gone ahead with the implementation of Certification of Forest Management, which activities are coordinated by the newly formed agency, the Malaysian Timber Certification Centre. The management prescriptions resulting of the proposed project, if they prove to be sound from both the production and conservation angles, would be readily adopted into the Criteria and Indicators for Sustainable Forest Management being formulated and tested for Malaysia at present.

The implementation of the project will be governed by the National Steering Committee while a Technical Working Committee will discuss the technical details and monitor the implementation of the project on the ground. The project will be implemented according to the work plan as shown in Annex VI.

The project will benefit from an international advisory panel, which will meet to provide guidance and feedback on the progress of the research being undertaken. The terms of reference of this panel is attached as Annex I. The composition of this panel will be elaborated upon in the UNDP project document.
The project will undertake training and dissemination activities to ensure that the tools and technologies are well understood to be utilised, and efforts will be made to facilitate their integration into forest planning protocols.

Although it is beyond the scope of the project, within its project period, to ensure that relevant authorities such as forest services within Malaysia or the regulating authorities in other countries implement these tools, the project proponents have incorporated many activities on knowledge dissemination and cross-project learning into the project design. It is hoped that with these extensive efforts, the tools will be implemented.

Project Objectives, Outputs, Activities and Expected Results:

DEVELOPMENT OBJECTIVE: To strengthen the inclusion of biodiversity conservation considerations into tropical forest management decision-making.
Based on the needs for research identified during project development, the proposed project has been developed around four Immediate Objectives. These Objectives, and their associated Outputs and Activities, are described below:

IMMEDIATE OBJECTIVE 1:
TOOLS FOR ECOLOGICAL ASSESSMENT OF BIODIVERSITY IN TROPICAL FORESTS ARE IMPROVED AND DISSEMINATED

Output 1.1: Efficient statistical methods for estimating biodiversity from small samples
GEF (USD 0.116 million), GoM (USD 0.147 million), Universities (USD 0.106 million)

Work on spatial patterns of species distributions in tropical forests (Condit et al., 2000, 2002; Plotkin et al., 2000a; Plotkin et al., 2000b; Harms et al., 2001; Potts et al., 2002; Plotkin et al., 2002) has led to theoretical advances that allow the prediction of the expected similarity from small samples and the prediction of the expected similarity between forest communities at given distances based solely on species dispersion. In addition, studies conducted in Malaysia confirmed the existence of a strong correlation between forest types and physical habitat characteristics (Potts et al., 2002). Therefore an estimation of biodiversity over a large area using small local samples requires special criteria for the selection of sample plots and new methods for re-scaling the sampled area. Research in the pre-proposal phase of the project led to new tools that improved the application of species-area relationships to the estimation of tropical forest tree diversity. The development of the method will be based on existing information collected from 50-ha demographic plots established in: (1) Pasoh, Malaysia; (2) Lambir, Brunei; and (3) Koa Chong, Thailand. Continuing these research lines will lead to improved methods for extrapolating diversity from small samples.

Before embarking on the work on the statistical methods for estimating biodiversity from small samples, a database system needs to be installed. The system will be used throughout the project for recording and managing data on biodiversity.

Capturing baseline data is crucial for effective planning of biodiversity management and conservation in managed productive and protective forest. Malaysia is quite fortunate as many of the baseline data needed for biodiversity management are available, continuously collected and documented. The current forest management practice prescribed inventory of trees and other vegetation before and after harvesting. A full taxanomic description of tree flora of Malaya has been documented. Most of the forest management has been digitised and compartment history recorded. Many CFI plots, growth plots, and experimental cutting growth and yield plots, silvicultural research plot have been established and still being monitored. A land-use map, which is important for biodiversity management is also available. There is a network of VJR throughout the country and most of the VJR has been inventoried at least once. These information should be pooled together into a database system for record and subsequent data analysis. Due to large amount of data required to assess, measure and monitor biodiversity, a standard protocol for data capturing, and handling needs to be developed. The data storage and reporting system form the foundation for ecological and planning models. For new data collection, customised hand-held computers will be used replacing the conventional method of

recording data manually in tally sheets. All historical and current data collected need to be combined in a database – GIS (Geographic Information System) systems.

Activity 1.1.1: Select an image processing software and an existing spatial database program (i.e., GIS program) as the single data management system for the ecological data generated by the project, and install it at FRIM, the Forestry Department Perak, and other project partners, if necessary. The system will have a nested spatial structure, to enable it to accommodate data from field plots of only a few hectares up to data for the state of Perak that are measured at a resolution of a kilometer or more.

- Objective: To develop the data storage and reporting system that will be the foundation for ecological and planning models constructed during the project, activity 3.2.1
- General approach: An image processing and an existing spatial database software package (GIS) will be selected as the single data system for the ecological data of the project and installed at FRIM, the Forestry Department in Perak and other project partners, if necessary. These software will allow disparate data such as climate, topography, plant community type, etc., at various locations to be correlated, interpolated, and presented in map form.
- Methods: An image processing software (eg ERDAS) and a spatial database software package will be selected. ArcINFO have been used by some FRIM staff and are commonly used throughout the world. We will, however, review alternatives that might provide greater flexibility for interfaces with the modelling effort before finalising the selection. The system will be installed on a computing system with high reliability, high bandwidth data communication capability, and a local support infrastructure. A facility at FRIM will be mirrored at the Perak Forestry Department, and at the sites of other project partners, if necessary. This mirroring will provide reliability through redundancy and will allow us to draw upon the systems expertise at each location, especially with regard to installing and maintaining the GIS software. The spatial extent of the database will be the entire State of Perak. This is necessary since valuations of and decisions about the hill forests that are the focus of the research must be in the context of the biodiversity at a larger scale. The database will have a nested spatial structure, to enable it to accommodate data from plots containing a homogeneous ecological community, which might only a few hectares in extent, up to data measured on grids of several kilometers, which might be used at the State level.
- Schedule: Year 1: Software selection and installation by month 6.
  Years 2-5: Software maintenance and user support.

***Activity 1.1.2*:** Develop a standard data recording system, to avoid incompatibilities and expensive data format conversions during the analysis phase of the project. This system will facilitate the collection, downloading, and management of field data recorded on hand-held data recorders. Data record types will be developed for both single observations and site summaries.

- Objective: To fix a single data format for the ecological data, which will avoid incompatibilities and expensive data format conversions during the analysis phase of the project. This output is an immediate part of activity 1.1.1 and will be the basis for the data collections of activities 1.4.1, 1.4.2, 1.4.3, 1,4,4 and 1.4.5.

- General approach: A standard data recording format will be established for the project. The format for all plots and taxa will be as similar as possible. A data recording system for hand-held computers will be developed and used throughout the ecological data collection.
- Methods: Data record formats will be designed for ecological data recording. There will be two general record types: (i) single observation and (ii) site summary. Both will include at least date and time, location, and species or other relevant taxon. Single observation records will include, for example, a single photo trap observation or a single tree identification. They will be aggregated with other records at later stages of the project. Site summary records (e.g., an algal density) might be calculated from repeated observations at a site. A data-recording programme will be written that assists, and contains, data entry in the standard formats by providing pull-down lists of species names, codes, and geographic location keys. Documentation and training materials for the data format and data recorder will be developed.
- Schedule: Year 1: Data record formats designed by month 6. Data recording program and support materials completed by year's end.
  Year 2: Software maintenance and modification as needed.

***Activity 1.1.3*:** Enter existing data on biodiversity in Perak and other relevant sites into the system. These data include forest inventory and land use maps, detailed topographical and geological maps, readings from existing meteorological and hydrological monitoring stations, and other spatial data for the state of Perak and areas within it (e.g., Temenggor and Belum Forest Reserves, and the PITC concession), as well as data from other parts of Malaysia (e.g., the large-scale forest research plots at Pasoh and Lambir Hills and virgin jungle reserves (VJRs) in various parts of Peninsular Malaysia).

- Objective: To avoid redundant data collection, existing data relevant to the project will be acquired and entered into the system. This data will be used in the construction of the forest planning model, activity 3.2.1.
- General approach: Existing data for biodiversity in Perak and at other relevant sites will be identified, evaluated, and logged into the system.
- Methods: The pre-project phase of the project identified numerous data sets that might be used by the project. Most critical are the existing forest cover maps, land use maps, climatological data, and detailed topographical and geological maps of Perak State. The maps of forest cover come from the National Forest Inventory (NFI), which is conducted by the Forestry Department every 10 years.

In addition, the 50-ha forest demography research plots at Pasoh and Lambir Hills have detailed tree species diversity data sets that will provide a basis for calibrating other assessment methods used in the project. Surveys of small mammals that will be immediately useful have been conducted near these plots. Data on tree growth and mortality generated by previous FRIM studies will also be important. The Perak Forest Department has made surveys of the large mammals and other animals in the Lower Belum Forest Reserve that can serve as the basis for further studies**.**

- Schedule: Year 1: Data evaluation, selection, and entry.
  Year 2: Complete existing data entry.

***Activity 1.1.4*:** Building on research undertaken in the pre-proposal phase of the project, a method will be developed that minimises the variance in an estimate of diversity of a large area from a given number and size of smaller sample areas.

Objective: To reduce the number and size of sampled area in estimating overall forest diversity. The results achieved here will guide the selection of sample plots for activities 1.4.1, 1.4.2,1.4.3 and 1.4.4.Those activities have been planned assuming that a sampling of approximately 1% of the area to be assessed will yield acceptable variances in the estimates of diversity.

- General approach: The estimation of biodiversity of a large area from small local samples requires special criteria for the selection of sample plots and new methods for re-scaling the sampled area. Research in the pre-proposal phase of the project led to new methods, which improved the application of species-area relationships to the estimation of tropical forest tree diversity. Continuing these research lines will lead to improved methods for extrapolating diversity from small samples.
- Methods: The persistence method of relating species richness to area studied in the pre-proposal phase of the project will be developed further to reduce the variance of the richness estimate for the hill forests of Perak. Alternative patterns for the random or stratified selection of sample areas will be compared. A sampling and extrapolation procedure for the PITC concession will be developed. The goal is a species-area relationship for trees in the hill forests of Perak. It will be parameterised and validated in the PITC concession.
- Schedule: Year 1: Development of tools and validation on the Pasoh and Lambir research plots.
  Year 2: Specification of a sampling pattern for the PITC concession.
  Year 3: Parameterisation of the species-area relationship for the hill forests as sample data for the PITC concession become available.

Activity 1.1.5: Develop optimal statistical methods for identifying beta-diversity, the differences in species composition among several sample areas. The methods will be important both in identifying distinct habitat types for the purpose of improved stratification of sampling protocols and in identifying unique ecological communities that require special conservation attention, that is, whose existence value might be high.

- Objective: To improve the recognition of distinct forest communities. This output is the key to our recognizing community types, our unit of biodiversity. It is essential to the construction of the model for activity 3.1.1.
- General approach: As with Activity 1.2.1, statistical methods developed in the pre-proposal phase of the project will be extended and improved to allow the efficient production of maps of community beta diversity for the region from a minimum of local samples.
- Methods: Differences between distinct forest communities are often obscured in variance between species assessments within a single community type. Previous work on the scale of aggregation of local species populations will be used to avoid the variance such aggregations induce in comparisons of forest communities. Optimal sampling patterns for recognising distinct forest communities will be developed based on the patterns of species spatial distribution. Indices of community similarity or difference, the measures of beta diversity

will be developed based on multivariate statistical techniques, such as principal component and linear discriminant analysis.

- Schedule: Year 1: Development of methods
  Year 2: Validation of the methods in Pasoh, Lambir and the PITC concession.

Output 1.2: Improved methods for assessing biodiversity within and between forest community types
GEF (USD 0.020 million), GoM (USD 0.290 million), Universities (USD 0.018 million)

The assessment of biodiversity over a large area is a monumental task given the time and effort to collect sufficient and reliable ground data. Currently, biodiversity data capturing was carried out manually in the field and thus, labour intensive and time consuming. With the available information technology today, new system of biodiversity assessment should be explored. A variety of multivariate statistical procedure to discriminate forest community structure and indicator species from field survey has been established and tested in different types of tropical forest data, but it is still least explored from remotely sense images. The success of using remotely sense images depended upon its accuracy from the survey data. Similarly, field identification of trees requires a skilled botanist. Using dichotomy tree pocket checklist is often still too complicated for field foresters. Alternative method using pattern-recognition from scan leaves will be explored.

Activity 1.2.1: Develop a statistical procedure that can discriminate forest community types from satellite data, by comparing high resolution satellite image data for sites where tree species diversity has been identified (e.g., Pasoh, PITC concession) to surface data for those sites. "Forest community type" refers to a species assemblage that contains a set of tree species with high affinity for each other but has distinct differences in species composition compared to other assemblages. The goal is to develop procedures for large-scale biodiversity assessments that involve sparser on-site sampling and entail much reduced costs.

- Objective: To develop a statistical procedure that can discriminate forest community types from satellite data. This procedure will be applied to the extrapolation from the selected samples to the total biodiversity in activities 1.4.1, 1.4.2, 1.4.3 and 1.4.4.
- General approach: High resolution satellite image data for areas where spatial tree species diversity has been identified will be compared to surface data to derive a reliable correlation between image data and forest community organisation.
- Methods: Multivariate statistical methods will be used to compare 1-meter resolution satellite image data sets for the Pasoh, Lambir and Kao Chong research plots and the PITC concession to the latest plot assessment data for each, with the goal of identifying algorithms that best estimate local diversity and community type on the basis of satellite images. By "community type," we refer to a species assemblage that contains a set of tree species with high affinity for each other but that has distinct differences in composition compared to other such assemblages.

  Using community type as a unit of biodiversity assessment differs from traditional approaches, which tend either to use units that have a lower species resolution, eg. "lowland dipterocarp forest," or a higher resolution, such as identifying each tree to the species level as

in the research forests at Pasoh, Lambir and Kao Chong. It is likely to provide a more accurate predictor of biodiversity than the former and be substantially less expensive and less time-consuming than the latter.

On the other hand, using community type in a biodiversity assessment, rather than explicit, local relative abundance data for individual species, increases the errors in biodiversity assessment due to variance of the statistical correlation of community type to species richness or diversity. It might fail to signal the presence or absence of unique species at any particular site. We need to understand the magnitude of these errors. Classical linear discrimination will be used initially. If no significant discrimination is found, several pattern recognition procedures from the computer artificial intelligence literature will be applied. If the resulting errors are acceptable, then the method will be applied to the Lower Belum and Temenggor survey plots, thereby permitting sparser on-site sampling and much reduced costs of such large- scale biodiversity assessments.

- Schedule: Year 1: Acquire image data.
  Year 2: Analyse data, from research plots.
  Year 3: Analyse PITC concession data from activity 1.4.2 as they become available.
  Year 3: Test method on other project survey plots.

Activity 1.2.2: Develop a computerised system that uses pattern-recognition software and data from optical and texture scans of leaves to estimate tree diversity from leaf collections. The goal is to speed up assessments of species richness for trees by reducing the need for skilled field workers and focusing the use of senior botanists based in herbaria.

In trying to assess and value biodiversity in tropical forest, it is critical to identify trees up to the species level. The leaves collected will be used for species identification using techniques that will be developed by the project. In anticipating an acute shortage of qualified botanist, the techniques developed will help to accelerate and secure the success in tree species identification. The project is not designed to estimate leaf litter biomass but rather use the leaves as an important key, among other relevant field characters for species identification.

- Objective: To increase the efficiency of tree species diversity assessments by identifying species from leaf collections (both fresh and fallen). If good results are achieved, this technique will be used to augment the traditional methods of tree species identification in activities 1.4.1, 1.4.2, 1.4.3 and 1.4.4. These methods are very labour intensive and require the time of senior botanists and access to herbarium collections.
- General approach: The survey protocols used to identify tree species in the Pasoh and Lambir forest research plots require skilled field workers and field supervision by senior botanists. Even then, a significant fraction of identifications are left to senior botanists in herbaria. We will test the hypothesis that estimates of species composition, with acceptable error, can be made remotely from field collections of leaves, from forest floor litter or fresh samples, by less skilled workers. The approach will, in addition to identifying the number of species available, also enable us to identify what species they are. This information is very important

in the management of production forests as the impact of management practices to floral composition of commercial or climax species is much more important then pioneers or non-commercials. We also note that identity matters for evaluating certain forest-related goods and services (NTFPs, pharmaceutical values) and for distinguishing among different forest community types.

- Methods: Leaf collections will be made for a subset of the Pasoh and Lambir research plots, and species composition and biodiversity assessments made from the leaf collection will be compared to the complete assessment. The sample size, selection, and collection protocols will be designed after initial experience in a 1-hectare plot within Pasoh. The final number of plots will be determined by using area-persistence results from previous research, including research conducting during the pre-project phase. If the error in the estimates is acceptable, then the method will be tested in traditionally observed plots in the PITC concession and Belum. A key to increasing the efficiency of assessments made in this manner is to identify as many species as possible by computer pattern recognition based on optical and texture scans of the leaves. While this is a relatively simple matter in low diversity forests, it has not yet been done successfully in forests with the diversity found in Perak.

- Schedule: Year 2: Compare leaf litter estimates and known diversity in Pasoh and Lambir.
  Year 3: Compare the procedure with surveys in Temenggor and Belum.
  Year 4: If justified, use the method to extend surveys in Temenggor and Belum.

Output 1.3: Assessing biodiversity on a landscape level and improved understanding of the impacts of logging on biodiversity in logged forests and in adjacent or enclosed unlogged forests

GEF (USD 0.446 million), GoM (USD 0.284 million), Universities (USD 0.055 million), ITTO (USD 0.313 million – to be confirmed)

The biodiversity spatial database established as Output 1.1 requires a series of assessments. These assessments provide a baseline for experimental monitoring of biodiversity not only to include protected forest only but also areas of forest designated as permanent timber production . Two basic approaches exist for conserving biodiversity at a landscape level where logging is the chief human impact. One is to spatially segregate uses by emphasising biodiversity conservation in some areas and timber production in others. This approach yields a mixed timber and biodiversity-related goods at the landscape level but not necessarily at a micro or stand level. The alternative is to allow logging throughout the landscape and integrate biodiversity conservation into timber management at the stand level. There is a considerable debate in the conservation community over which approach is superior for balancing biodiversity conservation and timber production objectives (Rice et al., 1997; Putz et al., 2000). Both approaches will be assessed in their effectiveness of conserving biodiversity with the latter being more challenging on how to integrate biodiversity conservation into timber management at the stand level. Species, either flora or fauna display a critical threshold level in which they will respond to changes in landscape structure (With & Crist, 1995). Most studies, including in tropical forest

show that the impacts of logging are non-linear (Hartman, 1976; Bowes & Krutilla, 1989; Swallow, Parks & Wear, 1990; Swallow, Talukdar & Wear, 1997; Boscolo & Vincent (in press)

Logging affects the forest biodiversity through the removal of trees during building of roads, skid trails, felling of trees, which causes soil disturbance, and subsequent changes to forest community structure. The degree of impact depends on the logging intensity, harvesting system, topography and subsequent forest dynamics. The assessments proposed here will improve our understanding of the impact of logging on biodiversity. The taxa to be assessed will be selected on the basis of their economic interest, their importance to ecosystem function and stability, their response to ecosystem change or disturbance, and the availability of efficient survey methods and local expertise to assess them. Birds and mammals are found to be more sensitive to habitat fragmentations (Andren, 1994). Among the taxa to be assessed will be:

- Trees;
- top predators, particularly raptors;
- rodents and other small mammals;
- birds
- butterflies
- bats; and
- pioneers (both plants and animals)

.

The faunal survey methods are based on the experience of surveying similar forest plots in Thailand in the mid-1990's and preliminary work by FRIM in Temengor Forest Reserve, Perak. Small *mammal* diversity will be surveyed and relative species abundance will be determined using transect-based Sherman and box live-traps (Lynam 1997). Live trapping will take 4–7 nights for typical 1-ha plots where a catch of about 12 species on or near the ground is expecetd. The sampling will move on after three consecutive nights without detecting new species. Species-level identification will be based primarily on morphology (Corbett and Hill 1992; Lekagul and McNeely 1988), with noninvasive and non-destructive genotyping based on pulled hair or skin biopsy to confirm problematic identifications by comparing mtDNA sequences with our existing database (Srikwan and Woodruff 2000). In addition to the small mammal surveys, attempts will be made to identify the resident mid-sized and large mammals by opportunistic observations of tracks, scat, and other signs. Species lists for each sample plot will be compared and analyzed for species-specific and community-level (nestedness) effects (Lynam and Billick 1999). Bird species diversity will be assessed (Lekagul and Round 1991; Wells 1999, in prep.) by standard sight and sound and netting surveys in and around the plots. We will assess *reptile and amphibian* diversity using standard exploratory methods, spotlighting, and pitfall trapping. The local fauna is not well known but probably comprises about 150 species (Inger and Voris 2001). Finally, we will assess species-level diversity in *butterflies* in cooperation with Malaysian collectors and existing field guides (Corbet and Pendlebury 1992, Lekagul et al. 1970). Collecting and baiting of adults will provide comparable data for each plot.

It is important to note that a range of taxa will be surveyed as it is recognised that there is no one group of bio-indicators that serves as a good indicator (Lawton *et. al*., 1998)

***Activity 1.3.1*:** Establish biodiversity assessment plots in 4-5 Virgin Jungle Reserves (VJRs) of varying size in Peninsular Malaysia, in adjacent logged forests, and in similar logged forests more distant from the VJRs, and use the estimates of biodiversity from these plots to determine

the impact of local refugia on recovery of biodiversity in logged forests. The taxa to be assessed will be selected on the basis of their economic importance, their importance to ecosystem function and stability, their response to ecosystem change or disturbance, and the availability of efficient survey methods and local expertise. At the very least, they will include trees, birds, butterflies, bats and small mammals. Given that areas adjacent to VJRs were logged decades ago, these assessments will provide information on biodiversity recovery over a medium to long-term time scale.

- Objective: To test the hypothesis that local refugia of limited size contiguous with harvested sites are important to biodiversity recovery. Conventional ecological thought suggests that small refugia are not of great value, but few rigorous field investigations have been conducted in tropical forests. This output will be used in activity 3.1.2 to model the influence of adjacent plots on the rate of recovery of biodiversity of harvested plots.
- General approach: The VJRs, which have been a part of the overall forest management plan of Malaysia since the colonial era, provide a excellent experimental framework to test this hypothesis. A selection of VJRs will be assessed, along with adjacent and nearby harvested areas, to determine whether or not their presence and size has had a differential effect on the diversity of the recovering forest.
- Methods: Most major taxonomic groups show a definite relationship between the number of species surviving in a site and the site area. This species-area relationship applies to scales from a meters square up to a continent. The implication is that small conserved areas do not support a large enough representation of the species in a larger forest to be of much benefit in re-establishing the natural diversity of a larger contiguous harvested area. This theory and its empirical foundation, however, pertain to long-term steady states. It is possible that on a transient basis, small areas may be of some value.

The VJRs in Malaysia have suffered a variety of fates, but some appear to be intact adjacent to logged areas to provide an experimental context in which to answer this question. We will pick 4 or 5 intact VJRs ranging in size from 20 to 500 hectares, each with adjacent harvested area. The harvested areas may differ in time since harvest. If possible, several harvested plots with different time histories around a single VJR will be selected. The potential flaw in this experimental design is that there is no control for the previous state of the harvested plot. Using the VJR as a control, that is as an estimate of the diversity of the harvested plot, is inappropriate because the VJR may have lost species by the species-area effect. It might also have been more directly affected by the adjacent harvesting (e.g., illegal logging).

To overcome this problem, we propose to sample a third plot near, but not next to the VJR that was harvested at about the same time as the contiguous plot. It will be selected to be as similar as possible with regard to topology, soil type and distance from other major sources of recolonisation. This will permit an analysis of the VJR's effect on recolonisation of the contiguous plot. Any differences in recovery of biodiversity between the adjacent and more distant point may be interpreted as the role of the VJR in the process. Tree species, small mammals, and several other taxa's diversity will be estimated for each set of three plots. The species-area relationship for the taxonomic groups will be estimated in the VJRs, and a multivariate analysis of effects of VJR size, time since harvest, etc, will be made for the logged sites."

- Schedule: Year 2: Select the VJRs and adjacent sites and design sampling protocol.
  Year 3: Complete assessments.
  Year 4. Statistical analysis of data.

Activity 1.3.2: Establish biodiversity assessment plots in the PITC concession to estimate biodiversity in logged and unlogged hill forests in Temenggor Forest Reserve. The criteria for taxa selection will be the same as described in Activity 1.3.1. A unique feature of this activity is PITC's willingness to leave unlogged areas of varying sizes, which will permit an analysis of the effect of unlogged area on diversity on a shorter time scale than in Activity 1.3.1. This activity will also provide a golden opportunity to test the effectiveness of the concept of integrating biodiversity conservation and timber production at the stand level. The data collected will be supplemented by existing information from the Forestry Department, MNS expedition and a small scale study on biodiversity within PITC concession by Azmi & Sukumaran (2002). Therefore a substantial information will be available for developing and testing improved biodiversity assessment methods in the Temenggor area.

- Objective: To assess the existing biodiversity of the Temenggor hill forests, in support of the valuation and planning models and to analyse the effect of refugia on biodiversity recovery. This output will be the details of the spatial forest data base established in activities 1.1.1 and 1.1.3.
- General approach: A set of sample plots in the PITC concession will be established. Species diversity of trees, birds, butterflies, bats, small mammals and other taxa will be selected and assessed.
- Methods: The plots selected for the survey will include some that are to be harvested shortly, some that are not to be harvested for some time, and some that have already been harvested. The overall number and size of plots assessed in the concession will be based on budgetary considerations and characteristics of the taxon sampled. For trees, clusters of 3 to 5 plots of approximately 1 hectare separated by about 1 kilometer, based on research done in the pre-project phase of the project, will be replicated over the sampled area. It is hoped that something like 1% of the PITC concession area will be surveyed.
- Schedule: Year 1: Select and survey sample plots.
  Year 2: Train field crews and begin surveys.
  Year 3: Complete the surveys.
  Year 4: Resample a few plots to identify change.

Activity 1.3.3: Establish assessment plots in the Lower Belum Forest Reserve to estimate biodiversity in unlogged hill forests. This activity will provide an "out of sample" test of the biodiversity assessment tools (i.e., an evaluation of them in an area other than where they were developed) and will support the economic analysis of existence (passive-use) values (see Activity 2.1.5). It will be less intensive than the assessment of the PITC concession in Temenggor Forest Reserve described in Activity 1.3.2.

- Objective: To gain an understanding of biodiversity resources of Perak outside the Temenggor Forest Reserve and the replicability of the biodiversity assessment tools. This allows the models of activities 3.1.1 and 3.2.1 to assign lower priority to conservation of

community type in the harvested areas that are well represented elsewhere in the planning landscape. It is an important component of the spatial database established as output 1.1.

- General approach: A set of sample plots will be set up in the Lower Belum Forest Reserve to assess a subset of the taxa assessed in the PITC concession.
- Methods: The sampling will, by necessity, be much sparser than the assessments in the PITC concession. It is therefore much more important for the sample to be stratified carefully to capture the range of habitats, and that is why it represents a separate task. In terms of implementation, this task and the previous one will actually be carried out jointly, sharing staff as much as possible. The sample sites will be selected on the basis of the experience of the Perak State Forestry Office, as well as topographical and geological considerations. The taxa used in the surveys of the PITC concession will be used here as well, so that data will be comparable. Continuing assessments of large animals by the Wildlife and National Parks Department will be included in the database.
- Schedule: Year 1: Select sample plots.
  Year 2: Train field crews and begin data collecting.
  Year 3: Complete the data collecting.
  Year 4: Resample a few plots to analyse changes.

***Activity 1.3.4*:** Establish biodiversity assessment plots in parts of the PITC concession where logging methods aim at maintaining the vertical and canopy structure of the forest through the selection of specific trees of different species and sizes in particular locations. In addition to being willing to leave unlogged areas of varying sizes (see Activity 1.3.2), PITC is experimenting with the application of different logging methods. Analysis of the "low impact" assessment plots before and after logging and comparison to the results for plots logged using standard methods will provide a test of the hypothesis that biodiversity is less impacted if the three-dimensional structure of the forest is maintained.

- Objective: To test the hypothesis that biodiversity is less impacted if the three-dimensional structure of the forest is maintained. The results of this experiment will be important in constructing the model of the regeneration of forests after harvest in activity 3.1.2.
- General approach: In collaboration with the concessionaire, a harvest protocol will be designed for several compartments in the PITC concession already designated for logging. This protocol will aim at conserving the vertical and canopy structure of the forest by removing a selection of trees of different species and sizes in particular locations. Sample plots in these compartments will be assessed before and after harvesting to estimate differences in biodiversity impacts relative to plots harvested according to standard protocols.
- Methods: Previous research suggests that many animal species abundances and forest regeneration processes are dependent on the maintenance of the three-dimensional physical structure of the forest: the foliage height diversity and a contiguous canopy. This structure is not maintained by harvest protocols that limit the size of crop trees without addressing the relative location of trees to be cut. Avoiding trees under a minimum or over a maximum diameter certainly does not maintain it. The idea that the largest trees must be conserved as important seed sources might also be misplaced, as these are also the trees that are most likely to fall naturally and create the largest canopy gaps with the greatest damage to adjacent trees when they do.

A new protocol that selects trees to be felled from a preliminary, spatially explicit inventory so as to maintain a contiguous canopy and least modify tree height diversity, for a given harvest volume, will be developed. It will be applied to 3 sites of approximately 50 hectares each in compartments in the PITC concession that are already designated to be logged. Pre- and post-harvest biodiversity assessments, using the methods of the general assessment above, will be made in these sites. Statistical comparison of the before and after assessments with those from elsewhere in the concession harvested by other protocols will test the hypothesis. The planning model then can use this harvesting method as one of the alternative treatments available to the planner.

- Schedule: Year 1: Design the tree size-location harvest protocol and select sample sites.
  Year 2: Pre-harvest assessment and harvest.
  Year 3: Initial post-harvest assessment.
  Year 4: Follow-up post-harvest assessment and analysis of results.

Output 1.4: Manuals, including data sets and software, that explain how to implement the ecological assessment methods developed in the activities under Outputs 1.1-1.3
GEF (USD 0.013 million), GoM (USD 0.016 million), Universities (USD 0.018 million)

Activity 1.4.1: Use the lessons learnt from the development of efficient statistical methods for estimating biodiversity from small samples, as well as the development of improved methods for assessing biodiversity and the biodiversity assessment on a landscape level and produce manuals for information dissemination and the training activities under Output 4.

- Schedule: Years 4-5

IMMEDIATE OBJECTIVE 2:
TOOLS FOR ECONOMIC VALUATION OF GOODS AND SERVICES ASSOCIATED WITH BIODIVERSITY IN TROPICAL FORESTS ARE IMPROVED AND DISSEMINATED
Output 2.1: Data and models necessary for testing the accuracy and precision of: (i) alternate data collection procedures, and (ii) alternate model specifications (e.g., approximations that require fewer and cheaper data inputs).
GEF (USD 0.307 million), GoM (USD 0.459 million), Universities (USD 0.106 million)

Several previous studies have developed integrated ecology-economic models for analysing biodiversity conservation in a production forestry landscape (Margules et al., 1988; Haight, 1995; Montgomery et al., 1994, 1999; Arthaud & Rose, 1996; Ando et al, 1998; Polasky et al., 2001; Calkin et al., 2002). Most of these studies, however focused on temperate forests, but they do provide the basis for developing model in the tropic as envisaged in this project.

Biologically rich tropical forests are a source of not only timber but also a wide range of nontimber goods and services. Nontimber forest products (NTFPs) collected by local communities include rattan, bamboo, fuelwood, medicinals, extractives (dyes, gums, incense, latex, oils, resins), and food such as fish, game, fruits, nuts, honey, and spices. Ecological services include soil and watershed protection. Forests also provide genetic resources (for example, for new pharmaceutical products and for improved varieties of timber and fruit trees), a

location for recreational activities (including ecotourism), and are increasingly valued for their sheer existence. These nonextractive uses of forest are indeed increasingly valued in Malaysia: recreation forests are attracting more local visitors, local environmental organization like WWF Malaysia are attracting more donations, the Malaysian Nature Society (MNS) is now the largest indigenous nature society in the tropics, and development projects that threaten to harm natural environment (i.e., Bakun Dam) are attracting more public criticism. On the other hand, standing timber is one of the few natural resources whose price has risen more rapidly than inflation (Barnett & Morse, 1963; Nordhaus, 1992). These studies suggest that the upward trend will continue into the middle of this century, including for tropical timber (Sedjo & Lyon, 1990; Vincent, 1992). Hence, the economically superior approach for balancing timber and biodiversity values in tropical forests remain an open question and could well change over time with economic development.

Due to the lack of reliable economic estimates, such values are often ignored in forest planning decisions. The following activities will generate economic estimates of several non-timber values, but, more important for the project, they will generate data that are necessary for the analyses in Activity 2.2.2. Those analyses will develop a better understanding of: (i) the impact of quantity and quality of data on the accuracy and precision of value estimates, and (ii) the impact of approximations that reduce data inputs on the accuracy and precision of models that relate economic values to ecological and socio-economic factors. Improved understanding of these factors is necessary for determining the reliability of valuation methods in countries with less and lower quality data than Malaysia.

Determining how the economic values biodiversity might change in the future requires methods for quantifying and forecasting these non-market values. Survey-based stated-preference methods are now the most commonly employed techniques used by economists to value non-market goods and services, either on their own or in combination with revealed preference methods (Louviere et al., 1999). A recent review reported more than five thousand studies in more than hundred countries since 1995 (Carson, in press). Most studies in developing countries have focused on improvements to water and sanitation services, but a few have begun to consider either conceptual (Carson, 1998) or empirical (Holmes et al., 1998; DeShazo & Fermo, 2002) aspects of rain forest valuation. The best principle in designing and implementing the survey were put forth in Mitchell & Carson (1989) and Bateman et al. (2002).

***Activity 2.1.1*:** This activity will generate data necessary for comparing alternate methods of quantifying the amounts of NTFPs collected by *orang asli* households. It will also generate data necessary for constructing models that relate NTFP collection to household characteristics (age, income, education, proximity to markets and wage employment, etc.). It will proceed in three stages. In the first stage (Year 1), ethnographic work will be conducted to learn how best to ask households about the extraction of NTFPs and other economic activities. In the second stage (Year 2), in-depth studies on the collection of NTFPs will be conducted in two villages. A range of data collection methods will be employed in both villages, to generate data for conducting a statistical comparison of the methods in Activity 2.2.1. The studies will last 12 months. In the third stage (Year 3), a less intensive but spatially more comprehensive survey of a larger number of villages (30-40) will be conducted to collect data on both NTFP collection and household characteristics. Each village will be surveyed three times over the course of 12 months. This survey will generate data necessary for developing a 'benchmark" model that relates NTFP

collection and utilisation to income and other household characteristics. The model will be developed under this activity and evaluated against less data-intensive versions in Activity 2.2.1.

- Objective: To collect data necessary for assessing alternate methods for estimating the current value of the forest as a source of NTFPs and for assessing models that predict changes in this value as the national economy develops or as incomes and relative prices change.
- General approach: Conduct in-depth surveys of household collection and consumption of NTFPs using different survey methods in two villages, and then conduct a less intensive survey of a larger group of villages in a broader range of socio-economic conditions.
- Methods: Two methods to estimate the value of nontimber forest goods collected by *orang asli* villages will be compared in the initial studies in the two villages, weigh-days and recall surveys. Only one of these methods will be used in the cross-sectional survey of the larger set of villages.

NTFPs flow out of the forest into households continuously throughout the year, making it difficult to estimate their volume and value from one-time recall surveys. A strong seasonal component makes it difficult to estimate with accuracy the flow of goods from one-time surveys. Moreover, although one can ask general questions such as "How much rattan did you extract last month/quarter/year," answers will contain error from poor recall. To obtain the most accurate measures of NTFPs removed, one must use the first-best approach: weigh-days. During days chosen at random, researchers directly monitor the quantity and value of all forest goods entering households over the course of a full day. They weigh, measure, and identify all goods brought to the household. The sampling intensity should be such that each household has, on average, at least one weigh-day per month.

Although the weigh-days method provides the most accurate information, it is labour intensive and costly, and it consequently entails small sample sizes. Weigh-days in a few villages can, however, provide a benchmark for evaluating how well the recall methods estimate the aggregate amount of nontimber forest goods households in those villages extract during a typical year. That is, one can carry out non-random, recall surveys, say, every month, quarter, or six months and compare the estimates to the estimates from weigh-days. If from this comparison one can reliably estimate the biases associated with the recall surveys, then one can conceivably still rely on them. This is a desirable goal, because the recall surveys can cover a larger number of households.

- Schedule: Year 1: Conduct background ethnographic work.
  Year 2: Conduct studies using weigh-days and recall surveys in two villages.
  Year 3: Conduct survey of larger set of villages.

***Activity 2.1.2*:** This activity will compile existing hydrological and land-use data for Peninsular Malaysia, and use those data to construct a *statistical* hydrological model that predicts the impact of changes in land use, in particular forest cover and logging status, on the level and variability of stream flow and suspended sediment. In addition, it will compile data necessary for relating stream flow and suspended sediment to economic consequences such as increased expenditures on dredging rivers and harbours in Peninsular Malaysia. The sensitivity of the "benchmark" statistical hydrological model to the amounts of data used to construct it and the number of

variables in it will be assessed in Activity 2.2.1. Also in that activity, the performance of the benchmark model will be compared to that of existing hydrological *process* models that have been constructed for particular Malaysian watersheds.

- Objective: To compile data necessary for constructing a landscape-level, statistical model that predicts the economic consequences of changes in hydrological functions caused by changes in forest cover, and to construct a "benchmark" version of such a model.
- General approach: Hydrological and land-use data for Peninsular Malaysia will be used to construct a *statistical hydrological model* that predicts the impact of changes in land use, in particular forest cover and logging status, on the level and variability of stream flow and suspended sediment. This hydrological model will be linked to *economic models* that relate stream flow and suspended sediment to two examples of economic consequences: (i) expenditures on dredging rivers and harbours in Peninsular Malaysia, and (ii) the economic lifetime of the Temenggor Reservoir. In addition, existing *hydrological process models* for river and stream basins will be compiled and evaluated. The performance of these models will be compared to that of the statistical model in Activity 2.2.1.
    - Methods: Daily data on stream flow and suspended sediment will be compiled from the Drainage and Irrigation Department's (DID) extensive system of hydrological stations. The DID maintained 84 stream flow stations and 53 suspended sediment stations in the early 1990s; these stations cover all the major river basins in the Peninsula. Data on the characteristics of the catchments above these stations will be compiled by applying GIS methods to maps of topography, soils, forest cover, and other land uses and to readings from the DID's rainfall stations (hundreds across the Peninsula in the early 1990s).

Land-use changes in catchment areas can affect the level and variability of stream flow and the quality of river water, in particular the amount of suspended sediment, in downstream areas. These hydrological impacts can have important economic consequences, which might include changes in the risk of flood damage, the costs of dredging river and harbours, and the lifetime of reservoirs. In view of the available data in Malaysia, the project will focus on the latter two consequences, although it will also generate information on flood risks in physical (non-economic) terms.

The hydrological model will relate the hydrological variables of interest—level and variability of stream flow and suspended sediment—to catchment characteristics that are expected to influence these variables: in particular, rainfall, topography, soil type, and land use. It will be a statistical model, not an engineering or "process" model. It will be estimated using existing data on individual catchments throughout Peninsular Malaysia. Once the data on hydrological variables and catchment characteristics have been compiled, statistical methods will applied to relate monthly measurements of the hydrological variables to monthly (rainfall) or annual (other variables) values of catchment characteristics. The analysis will likely be restricted to the year 1992, the year of the most recent forest inventory in Peninsular Malaysia. An attempt will be made to include data for 1982, the year of the previous forest inventory, and a more recent year if data from Forest Inventory IV become available in time.

Expenditures on dredging will be analysed as follows. DID has recorded annual expenditures on river and harbour dredging by individual states since the late 1970s. Statistical methods will be used to relate these expenditures to corresponding estimates of the total sediment load in the

states' rivers, which DID also reports. An unpublished, partial analysis of such data conducted by Harvard Institute for International Development and the Institute of Strategic and International Studies Malaysia in 1992-93 yielded promising results. When combined with the hydrological model, the "damage functions" generated by this analysis will permit the estimation of the impacts of forest conversion on dredging expenditures in the state where forest conversion occurs.

Turning to the impact of sedimentation on the lifetime of the Temenggor Reservoir, the hydrological model will be used to predict sediment loads entering the Temenggor Reservoir under different forest conversion scenarios. When combined with data on the storage capacity of the reservoir, from Tenaga Nasional, these predictions will permit the estimation of impacts on the lifetime of the reservoir. These impacts will be translated into economic terms by using public-domain information on Tenaga Nasional's hydropower costs and revenues.

- Schedule: Year 1: Compile DID data (stream flow, suspended sediment, rainfall) and maps.
  Year 2: Conduct GIS analysis of catchment areas.
  Year 3: Construct "benchmark" hydrological and economic models.

***Activity 2.1.3*:** This activity will develop probability-based models for valuing genetic resources in Perak's forests as a source of "leads" for new pharmaceutical products. Data from previous studies that have screened Malaysian plants for pharmacological activity will be used to calculate the probabilities that species in different taxonomic groups contain pharmacologically active compounds. Secondary data on the pharmaceutical industry will be used to estimate the probability of developing commercially viable products from such compounds, and the net profits generated by those products.

- Objective: To generate a detailed model that takes full advantage of available ecological and economic information to predict the value of genetic resources in tropical forests in Perak. The performance of this "benchmark" model will be compared to that of less data-intensive and more approximate versions in Activity 2.2.1.
- General approach: Probability-based models will be developed to predict: (i) how changes in forest area affect the pool of genetic resources in Perak's forests, taking into account not only the number of species present but also their genetic relatedness; and (ii) how the changes in genetic resources affect the expected net commercial value of new or improved products derived from the resources.
- Methods: The model for predicting how changes in forest area affect the pool of genetic resources in Perak's forests will be based primarily on the outputs of the ecological research conducted under Immediate Objectives 1 and 3. It will also draw on published information on the genetic relatedness of different species based on taxonomic relationships and direct genetic measurements. The model for predicting the impact of changes in genetic resources on net pharmaceutical values will be developed using an approach similar to the one used by Simpson, Sedjo, and Reid (1996) and Rausser and Small (2000) to estimate the pharmaceutical value of biodiversity "hot spots" in the tropics.

Chemical compounds produced by living organisms in protected forests represent a potential resource for developing new commercial products or improving existing ones. The "blueprints" for these compounds are contained in the genetic codes of the organisms. Extinction erodes this

information base, which in turn reduces the potential payments for "bioprospecting rights" that a country might receive from private companies.

The study will focus on genetic resources in higher plants. It will include fungi if sufficient data are available. It will use data from previous projects that have screened Malaysian plants and fungi for pharmacological activity (e.g., the U.S. National Cancer Institute). These data will be used to calculate the probabilities that species in different taxonomic groups contain pharmacologically active compounds. Additional data from studies of the pharmaceutical industry will be used to estimate the probability of developing commercially viable products from such compounds, and the net profits generated by those products (taking into account R&D costs). With this information, it will be possible to calculate changes in the expected net pharmaceutical value of the genetic resources in forestland in Perak that occur as a consequence of changes in the area of different forest community types.

- Schedule: Year 2: Compile and analyse existing data from pharmaceutical trials, R&D efforts, etc.
  Year 3: Develop probability model.

Activity 2.1.4: This activity will survey Peninsular Malaysian households to generate data necessary for estimating two important nonextractive nontimber values: recreation and passive use. Passive use refers to the value individuals place on the continued existence of forests—e.g., protected areas that harbour endangered species—even if they do not visit those forests or use them in other tangible ways. The survey will include questions that will permit the use of a choice modelling approach to value the recreational importance of specific site characteristics (such as wildlife viewing opportunities) and specific park services (such as availability of skilled nature guides). A choice modelling approach will also be used to value passive use; Belum Forest Reserve will be the site valued. Econometric methods will be used to estimate a system of demand functions that relate the number of visits to recreational sites in Peninsular Malaysia, including but not limited to forest-based recreational sites, to access costs, site characteristics, and individuals' socio-economic characteristics. Similar demand functions that relate passive use value to income and other socio-economic variables will also be estimated.

- Objective: To generate data and "benchmark" models (demand functions) necessary for evaluating, in Activity 2.2.1, the impact of data availability and model sophistication on the accuracy and precision of estimates of recreational and passive use values of tropical forests.
- General approach: A random sample of 1,500 Peninsular Malaysian households will be interviewed 3 times over the course of a 12-month period, to collect data necessary for estimating demand functions for forest-based recreation and passive use.
- Methods: At each interview, information will be collected on the number of visits by household members to various existing recreation sites—both forest-based and other—during the preceding 3-4 months, the activities they engaged in at the sites, their mode of transportation to and from the sites, and their expenditures on travel and on-site activities. Additional information will be collected on households' socio-economic characteristics, in particular income and education. Econometric methods will then be applied to estimate a system of recreation demand functions. As part of the same survey, households will be presented with information on a range of hypothetical options related to the management of

Belum Forest Reserve as a protected area. The options will vary in terms of: (i) the proportion of Belum classified as a protected area, (ii) the restrictions placed on access to that area, (iii) estimated impacts of protection on biodiversity, (iv) costs to the public of maintaining the protected area, and (v) the financial mechanism instituted to support the protected area (e.g., general tax revenues or voluntary contributions into a trust fund). From these data it will be possible to estimate the households' passive use values and to relate those values to the households' socio-economic characteristics.

Estimates of current recreational and passive use values, whether at existing sites or prospective new sites, are insufficient for policy decisions about protected areas. Such decisions also require information on likely future values. This is especially true in developing countries with high rates of population growth, income growth, and rising educational levels. Because the demand functions for existing and new sites will be individually based and will include these and other socio-economic variables, they can be used to project values into the future when they are coupled with demographic and socio-economic projections. These dynamic (forward-looking) demand functions will be included in the forest planning model.

- Schedule: Year 1: Design and pre-test questionnaire, select sample frame.
  Year 2: Conduct survey.
  Year 3: Estimate demand functions for existing and new sites.

Output 2.2: Manuals, including data sets and software, that explain how to implement the valuation methods developed in Activities 2.1.1-2.1.4 and provide information on the degree of accuracy and precision that is sacrificed if the methods are based on less and lower quality data and simplified models.
GEF (USD 0.143 million), GoM (USD 0.144 million), Universities (USD 0.084 million)

The "benchmark" models developed in Activities 2.1.1-2.1.4 require substantial amounts of data and involve sophisticated representations of the relationships between nontimber values, forest characteristics, and socio-economic factors. Estimation of such models will not be possible in many tropical developing countries. Hence, the project will assess the degree of accuracy and precision that is sacrificed if models are instead based on less data (e.g., from smaller surveys), lower quality data (e.g., from recall surveys instead of random weigh-days in the case of NTFPs), or include a more limited number of variables (e.g., recreation demand functions that include only variables for which secondary data are readily available). That is, the project will develop not only the "benchmark" data collection and modelling methods but also more approximate versions that are less data-intensive, and it will evaluate the relative performance of the different versions.

Activity 2.2.1: Use the data from Activities 2.1.1-2.1.4 to develop models that are less data-intensive than the benchmark models. For example, passive use values will also be estimated using only a subsample of the households surveyed and only a subset of the variables from the surveys, to mimic the situation in countries where "quicker and dirtier" valuation methods must be employed. The estimates of economic values generated by these simplified models will be

compared to those from the benchmark models to measure the loss of accuracy associated with use of the former.

- Objectives: To generate models that are less data-intensive than the "benchmark" models developed under Output 2.1, and to evaluate the tradeoff between reduction in cost and loss in accuracy for these models compared to the benchmark models.
- General approach: Models based on subsets of the full data sets developed in Activities 2.1.1-2.1.4 will be constructed, and the estimates of forest values generated by these models will be compared to the more accurate estimates of the "benchmark" models.
- ***Methods: Precise methods will vary by type of forest value and will depend on the final form of the "benchmark" models developed under Output 2.1. They will, however, follow the principles described in the "General approach" section above.***
    - Schedule: Years 3-4: As "benchmark" models are finalised, develop and evaluate simpler models.

IMMEDIATE OBJECTIVE 3:
TOOLS FOR INTEGRATING ECOLOGICAL AND ECONOMIC ASPECTS OF BIODIVERSITY INTO FOREST PLANNING DECISIONS AT A LANDSCAPE LEVEL ARE IMPROVED AND DISSEMINATED

Output 3.1: Improved models for predicting biodiversity within and between forest community types, taking into account logging status and location
GEF (USD 0.225 million), GoM (USD 0.089 million), Universities (USD 0.091 million), ITTO (USD 0.206 million – to be confirmed)

***Activity 3.1.1*:** Develop statistical models that relate measures of biodiversity and forest community type to forest characteristics (e.g., area, topography, geology, climate, canopy structure, years since logging in production forests). As they become available, biodiversity assessment data will be analysed to construct summary measures of biodiversity and forest community types. These measures will be correlated with forest characteristics in an effort to identify surrogates for biodiversity and forest community types that can be measured more easily yet remain sufficiently accurate when extrapolated to larger scales (e.g., in forest planning exercises). The application of these models at a landscape level for Perak will yield a spatial map of alpha (within habitat) and beta (between habitat) diversity for the state.

- Objective: To reduce the raw assessment data to summary biodiversity statistics that have the lowest variance (estimation error) for a given quantity and complexity of data. This will allow specification of the spatial biodiversity in the database, output 1.1, from spatial maps of the physical site characteristics. It will be a component of the forest planning model, activity 3.2.1.
- General approach: As assessment data become available during the project, they will be combined and analysed to produce summary measures of biodiversity and forest community type. Statistical methods will be combined with measures of ecological distance to produce a spatial map of alpha (within habitat) and beta (between habitat) diversity for Perak.
- Methods: Correlation, principal component, and other multivariate analyses of assessment data will be conducted as the data become available throughout the project. Minimum variance measures of biodiversity, reflecting the relative abundance of species as well as the

number of species, and community type will be the result. The ecological distance between local communities will be calculated by similarity coefficients based on the fraction of the summed species in two sites held in common between them and by the Mahalonobis D squared distance based on their multivariate species composition. The measures will then be correlated with physical habitat, local topography, geology, and climate to extrapolate the sample data to the regional scale. The strength of this correlation will test the hypothesis that statistics based on physical measurements can be used as surrogates for diversity and community type and indicators of spatial distributions of them. This will go in hand with the results of the satellite imaging research in attempting to reduce the spatial and taxonomic resolution of the expensive field assessment whenever possible. The conversion of the raw ecological data to a spatial diversity map will provide a key ecological input for the forest planning model.

The main goal of the research will be to identify a parsimonious, easily measured set of forest characteristics that can be used to form reliable estimates of the biodiversity in a region on the scale of Perak. The research will explore the tradeoff between predictive accuracy and the quantity and quality of data inputs, to gauge the reliability of the models in data-constrained situations. The generally high quality of forestry data in Malaysia makes the country ideal for conducting research aimed at understanding the relationship between forest characteristics and biodiversity at different spatial scales, but the research must ultimately have relevance for biodiversity conservation in other tropical countries.

- Schedule : Year 2: Development of the statistical methods to be used.
  Year 3-4: Continuous statistical analysis of assessment data.
  Year 5: Develop final computer program to convert assessment data to diversity map.

Activity 3.1.2: Develop a model that predicts the regeneration of forests, and the biodiversity they harbour, after logging. An existing forest growth model will be selected and modified to interact with the project database (Output 1.1) and the forest planning model (Output 3.2). Such a model is needed to predict changes in biodiversity over time (by relating forest characteristics to biodiversity, via the statistical relationships developed in Activity 3.1.1) and to estimate the chief cost of biodiversity protection, which in production forests is the opportunity cost of forgone stumpage value from logging. Separate parameter sets will be developed to describe the major forest community types of Perak.

- Objective: To develop a model that will predict the regeneration of the forest structure and biodiversity in harvested forest. Such a model is essential for estimating the loss of biodiversity over time due to harvesting.
- Methods: A general forest recovery model must be selected or developed to assess the long-term impacts of logging on biodiversity. Existing models such as FORMIND and FORMIX will be validated against data from the Pasoh and Lambir research plots and the PITC concession assessments. The model that best describes the data and that has the best potential for interfacing with our database and statistical analyses will be selected. Necessary programming changes to implement the interface will be made. Tree growth data, including gap or harvest history, for Pasoh, Lambir, and the set of existing FRIM research sites will be assembled into a single database and used to refine the parameters of the model. Separate

parameter sets will be developed to describe the major habitat and forest community types of Perak.

- Schedule: Year 2: Selection of an existing forest model.
  Year 3: Validation and fine-tuning of the model; interface programming.
  Year 4: Operating forest model in place.

Output 3.2: Improved forest planning model for predicting the impacts on biodiversity, and associated economic benefits and costs, of different allocations of forests in Perak between production and protection categories

GEF (USD 0.040 million), GoM (USD 0.053 million), Universities (USD 0.057 million), Private Sector (USD 0.047)

***Activity 3.2.1*:** Construct a dynamic optimisation model, linked to the spatial database for Perak (see Output 1.1), that predicts the landscape-level allocation of forests between production and protection categories that maximises a specified biodiversity conservation objective (expressed in ecological or economic terms) subject to a set of timber management constraints (e.g., a desired annual allowable cut). This model will draw directly or indirectly upon the results of all the activities described above, in particular Activities 3.1.1 and 3.1.2 and the economic valuation models developed under Immediate Objective 2. It will predict biodiversity not only in protected areas but also in production forests. Because it will be spatial, its predictions will take into account not only the area of protected forests but also the characteristics of neighbouring forests. Because it will be dynamic, it will predict changes in biodiversity as permanent production forests recover from logging and other forests are converted to nonforest land uses.

- Objective: To develop a computer-based forest-planning model that will assist forest planners in practical decision-making, especially decisions about the allocation of forests between production and protection categories.
- General approach: The model will be constructed in three phases. The first phase will involve the construction of a nonoptimising model. This model will enable the user to explore the biodiversity (and timber) implications of user-specified allocations of forestland between production and protection categories. The model will be structured to ensure that users can only input feasible allocations (e.g., allocations must stay within constraints on available areas of specific forest community types, etc.). As output, it will generate predictions related to biodiversity and timber production. It will include options to express these outputs in either economic as well as physical terms.

In the second phase, an optimisation algorithm will be added to enable the model to predict the allocation of forestland that maximises a specified biodiversity conservation objective subject to a priori timber management constraints (e.g., a desired annual allowable cut). The model will be designed to make it easy for users literally to see (through graphics features) how a change in a timber-management goal (e.g., an increase in the cut) affects areas of production and protection forests and associated biodiversity impacts.

In the third phase, the project will develop simpler versions of the model that include less spatial detail and can be solved on less powerful computers. It will compare the results of simulations

of these simpler versions to the results of simulations of the full version, in order to determine the loss of predictive accuracy associated with use of the simpler versions. It will also seek to identify simple rules-of-thumb that can provide guidance on forest allocation decisions in the absence of sufficient data to implement even the simplest computer-based versions.

- Methods: The model will be designed for forest planning decisions in regions on the scale of tens of thousands of km^2. This scale is comparable to the median area of subnational political jurisdictions in Southeast Asia (e.g., the states in Peninsular Malaysia), which is the political level at which forest planning typically occurs. It is also large enough to completely subsume the territories of most of the wide-ranging animals found in the region, although not of course not migratory birds. In this sense, a region of this size is an essentially, although not perfectly, self-contained ecological planning unit.

  The database supporting the model will be spatial and will contain information on topographical characteristics like elevation and average slope, forest type, logging status (virgin vs. logged-over), number of years since the most recent harvest in logged-over forests, and additional forest characteristics associated with biological richness. For a description of the development of this database, see Output 1.1. The detail on logging status and years since logging is needed to enable the model to predict biodiversity not only in protected areas but also in production forests, and to enable these predictions will take into account not only the area of protected forests but also the characteristics of neighbouring forests: the "sea" surrounding the "islands." The detail on topographical features will enable users to solve the model with constraints related to physical characteristics of forests imposed (e.g., a logging prohibition for slopes steeper than some specified amount), in addition solving for the biodiversity-maximising forest allocation in a completely unconstrained way.

  The research conducted under Activity 3.1.1 could well find that a single set of forest characteristics does not provide an equally reliable indicator of biodiversity across a wide range of taxonomic groups (e.g., both plants and animals, both large and small animals, etc.). If this is the case, then the model will be designed to highlight spatial discrepancies between forest allocations that maximise the diversity of different taxonomic groups. For example, the model might predict that protecting certain areas is more important for large mammals, while protecting other areas is more important for birds.

  The model will be dynamic: it will predict the impact of planning decisions on biodiversity in not only the current period but also future periods. Its time horizon will likely be a century or more. It will thus need to include growth and yield models that predict how forests recover from logging; hence the need for Activity 3.1.2. Unlike conventional growth and yield models, which predict just timber growth and yield, these models will also need to predict changes in the broader set of forest characteristics that affect biodiversity.

- Schedule: Year 3: Construct nonoptimising model.
  Year 4: Construct optimisation model.
  Year 5: Construct and evaluate simpler versions of the model.

IMMEDIATE OBJECTIVE 4:
ENHANCE AND DISSEMINATE KNOWLEDGE AS WELL AS BUILD CAPACITY WITH VIEW OF REPLICATING IMPROVED FOREST PLANNING PROCEDURES

Although the methods and tools it generates will be developed in a Malaysian context, they will be applicable to forests throughout Southeast Asia and in other tropical countries.

To ensure that the global benefits of the research are maximised, the project will include a variety of dissemination activities, targeting GEF projects under the Operational Programme 3 on Forestry Ecosystems throughout the world as well as national Malaysian stakeholders.

Output 4.1: Enhance and disseminate knowledge biodiversity conservation through improved planning procedures
GEF (USD 1048 million), GoM (USD 0.826 million), Universities (USD 0.039 million)

Activity 4.1.1: Hands on training for Perak State Forestry Department counterparts and more formal training for Malaysian decision makers, especially other State Forestry Department officers, as well as relevant regional participants and GEF OP3 project management teams. The capacity building activities will cover all the research tools being developed. They will cover aspects of:

- rapid biodiversity assessments—both qualitative and quantitative—at the landscape and stand levels. The assessments will include the number of species present in a region, and the presence of ecological communities that are not well represented elsewhere
- valuation studies aimed at understanding the key determinants of the economic value of each major good or service
- development of models and expert systems that will enable forest planners to predict how the allocation of forestland between protection and production categories, and the retention of unlogged areas within production forests, affect biodiversity.

As a targeted research project exploring new areas in the planning and management of biodiversity it is expected many new skills and capacity can be built. The input from external experts working together with local experts will be very valuable in the exchange of skills and experience. It is thus important that the project be implemented focusing on this capacity building both the on-the-job training as well as more formal classroom training involving not only local personnel but also relevant people from the region with similar situations, as well as project teams working on other GEF projects. The project should be undertaken in such manner that by the end of the project sufficient skill would have been built locally to adapt and apply to other parts of the country and the region.

- **Objective:** To ensure capacity building and training is enhanced through on the job training and more formal classroom cum field training on involving all aspects of the project, which includes, both the assessment, economic valuation as well as the modeling techniques.

- **Approach and Methodology**: The terms of reference of the Experts hired for the work will be explicit in ensuring that focus will be given to ensure transfer of knowledge and capacity building to local counterparts. At the same time local counterparts need to be assigned specifically to the research activities to ensure that the work is undertaken mainly by them. In addition training activities will be organized through workshops and conferences involving both theory and application in the field.

Activity 4.1.2 Develop a website on the project status and outputs that can be assessed by all interested parties

One of the easiest and cost effective means of dissemination of information and knowledge to a wide audience globally would be through the Internet. In this regard, the project develop a website on the project to include information on the project, the progress of the research, technical papers and publication that has been developed and a contact address for interested parties to seek information and may be even exchange views or collaborate in any means. The website should however be managed and updated regularly. The website could also serve as a platform for research team to communicate and refer especially between the external consultants and the local counterparts.

- **Objective**: To develop a website on the project that is managed and updated regularly with information on the project progress and technical papers produced.

- **Approach and Methodology**: The project will develop a website on the project to include information on the project, the progress of the research, technical papers and publication that has been developed. Local personnel assigned to develop and maintain the website may be required to have external supervision initially and undergo relevant training to ensure that the website is developed and maintained effectively.

Activity 4.1.3 Develop a scientific exchange programme through research fellowships

Again as a research project dealing in new and complex subjects, ensuring the development of local capacity is of utmost importance. One way of enhancing the skills of counterparts who will the future trainers is through effective fellowship research programmes. The project will likely involve external experts that are affiliated with universities or research institutions and as such local counterpart may be attached to these institutions for a period of one or two months. The fellowship will provide exposure and enable the local counterparts to interact with a broader group of experts within the relevant institutions he/she is attached.

- **Objective**: To develop a research fellowship scheme to enhance the capacity of local counterparts.

- **Approach and Methodology**: Local State and Federal counterparts will be provided opportunities to undergo training and capacity building through research fellowship programmes designed in line with the project. In addition, GEF OP3 projects will be asked to identify and nominate suitable candidates from their countries to undergo the research fellowship programmes. Many skills are required in the effective implementation of the research that are

being proposed for the project, and having local counterparts fully involved and trained would ensure success. There could be even parts of the project such as the analysis of data and development of the models that could be partly implemented through a fellowship research programme.

Activity 4.1.4 Hold annual research seminars for GEF OP3 Chief Technical Advisors (CTAs)

This activity seeks to allow GEF OP3 colleagues to gather at least once a year, to discuss the research tools that are being developed. The interaction of GEF OP3 project CTAs or other senior members of the project management team with this targeted research project team will be mutually beneficial, as the GEF OP3 projects could learn about the tools as well as provide feedback to the targeted research team on their real needs and challenges in the field.

Activity 4.1.5 Organise cross project learning visits to PITC, Malaysia

As a follow up to Activity 4.4, the project will also envisage cross project learning visits to be undertaken by selected GEF OP3 projects outside Malaysia to come to Perak to learn about the research that is being undertaken. This learning by doing activity will also be beneficial to the targeted research team as they gain feedback from counterparts managing "implementation" projects. At the early stage of project implementation, the project will identify those existing GEF-funded projects that are most likely to benefit from the exchange of lessons learnt. The project will also incorporate sufficient flexibility in the workplan to accommodate future GEF funded projects also.

Activity 4.1.6 Organise cross project learning visits to other forestry project sites

To complement Activity 4.5, the project will also provide for the targeted research team as well as the State and Federal Forestry Department counterparts to visit other GEF OP3 project sites. This will enable the targeted research team to have a first hand experience on the needs of the ultimate beneficiaries of their research – other GEF teams working in the field. In accordance with the Strategy Priority "pillar" IV, these cross project learning activities would provide help stimulate knowledge generation and north-south and south-south exchange of information.

Activity 4.1.7 Develop user-friendly information services

Besides creating and maintaining the website (Activity 4.1.2), which is mainly targeted for the more informed and technical audience, there will be a need to develop user-friendly information services, tailored for different audiences. This would include, for example, newsletters and other communication material that could be used to disseminate information on the project's progress as well as best practices on forestry planning to decision makers, politicians, the media and other target groups. A precursor to this activity would be to draw up a communications and information strategy.

Activity 4.1.8 Ex-post evaluation

An independent evaluation of PITC and one other GEF OP3 pilot project, which would have applied the tools developed by the project will be carried out in order to examine whether the biodiversity value of these two areas as a whole is significantly higher than those of comparable sites that have not applied the methodology, while the net financial benefits derived from the

concession are equal to or greater than those from comparable sites. This activity will be carried out in Year 7, and results as well as lessons learnt will be disseminated to all GEF OP3 projects.

End of project situation:
At the end of the project, both relevant government agencies, notably FRIM and the Forestry Departments, and the industry notably PITC will have increased skills and capacity in biodiversity management and conservation. Together with GEF OP3 projects, they will have better tools and methods to assess biodiversity and optimise their conservation in the planning and management of the forest resources that also considers costs and benefits. They will also have a better understanding of the impacts of their interventions on the forest ecosystem especially on its sustainability and biodiversity. They will have the following:

- Computerised system (and a database) for recording and managing biodiversity
- Efficient statistical methods for estimating biodiversity from small samples
- Improved methods for assessing biodiversity
- Improved understanding of the overall impacts of logging on biodiversity
- Models that relate economic values associated with biodiversity to ecological and socioeconomic factors that influence them
- Improved models for predicting biodiversity taking into account logging systems and location
- Employ harvesting protocols and technology that would conserve or protect biodiversity
- Improved forest planning model for allocation of lands between protection and production taking into consideration biodiversity and economic benefits and costs
- Increased skills and capacity of local counterparts in all aspects of the research
- Dissemination of the tools and methods to other countries

Understanding the impacts will allow managers to develop appropriate strategies and procedures that will promote the conservation of biodiversity at the landscape level. The models developed will allow managers to predict the impacts of their decisions and enhance confidence of stakeholders, interested parties and the public on the policies and management strategies adopted.

The project will seek to involve experts that are amongst the best in their respective fields. This is necessary as the research being undertaken also involves new dimensions that require high levels of skills. This is also advantageous to Malaysia, as it will provide opportunities to increase capacity and experience through interaction with the experts. At the same time training will be organized to disseminate the findings of the project progressively. These opportunities for training will also be provided for other GEF OP3 project teams.

Project Beneficiaries:

Key stakeholders who will benefit from the project directly or indirectly are:
The ultimate beneficiaries of the project would be the global community as the conservation biological diversity within tropical forests will benefit all. If the techniques and tools prove to be adequately rigorous and easily applicable, they can be adopted by all forestry management systems that have to deal with conservation of biodiversity while meeting sustainable development.

The beneficiaries of the long-term sustainability of the forests and conservation of biological diversity would include all parties. The direct beneficiaries would be the Malaysian State and Federal Forestry Departments, PITC and FRIM, as well as all GEF OP3 projects, both on-going and planned.

FRIM will be able to enhance its knowledge and capacity in carrying out assessment of biodiversity, predicting impacts of management on biodiversity and developing models to predict biodiversity changes related to current management practices. The Forestry Department and PITC will also be able to utilize relevant methodologies developed to enhance its capacity to manage the forest in a manner that promote sustainability and facilitate the concession to be certified following the existing guideline on the best forest management practices.

Indirect beneficiaries would include research institutions, academicians, conservationists, forest communities, environmental NGO's, nature lovers and the public at large. Although the project is being implemented in Malaysia, the results and technologies developed could be easily adapted and applied to many other tropical countries.

Stakeholder Participation in Project Design:

In the formulation of this project during the PDF phase, due consultations with stakeholders were undertaken. Two consultations were undertaken one at the beginning of the PDF-b phase to introduce the project to stakeholders and obtain their input in the project formulation and one towards the end to present the formulated project for their comments and support. The First Stakeholders' Consultation for the Project was held in Ipoh, Perak on 26 April 2001. The Consultations began with a welcoming address and theme paper presentation by Y. Bhg. Dato' Dr. Abdul Razak Mohd. Ali, Chairman of the Project's National Steering Committee and Director General of FRIM. Subsequently, two other papers clarifying the background, scope and aim of the proposed project were presented at the Stakeholders' Consultation followed by three working group discussions between the stakeholders and finally a presentation and discussion of the working group outputs.

The Consultation was attended by a total of 51 participants from 26 agencies (Table2) representing government departments, non-governmental agencies, private sector, local communities, and universities. In addition, two representatives from United Nations Development Programme and three consultants from Harvard University, USA was also in attendance.

The stakeholders have shown support for the project and provided valuable information for its formulation. They have together identified all relevant stakeholders, their roles and activities as well as linkages with one another. At the same time they discussed amongst themselves and

identified the actual and potential threats to biodiversity conservation in Malaysia and Perak. At the same time they also provided information on the causes of these threats, their consequences and the management options to address these threats. This information was very valuable was referred to during the Logical Framework Analysis Workshop for the development of the problem tree and objective tree and subsequently the formulation of the planning matrix.

The Second Stakeholders' Consultations was held on 13 June 2002 Kuala Lumpur. It was again attended by all major stakeholders. A detailed presentation of the project activities and outputs were presented by FRIM to the stakeholders and very positive comments and feedback were obtained and was subsequently used to improve the project proposal. Advice and directions were also given to ensure the project is implemented smoothly when it is realised.

In both consultations, the local indigenous communities, the *orang asli*, were represented. It is useful to note during the field audit of the forest management certification evaluation on the forest concession area of PITC, conducted under the auspices of the SCS Forest Conservation Programme in 2001, it was found that there are no outstanding land claims by the *orang asli* on the concession area and generally, harvesting on the PITC concession has been viewed as favourable as it allow better access for the harvest of rattan.

A representative of the *orang asli* community will be invited as a member of the National Steering Committee, to ensure that the views of the community are represented.

Table 2: Agencies and interested parties included in the stakeholders consultations include:

Categories	Agencies/Interested Parties
Government Agencies	1. Perak Forestry Department 2. Forestry Department Headquarters Pen. Malaysia 3. Wildlife Department and National Parks 4. Ministry of Culture, Arts and Tourism (MOCAT) 5. Department. of Environment 6. Department. of Fisheries Malaysia 7. Drainage and Irrigation Department Malaysia 8. Economic Planning Unit 9. Ministry of Primary Industries Malaysia 10. Aborigines Affairs Department Malaysia 11. Forest Research Institute Malaysia
Logging Concessionaire, Timber Industries	1. Perak Industrial Timber Complex 2. Perak Timber Traders Association 3. Sawmillers Association Perak 4. Bumiputra Loggers Association Perak 5. State Economic Development Cooperation, Perak 6. Banding Island Resort, Perak 7. Mabelo Enterprise (Tours)
Categories	**Agencies/Interested Parties**
Local Communities	1. Orang Asli Community, Grik, Perak 2. Orang Asli Association
Non-Governmental Organisations & Universities	1. WWF Malaysia 2. WWF Perak 3. Malaysian Nature Society 4. University Putra Malaysia
International	1. UNDP, Kuala Lumpur 2. Harvard University, USA

Eligibility under the CBD:

There are several areas under the CBD where this project can easily be eligible. Some of these are as follows:

Article 6. General Measures For Conservation And Sustainable Use

(a) Develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes which shall reflect, inter alia, the measures set out in this Convention relevant to the Contracting Party concerned; and
(b) Integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.

Article 7. Identification and Monitoring

(a) Identify components of biological diversity important for its conservation and sustainable use having regard to the indicative list of categories set down in Annex I;
(b) Monitor, through sampling and other techniques, the components of biological diversity identified pursuant to subparagraph (a) above, paying particular attention to those requiring urgent conservation measures and those which offer the greatest potential for sustainable use;
(c) Identify processes and categories of activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity, and monitor their effects through sampling and other techniques; and

Article 8. In-situ Conservation:

b) Develop, where necessary, guidelines for the selection, establishment and management of protected areas or areas where special measures need to be taken to conserve biological diversity;
(c) Regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use;

(e) Promote environmentally sound and sustainable development in areas adjacent to protected areas with a view to furthering protection of these areas;;

Article 10. Sustainable Use of Components of Biological Diversity

(a) Integrate consideration of the conservation and sustainable use of biological resources into national decision-making;
(b) Adopt measures relating to the use of biological resources to avoid or minimize adverse impacts on biological diversity;

Article 12. Research and Training

(a) Establish and maintain programmes for scientific and technical education and training in measures for the identification, conservation and sustainable use of biological diversity and its components and provide support for such education and training for the specific needs of developing countries;
(b) Promote and encourage research which contributes to the conservation and sustainable use of biological diversity, particularly in developing countries, inter alia, in accordance with decisions of the Conference of the Parties taken in consequence of recommendations of the Subsidiary Body on Scientific, Technical and Technological Advice; and
c) In keeping with the provisions of Articles 16, 18 and 20, promote and cooperate in the use of scientific advances in biological diversity research in developing methods for conservation and sustainable use of biological resources

Article 14. Impact Assessment and Minimizing Adverse Impacts

(b) Introduce appropriate arrangements to ensure that the environmental consequences of its programmes and policies that are likely to have significant adverse impacts on biological diversity are duly taken into account;
(c) Promote, on the basis of reciprocity, notification, exchange of information and consultation on activities under their jurisdiction or control which are likely to significantly affect adversely the biological diversity of other States or areas beyond the limits of national jurisdiction, by encouraging the conclusion of bilateral, regional or multilateral arrangements, as appropriate;

Article 17. Exchange of Information

1. The Contracting Parties shall facilitate the exchange of information, from all publicly available sources, relevant to the conservation and sustainable use of biological diversity, taking into account the special needs of developing countries.
2. Such exchange of information shall include exchange of results of technical, scientific and socio-economic research, as well as information on training and surveying programmes, specialized knowledge, indigenous and traditional knowledge as such and in combination with the technologies referred to in Article 16, paragraph 1. It shall also, where feasible, include repatriation of information.

Article 18. Technical and Scientific Cooperation

1. The Contracting Parties shall promote international technical and scientific cooperation in the field of conservation and sustainable use of biological diversity, where necessary, through the appropriate international and national institutions.
2. Each Contracting Party shall promote technical and scientific cooperation with other Contracting Parties, in particular developing countries, in implementing this Convention, inter alia, through the development and implementation of national policies. In promoting such cooperation, special attention should be given to the development and strengthening of national capabilities, by means of human resources development and institution building.
3. The Contracting Parties shall, subject to mutual agreement, promote the establishment of joint research programmes and joint ventures for the development of technologies relevant to the objectives of this Convention.

Eligibility for GEF Financing:

The project is eligible for GEF assistance under Operational Programme 3, and will generate substantial global benefits.

Implementation and Execution Arrangements:

Management Structure

The project will be implemented by the Forest Research Institute of Malaysia. A National Steering Committee (NSC) will be established to govern the implementation of the project. The NSC will provide guidance on matters pertaining to the implementation of the project and ensure that the project is directed towards achieving its intended goals. It will enable the coordination of different agencies involved in the project.

The members of the National Steering Committee (NSC) will be as follows: Director-General, FRIM, Ministry of Primary Industries Malaysia, Ministry of Science, Technology and Environment, Economic Planning Unit, Forestry Department HQ Peninsular Malaysia, Forestry Department of the State of Perak, Perak State Economic and Development Corporation, representatives of the local communities and UNDP Malaysia

At the same time an International Advisory Panel (IAP) will also be established to give advice on technical matters and facilitate the dissemination and management of knowledge.

A national Technical Working Group (TWF) will be established to provide advice on technical issues as well as to provide the linkage with State Forestry Department decision making processes.

The terms of references (TOR) for the NSC, TWG and IAP are enclosed as Annex I

The organization structure of the project is shown in Figure 3.

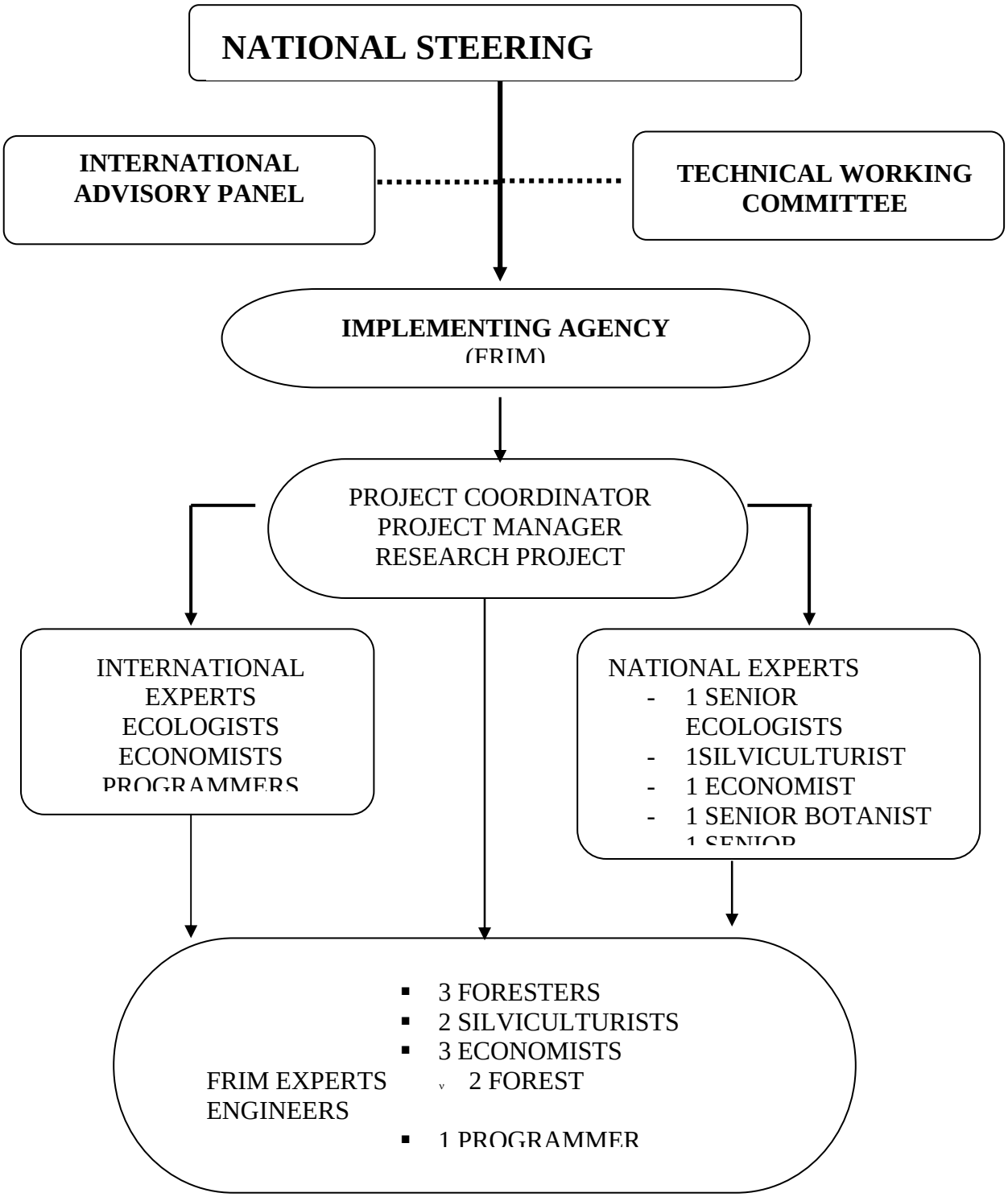
Future Operations and Maintenance

The initiation and subsequent implementation of the activities of the project will be contingent upon the timely provision by the Malaysian Government through the Implementing Agency, FRIM, of the adequate facilities and services, including secondment of staff, required for the effective operation of the project. The equipment, components and materials acquired for the project will be the responsibility of the Implementing Agency, FRIM, which at the completion of the project will decide on its disposal in conformity with UNDP procedures.

The thrust of the project deals with research on biodiversity of the natural forests. The project is expected to complement and supplement other research projects being undertaken by FRIM especially the proposed joint FRIM-GEF project. The project would have implemented all the

research activities, and local capacities would have been enhanced to a level that subsequent application of the results could be undertaken using local input. However, the nature of the research being complex and exploring into new areas in biodiversity impact assessment and prediction using modeling techniques may open new aspects that needs to be further investigated or enhanced. For this, if expertise is required, FRIM will submit a new project proposal for GEF's consideration. It should be mentioned here that data collection of plots established within the project will have to be continued to further strengthen the model developed as a 3-4 year data collection period for biodiversity assessment may not be sufficient to provide reliable information on changes to the residual forest stand. It is well known that different animals respond differently to disturbances. Some may recover immediately after the disturbances, while some may even prosper, while others may temporarily move to another area that are less disturbed and return only after several year, and yet others may disappear altogether. In this regard, depending on the situation at the end of the project FRIM may request assistance in the form of a much smaller grant for supporting such activities.

FIGURE 3. ORGANISATIONAL CHART



Incremental Costs:

The total project cost amounts to USD 5.804 million of which the incremental costs to be financed by the GEF amount to USD 2.261 million excluding preparatory assistance. Co-financing amounting to USD 3.443 million has been leveraged, reflecting the fact that the project will generate domestic in addition to global benefits. The full incremental cost analysis (including the Incremental Cost Matrix) has been appended as Annex II. This analysis has been undertaken in close consultation with the Government of Malaysia and represents an agreed estimate of total project costs.

Budget:

The budget for the project is summarised in the table below (USD million).

	GEF	**GoM**	**Universities ***	**ITTO****	**Private sector**	**Total**
Output 1	0.594	0.738	0.192	0.3130	0	1.836
Output 2	0.450	0.603	0.190	0	0	1.242
Output 3	0.270	0.141	0.148	0.206	0.047	0.812
Output 4	0.948	0.826	0	0.39	0	1.813
Total financing requirements	2.261	2.307	0.530	0.558	0.047	5.704

Totals might not add up because of rounding

* Harvard University and University of California at San Diego (UCSD), USA

** To be confirmed

Based on the budget the total amount of efforts in terms of percentage for the different outputs are 32%, 22%, 14%, and 32% respectively. This is expected as output 3 involves model development and uses the information collected through assessment tools developed in outputs 1 and 2. Although the model development represents a very crucial output of the project, the output 1 and 2 are necessary and important in ensuring that output 3 is achievable. In this respect, similar to most modelling exercises, the efforts required in acquisition of reliable and cost effective information are the most time consuming and expensive. For this targeted research project outputs 1 and 2 are not just data collection activities but include development reliable and efficient tools in assessing and valuation of biodiversity.

Risks and Sustainability

Project Risks

There are several potential risks to project success, but none is perceived to be of such high probability as to endanger project implementation or continuation. Risks have been anticipated through the project's evolution, and measures have been taken to reduce their impact. The risk on the successful implementation of the project is considered low as it conforms to the national goals and aspirations in managing the forests on a sustainable basis. In this regard, the project has the support of the major stakeholders including the Forestry Department, PITC as well as other relevant government agencies and NGOs. The scope and activities of the project have been well defined, encompassing the logistic support from the host country and firm commitment from renowned experts both at local and international research institutions and universities.

Although developing a new assessment tool for biodiversity is associated with certain risk, additional data collected from other projects exists to support the building of the models. This includes the 50-ha demography plots in Pasoh and Lambir where complete enumeration of all vegetation, are available. The model is designed to provide good estimate with reasonable amount of existing data. In the present project, the data collected is minimised, as they will be generated by various small studies scattered at different locations. With this flexibility the model developed may be of practical use in the developing tropical countries where extensive data is still lacking. The accuracy of prediction will improve with increase in the extent and reliability of data collected. Therefore flexibility and greater sensitivity of the model to data inputs remains the key factor for positive outcomes of this project.

A more detailed risk analysis and response strategy will be developed doing the project document formulation stage.

Sustainability:

Institutional Sustainability

FRIM is the national agency for forestry research in the country. It started as the Forest Research Institute under the Forestry Department as early as 1929. In 1985, the Malaysian Forestry Research and Development Board Act was passed which allowed the Institute to change its status to that of a statutory body called Forest Research Institute Malaysia (FRIM). This was to enable the Institute to serve a Malaysia-wide clientele and interact better in an international context. FRIM is now responsible to the Malaysian Forestry Research and Development Board (MFRDB), which in turn is responsible to the Ministry of Primary Industries. FRIM has extensive linkages with national & international agencies such UNDP, FAO, IPGR. ODA, NIES, JIRCAS, CIFOR, ITTO and DANCED.

FRIM today has the facilities and expertise to provide technical services to the industries in addition to the research and development activities that it was established to carry out. For the forest products industries, FRIM provides a range of testing, consultancy, advisory, training and technology diffusion services to assist in the manufacturing and utilization of wood and non-wood based products. Many of these laboratories and experimental plants are equipped with commercial size equipment and machines, some of which are not available elsewhere in Malaysia. These facilities are accessible to the wood users and entrepreneurs via various means, such as joint research, demonstrations, training and production trial runs.

FRIM has with her a commendable Library, Herbarium, and arboreta that often been an important source of reference for both local and international scientists. FRIM also has a strong workforce representing almost all fields expertise related to natural forest management, plantation forest management, forest environment and biodiversity, medicinal plant, timber technology, non-timber forest products, and economy. The total number of staff within FRIM amounts to 556, of which 151 are research officers. There are all together 64research officers qualified with a Master Degree and 56 with Doctorate in various fields. In addition another 11 and 28 officers are currently undergoing their Masters and Doctorate training programmes respectively.

Institutional sustainability will also be ensured by the linkages created between the project, FRIM and the State and Federal Forestry Departments.

Although the "designated institution" for the project is FRIM, the Ministry of Primary Industries will be the Executing Agency – assuming overall responsibility and accountability. The MPI is home to both FRIM and the Forest Department, providing a direct link between research and policy formulation that is based on existing government structures (thereby increasing sustainability). The Federal Forest Department also provides an institutional avenue to link the project research activities into the Perak State forestry planning processes.

In addition, the test site, PITC, is a subsidiary of the Perak State Government's economic arm called the State Economic Development Cooperation (SEDC). Therefore it is the expectation that the SEDC will be constantly engaged in the project activities.

The linkages with state level policy makers will be further strengthened by the fact that the Directors of the Perak State Forestry Department and the SEDC will be members of the National Steering Committee.

Furthermore the Forest Department (Federal) will be the Chair of the Technical Working Group, which also includes the State Forestry Department.

Financial Sustainability

FRIM's research is mainly obtained from the Federal Government through the Intensive Research Priority Area (IRPA) grants, although it does get research grants from other local and international donors In this respect the Institute is financially very stable. For the period 1996-1999 the funding (US$ million) received are as follows:

Sources	***1994***	***1995***	***1996***	***1997***	***1998***	***1999***
Operating	4.11	4.74	5.76	4.76	4.74	5.03
Development	2.71	2.11	0.16	2.29	1.84	1.92

IRPA	1.05	1.0	.58	1.05	1.08	1.0
Total	7.87	7.85	6.5	8.10	7.66	7.95

Monitoring, Evaluation and Lessons Learned

Monitoring and Evaluation:

The overall progress of the project implementation in will be monitored through the NSC of which UNDP as the GEF implementing agency is a member. Annual progress reports will be prepared by Project Coordinator and submitted for to the NSC for consideration. The Project Coordinator will be responsible for the preparation of the reports. He will be guided by the NSC, as to what detail the report should be. In addition a final terminal report will be prepared by FRIM at the end of the project for submission to the UNDP.

The project will be monitored by UNDP/GEF through the annual progress reports submitted through the NSC. The first monitoring mission could visit the Implementing agency and the project location soon after the submission of the first progress report. The date and mode of the evaluation will be determined jointly by UNDP and the executing agency. The NSC will determine the terms of reference for the evaluations. An independent final evaluation will be scheduled no later than three months before the end of the project. A Terminal Tri-Partite Evaluation will be scheduled upon project termination and UNDP, may, at its discretion, schedule additional independent evaluations if deemed necessary.
The monitoring of the technical aspects in terms of research outputs, data collection and analysis, completion of technical reports will be undertaken by the project secretariat, with guidance from the International Advisory Panel members. Progress of the implementation of each activity will be reported and discussed at the IAP meetings. Progress of the implementation of each activity will be reported and discussed at the TWG. Progress reports will be submitted by relevant research project leaders to the TWG regularly.

All activities stipulated in this project document will be implemented accordingly. However, should there a need to make changes or modifications to any provisions or agreed activities, the Project Coordinator should get the endorsement of the NSC to do so. The NSC is also in a position to direct the Project Coordinator to make any necessary changes or modifications to the project

Lessons Learned

The project enabled a look of the current situation of biodiversity conservation in the context of forest planning and management in Malaysia. This involved not only the perspective of the Forestry Departments as custodians of the forests and FRIM as the national forest research

agency, but also the views of other major stakeholders and interested parties. Several informal meetings and discussions have also been undertaken with these parties in the course of developing the proposal. In all these consultations the following salient points have been raised:

- Current management practices (particularly harvesting) have a negative impact on the long-term sustainability of the forest ecosystem.
- There is a lack of information on the status of biodiversity and their roles and linkages with the each other and the maintenance of the integrity of the forest ecosystem.
- There is a need to have greater incorporation of biodiversity conservation considerations into the current forest planning and management procedures
- There is lack of understanding on the biological diversity of our forests, their roles in maintaining the integrity of the ecosystem and what are the short and long term impacts of management on them.
- There needs to be more consultations with interested by parties and in their inputs be included in the overall planning and management strategies

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b) Perak Integrated Timber Complex

c) Forestry Department Headquarters

d) FRIM

Annex I

Terms of Reference for the National Steering Committee

It has been stated in the Project Document for the GEF Project on "Conservation of Biological Diversity Through Improved Planning and Management Procedures" that a National Steering Committee (NSC) will be established to provide the overall guidance to the implementation of the project. The Chairman of the Project Steering Committee will be the Secretary General of the Ministry of Primary Industires Malaysia and co-chaired by the Director General of FRIM. Its members will consists of representatives of relevant agencies in Peninsular Malaysia, and UNDP as the implementation agency for the GEF. The Director of Natural Forest Division of FRIM as the overall coordinator for the Project will be secretary of the NSC. The NSC will consist of members of the following agencies/institutions:

1. Secretary General - Chairperson
   Ministry of Primary Industries Malaysia

2. Director General - Co-Chairperson
   Forest Research Institute Malaysia

3. Director General
   Economic Planning Unit
   Prime Minister's Department

4. Secretary General
   Ministry of Science, Technology and Environment

5. Director General
   Forestry Department Headquarters Peninsular Malaysia

6. Director
   Perak State Forestry Department

7. Director
   State Economic Development Cooperation of Perak

8. Representative
   Orang Asli Association (local communities)

9. Resident Representative
   United Nations Development Programme
   Kuala Lumpur

The NSC will meet regularly to oversee the implementation of the Project. They will meet at least twice a year and have the following responsibilities:

1. Provide Policy guidance on matters pertaining to the implementation of the project

2. Monitor and evaluate the implementation of the project towards fulfilment of the objectives stated in the project document

3. Coordinate and manage overall project activities and budget

4. Review and comment on each years proposed work plan and budget

5. Initiate remedial actions to overcome all constraints in progress of the project

6. Review and approve relevant changes to the project design

7. Coordinate the roles of the various organisations involved in the execution of the project and ensure harmony with related activities.

8. Review and approve progress and technical reports

9. Establish a Technical Committee to oversee technical details related to the project

10. The NSC operates and makes decision by consensus.

Establishment of an International Advisory Panel (IAP)

In view that the project involves aspects in the development of state-of-the-art methodologies and techniques related good management and conservation of forest resources, an International Advisory Panel will be established.

The Chair and the other members of the IAP will be identified during the formulation of the UNDP project document.

The Chair of the IAP may invite additional experts to attend the meeting sessions of the IAP, where their technical inputs will be beneficial to the successful implementation of the project. The IAP will meet at least one each year and will have the following responsibilities:

1. Assist the project staff and consultants in the implementation of the Project's activities and ensure that related activities remain directed towards the project's goal and objectives;

2. Promote effective collaboration and support from relevant international agencies and individuals to ensure smooth implementation of the project activities at the technical level;

3. Provide technical input and advice to the project staff and ensure that outputs are relevant in solving practical problems and contribute to the project implementation; and

4. Ensure that knowledge management and dissemination activities reach a global audience, including advocating project outputs and outcomes to appropriate forest managers and policy decision makers.

Establishment of a Technical Working Group (TWG)

A national level Technical Working Group (TWG) will be established to assist the NSC in monitoring and controlling the technical implementation of the project and the activities. The TWG will act as the technical advisors to the NSC, and ensure that the project work will link into State and Federal forestry planning processes.

The tentative members of the TWG are as follows. This will be confirmed in the first National Steering Committee meeting.

Federal Forestry Department (Chair)

Perak Integrated Timber Complex

Forestry Department HQ Peninsular Malaysia

State Forestry Department, Perak

Wildlife Dept. & National Parks

University Putra Malaysia

University Kebangsaan Malaysia

Aborigines Affairs Department

Malaysian Nature Society

Worldwide Fund for Nature (WWF)

Responsibilities of the TWG include:

1. Reporting to the NSC on the technical progress of the Project and research activities in the project area;

2. Advising the NSC on the technical aspects of the implementation of the project;

3. Reviewing and reconciling all relevant technical reports and information produced by the project; and

4. Ensuring that the research remains relevant to State and National forestry planning processes.

Annex II

Incremental Costs and Global Environmental Benefits

Broad Development Goals

The goal of the project is to conserve biological diversity of tropical forest ecosystems through improved forest planning and management procedures. The project will contribute towards realisation of goals and strategies stated in the National forest policy and National Policy on Biological Diversity with emphasis on improvement of the knowledge base, strengthening of institutional framework, and integration of biological diversity considerations into sectoral planning.

Global Environmental Objective

The project will enable the conservation of globally significant biodiversity through the development of tools and methods for assessing and valuing biological diversity in a landscape that includes timber production forests. The project will also develop models to assist planners and managers to allocate those forests between production and protection categories in order to maximise biodiversity, while achieving timber management goals. The tools and models although developed in Malaysia can also be adopted and adapted by other tropical countries and thus promote the conservation of biodiversity not only in Malaysia but also globally.

Baseline Scenario

The baseline scenario for this project is that forest planning in tropical regions will continue to depend upon expensive, time- and data-intensive biodiversity assessment and valuation methods. As a consequence biodiversity values (including biodiversity of global significance) will not be incorporated into developmental decision-making in an efficient manner. Inadequate valuation of biodiversity in developmental decision-making will continue to result in inefficient (generally sub-optimal) allocation of forest resources to conservation.

At the site level the baseline scenario is that forest resources in Perak (particularly the PITC forest concession and nearby forest reserves such as Belum and Temenggor) will continue to be managed according to conventional forestry management practices in Malaysia. Biodiversity assessment activities will be limited to the existing National Forest Inventory and concession-level timber surveys undertaken by timber concessionaires. Little or no valuation analyses will be conducted, and as a result decision-making on allocation of forest areas to conservation versus production will be driven by subjective assessments and policy imperatives rather than formal, informed allocation mechanisms.

GEF Alternative

The GEF Alternative scenario builds upon baseline activities both on-site and within the research realm by facilitating the development of tools to better assess and value biodiversity in tropical forests. Development of these tools will be built upon extensive field biodiversity assessments in the project area, surveys and valuation studies of individual preferences and experimentation with varying harvesting approaches and regimes. Computer modelling and simulation will also be extensively used.

The tools to be developed will be simple, cost-effective and easily-deployed in tropical forest countries. In situations where decisions have to be made on the basis of incomplete or inaccurate data (i.e. where the cost of collecting accurate, comprehensive data is prohibitive) the tools to be developed will allow decision-makers to understand the level of precision being sacrificed, thereby allowing informed decision-making even in the presence of inadequate baseline data.

The GEF alternative also will include activities to enhance and share knowledge between the project, other research institutions and decision makers, on the use of the tools and methodologies that will be developed. This will contribute towards the sustainability and replicability of the project outputs.

Incremental Costs

The incremental cost of the GEF Alternative is USD 5.704 million, of which the request to the GEF is for USD2.261 million. The GEF request will be used to finance project activities and outputs which contribute most directly to global benefits, particularly in the development of tools, methodologies or systems which applicable to sustainable management of tropical forests throughout the world, as well as the generation and dissemination of the tools and best planning and management practices.

USD3.443 million of the GEF Alternative will be required to address Sustainable Baseline activities, and these funds will be sourced from national sources as well as support from overseas research organisations and multilateral donors.

The Government of Malaysia, through research grants funded out of the 8th Malaysia Plan budget and the Timber Levy Fund will provide cash co-financing of $0.340 million. In addition, the Government of Malaysia will provide a total of USD 1.967 million to cover the costs of national consultants, the project support unit and the rental of office space.

A project proposal had been submitted for the consideration of the International Tropical Timber Organisation (ITTO). The proposal is currently in the second and final stage of technical screening, and a response from the ITTO Council is expected by the end of 2003.

This project has benefited from strong support from the host of the project site, the Perak Integrated Timber Complex (PITC). Much of the PITC's invaluable support has been in-kind during the preparation of the GEF project brief, and the project team has been given assurance that this support will continue during the project itself. In addition, PITC will also provide cash co-financing of USD 0.05 million. There is a further, and more substantial contribution from PITC as they will consider the implementation of the new cutting regimes, on a pilot basis, and this could considerably affect their revenue. This indirect, but

nevertheless crucial support has not be quantified and therefore not included in the incremental cost analysis.

The Universities of Harvard and UCSD (University of California at San Diego), which have been actively involved in the PDF B would provide co-financing of USD 0.530 million.

A breakdown of global and national benefits and attendant costs by project output is provided in the Incremental Cost Matrix below:

Incremental Cost Matrix

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
Output 1.1: Efficient statistical methods for estimating biodiversity from small samples	Baseline	0.210	Limited existing research on application of species-area relationships to the estimation of tropical forest tree diversity.	No existing research on application of species-area relationships to estimation of tropical biodiversity.
	GEF Alternative	0.627	Improved methods for extrapolating diversity from small area samples, allowing minimal variance in diversity estimates of a large area from a given number and size of smaller sample areas.	More accurate methods for diversity estimation from small sample sizes reduces cost of estimating biodiversity in tropical forest areas, and in other ecosystems more generally. Improved identification of beta-diversity allows identification of unique ecological communities for special conservation attention.
	Increment	GEF: 0.116 GoM: 0.147 Universities: 0.106	Preliminary research on estimation methods carried out. Optimal statistical models for identifying beta-diversity developed to improve sampling protocols.	Existing preliminary research on estimation methods further advanced. More accurate diversity estimation models developed. Beta-diversity identification improved to allow identification of unique ecological communities

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
Output 1.2: Improved methods for assessing biodiversity within and between forest community types	Baseline	0.181	No existing system for automated assessment of species richness.	Satellite-based forest community identification currently undertaken by visual analysis of satellite data. Identification requires skilled analysts using subjective skills and experience. No existing statistical systems for large-scale biodiversity assessment using satellite data for tropical forest areas.
	GEF Alternative	0.510	Automated species richness assessment using computerised pattern recognition reduced need for skilled staff.	Statistical procedures developed for large-scale analysis of high-resolution satellite data, allowing large-scale, low-cost biodiversity assessment of tropical forests using remote sensing technology.
	Increment	GEF: 0.020 GoM: 0.290 Universities: 0.018	Statistical procedures which can be applied to the extrapolation from selected samples	Satellite data studied and compared with field survey data using multivariate statistical methods, to develop algorithms for discriminating forest community type from remote sensing data.

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
Output 1.3: Improved understanding of the impacts of logging on biodiversity in logged forests and in adjacent or enclosed un-logged forests	Baseline	2.619	Limited understanding of biodiversity and hydrological resources within the project study area inhibits development of planning and valuation models.	Limited understanding of the role and impact of local refugia on recovery of biodiversity in logged-over forests., resulting in sub-optimal design and planning of refugia/ set-aside within production forests.
	GEF Alternative	3.717	Improved understanding of biodiversity and hydrological resources within the project study area to provide adequate data for development of planning and valuation models.	Enhanced understanding of the role of refugia in regeneration of biodiversity in logged-over forest, resulting in better planning and allocation of set-asides within logging concessions and forest landscapes.
	Increment	GEF: 0.446 GoM: 0.284 Universities: 0.055 ITTO: 0.313	Biodiversity and hydrology of the project study area (PITC concession and Temenggor and Belum Forest Reserves) assessed through plot sampling of selected taxa and hydrological monitoring at selected stations..	Biodiversity assessments of varied refugia (different-sized virgin jungle reserves and adjacent harvested areas) to determine impact of refugia on biodiversity regeneration, resulting in more efficient allocation of VJRs and other set-asides within forest management planning. Conservation monitoring system contributes to better management and understanding of forest biodiversity

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
Output 1.4: Manuals that explain how to implement the ecological assessment methods developed	Baseline	0	Limited manuals and training aids on how to implement the biodiversity assessment methods	Limited manuals and training aids on how to implement the biodiversity assessment methods
	GEF Alternative	0.047	Manuals produced based on the findings in Outputs 1-1-1.3	The manuals produced are targeted for GEF OP3 project managers and their host governments and will be used in the activities under Output 4 of this project, fulfilling the need for knowledge dissemination and exchange of information.
	Increment	GEF: 0.013 GoM: 0.016 Universities: 0.018	Manuals can be used to train Malaysian State Forestry Department personnel	Manuals used for dissemination of information to other GEF OP3 project managers.

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
Output 2.1: Detailed, "benchmark" models that relate economic values associated with biodiversity to ecological and socioeconomic factors that influence those values	Baseline	0.596	Limited data on socio-economic values of biodiversity resources, recreational use and existence values of tropical forests in the study area. No measurement of the impact of changes in forest cover on the hydrological regime in forest areas, or the economic costs associated with such hydrological changes. Genetic resources in forest areas not adequately valued.	Time- and cost-effective sample methods are available but their accuracy is uncertain. Lack of accurate estimates on economic costs of hydrological degradation results in non-optimal decision-making in forest and watershed management. Inaccurate estimation of value of genetic resources in tropical forest results in inefficient allocation of forest area between conservation and logging.
	GEF Alternative	0.468	Comprehensive socio-economic surveys provide baseline data for valuation studies, and allow estimation of the accuracy of periodic surveys. Landscape-level model accurately predicts economic impact of hydrological changes caused by changes in forest cover. Economic value of genetic resources in forest areas better assessed.	Small sample surveys more accurately used to assess socioeconomic values of tropical forests. Hydrological costs of loss of forest cover more accurately factored into forest management decision-making. Potential value of genetic resources in tropical forest areas more effectively estimated and factored into decision-making.
	Increment	GEF: 0.307 GoM: 0.459 Universities: 0.106	Comprehensive weigh-day samples of non-timber forest product harvesting compared with data from periodic surveys to assess accuracy of latter method. Recreational use and existence values of forests valued using econometric modeling. Linked hydrological and economic models	Baseline socio-economic data and existing hydrological and ecological data used to develop economic models to more accurately value resources and functions of tropical forests.

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
			developed to predict economic impact of hydrological changes caused by forest loss.	
Output 2.2: Simplified models that relate economic values associated with biodiversity to ecological and socioeconomic factors that influence those values	Baseline	0.068	Baseline models developed under Output 2.1 are relatively complicated and time-consuming to generate.	Baseline models developed under Output 2.1 are relatively complicated and time-consuming to generate. Applicability to other developing/ less-developed tropical countries is limited.
	GEF Alternative	0.439	Relatively few simplified, 'quick-and-dirty' models developed. Data collection therefore remains costly and time consuming	Simplified, 'quick-and-dirty' models developed and tested to enable more widespread application of valuation models by less skilled staff using simpler data, for example in less developed tropical countries.
	Increment	GEF: 0.143 GoM: 0.144 Universities: 0.084	Construct and test models based on subsets of the data used in Output 2.1	Construct and test models based on subsets of the data used in Output 2.1 Evaluate applicability in other tropical forest contexts.

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
Output 3.1: Improved models for predicting biodiversity within and between forest community types, taking into account logging status and location	Baseline	0.568	Existing models for predicting biodiversity within and between forest community types are limited and inaccurate, and require extensive survey data.	Lack of summary or surrogate measures for biodiversity in tropical forests means that biodiversity assessments are expensive and time-consuming. Data on alpha and beta diversity in tropical forest areas is therefore limited, inhibiting effective management and conservation of tropical forest areas globally.
	GEF Alternative	1.180	Development and application of the biodiversity models generates landscape-level data on alpha and beta diversity for forests in Perak state as well as estimates of forest regeneration after logging.	Development of summary measures/ surrogates for biodiversity and forest community types simplifies biodiversity assessment of tropical forests throughout the immediate region and other tropical countries. Models to predict regeneration after logging will assist in estimating the longer-term impact of logging activities on biodiversity.
	Increment	GEF: 0.225 GoM: 0.089 Universities: 0.091 ITTO: 0.206	Develop statistical methods and models to relate measures of biodiversity and forest community type to forest characteristics, and to predict regeneration rate after logging.	Develop and test summary measures of biodiversity in tropical forests as well as models to predict regeneration of forest cover and biodiversity after logging.

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
Output 3.2: Improved forest planning model for predicting the impacts on biodiversity, and associated economic benefits and costs, of different allocations of forests in Perak between production and protection categories	Baseline	0.137	No comprehensive or accurate means of incorporating biodiversity values into forest planning in Malaysia. Forest planners currently take biodiversity into account in a subjective manner, without accurate economic estimates. Allocation of forests between production and protection is therefore sub-optimal for biodiversity conservation.	Globally-significant biodiversity values not adequately incorporated into forest planning and forest allocation decisions in tropical forest areas, due to a lack of simple, cost-effective and accurate methods of valuing biodiversity versus other forest uses.
	GEF Alternative	0.338	Biodiversity values more easily and accurately incorporated into forest planning and forest resource allocation, through the development of a computer-based forest planning model which incorporates biodiversity values.	Globally-significant biodiversity values more effectively factored into decision-making in forestry management in tropical forest areas, through the use of a comprehensive, computer-based forest planning model.
	Increment	GEF: 0.04 GoM: 0.053 Universities: 0.057 Private sector (PITC): 0.047	A dynamic optimization model developed and linked to the spatial database for Perak, to maximise biodiversity conservation values for a given set of timber management constraints.	Computer-based forest planning model developed which assists in forestry management in tropical forest areas, using simple and cost-effective survey data.

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
Output 4.1: Enhance the knowledge and capacity to assess impacts on biodiversity and modelling changes due to human intervention on forest stands.	Baseline	0.126	No formal mechanisms to disseminate the tools, methods and approaches developed by the project within the forest management sector in Malaysia	No formal mechanisms to disseminate the tools, methods and approaches developed by the project to forestry sector stakeholders regionally and globally.
	GEF Alternative	1.739	Training and capacity-building activities undertaken to disseminate project developments to forestry managers throughout Malaysia.	Formal counterpart training and information dissemination program developed and implemented to share project successes with all interested parties involved in managing tropical forests, especially GEF OP 3 projects.
	Increment	GEF: 0.948 GoM: 0.826 Universities: 0.039	On-the-job training and formal instruction programmes designed and implemented, research fellowship scheme established for local counterparts	On-the-job training and formal instruction opportunities provided for regional counterparts. Project website established and maintained to disseminate project information and outputs.
Total	Baseline Increment GEF Altern. PDF B	4.508 5.704 10.212 0.196		

ANNEX III

Logical Framework Analysis

"Conservation of Biological Diversity through Improved Forestry Planning and Management Procedures"

Project Strategy	Indicators of success:	Means of Verification:	Assumptions:
Goal: To conserve forest biodiversity resources and to use them in a sustainable manner	Independent evaluation of PITC and one other GEF OP3 pilot project concludes that the biodiversity value of the areas as a whole is significantly higher than those of comparable sites that have not applied the methodology, while the net financial benefits derived from the concession are equal to or greater than those from comparable sites.	Ex-post evaluation of PITC and one other GEF OP3 site undertaken in year 7	PITC and one other GEF OP3 project show continuous interest and support in implementing the tools developed

Development Objective: To strengthen the inclusion of biodiversity conservation considerations into tropical forest management decision-making	The tools developed for improved tropical forest management decision-making are being recommended by relevant international bodies by the end of the project. Tools are incorporated into the Government of Malaysia'sforest management policies by the time of the ex-post evaluation	International organisations' policy papers, web-pages, meeting reports GoM policy documents, 5-year plan, medium-term plan	Project has sufficient influence and reach to appropriate international bodies Project impacts and outputs coordinate with the policy-making cycle of GoM and can be incorporated.
Project Strategy	**Indicators of success:**	**Means of Verification:**	**Assumptions:**

Immediate Objective 1: To improve and disseminate biodiversity assessment tools	Tools are disseminated to all GEF OP3 (Forest ecosystem) projects. Tools are applied by 50% of relevant GEF OP3 projects by the end of the project	Survey undertaken as part of the terminal evaluation to assess the application and applicability of the tools developed under the project.	Capacity , willingness and budgetary capacity of GEF OP3 project teams to work together with their respective host governments to implement the tools, where relevant, and have sufficient funding to do so.
Develop the data collection, storage and reporting system that will be the foundation for ecological and planning models	Data management system developed by the end of Year 1. Number of agencies accessing the data management system	Software, database and manuals	Computerised system is implemented by the State Forestry Department
Enter existing data on biodiversity in Perak and other relevant sites into the system such as forest inventory and land use maps, detailed topographical and geological maps, using a standard data recording system	Standard data format used by 30% of relevant GEF OP3 projects by the end of Year 3. GIS database developed having all relevant information on Perak State, by end of Year 2.	GIS database and reports Feedback survey results from other GEF OP3 projects	State Government guarantees free and unlimited access to data. Universities and research institutions share data and co-ordinate on research activities Capacity and willingness of GEF OP3 project teams to use the data format, in accordance to their specific needs.
Output 1.1: Efficient statistical methods for estimating biodiversity from small samples			

developed			
Develop method that minimizes the variance in an estimate of diversity of a large area from a given number and size of smaller sample areas.	Methodology developed and used by at least 1 other GEF OP3 or other forestry research project, on a pilot basis by year 4.	Reports and evaluation from the PITC, Lambir and Pasoh and the other pilot site	Existing state of knowledge is sufficient to enable the project team to accurately prioritise biodiversity values. Need to identify early in the project the other GEF OP3 or other forestry research project having the funds and interest to apply these procedures on a pilot basis
Develop optimal statistical methods for identifying beta-diversity, the differences in species composition among several sample areas	Statistical methods developed and used by at least 1 other GEF OP3 or other forestry research project, on a pilot basis by year 4.	Reports and evaluation from the PITC, Lambir and Pasoh and the other pilot site	Existing state of knowledge is sufficient to enable the project team to accurately prioritise biodiversity values.
Output 1.2: Methods for assessing biodiversity within and between forest community types improved			
Develop a statistical procedure that can discriminate forest community types from satellite data.	Statistical procedures developed by year 3.	Test results from PITC concession and other project survey plots	High resolution satellite image data acquired
Output 1.3: Biodiversity on a landscape level assessed and understanding of the impacts of logging on biodiversity improved			

To assess the utility of local refugia of limited size contiguous with harvested sites for biodiversity recovery	Evaluation criteria for utility assessment developed by Year 2. Utility of local refugias for biodiversity recovery assessed. Research paper on the assessment method and results receives favorable peer review (in research seminar or similar) after the statistical analysis of data (i.e. by early Year 5)	Evaluation criteria Peer review of results of the assessment method and results	State Governments will establish local refugias.
Assess biodiversity in environmentally-sensitive areas	Biodiversity in environmentally-sensitive areas assessed	Assessment report on biodiversity in environmentally-sensitive areas	Existing knowledge will enable us to identify indicator group(s)
Integrate results of biodiversity assessment in both priority and environmentally-sensitive areas	Results of biodiversity in both priority areas and environmentally-sensitive areas integrated	Report on conservation areas	Existing knowledge will enable us to identify indicator group(s)
To assess the existing biodiversity of the study area and adjacent undisturbed areas	Biodiversity of study areas assessed	Assessment reports	Existing knowledge will enable us to identify indicator group(s)
Output 1.4: Manuals that explain how to implement the ecological assessment methods developed	User-friendly manuals developed and disseminated to all relevant GEF OP3 project teams. Tools are applied by 50% of relevant GEF OP3 projects by the end of the project	Software and manuals. Feedback from other GEF OP3 project teams	Manuals are used in to guide decision making by State Authorities Capacity and willingness of GEF OP3 project teams to use the data format, in accordance to their specific needs.

Immediate Objective 2: To improve and disseminate economic valuation tools	Tools are disseminated to all GEF OP3 (Forest ecosystem) projects. Tools are applied by 50% of relevant GEF OP3 projects by the end of the project	Survey undertaken as part of the terminal evaluation to assess the application and applicability of the tools developed under the project.	Capacity and willingness of GEF OP3 project teams to work together with their respective host governments to implement the tools, where relevant.
Output 2.1: Improved tools for rapid, accurate assessment of biodiversity developed			
Develop practical methods for estimating values of non-timber goods and services	Guidelines on practical methods for estimating values of non-timber goods and services developed, and disseminated to all relevant GEF OP3 projects by year 4. Guidelines used by at least 20% of GEF OP3 projects working in similar conditions.	Guidelines on practical methods Feedback from recipients and users of the guidelines	Respondents interviewed in the process of developing methods to evaluate values of NTFPs give reliable information. Valuation methods are used in decision making
Develop probability-based models for valuing genetic resources in Perak's forests as a source of "leads" for new pharmaceutical products.	Probability-based models developed by Year 3. Simplified version of the results of the models developed for decision makers, and presented to at least 5 Malaysian State Forestry Departments. Favorable peer review by at least 50% of relevant GEF OP3 project teams on the model by mid Year 4.	Software and manuals. Version of the model results specifically tailored for decision makers Feedback from relevant GEF OP3 project teams.	Models are used in decision making by State Authorities.

To compile data for constructing a landscape-level, statistical model that predicts the economic consequences of changes in hydrological functions caused by changes in forest cover	Landscape-level models developed Simplified version of the results of the models developed for decision makers, and presented to at least 5 Malaysian State Forestry Departments. Favorable peer review by at least 50% of relevant GEF OP3 project teams on the model by mid Year 4.	Software and manuals. Version of the model results specifically tailored for decision makers. Feedback from relevant GEF OP3 project teams.	Models are used in decision making by State Authorities Capacity and willingness of GEF OP3 project teams to use the data format, in accordance to their specific needs.
Output 2.2: Manuals, data sets, and software developed	User-friendly manuals developed and disseminated to all relevant GEF OP3 project teams. Tools are applied by 50% of relevant GEF OP3 projects by the end of the project	Software and manuals. Feedback from other GEF OP3 project teams	Manuals are used in to guide decision making by State Authorities Capacity and willingness of GEF OP3 project teams to use the data format, in accordance to their specific needs.
Immediate Objective 3: To improve and disseminate tools for integrating ecological and economic aspects of biodiversity into forest planning decisions at a landscape level	Tools are disseminated to all GEF OP3 (Forest ecosystem) projects. Tools are applied by 30% of relevant GEF OP3 projects by the end of the project The models are integrated into Malaysia's forest management practices and in at least five other countries where GEF is supporting forestry projects.	Survey undertaken as part of the terminal evaluation to assess the application and applicability of the tools developed under the project.	Capacity and willingness of GEF OP3 project teams to work together with their respective host governments to implement the tools, where relevant. Government of Malaysia will implement tools developed in the project
Output 3.1: Models for			

predicting biodiversity within and between forest community types improved			
Develop statistical models that relate measures of biodiversity and forest community type to forest characteristics (e.g., area, topography, geology, climate, canopy structure, years since logging in production forests).	Statistical models developed by end Year 2. Spatial diversity map produced by end Year 5 Results of models shared with all relevant GEF OP3 projects	Software and manuals Diversity map	Models are used in the decision making process
Output 3.2: Models for predicting impacts on biodiversity and associated economic costs and benefits developed			
To develop a model that will predict the regeneration of the forest structure and biodiversity in harvested forest.	Prediction models developed Tools are applied by 30% of relevant GEF OP3 projects by the end of the project	Software and manuals Feedback from other GEF OP3 project teams	Models are used in the decision making process Capacity and willingness of GEF OP3 project teams to work together with their respective host governments to implement the tools, where relevant. Interested GEF OP3 project teams are involved in the final stages of the development of the tool.
To develop a computer-based forest-planning model that will	Forest planning models developed	Software and manual	Models used by State Authorities in decision

assist forest planners in practical decision-making, especially decisions about the allocation of forests between production and protection categories.	Tools are applied by 30% of relevant GEF OP3 projects by the end of the project	Feedback from other GEF OP3 project teams	making Capacity and willingness of GEF OP3 project teams to work together with their respective host governments to implement the tools, where relevant. Interested GEF OP3 project teams are involved in the final stages of the development of the tool.
Immediate Objective 4: To enhance and disseminate knowledge and capacity in biodiversity conservation through improved forest planning procedures	Extent to which knowledge and capacity on tools are disseminated in the region, and outside the region.		Tools are used by other countries
Output 4: Knowledge disseminated and capacity built with the view of replicating improved forest planning procedures			
Hands on training for State and Federal Forestry Department counterparts, members of other research institutions and GEF OP3 projects internationally, to cover all the research tools being developed	Number of training courses undertaken Proportion of Malaysian participants should be > 50% Number of follow up measures undertaken in Malaysia as a result of the training	Training reports Post training evaluation	Strategic identification of trainees Follow up strategy drafted and implemented.

Develop a web-site, publications, scientific exchanges, fellowships, etc. to disseminate results of research, tools, manuals and procedures/techniques developed by the project at national, regional and international levels	Results of research, tools, manuals and procedures/techniques developed are disseminated Number of times the website is visited. Number of searches performed on the website. Number of queries on the project tools (target 30) and maximum delay before an information request is satisfied (target value 3 days)	Web-site, publications and reports on workshops, conferences, scientific exchanges, fellowships etc.	Website is adequately publicized.
Cross project learning visits	Number of visits from other GEF OP3 projects to Perak. Number of visits of project team to other GEF OP3 projects	Post visit report and report on follow up measures	Follow up strategy drafted and implemented.

Note 1: Prior to the STAP review, a peer review was carried out. Mr. William Maynard was commissioned to do the said review, based on his previous experience at the PITC concession as well as his tropical forest management experience. The comments made by Mr. Maynard as well as the responses to those comments informed the STAP reviewer, and have been incorporated into the brief. Further follow up will be done during the formulation of the project document.

Note 2: The response to the STAP review, as well as the revised project brief and executive summary was sent to the STAP reviewer on 11 July 2003, as requested by the GEF Secretariat. The second review received from the STAP reviewer is attached to this annex.

June 10, 2003

To: UNDP-GEF Regional Service Unit Asia and the Pacific

From: Roger A. Sedjo, Consultant

Subject: STAP Review of the proposed project **"Conservation of Biological Diversity Through Improved Forest Planning."** Special Service Agreement (SSA) for UNOSP project INT95R71

Introduction

This paper provides a Review of the proposed project **"Conservation of Biological Diversity Through Improved Forest Planning,"** which is of 5 year duration, implemented by the GEF and UNDP, and to take place in Malaysia with a focus on biodiversity.

The basic idea is a good one: to try to formally integrate biodiversity consideration into forest management, both for protected and for periodically harvested forest. To do this the researchers will develop tools that will enable forest planners in tropical countries to make more informed decisions about the allocation of forests between biodiversity protection and timber production categories and about way to integrate biodiversity conservation measures into timber management systems. Given this information more biodiversity friendly system of forest production and production forests may be developed in the future.

The choice of Malaysia as the country in which the work is to be undertaken appears to a good one. Malaysia has tropical forests that have both significant timber and biodiversity values. Also the country has a history of research in forestry and a literature that is probably as rich as any tropical country in the world. Additionally, there are high level in country human resources to work with, including FRIM. Finally, it appears that the project has substantial in country support.

The project is sensibly constructed for addressing its questions. It has three components: one ecological, one dealing with valuation or economics, and one integrating these factors into "computer based forest-planning models"

Although, as suggested above, many of the features of this proposal are positive, this project is not without substantial challenges. I view the objectives of this proposal as extremely ambitious. It appears to me that the likely outputs have probably been overstated in the proposal, especially when the authors talk about new "methodologies," and widespread applications beyond the region in which the "tools" are developed. The notion of developing "quick and dirty" short-cut guides to appropriate decision making that include timber, biodiversity and other forest values, while appealing, may not be attainable at this time.

I know of no area of the world where the types of "tools" that the proposal for development for the tropical forests of Malaysia have been developed and are commonly in use. I am familiar with a recent attempt (within the past 20 years) of a similar nature for the public lands of the U.S. The project objective was to develop simple rules to determine the appropriate multiple-use mix of outputs on the forest lands. The researchers eventually gave up on the idea of simple "rules of thumb," conceding that the complexities and heterogeneous nature of the full complement of relevant considerations made such an approach unworkable. The tropical forests of the developing world are likely to be even more complicated than the well studied forests of the US. This is not to say that the development of such an approach ought not be tried again, but it should be recognized that such an approach is likely to be very difficult and probably has not been successfully implement anywhere in the world. If the investigators know of a working paradigm, then that paradigm should be cited and it certainly should be used to inform the development of this project and should probably be used as a conceptual and working model for this project.

Overall, this project also appears to be a bit of a fishing expedition. Many interesting questions are raised and the additional data collected and analyzed are likely to yield some useful findings, which may lead to better decisions in the forests. This effort may be well worth doing if done be competent focused people and given sufficient time. Nevertheless, I find the notion that this project can generate a broadly operational system of easy to use low data requirement tools for evaluation biodiversity and trade-offs in tropical forests unlikely and oversold in this proposal.

Some Specific Points

Most of these points were raised by going through the approximately 17 pages of matrix in the proposal.

1. The proposal commonly its objectives as the development of methodologies. Throughout, however, the proposal actually calls for the using of existing methodologies to ask researchable questions or develop operational tools. I see little of what I would call the "development of methodologies" although tool development is a likely result.

2. The proposal regularly makes statements like "the tools developed by the project will be applicable to forests throughout Southeast Asia and in other tropical countries."
I doubt this. The critical component will be the empirical relationships that will be found via the data collection and analysis. The area of investigation in Malaysia is characterized in the

proposal as somewhat unique. It will probably be inappropriate to generalize these findings to other sites and conditions. Note here that the data and observations are drawn almost entirely from one somewhat unique site. It is problematical whether these findings from one site can creditably be extended to different sites, especially outside of the dipterocarp forests and in forests beyond SE Asia. Furthermore, the ecological issue, which is complex even within the traditional ecological perspective, becomes even more complex within the context of an ecological view such as that of Botkin's *Discordant Harmonies: A New Ecology for the 21st Century* (1990, Oxford University Press). I should note that Botkin's view of a much more complex and therefore more difficult to predictable forest ecological system has become widely accepted.

3. Ecological processes occur over time. The long term equilibrium relationship between a logging regime and local biodiversity cannot achieved in the 5 year time period of the project. Thus the time frame of the project is likely to provide a "snapshot" while the relevant phenomena that we need to understand is dynamic and intertemporal.
However, by utilizing the rather large volumes of earlier data together with data generated currently, it might be possible to make some useful long term inferences. I note that the proposal is somewhat dismissive of much of the earlier data.

4. Administratively, it is difficult to see how all the parts of this project fit. GTZ and NIES are mentioned and their expertise cited including satellite imagery. How would they be used? Through consultancy arrangements?

5. The discussion many places of the proposal concerning reducing the sample variance is perplexing and obscure. One way to do this would be to increase the sample size. Another is to use a priori information, e.g., in a rationale for data stratification. Is this what is envisioned? If so, it should be stated, if not, the approach needs clarification.

6. Simple, cost-efficient and easily deployed tools. Much of the proposal is really about collecting and storing new and more data. New approaches for storing and to some extent collection data are an excellent idea, but inadequate in itself of improving decisions.

7. There are places where the proposal seems to suggest that models will substitute for data. One needs data to determine how the world works. Abstract models alone are not sufficient. Models need verification.

8. Much of what is called "developed of methods" is simply the application of existing methods to data sets for a new sites.

9. Some tasks are asserted without much indication of how this might be done. For example "the utility of local refugias for biodiversity recovery will be assessed." Is there really a widely accepted scientific way to do this?

10. There are a number of well know techniques for valuing nonmarket outputs, most of these remain somewhat controversial and often the estimates obtained are not taken very seriously by policy makers. As described in the proposal, the physical volumes of many of the nontimber values will be measured, however, how the economic values will be estimated remains vague. In many cases local markets exist and would provide appropriate prices. However, valuation for

nonmarket outputs is likely to be more difficult. Are existence values to be determine by a Malaysian survey or a global survey? The literature suggests that the pharmaceutical values of the biodiversity is likely to be very modest. It may be more efficient to simply try to find least cost ways to prevent biodiversity destruction.

11. The statistical models that will related "biodiversity to the forest community" are likely to be of limited value when applied outside of the particular forest area in question. Recall, this forest area was characterized as somewhat unique.

12. Regeneration of the forest structure and biodiversity is largely an empirical question
A statistical model to predict regeneration is no better than the data. Also, regeneration of both trees and other forest biodiversity has an important intertemporal dimension. As noted above, it is not clear that the time period of the project, 5 years, is sufficient to give a adequately complete picture of regeneration over time.

Summary and Recommendations

Overall, I like many of the ideas found in this proposal. The ideal of trying to formally integrate biodiversity consideration into forest management, both for protected and for periodically harvested forest has a great deal of appeal. The notion of the development of tools that are broadly applicable in various tropical forests is also appealing and enhances the attractiveness of the proposal.

However, I doubt that many of these objectives can be achieved in the context of the proposed research. The proposal simply promises too much. While the activities of this proposal should add substantially to our knowledge of a specific tropical forest, and indeed probably provide very useful insights to many tropical forests generally, it is unlikely to provide tools of broad applicability without recalibrating them to the data (conditions) of other forests and regions.

Given this very major caveat, I still recommend proceeding with the project, particularly if very qualified professionals are involved.

Amendments made following the STAP review

Response to the STAP Technical Review Matrix

	STAP review issue	Response	Mention in amended project brief
	Introduction		
1	(page 1) I view the objectives of this proposal as extremely ambitious. It appears to me that the likely outputs have probably been overstated in the proposal, especially when the authors talk about new "methodologies," and widespread applications beyond the region in which the "tools" are developed. The notion of developing "quick and dirty" short-cut guides to appropriate decision making that include timber, biodiversity and other forest values, while appealing, may not be attainable at this time.	For the most part, we are indeed proposing to use well-established research methods to develop new tools, as the reviewer implies here and in point 1 below. Our use of the term "new methodologies" could thus be confusing. We note, however, that in the ecological literature it is common to refer to the development of "methodologies" (e.g., for assessing biodiversity) that can then be calibrated for use in different settings on the basis of small data samples in each different setting. This is exactly one of the project's goals, and is certainly attainable. Indeed, recent work (Plotkin et al, 2000, PNAS) has already improved our ability to predict tropical tree diversity on the basis of small samples in tropical forests ranging from Malaysia, to India, to Panama. To avoid confusion, in the rest of our comments we will use "tools" instead of "methodologies."	Page 21 first paragraph under Output 1.2: Efficient statistical methods for estimating biodiversity from small samples. The term "tool" has been now used throughout the brief to avoid any confusion.

2	(page 2) The tropical forests of the developing world are likely to be even more complicated than the well studied forests of the US. This is not to say that the development of such an approach ought not be tried again, but it should be recognized that such an approach is likely to be very difficult and probably has not been successfully implement anywhere in the world. If the investigators know of a working paradigm, then that paradigm should be cited and it certainly should be used to inform the development of this project and should probably be used as a conceptual and working model for this project.	Pertinent citations include Plotkin et al. (*PNAS*, 2000), Plotkin et al. (*J. Theor. Biol.*, 2000), and Plotkin & Muller-Landau (*Ecology*, 2003). These cutting-edge works are representative of the paradigm within which we will develop tools for assessing biodiversity.	Page 21 first paragraph under Output 1.2: Efficient statistical methods for estimating biodiversity from small samples
3	(page 2) Overall, this project also appears to be a bit of a fishing expedition. Many interesting questions are raised and the additional data collected and analyzed are likely to yield some useful findings, which may lead to better decisions in the forests. This effort may be well worth doing if done be competent focused people and given sufficient time.	As noted above, we are not claiming that we will be able to create a single system with low data requirements that is applicable in all tropical forests. Quite the contrary: we are proposing to develop a hierarchical set of tools, whose sophistication, data requirements, costs, and reliability will vary. Because we are seeking to develop <u>procedures</u> for assessing biodiversity, valuing biodiversity, and evaluating timber production-biodiversity conservation tradeoffs, not to identify guidelines that are universally applicable (such as, say,	Paragraph 2 and 3 under Project Strategy in page 15 Two activities, Activity 1.3.2 and 1.3.4 (old numbering), on the development of a telemetered digital photo trapping and the establishment of a genetic market database respectively have been excluded from the current brief

		"always protect x% of the landscape," or "the value of NTFPs is always $X per hectare"), the results of the research should be broadly applicable. That is, although in developing and evaluating these procedures we will collect and analyze data from a small number of specific sites, we are not in the end interested in those data or the findings that come from applying the procedures at those sites. Instead, we are interested in the procedures themselves, and what we learn about their reliability by pilot-testing them at specific sites. We do not believe we have "oversold" the research. Instead, we believe we may not have described it clearly	
	Some Specific Points		
4	(para 1, page 2) The proposal commonly its objectives as the development of methodologies. Throughout, however, the proposal actually calls for the using of existing methodologies to ask researchable questions or develop operational tools. I see little of what I would call the "development of methodologies" although tool development is a likely result.	We have addressed this point above. The issue to some degree revolves around semantics and lack of clarity on our part. By "methodology," we refer, for example, to the development of new ways to sample forests for estimating biodiversity: how much area to sample? where? when? We will answer these questions by collecting data in ways that are consistent with existing theory. The "tools" will be the practical, on-the-ground ways of implementing these methodologies	Project Strategy in pp 14 – 15 has been rewritten in order to clarify the scope of the proposed research. The section on Research methodology (pg. 15) has been added for further clarification. Throughout the brief, wording has been

	(para 8, page 3) Much of what is called “development of methods” is simply the application of existing methods to data sets for new sites.	Preliminary versions of these types of tools for estimating diversity of tree species have *already* been shown to be widely applicable throughout Southeast Asia as well as India and Panama! See Plotkin et al. (*PNAS*, 2000). As noted above, we are not interested in the “empirical relationships” developed in Malaysia, by which we understand the reviewer to mean such things as the relationship between the area of refugia within the PITC concession and the number of species in a particular taxonomic group with viable populations being maintained. Such a relationship may be of interest to Malaysian stakeholders, but the project aims at products that are of global value, not at products of value to Malaysia, since it is a GEF project. So instead, we are interested in the procedures—the tools—that yield these empirical relationships. If, in some tropical country, a forestry department wanted to know the relationship between area of refugia and biodiversity conservation, what kinds of data should it collect, and how should it analyze the data? These are the sorts of	revised to refer to “tools”.

		questions we hope to answer, and we hope to provide a range of answers (i.e., suggested procedures) from quick-and-dirty guidelines to more elaborate procedures.	
5	(para 2, page 2) The area of investigation in Malaysia is characterized in the proposal as somewhat unique. It will probably be inappropriate to generalize these findings to other sites and conditions. Note here that the data and observations are drawn almost entirely from one somewhat unique site. It is problematical whether these findings from one site can creditably be extended to different sites, especially outside of the dipterocarp forests and in forests beyond SE Asia.	We would agree if our goal was to generalize findings about empirical relationships, but as noted above that is not our goal. What is unique about the Temenggor site is that it has a number of characteristics that make it ideal for the research: an unusually cooperative concessionaire, examples of a range of important nontimber values (NTFPs used by local people, hydrological functions, existence values, etc.), available data from earlier biodiversity assessments, etc. Its uniqueness is thus a good thing, not a bad thing. The site is in hill dipterocarp forest, which is the principal type of forest subject to logging in Southeast Asia (now that the lowlands have been extensively cleared), so from a policy standpoint the site is representative, not unique.	
6	Furthermore, the ecological issue, which is complex even within the traditional ecological perspective, becomes even more complex within the context of an ecological view such as that of Botkin's *Discordant Harmonies: A New Ecology for the 21st Century* (1990, Oxford	There are universal dynamics to tropical rainforests, such species-area relationships and the effects of dispersal limitations. Our aim is to develop tools that include the key sources of	

	University Press). I should note that Botkin's view of a much more complex and therefore more difficult to predictable forest ecological system has become widely accepted.	complexity as variables, which can be quantified for different forest types by following procedures we will develop. In this sense, in generic terms the empirical relationships we develop will be robust, although the specific form of those relationships will vary from forest to forest.	
7	(para 3, page 3) Ecological processes occur over time. The long term equilibrium relationship between a logging regime and local biodiversity cannot achieved in the 5 year time period of the project. Thus the time frame of the project is likely to provide a "snapshot" while the relevant phenomena that we need to understand is dynamic and intertemporal.	We are not dismissive of earlier data. The existence of such data is, as mentioned in the proposal, a reason for conducting the project in Malaysia. In developing tools for assessing biodiversity, the project will draw upon data from long-term, large-scale forest research plots elsewhere in Malaysia (Pasoh and Lambir), and to a certain extent similar plots in other areas of the tropics (e.g., Barro Colorado Island). One of the proposed activities involves using data from VJRs established over several decades, to permit the analysis of biodiversity recovery over a longer time frame, and the development of forest growth models will draw data from forest regeneration plots in Pahang.	References to literature have been incorporated throughout the proposal, and a list of references added on p. 58
8	(para 4, page 3) Administratively, it is difficult to see how all the parts of this project fit. GTZ and NIES are mentioned and their expertise cited including satellite imagery. How would	The involvement of GTZ and NIES will be collaborative in nature where the research activity will be undertaken by these agencies as part of their work programme. The information and	Item ii) page 16 under Project Strategy

	they be used? Through consultancy arrangements?	results of the activity will be used by this GEF project. GTZ has an on-going collaboration with the Forestry Department Peninsular Malaysia on Sustainable Forest Management and Conservation while NIES has an on-going research programme with the Forest Research Institute Malaysia. Some of the objectives and planned activities of these agencies are similar to what is being proposed in this project. Implementation arrangements and contractual bases for collaboration will be clarified in the Project Document	
9	(para 5, page 3) The discussion many places of the proposal concerning reducing the sample variance is perplexing and obscure. One way to do this would be to increase the sample size. Another is to use a priori information, e.g., in a rationale for data stratification. Is this what is envisioned? If so, it should be stated, if not, the approach needs clarification.	As noted earlier, we will evaluate a hierarchical set of tools. The effects of sample size and stratification on the accuracy and precision of estimates of biodiversity and forest values are indeed among the issues we will consider in evaluating the tools, along with other statistical considerations (e.g., the incorporation of a priori information and learning, i.e. Bayesian updating)	Page 21 first paragraph under Output 1.2: Efficient statistical methods for estimating biodiversity from small samples
10	(para 6, page 3) Much of the proposal is really about collecting and storing new and more data. New approaches for storing and to some extent collection data are an excellent idea,	As noted above, the project is not about collecting and storing more data. The reason for collecting new data is to permit the development and evaluation of new tools. Yes, we will collect data	

	but inadequate in itself of improving decisions.	on biodiversity in Temenggor, but not for the sake of knowing more about biodiversity in Temenggor. The purpose is rather to determine whether more data-intensive procedures are worth the extra time and effort; does more data improve estimates of biodiversity very much?	
11	(para 7, page 3) There are places where the proposal seems to suggest that models will substitute for data. One needs data to determine how the world works. Abstract models alone are not sufficient. Models need verification.	We agree that models need verification. Hence the emphasis on data collection is reflected in the proposal.	
12	(para 9, page 3) Some tasks are asserted without much indication of how this might be done. For example "the utility of local refugias for biodiversity recovery will be assessed." Is there really a widely accepted scientific way to do this?	**The description of Activity 1.4.1 actually contains an extended discussion of how we will conduct this assessment. We quote:** **"We will pick 4 or 5 intact VJRs ranging in size from 20 to 500 hectares, each with adjacent harvested area. The harvested areas may differ in time since harvest. If possible, several harvested plots with different time histories around a single VJR will be selected. The potential flaw in this experimental design is that there is no control for the previous state of the harvested plot. Using the VJR as a control, that is as an estimate of the diversity of the harvested plot, is inappropriate**	

because the VJR may ha
species by the species-area e
might also have been more
affected by the adjacent ha
(e.g., illegal logging).

To overcome this problem, we
sample a third plot near, but no
VJR that was harvested at abou
time as the contiguous plot. It v
selected to be as similar as poss
regard to topology, soil type an
from other major sources of rec
This will permit an analysis of
effect on recolonisation of the c
plot. Any differences in recove
biodiversity between the adjace
distant point may be interpreted
of the VJR in the process. Tree
small mammals, and several oth
diversity will be estimated for e
three plots. The species-area re
for the taxonomic groups will b
in the VJRs, and a multivariate
effects of VJR size, time since
will be made for the logged site

Relevant citations for this pa
study include (Laidlaw 19
Laurance & Bierregaard, 199

13	(para 10, page 4)	All these issues are addressed in the proposal. For example, the first	Page 31 last paragraph under Output 2.1

	Are existence values to be determined by a Malaysian survey or a global survey? The literature suggests that the pharmaceutical values of the biodiversity is likely to be very modest. It may be more efficient to simply try to find least cost ways to prevent biodiversity destruction.	sentence of Activity 2.1.4 states, "This activity will survey Peninsular Malaysian [emphasis added] households to generate data necessary for estimating two important nonextractive nontimber values: recreation and passive use.	
14	(para 11, page 4) The statistical models that will related "biodiversity to the forest community" are likely to be of limited value when applied outside of the particular forest area in question. Recall, this forest area was characterized as somewhat unique.	Again, it is unique from the standpoint of being ideal for the research—which does not mean it is unrepresentative of Southeast Asian dipterocarp forests from ecological, economic, or policy standpoints. Moreover, it is not the empirical relationships in the statistical models that will applicable elsewhere, but rather the generic form of those relationships and the procedures for quantifying variables and parameters included in them	
15	(para 12, page 4) It is not clear that the time period of the project, 5 years, is sufficient to give a adequately complete picture of regeneration over time.	As noted above, we will draw upon data from other sites in Malaysia, in particular VJRs and logged-over forests surrounding the VJRs, which will give us a time span of several decades to analyze	
	Summary and Recommendations	Our goal is to develop tools—procedures—that are broadly applicable across different forest types, requiring only recalibration of parameters on the basis of small samples. As noted earlier, this paradigm has already been	

		proven to be extremely effective for (the limited goal) of predicting tropical tree diversity in a wide range of forests ranging from Southeast Asia, to India, to Panama (Plotkin et al., *PNAS*, 2000).	

SECOND REVIEW BY STAP REVIEWER, DR ROGER SEDJO

July 13, 2003

To: Tim Clairs

Regarding: UNDP-GEF Regional Service Unit Asia and the Pacific

From: Roger A. Sedjo, Consultant

Subject: Re-review of the STAP proposed project **"Conservation of Biological Diversity Through Improved Forest Planning."** Special Service Agreement (SSA) for UNOSP project INT95R71

As before, I continue to be quite positive toward this proposal. As now revised, I view the proposal as somewhat less ambitious and certainly more doable. In this context I agree with the writers that the project, as clarified, is not oversold.

I have examined the main review points of the proposal and particularly the "Amendments made following the STAP review as found in the "Response to the STAP Technical Review Matrix." Overall, I find that the Response was forthright and generally addressed adequately many of my concerns.

A major confusion in the original proposal related to the use of the term "methodologies." In the Response the proposal writers indicate that this means, what I would call, a "tool" or a "procedure." The writers have revised the proposal to substitute the term (and concept) tool for what was earlier called methodologies (which I view as involving a more ambitious concept). I find this rearticulation using the term tool much less theoretical and more reflective and accurate in terms of what the proposal actually appears to be proposing to accomplish.

Many of the comments throughout the "Response" relate to clarification of the project objectives, where some of the confusions resulted from definitional differences between the term "methodologies" and "tools." Additionally, the writers have now provided some references of recent work that can provide a conceptual and perhaps empirical basis for the undertaking of their new efforts. This suggests the research is building upon some serious recent work in the area. This is reassuring.

Also, one of my earlier criticisms related to the "unique" nature of the major forest site. The Response indicates that much of the uniqueness relations to a unique degree of cooperation and unique existing data for certain site ecological and economic variables. Of course, this is useful. Similarly, the writers stress the use of some of the data obtained in earlier research and reporting efforts.

The hypothesis that there are universal dynamics to tropical rainforests, such as species-area, relationships, is useful. However, these relationships may be quite different across forest types.

One of the important outputs of this study could be to clarify the stability or variability of such relationships, at least within the dipterocarp forests. Comparisons with other plots in Malaysia and elsewhere in the tropics, e.g., Barro Colorade Island, would be most enlightening.

The Responses also clarified my questions, e.g., regarding statistical considerations for increasing precision and approaches to estimating nontimber values.

Overall, I found the Response discussion useful and responsive to my inquiries. As before, I believe this is a useful project. The extent to which tools and protocols that are broadly useful across numerous forests remains an open question. However, it is reasonable to posit that there are likely to be broad similarities in underlying ecological relationships across forests of similar types and these similarities can be characterized.

A major limitation that remains in the study is that ecological processes occur over time. The long term equilibrium relationship between a logging regime and local biodiversity cannot achieved in the 5 year time period of the project. Thus the time frame of the project is likely to provide a "snapshot," while the relevant phenomena that we need to understand are dynamic and intertemporal. As noted, by utilizing the rather large volumes of earlier data together with data generated currently, it might be possible to make some useful long term inferences. One approach would be to determine the extent to which species noted in earlier inventories are still present. Can the earlier species all be located? How many are lost? This investigation might provide very useful perspectives as to the degree that many of these species are truly threatened, as opposed to being hypothetically threatened.

Summary and Recommendations

As before, I like much of what is found in this proposal. The ideal of trying to formally integrate biodiversity considerations into forest management, both for protected and for periodically harvested forest, has a great deal of appeal. The notion of the development of tools that are broadly applicable in various tropical forests is also appealing and enhances the attractiveness of the proposal.

I am now more sanguine than before, based on the review dialogue, that many of these objectives can be achieved in the context of the proposed research. The proposal, while it still promises much, is in the range of the achievable. The activities of this proposal should add substantially to our knowledge of a specific tropical forest, and indeed probably provide very useful insights to many tropical forests generally.

Hence, I recommend proceeding with the project.

Annex V: Letter of Endorsement

MINISTRY OF SCIENCE, TECHNOLOGY
AND THE ENVIRONMENT, MALAYSIA,
LEVEL 1-7, BLOCK C5,
FEDERAL GOVERNMENT ADMINISTRATIVE CENTRE
62662 PUTRAJAYA
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Telephone: 03-88858000
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19 MAY 2003

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Your Ref: KSTAS(S)130.010
Our Ref: P001/011(14)
Date: 9 May 2003

Ms. Maxine Olson
Resident Representative,
United Nations Development Programme Malaysia
P.O. Box 12544,
50728 KUALA LUMPUR

Dear Ms. Olson,

Project Name: Conservation of Biological Diversity Through Improved Forest Planning and Management Procedures

We would like to refer to the project proposal 'Conservation of Biological Diversity Through Improved Forest Planning and Management Procedures', that will be submitted for the consideration of the Global Environmental Facility (GEF) Council through UNDP. We are pleased to inform that the Ministry of Science, Technology and the Environment Malaysia, as the GEF Operational Focal Point, hereby endorsed the said project for GEF support and we look forward to work with UNDP Malaysia on the above stated project.

2. The proposed project will certainly help to enhance the existing biodiversity conservation efforts in Malaysia, as well as complement efforts to promote sustainable forest management. In this respect, we would like to confirm our full support and endorsement of this project proposal and to work with UNDP Malaysia.

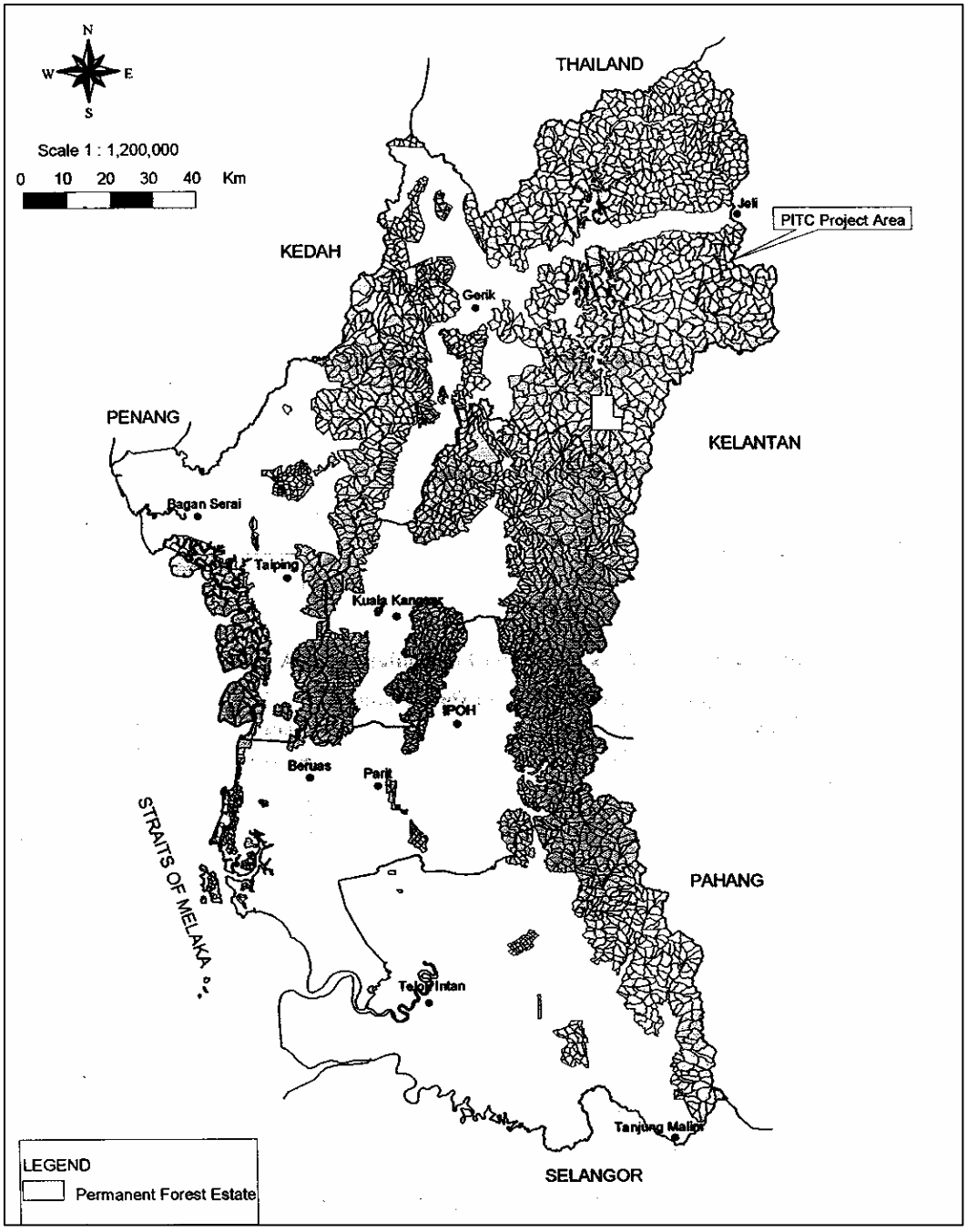
Thank you.

Yours sincerely,

(DR. ZULKIFLI IDRIS)
Director
Conservation and Environmental Management Division
For Secretary-General
Ministry of Science, Technology and the Environment

PLEASE REFER TO MAL OP3 SUBMISSION ATTACHMENT – FIGURE 4 – WORKPLAN.XLS

Annex VII: Map of Project Test Site



Annex VIII : Information on Project Test Site (PITC)

Introduction

The Perak Integrated Timber Complex Sdn Bhd (PITC) is a subsidiary of the Perak State Government's economic arm called the State Economic Development Cooperation (SEDC) The concession area consist of rich and highly diverse tropical rain forest, although some parts of it has been logged in the past. The entire concession area constitutes part of Temengor Forest Reserve within Hulu Perak district, Perak Darul Ridzuan, Malaysia. It lies in the northeastern corner of Perak between latitudes 5°24'40" to 5°34'15" North and longitudes 100°33'0" to 101°39'30" East covering a total area of 9,765 hectares of rich and pristine lower and upperhill dipterocarp forest. To its north is the Belum State Nature Park while not far to the east is the Perak-Kelantan border .

The entire forest has been found to be generally rich in various types of flora and fauna including giant Meranti bukit (*Shorea platyclados*), Keruing Kipas *(Dipterocarpus constulatus*.), Keruing mempelas (*Dipterocarpus crinitus*) and Merbau (*Intsia palembanica*) trees as well as large mammals and birds. On the other hand there are also patches of areas dominated by bamboos which are good for the elephants. According to the records of the State Forestry Department of Perak, Temengor Forest Reserve was officially gazetted as a permanent forest estate (PFE) in 1991 covering an area totaling 148,670.00 ha. The latter represents about 14.93 per cent of the total area of PFE in the state – by far the largest contiguous PFE in Perak after Belum FR (134,167.00ha) and Bintang Hijau FR (118,860.00 ha).

Administratively, the PITC concession forest falls under the ambit of the forest district of Hulu Perak which has its office in Gerik town. The forest district is headed by a District Officer (DFO) who reports directly to the State Director of Forestry in Ipoh. The DFO is being assisted by an Assistant DFO (ADFO) and several Forest Rangers and Foresters.

The composition of the stakeholders within PITC is as follows:

- Perak SEDC 60%
- Ivory Pearl Sdn Bhd (IPSB) 30%
- Etika Mekar Sdn Bhd (EMSB) 10%

For a start PITC has been granted a 30-year license to log and manage, under the sustainable forest management (SFM) principles, the concession forest now being described in this report. Round timbers from this forest concession and other sources will be fed and processed at PITC sawmill before being sent to vendors for further processing into furniture parts. Upon a stringent quality control procedure, these furniture parts will be subsequently taken to Ivory Pearl Sdn Bhd.'s (IPSB) factory for final assembly, finishing and packaging before going for export. The strategic alliance between PITC and IPSB (and its associate Home & Leisure International (HLI)) is critical by virtue of

the latter's vast experience and extensive access to export market outlets in the United Kingdom and Europe.

Management Mission, Strategy and Objectives

PITC's mission has been stated thus "to develop an environmentally appropriate, socially responsible and economically viable sustainable integrated timber based industry in the State of Perak that fulfils Perak State economic policy".

The company's corporate objectives are:

a) to develop a sustainable vertically integrated timber based industry,
b) to continuously improve processing of timber resources and enhancing the value of downstream activities
c) to promote export of high value-added forest products,
d) to manage the forest resources in compliance to internationally recognised criteria & indicators for continuous production of forest products,
e) to enhance public awareness on the environmental and conservational roles of forests, and
f) to seek internationally recognised and accredited FSC and ISO 14001 certifications.

Climate

Hulu Perak District has a typical tropical monsoon climate characterised by uniformly high temperatures and high humidity. The northeast monsoon occurs during the months of November to March whereas the southwest monsoon occurs during the months of May to September. In between these two monsoons there are two doldrums which are characterised by heavy precipitation especially in April and October. It is not surprising therefore when Temengor FR receives rains in excess of 3,000 mm per year at times.

Geology, Topography and Site Conditions

The forest concession area forms part of Peninsular Malaysia Titiwangsa Main Range. The topography is very variable ranging from riverine plains of lower hill dipterocarp forest to rolling hills with long slopes and seemingly endless, knife-edge narrow ridge tops, with the much of the area lying between 400 meter asl to about 1,000 meter asl. However, the hills close to the rivers tend to be lower with short but steep slopes. On general the terrain gets higher and steeper as one moves towards the eastern and southern borders.

The geology is composed mostly of metamorphic arecaceous rock/carbonaceous slate especially on the lower grounds which evolve into acid igneous rock on the hills and steep slopes. These parent materials yield the fertile alluvial soils on the lower grounds

and sandy clay loam respectively thus enabling them to support lush tropical forest vegetation. However, due to an extremely visible presence of animal activities (especially elephants), much of the soils on the slopes are disturbed leading to severe erosion, and loss of top soil. The presence of thick bamboo growth in many locations may also contribute to the lack of humus layer, exposure of the top soil rendering it prone to erosion and hence a below average fertility.

Site conditions such as site sensitivity risk, slope steepness and presence of fast flowing rivers have significant influence on the choice of harvesting methods, logging intensity (species, size, and number of trees cut and removed as well as logging damage), road alignment, bridge and culvert design, size and positioning, working condition, degree of supervision and control required as well as rehabilitation approaches. Table 1 shows the analyses of slope classes in the concession area which can be categorised into gentle, moderately steep, steep, very steep and extremely steep.

Table 1 Summary of Slope Classes in the Concession Forest Area

Slope Class	**Gradient (as observed at centre of circular plot)**	**Total Area, ha**	**Proportion of total area, %**
GENTLE	0 - 10° (0 – 18%)	2,099.96	21.51
Moderate Steep	11 - 20° (19 – 37%)	3,116.80	31.92
Steep	21 - 30° (38 – 59%)	3,364.00	34.45
Very Steep	31 - 40° (60 – 84%)	1,053.00	10.78
EXTREMELY STEEP	> 40° (>84%)	131.20	1.34
Total		9,764.96	100.00

Hydrology

Several large and fast-flowing rivers run along and form natural boundaries for the northern and eastern perimeters of the concession area. For example, Sungai Selaur which meets Sungai Mangga forms the concession's northern boundary, before flowing to the west to meet Sungai Singor at the area's western extremity. A good part of the latter constitutes more than half of the western boundary before splitting into Sungai Sengeh and Sungai Talong. Sungai Sengeh which cuts the concession area into two unequal halves (northern and southern portions) has its origin in the high mountains along the Kelantan border. On the other hand, Sungai Talong which runs through the southern portion of the concession forest area are equally unique with rapids and cascading water and flowing in between creeks. During heavy rains all of these rivers quickly swell up and flow dangerously fast. In other words, this situation implies the need for an extreme caution during planning for roads, bridges, culverts and other infrastructure which in turn calls for a need to carefully consider the local site peculiarity

and variability. The rather high densities of river and stream networks inside the three major watersheds of Singor, Sengoh and Talong signify the need for meticulous control of water flow and soil stabilisation measures.

Wildlife

Besides the multitudes of flora species of all kinds, the virgin stand of tropical forest within the concession area is also rich in fauna. These include large mammals such as elephant, bear, deer, mountain goat, tiger, birds, insects as well as aquatic life. This is not surprising since the area is located not too far from Belum State Nature Park and the Temengor dam area which are popular destinations for wildlife relocation scheme conducted by the Department of Wildlife and National Parks. In view of this, the concession forest therefore holds promise as a potential destination for ecotourists, scientists and nature lovers.

Forest Resource Base

The forests in this area belong to the lower and upper hill dipterocarps forest types rich in commercial species such as Meranti (Shorea spp.) Mersawa (Anisoptera spp.), Keruing (Dipterocarpus spp.), Kempas (Koompassia malaccensis), Merbau (Intsia palembanica), Medang (Lauraceae) and Perah (Elateriaspermum tapos). The average total standing volume of trees of 30.0cm dbh and above has been estimated at 231.86m^3/ha which is above average by Peninsualr Malaysian standard. The timber trees which grow luxuriously exhibit their own peculiarities in terms of population structure, growth habit and distribution. Merbau, Meranti tembaga, Meranti sarang punai, Balau and Damar hitam for example can be found both by the river sides as well as on the higher plains and low hills whereas Keruing tends to locally colonise high, steep and narrow ridges is much the same way as Meranti bukit.

Table 2: Distribution of trees by diameter classes

Diameter Class (cm)	***Number of trees/ha***		
	Non- Dipterocarps	***Dipeterocarps***	***All species***
30-39	*23.28*	*11.11*	*34.93*
40-49	*20.71*	*12.22*	*32.93*
50-59	*18.02*	*11.89*	*29.91*
60-69	*17.61*	*11.09*	*28.70*
70-79	*13.15*	*12.07*	*25.22*

80-89	*12.55*	*12.81*	*25.36*
90-99	*11.2*	*12.22*	*23.42*
>100	*10.8*	*13.53*	*24.33*

Upon studying their habitats and population structures it was clear that the timber stands which have achieved their climax formation are dominated by emergent trees of large dbh's (diameters and breast height) with abundant of seedlings on the forest floor. On the other hand, the representation of the pole sized trees are poor by comparison which gives rise to the question**:** whether the selective felling system of management (SMS) is appropriate to this concession forest or not. This is by virtue of the fact that a successful implementation of the SMS is contingent upon an adequate presence of pole sized trees and advanced regeneration of good quality and commercial value. With the controlled opening and release provided by a reduced impact logging operation to be judiciously conducted by the company, these advanced regeneration are expected to be able to put on a reasonably high growth rates and achieve timber sizes in about 30-40 years before being logged again during the following cutting cycle. Now with the poor presence of the pole sizes and advanced regeneration, the vest approach to regenerate the logged stands would be through the longer-cycle seedling based system such as the Modified Malayan Uniform System (MMUS) which takes about 60 – 70 years for the tress to reach maturity.

The forest is also rich in non-timber resources such as medicinal plants, palms, wild orchids apart from bamboo and rattan which can be found in abundance. The rich presence of wildlife especially elephants, monkeys, sambar deer, birds and insects as well as aquatic life is unmistakable.

Forest Reserve and Compartments

As mentioned earlier, the whole concession area of about 9,765 ha lies within Temengor Forest Reserve and covers a total of 26 forest compartments whose delineation follow the boundary demarcation system normally adopted in Peninsular Malaysia for inland forests. In other words, compartment boundaries follow as much as possible natural physical features/boundaries such as permanent rivers, ridge-tops, watersheds, roads, etc.. However, due to the way the concession area has been delineated such that only areas below 1,000m asl were leased out, several compartments had their boundaries cut through by the concession boundary. As a result the extents of the respective forest compartments in the concession vary form very small as 18 ha to as large as 688 ha.

Forest Management

Although its parent Organisation the Perak State Economic Development Corporation (SEDC) has had a considerable experience in logging and timber trading in the past

through its various subsidiaries, PITC being a new entity, has no such advantage to fall back on. Everything needs to start afresh with no precedence to follow. Moreover all of the forestry operations conducted by the various Perak SEDC's previous subsidiaries were mainly short-term leases. PITC's operations will be different in that; through a 30-year concession agreement with the State Forestry Department, the company will be responsible for managing the forest sustainably, in addition to being an anchor company to selected groups of vendor entrepreneurs in the state in the furniture industry.

PITC fully acknowledges this heavy responsibility and the high expectation placed on it by the parties concerned despite all its shortcomings. The company therefore views these responsibilities very seriously as a challenge to be tackled and overcome effectively and in a professional way. The successful implementation of this project and hence the realisation of the state's industrialisation objectives are certainly contingent upon the full cooperation of the various related agencies including the state and district forest offices, MTIB, MTC, FRIM and NTCC, etc whose experiences and expertise PITC aspires to draw on. The agreement on the technical cooperation signed between Perak SEDC and the Regional Centre for Forest Management (RCFM) in June 1999 was a case in point. Under the agreement, RCFM has agreed to extend its consultation and technical expertise in various aspects of forest management and information technology (IT) to PITC in order to help the latter to successfully manage the forest concession under consideration over a stipulated period of time.

Conservation Of Biodiversity And Genetic Resources

Biological diversity or biodiversity is the variety and variability among living organisms and the ecological environment in which they occur. It can be defined as the number of different items and their relative frequencies. Biodiversity is usually considered at three levels namely, genetic diversity, species diversity and ecosystem diversity.

The objectives of biodiversity conservation within PITC area have been determined as follows:

a) to ensure that sufficient areas are protected for the conservation of biodiversity (flora and fauna)
b) to maintain and perpetuate genetic diversity represented by populations of selected (i.e. target) species within the areas where such genetic diversity is at risk of erosion
c) to use source-pedigreed populations for collection of seed for enrichment planting programme
d) to maintain essential ecological services provided by this forest reserve

The removal of genotypes of the best trees from selected species through selective cutting has led to genetic erosion of these species. Logging activities also affect wildlife, from frogs to elephants, to varying degrees. Birds and primates that are dependent on primary forests receive the greatest impact. Forest understorey birds such as babblers are

significantly reduced in logged forest because they cannot tolerate changes in the microclimate, while fruit-eating canopy birds are significantly reduced owing to a reduction in certain types of fruit-bearing trees. On the other hand logging may also cause a slight increase in the numbers of some species of mammals and birds. In other words, logging has the tendency to influence and subsequently alter local population structure and demographic composition of wildlife in the forest under management. This in turn calls for an in-depth understanding of the respective animal's behaviour and their response to different intensities of logging. There is also a need to understand the lingkages these animals play in the overall forest ecosystem and how changes in their structure and population will effect the integrity of the ecosystem in the long run.

Other than timber trees, the concession forest also houses non-timber forest produces including rattan, bamboo, ornamental plants (including palms such as fan palms (Daun Sang) and wild orchids as well as plants of medicinal value such as ginger, tongkat ali, kacip fatimah, ubi jaga which need to be wisely managed and conserved.

Conservation of Species

The conservation of selected tree and other species in the PITC area can be affected by adopting stringent conservation and mitigation measures through the practice of reduced impact logging (RIL) and establishment of in situ conservation plots.

Habitat conservation is especially vital for the in situ conservation and preservation of species. In this respect, a few areas can be kept as small unlogged forest areas within the concession area based on the following criteria:-

- areas adjacent to totally protected area (Belum Forest Reserve)
- areas of rare or endangered species
- areas of exceptional species richness
- areas with unique landscape.

Among the natural processes involving forests worthy of conservation is the links and interactions many of which are unique in particular in the tropics i.e. ecosystem-ecosystem relationship (forest and rivers). Any change to a forest ecosystem may influence other nearby ecosystems, for example logging and increased soil erosion can cause siltation of rivers.

An important step towards realising the strategies and objectives of biodiversity and genetic resource conservation in the area is through the implementation of harvesting that is least damaging to the environment.

In carrying out logging steps should be taken to ensure that the detrimental effects on the biodiversity are kept to the minimum. Forest harvesting and all related infrastructure development will be properly coordinated and regulated in accordance with the

prescribed forest management so as to minimise damage to younger regeneration, safeguard environmental quality and maintain ecological balance.

The compartments to be logged in a particular year should be spread out. Compartments adjacent to the one being logged should not be logged within a period of three to five years. A mosaic of undisturbed forests in close proximity to logged forests will help maintain biodiversity. It is axiomatic that logging damage increases proportionately with logging intensity. PITC will therefore endeavour to minimise damage through strict observance of sound forestry practices whereby intensity of logging will be tied against original stocking and risk of stand degeneration.

As for the legal and customary use-rights in PITC, there is no *orang asli* community in PITC concession, except for about ten families, which have been employed by PITC to work in the logging operations within PITC. As of last year, PITC has allowed these *orang asli* to establish a village inside the concession area.

There are nine villages of indigenous communities scattered outside the concession area. These local communities around the concession consists of around 700 people. These local communities are traditionally dependent on the forest for their livelihood, with hunting and collection of non-timber forest products as the main activities.

The villagers continue to depend on the nearby forest for their livelihood, as not much agriculture land has been developed, besides small areas planted with hill paddy, maize, tapioca and yam. In addition, the Jahai community moves from place to place, unlike the other local communities, called the Temiar and Semai, which do practise some agriculture for subsistence. Around 50% of the villagers are involved in rattan harvesting or fruit harvesting from the forest. Harvesting rattan for cash income is the main income-generating economic activity of the villagers.

However, the *orang asli* do not find adequate forest resources to sustain livelihood from the surrounding area. As they are located relatively far from the urban centre and agricultural estates, there is an acute shortage of employment opportunities. The residents mainly depend on the harvesting of non-timber forest produce (NTFP) for subsistence needs and cash income generation. These NTFP resources are depleting over the years.

Under the project, activities have been planned to generate data necessary for comparing alternate methods of quantifying the amounts of NTFPs collected by the indigenous *orang asli* households. It will also generate data necessary for constructing models that relate NTFP collection to household characteristics (age, income, education, proximity to markets and wage employment, etc.). This data will feed into the economic valuation models that will be developed.

It is important to note that on 1st July 2002 Scientific Certification Systems (SCS) certified PITC under the FSC scheme.

Annex IX: Letters of Support

Letters of support received from

- FRIM
- Forestry Department Headquarters of Malaysia
- Ministry of Primary Industries
- Perak Integrated Timber Complex Sdn. Bhd.
- International Tropical Timber Organisation (ITTO)

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Forest Research Institute Malaysia (FRIM)
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27 MAY 2003

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PSU	
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GS	
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20 May 2003

FRIM 394/674/3/2/ Klt 3 (119)

United Nations Development Programme
Wisma UN Block C,
Komplek Pejabat Damansara
Jalan Dungun, Damansara Heights
50490 Kuala Lumpur

Dear Sir,

The Forest Research Institute Malaysia is pleased to confirm our direct involvement, contributions and support on the proposed targeted research project, "Conservation of Biological Diversity through Improved Forest Planning and Management Practices". We have been working closely with a group of experienced and committed international and national consultants as well as members of the National Steering and Technical Working committees towards the preparation of the above mentioned proposal with PDF-B funds granted in March 2001. In show of our commitment and true belief on the importance of such a globally and nationally important project, we have therefore pledged to co-finance a total of US$ 2,249,300 in local consultant salaries, DSA, logistics as well as time and effort with regards to project support, training and monitoring activities. In addition to this, FRIM has recently forged collaborations with a wholly-owned Malaysian company, Insilico Sdn. Bhd. that will venture in biodiversity discovery, conservation and commercialisation or genetic resources from tropical forests. This venture will directly contribute to Activity 2.1.3 of the proposed GEF project amounting to US$105,300. Thus the total contribution from FRIM amounts to US$ 2, 354, 600. We are very excited about this project, and believe that it will provide important new tools for the conservation of biodiversity and the improvement of forest management practices and therefore strongly urge the consideration of this project for funding.

I look forward to our collaboration.

Sincerely yours,

(DATO' DR. ABDUL RAZAK B. MOHD. ALI)
Director General FRIM

IBU PEJABAT PERHUTANAN
SEMENANJUNG MALAYSIA
(FORESTRY DEPARTMENT HQ)
JALAN SULTAN SALAHUDDIN
50660 KUALA LUMPUR
Telefon : 03-26988244 Fax : 603-26925657 Homepage : http://www.forestry.gov.my

JH/(S) 347.11

3 April, 2003

Director General
Forest Research Institute Malaysia
52109 Kepong
Kuala Lumpur
MALAYSIA

(Fax: +6 03 6279 7857)

Dear Sir,

We are pleased to support and collaborate with the Forest Research Institute Malaysia on the proposed targeted research project "Conservation of Biological Diversity through Improved Forest Planning and Management Practices". We believe that the project will provide important new tools for the conservation of biodiversity through improved forest management practices. We will take an active role in the project implementation through our involvement in the Project Steering and Technical Working Committees and will contribute in kind with regard to project support, training and monitoring activities.

I look forward to our collaboration.

Sincerely yours,

(THANG HOOI CHIEW)
for the Director General of Forestry
Peninsular Malaysia

KEMENTERIAN PERUSAHAAN UTAMA
(Ministry of Primary Industries),
MALAYSIA,
TINGKAT 6-8, MENARA DAYABUMI,
JALAN SULTAN HISHAMUDDIN,
50654 KUALA LUMPUR.

Tel : 03-227 47511
Fax : 03-227 45649 /
: 03-227 45014
Telex : MA 30308
Kawat : PERUSAHAAN
(Cable) KUALA LUMPUR
Laman Web: http://www.kpu.gov.my

Ruj Tuan : *Your Ref*
KPU19(04)77/1Klt.5(8)
Ruj Kami : *Our Ref :*
Tarikh : *Date :* 26 April 2003

SEGERA/DENGAN FAKS

Director General
Forest Research Institute Malaysia
52109 Kepong
Kuala Lumpur
(u.p. : Dr. Shamsuddin Ibrahim)

BAHAGIAN HUTAN ASLI
DI TERIMA PADA
13 MAY 2003
Masukan dlm. fail
Edarkan kpd.....
SDP.....

Dear Sir,

SOKONGAN BAGI CADANGAN PROJEK FRIM-GEF "CONSERVATION OF BIOLOGICAL DIVERSITY THROUGH IMPROVED FOREST PLANNING AND MANAGEMENT PRACTICES".

We are pleased to confirm our support and interest in collaborating with the Forest Research Institute Malaysia on the proposed targeted research project, "Conservation of Biological Diversity through Improved Forest Planning and Management Practices". We are excited about this project, and believe that it will provide important new tools for the conservation of biodiversity and the improvement of forest management practices. We would take an active role in the project implementation through our involvement in the Project Steering and Technical Working Committees and will contribute in kind with regards to project support, training and monitoring activities.

I look forward to our collaboration.

Sincerely yours,

"BERKHIDMAT UNTUK NEGARA"

Saya yang menurut perintah,

(AZIYAH MOHAMED)
b.p. Ketua Setiausaha
Kementerian Perusahaan Utama
Malaysia.

Surat ini telah dihantar/disarung melalui fax pada 26 APR 2003

Perak ITC Sdn Bhd (Co.No. 473712-W)

No. 8 Lebuh Lasam, 30350 Ipoh, Perak, Malaysia.
Tel No. : 05 - 243 2022 Fax No. : 05 – 243 2026 Email No. : peritc@po.jaring.my

March 19, 2003

Our Ref no : PITC/FRIM/024 /03

Director General
Forest Research Institute Malaysia
52109 Kepong
Kuala Lumpur
MALAYSIA

Dear Sir

I am pleased to confirm PITC's interest in collaborating with the Forest Research Institute Malaysia on the proposed targeted research project, "Conservation of Biological Diversity through Improved Forest Planning and Management Practices". I am extremely excited about this project, and believe that it will provide important new tools for the conservation of biodiversity and the improvement of forest management practices. With the support of relevant authorities, PITC will allow the research team to establish biodiversity assessment plots within selected areas of the concession before and after logging. PITC will also consider the experimental implementation of new cutting regimes and work with the study team to estimate the cost impacts of such changes in the logging systems.

I look forward to the realization of the project.

Sincerely yours
For PERAK ITC SDN BHD

Tan Chin Tong
Chief Executive Officer

Sam Hwa.

Untuk Tindakan

BAHAGIAN HUTAN ...
24 MAR 2003
Masuk ...
Edarkan kpd .....
SDP.....

ITTO

INTERNATIONAL TROPICAL TIMBER ORGANIZATION

PEJABAT KETUA PENGARAH FRIM
Tarikh 17 JUN 2003
☑ Untuk Tindakan PCTO
segera/sebelum
☑ Untuk maklumat PCTO
☐ Untuk simpanan
☐ Maklum kpd. Ketua Pengarah
segera/sebelum
☐

PEJABAT KETUA PENGARAH
Salinan telah diedarkan pada
19 JUN 2003

9 June 2003
L. 03-0274

Dear Sir,

We are pleased to acknowledge that your agency has submitted a proposal entitled "Conservation of Biological Diversity through Sustainable Forest Management Practices [PD165/02 Rev.1(F)]" in May 2003. We understand that this proposal is a subset of a larger proposal which you intend to submit to the Global Environment Facility (GEF) for funding in the future.

The project proposal has already been positively appraised by the 25th Expert Panel for the Technical Appraisal of Project Proposal in January 2003, which had recommended modifications prior to its endorsement at the 26th Expert Panel to be held in August 2003. The project proposal, after the approval of the 26th Expert Panel, will be forwarded to the relevant committee under the International Tropical Timber Council for final appraisal. In view of the relevance of the proposed project's objectives to ITTO, we are indeed looking forward to an opportunity to implement this with FRIM, provided the Council grants approval and funding.

We believe that this project will contribute important new tools for the conservation of biodiversity and in the improvement of forest management practices leading to sustainable forest management. We are optimistic that the proposal will be considered for funding in the next Council meeting to be held from 3 to 8 November 2003.

We look forward to our collaboration.

With best wishes,

Yours sincerely,

Takeichi Ishikawa
Assistant Director
Management Services

Director
Forest Research Institute Malaysia
52109 Kepong
Kuala Lumpur
Malaysia

F.R.I.M
UNIT PERSURATAN
DITERIMA PADA
16 JUN 2003
Masukan Dlm Fail
Edarkan Kpd.
SDP pada

INTERNATIONAL ORGANIZATIONS CENTER, 5TH FLOOR
PACIFICO-YOKOHAMA, 1-1-1, MINATO-MIRAI, NISHI-KU, YOKOHAMA, 220-0012 JAPAN

Telephone: +81(045) 223-1110 Facsimile: +81(045) 223-1111 E-mail: itto@itto.or.jp URL: http:// www.itto.or.jp

TOTAL P.02

PROJECT EXECUTIVE SUMMARY

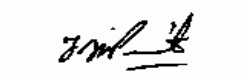
AGENCY'S PROJECT ID: PIMS 1370
COUNTRY: Malaysia
PROJECT TITLE: Conservation of Biological Diversity Through Improved Forest Planning Tools
GEF AGENCY: UNDP
OTHER EXECUTING AGENCY(IES): Ministry of Primary Industries
DURATION: 5 years
GEF FOCAL AREA: Biodiversity
GEF OPERATIONAL PROGRAM: OP #3
GEF STRATEGIC PRIORITY: IV Generation and Dissemination of Best Practices for Addressing Current and Emerging Biodiversity Issues
ESTIMATED STARTING DATE: January 2004
IA FEE: 382,000

FINANCING PLAN (IN US$ MILLION):	
GEF PROJECT/COMPONENT	
Project	2.261
PDF A	
PDF B	0.196
PDF C	
Sub-Total GEF:	2.457
CO-FINANCING	
ITTO (to be confirmed)	0.558
Government of Malaysia	2.307
Universities	0.530
Private Sector	0.047
Sub-Total Co-financing:	3.443
TOTAL Project Financing:	5.900
FINANCING FOR ASSOCIATED ACTIVITIES IF ANY:	

CONTRIBUTION TO KEY INDICATORS OF THE BUSINESS PLAN:
This proposed project will develop tools and generate knowledge needed to ensure that production systems, in this case, forestry production systems, are planned and managed in a manner which will contribute to biodiversity conservation or the sustainable use of its components against the baseline scenarios. These tools will be developed and disseminated for broader application to Strategic Priority #2 on Mainstreaming Biodiversity in Production Landscapes and Sectors.

RECORD OF ENDORSEMENT ON BEHALF OF THE GOVERNMENT(S):
Dr. Zulkifli Idris — Date: 19 May, 2003
GEF Operational Focal Point
Director, Conservation & Environmental Management Division, Ministry of Science, Technology and the Environment

Approved on behalf of UNDP. This proposal has been prepared in accordance with GEF policies and procedures and meets the standards of the GEF Project Review Criteria for work program inclusion.



Frank Pinto
Executive Coordinator
17 July 2003

Project Contact Person
Mr. Tim Clairs
Tel:+603-2091-5128
email: tim.clairs@undp.org

1. PROJECT SUMMARY

a) Project rationale, objectives, outputs, and activities.

The development goal of the project is to conserve biological diversity of tropical forest ecosystems through the improved forest planning procedures. The project will contribute towards realisation of goals and strategies stated in the National Forest Policy and National Policy on Biological Diversity with emphasis on improvement of the knowledge base, strengthening of institutional framework, and integration of biological diversity considerations into sectoral planning.

Tropical forests are the most complex and diverse ecosystems on earth. In addition to having extremely rich and diverse plant and animal life, these forests also play a significant role in the socio-economic development of the countries that harbour them. These countries also value the forests for their roles in the maintenance of soil and water resources, stabilising climate and the conservation of biological diversity. However, current forest management practices in many topical countries tend to maximise timber production goals and are deficient in certain critical aspects that threaten sustainability and conservation of biological diversity. The procedures for identifying forest areas that should be protected within the permanent forest areas and within individual forest concessions do not give sufficient consideration for biodiversity conservation. It is also now generally accepted that effective biodiversity conservation strategies must include not only a system of protected areas but also the integration of biodiversity considerations into the management of timber production forests—especially production forests that are adjacent to protected areas or include assemblages of species that are not well-represented elsewhere. The proposed targeted research project addresses these issues by developing tools that will enable forest planners to assess the adequacy of existing protected areas for biodiversity conservation and, if there is a need to establish additional areas, to determine how large they should be and where they should be located.

Three categories of information are required to manage biodiversity more effectively, in both ecological and economic terms, in landscapes that include timber production forests:

1. information on the impacts of changes in total forest area and changes in the allocation of forests among different use categories (protection, production, etc.) on biodiversity;

2. information on the direct and indirect economic benefits that result from enhanced biodiversity conservation;

3. information on the costs of biodiversity conservation, in particular the opportunity cost associated with forgone logging activity.

Generating this information and the tools needed to integrate it into forest planning processes requires a multi-year, multidisciplinary research effort. This project brief describes a targeted research project, to be funded jointly by GEF and other national and

international sources, aimed at filling this information gap. Specifically, the project will aim to:

4. develop improved tools for rapidly assessing the biodiversity in tropical rainforests;

5. develop improved tools for estimating the economic value of goods and services associated with biodiversity in tropical rainforests;

6. develop improved models for predicting the biodiversity impacts, and associated economic benefits and costs, of alternative allocations of forests among different use categories at a landscape level; and

7. enhance and disseminate knowledge as well as build capacity with view of replicating improved forest planning procedures

The outputs and activities of the project are detailed in the project brief and the logframe matrix.

This project fits under the GEF Strategic Priority #4 on the Generation and Dissemination of Best Practices for Addressing Current and Emerging Biodiversity Issues. In addition, the tools developed under the project will be disseminated for broader application to Strategic Priority #2 on Mainstreaming Biodiversity in Production Landscapes and Sectors.

The research activities for the project will be conducted in Malaysia, which has high levels of biodiversity and the wide range of socioeconomic conditions necessary for development and testing the biodiversity assessment and economic valuation methods. In addition, Malaysia has a long history of forestry research and this offers ample existing data useful for the project. The Perak Timber Integrated Complex (PITC) concession and the state of Perak, as a whole, will act as a laboratory for the development of tools. In addition, the proposed research activities will also draw upon data from other sites in Malaysia, in particular Virgin Jungle Reserves (VJR) and logged-over forests surrounding the VJRs, as well as the rich data from the Pasoh Forest Reserve, as a comparative test site.

Perak Integrated Timber Complex Sdn Bhd (PITC)

The Perak Integrated Timber Complex Sdn Bhd (PITC) is a subsidiary of the Perak State Government's economic arm called the State Economic Development Cooperation (SEDC) The concession area consist of rich and highly diverse tropical rain forest, although some parts of it has been logged in the past. As of 1st July 2002 Scientific Certification Systems (SCS) certified PITC under the FSC scheme.

The general management objectives of PITC include developing a sustainable vertically integrated timber-based industry, managing the concession for timber production and to ensure that all other uses, functions and services whether economic, ecological, or social are continuously improved and safeguarded, improving processing of timber resources

and enhancing the value of downstream activities and promoting the export of high value added forest products.

PITC practices Selection Management System (SMS) which allows for a more flexible timber-harvesting regime that is consistent with the need to safeguard the environment. The average sustainable yield for the 30-year harvesting cycle for PITC concession areas has been estimated at about 108m3/ha gross.

Several potential areas of High Value Conservation Forest include unique habitats harboring rare or endemic plants, or known areas where the congregation of animals in search of food or minerals occurs. From the field audit carried out under the Forest Management Certification Evaluation in May 2001, it was felt that the forested areas around salt licks, which protect many large mammals, should be classified as HCVF. Groups of plants with economic potential as high quality timber or pharmaceutical resources should also be considered for protection so as to provide a source of generic material useful for future improvement through selective breeding. (Source: The Forest Management Certification Evaluation on the Forest Concession Area of Perak Integrated Timber Complex (Perak ITC), SCS, May 2002)

As for the legal and customary use-rights in PITC, there is no *orang asli* community in PITC concession, except for about ten families, which have been employed by PITC to work in the logging operations within PITC. As of last year, PITC has allowed these *orang asli* to establish a village inside the concession area.

There are nine villages of indigenous communities scattered outside the concession area. These local communities around the concession consists of around 700 people. These local communities are traditionally dependent on the forest for their livelihood, with hunting and collection of non-timber forest products as the main activities.

The villagers continue to depend on the nearby forest for their livelihood, as not much agriculture land has been developed, besides small areas planted with hill paddy, maize, tapioca and yam. In addition, the Jahai community moves from place to place, unlike the other local communities, called the Temiar and Semai, which do practise some agriculture for subsistence. Around 50% of the villagers are involved in rattan harvesting or fruit harvesting from the forest. Harvesting rattan for cash income is the main income-generating economic activity of the villagers.

Under the project, activities have been planned to generate data necessary for comparing alternate methods of quantifying the amounts of NTFPs collected by the indigenous *orang asli* households. It will also generate data necessary for constructing models that relate NTFP collection to household characteristics (age, income, education, proximity to markets and wage employment, etc.). This data will feed into the economic valuation models that will be developed.

Please see Annex D for more details.

b) Key indicators, assumptions, and risks (from Logframe)

The key indicators in the implementation of the project are that the research on biodiversity to develop tools and methods are undertaken effectively. The tools for biodiversity assessment and valuation are developed and disseminated to targeted levels and are integrated into Malaysia's forest management practices. Local staff and regional participants are trained in valuation and rapid assessment techniques and tools are developed through workshops and on the job training activities. A web-site on the project is established and updated to allow extensive access on information and technology developed under the project.

The key assumptions made under the project are that the activities being undertaken has the full support of all major stakeholders and developed tools and technology are used by the State and Federal Government in the planning and management procedures to enhance biodiversity conservation. These tools will also be useful for other countries in the region. The development of the tools assumes that existing state of knowledge will enable us to accurately prioritise biodiversity values and accurately assess biodiversity.

There are several potential risks to project success, but none is perceived to be of such high probability as to endanger project implementation or continuation. Risks have been anticipated through the project's evolution, and measures have been taken to reduce their impact. The risk on the successful implementation of the project is considered low as it conforms to the national goals and aspirations in managing the forests on a sustainable basis

2. COUNTRY OWNERSHIP

a) COUNTRY ELIGIBILITY

Malaysia ratified the Convention on Biological Diversity on 24 June 1994.

b) COUNTRY DRIVENNESS

Sustainable management and conservation of the forests have been accorded a high priority by the Malaysian Government. Efforts are being advanced to ensure the flora and fauna is conserved for future generations. Malaysia has launched her own National Policy on Biological Diversity. The policy aims 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. Included in the policy is an Action Plan that outlines the strategies to be adopted to conserve biological diversity.

Malaysia, through its Forest Research Insitute Malaysia (FRIM), offers a great amount of existing data pertinent to the proposed research. Hence, the research can be jump-started and can make substantial progress within the relatively short time frame (from a forestry standpoint) of 5 years. This is especially the case for the ecological research where the existing and computerized forest census (i.e., individual tree) data from the 50-ha forest demography plots at Pasoh Forest Reserve (Peninsular Malaysia), will enable the research team to test alternate forest sampling procedures at a low cost on the computer, thus minimizing the need for baseline data collection. On the economics side, Malaysia's (human) population census is generally regarded as one of the highest quality in the developing world. This will facilitate the surveying of a large sample of households for estimating forest-related economic values. Malaysian stakeholders—in particular, federal and state governments, environmental NGOs, and, perhaps most important, the Perak Integrated Timber Complex (PITC) concession (where much of the field data collection will be undertaken)—strongly support the research. Hence, the project will have ready access to key data, and will be able to include experimental protocols that would be impossible in many other potential host countries. There also strong forest policies and legislations in place that will promote the conservation of biodiversity and the management of forest resources on a sustainable basis.

3. PROGRAM AND POLICY CONFORMITY

a) PROJECT DESIGN

The project will develop tools that will enable forest planners to assess the adequacy of existing protected areas for biodiversity conservation and, if there is a need to establish additional areas including within the production areas, to determine how large they should be and where they should be located. Towards this end the project will develop biodiversity assessment and economic valuation tools and optimisation models, all of which will enhance the capacity of tropical countries in sustainably managing and conserving their valuable forest resources. This is directly relevant to GEF Strategic Priority II on mainstreaming biodiversity in production landscapes and sectors. The proposed targeted research project will be an integral part of the Government of Malaysia's broader effort to promote sustainable forest management and conservation of biodiversity and is expected to last 5 years. The project will be implemented through a multi-disciplinary group of experts, agencies and stakeholders jointly undertaking this work. The project would be executed by the Ministry of Primary Industries, under whose purview comes forestry related matters.

To ensure that the project outputs will effectively untilised and will benefit both Malaysia and other tropical countries, information dissemination and training activities will be conducted. Guidelines and manuals on tools and methods formulated will also be developed to facilitate this process. These activities are in line with GEF's Strategic Priority IV on support for building scientific and technical cooperation and improve compilation and dissemination of best practices.

The project will be implemented in Perak State in collaboration with the State Forestry Department. Fieldwork for the project will be carried out primarily in PITC Concession located in Temenggor Forest Reserve, Perak. The implementation of the project will be governed by the National Steering Committee while a Technical Working Committee will discuss the technical details and monitor the implementation of the project on the ground.

Research methodology

The project will utilize existing information on demographics of tree species that have been extensively collected within 50-ha plot in Peninsular Malaysia, Brunei and Thailand. The information gathered from these plots will provide invaluable inputs to developing an efficient but statistically sound sampling techniques for collecting additional information on biodiversity in different locations. These sampling techniques will be applied in the Temenggor Forest Reserve, Lower Belum Forest Reserves and around a number of VJR plots within the country. This ecological information, supplemented by economic valuation of forest goods and services will provide critical inputs to developing improved tools and models in assessing biodiversity in tropical forests. The tool will be used by the forest planners in prescribing an optimal balance between biodiversity conservation and timber production. Therefore forest planners will address the issue of "landscape permeability" as raised by the review panel at the implementation stage. The project was not designed to implement specific logging practices but it will examine the impact of experimental logging techniques that seek to maintain the three dimensional structures of the forest.

b) SUSTAINABILITY (INCLUDING FINANCIAL SUSTAINABILITY)

The Forest Research Institute of Malaysia (FRIM), under the Ministry of Primary Industries, is the proposed implementing agency for the project. It is the national R&D Institution and has a pool of skilled multi-disciplinary staff.

The Ministries of Primary Industries and Science, Technology and Environment are in support of the Project. Above all, the Federal Government is committed to sustainable forest management practices. The thrust of the project deals with research on biodiversity of the natural forests. The project is expected to complement and support other projects being undertaken by FRIM, in particular, the ongoing **UNDP GEF Project on Conservation and Sustainable Use of Peat Swamp Forests and Associated Wetlands Systems**.

The project would have implemented all the research activities, and local capacities would have been enhanced to a level that subsequent application of the results could be undertaken using local input. In the implementation of the project FRIM will shoulder a large portion of the cost of contirbution by local experts and staff such as salaries, office space and many other local expenses. In kind support is also provided by collaborating local agencies such the Forestry Department Peninsular Malaysia through their staff

involvement in Meetings and field visits and the local concessionaire providing local support in the implementaion of the activities in the concession study area. Since the project involves a broad range of expertise FRIM has very good linkages and on-going cooporation with various relevant forestry agencies from both the public and private sector in Malaysia, NGO's, universities and international agencies. FRIM is in a good position to utilise existing, on-going or future research results that may complement the research activities of the proposed project.

c) REPLICABILITY

Although the research will be conducted in Malaysia, the tools developed by the project will be applicable to forests throughout Southeast Asia and in other tropical countries. The project will not produce a single set of "best" models, instead, it will develop and test a range of models and it will evaluate how their performance is affected by data quantity and quality. As a result of the project, forestry departments will have not only a larger set of tools available for practical use but also thorough information on the reliability of those tools.

To ensure that potential users of these tools are informed of their availability and trained in their use, the project will include a variety of dissemination and capacity building activities. There will be opportunities for cross-project learning among relevant GEF OP#3 projects in tropical countries. A strategy for replication has been included in the project under the 4th immediate objective of the project, building on the awareness and dissemination activities. In addition, the international dissemination of the tools developed by the project and the lessons learnt from it will be ensured by the project's International Advisory Panel.

The replication strategy complements the awareness component by focuses on learning-by-doing approach, and hence includes, for example, Activity 4.1.3 on scientific exchange programmes, Activities 4.15 and 4.1.6 on cross project learning visits. In addition, the proposed project has an output (output 2.2) on the production of manuals, including data sets and software that explain how to implement the valuation methods developed and tested. This output would be an input into the replication strategy.

The choice of PITC as a test site would not restrict the potential of replicability of the tools. It is not the empirical relationships in the statistical models that will be applicable elsewhere, but rather the generic form of those relationships and the procedures for quantifying variables and parameters included in them.

The sites on which the research will be tested on are hill dipterocarp forest, which is the principal type of forest subject to logging in South East Asia, therefore from a policy standpoint, the test site is representative. This enhances the replicability of the tools.

d) STAKEHOLDER INVOLVEMENT

In the formulation of this project during the PDF phase, extensive consultations with stakeholders were undertaken. Two stakeholders' consultations were held, one at the beginning of the PDF-B phase to get the feedback and general agreement on the objectives and approach of the project and one at the end of the project development phase to get feedback of stakeholders on the contents of the project proposal. The First Stakeholders' Consultation for the Project was held in Ipoh, Perak on 26 April 2001 and was attended by a total of 51 participants from 26 representing government departments, non-governmental agencies, private sector, local communities, and universities. In addition, two representatives from United Nations Development Programme and three consultants from Harvard University, USA were also in attendance. The stakeholders have shown support for the project and provided valuable information for its formulation. They have together identified all relevant stakeholders, their roles and activities as well as linkages with one another. At the same time they discussed amongst themselves and identified the actual and potential threats to biodiversity conservation in Malaysia and Perak. The Second Stakeholders' Consultation was held in Kuala Lumpur on 13 June 2002. During the consultation major stakeholders provided valuable feedback to further improve the proposal presented to them and had also commented on strategies for its effective implementation. The project proposal in principle was well supported and stakeholders were looking forward to its realisation. The implementation of the project will involve FRIM in collaboration with several agencies in the public and private sector, NGO's and universities. In fact private sector participation is high as the field data collection for the research will be undertaken in a timber concession (PITC) in Perak, Peninsular Malaysia.

In both consultations, the local indigenous communities, the *orang asli*, were represented. It is useful to note during the field audit of the forest management certification evaluation on the forest concession area of PITC, conducted under the auspices of the SCS Forest Conservation Programme in 2001, it was found that there are no outstanding land claims by the *orang asli* on the concession area and generally, harvesting on the PITC concession has been viewed as favourable as it allow better access for the harvest of rattan.

A representative of the *orang asli* community will be invited as a member of the National Steering Committee, to ensure that the views of the community are represented.

e) MONITORING AND EVALUATION

A National Steering Committee (NSC) will be established to govern the implementation of the project. The overall progress of the project implementation in will be monitored through the NSC of which UNDP as the GEF implementing agency is a member. Annual progress reports will be prepared by Project Coordinator and submitted to the NSC for consideration. A Technical Working Group, to be chaired by the Forestry Department Headquarters will be established to provide technical inputs to the project team. A International Advisory Panel (IAP) will also be established to discuss in detail the technical aspects of the project and provide technical advice to the NSC on the project

implementation and progress. This would ensure that the outputs are relevant and result in the desired pragmatic applications. The monitoring of the technical aspects in terms of research outputs, data collection and analysis, completion of technical reports will be undertaken by the IAP. Progress of the implementation of each activity will be reported and discussed at the annual IAP meeting. Progress reports will be submitted by relevant research project leaders to the IAP regularly.

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4. FINANCIAL MODALITY AND COST EFFECTIVENESS

The proposed research aims to develop tools that will be easily adaptable to any tropical forest site. To achieve this the PITC concession and the state of Perak, as a whole, will act as a laboratory for the development of tools. In addition, the proposed research activities will also draw upon data from other sites in Malaysia, in particular Virgin Jungle Reserves (VJR) and logged-over forests surrounding the VJRs, as well as the rich data from the Pasoh Forest Reserve, as a comparative test site.

The process of developing the tools will include testing and improving methods of data collection in order to verify the robustness of the tools developed. Hence project resources will be used to develop a hierarchical set of tools whose sophistication, data requirements and costs will vary. The project then investigates whether more data-intensive procedures are worth the extra cost, time and effort and seeks to answer the question: does more data improve estimates of biodiversity very much? The project will assess the degree of accuracy and precision that is sacrificed if models are instead to be based on varying levels of data, quality of data, or more limited number of variables.

Therefore the project proposes to undertake research to find out how to assess the species diversity of a large tropical forest region on the basis of a small number of small samples distributed within the region. This will be reasonably cost-intensive research, as extensive data collection will be needed to be undertaken in order to verify the robustness of the assessment. However, these results will have immense practical value to other tropical countries.

The one-off, up-front costs involved with this research do not reduce the replicability of the project's outputs. Indeed, the high up-front costs will lead to future cost-effectiveness if simple tools can be developed that are applicable for less data rich sites. The project will work towards identifying the most cost-effective techniques. In this way, the costs of the research should not be attributable only to the PITC concession site, but can be defrayed across the future tropical forest sites at which the tools are applied.

Direct financial support will be provided by GEF, Government of Malaysia through FRIM as the Implementing agency, PITC, as well as research grants from the 8th Malaysia Plan budget and the Timber Levy, and Harvard University and the University of California at San Diego (UCSD), USA. Indirect financial support is also being provided by other local collaborating agencies such as Forestry Department Peninsular Malaysia and the Perak Integrated Timber Complex. The project development team had also

submitted a proposal for co-financing to the International Tropical Timber Organisation (a letter of support from ITTO is attached as an annex to the project brief).

UNDP will monitor the costs of the various components of the project.

5. INSTITUTIONAL COORDINATION AND SUPPORT

a) CORE COMMITMENTS AND LINKAGES

FRIM is the national agency for forestry research in the country. It started as the Forest research Institute under the Forestry Department as early as 1929. In 1985, the Malaysian Forestry Research and Development Board Act was passed which allowed the Institute to change its status to that of a statutory body called Forest Research Institute Malaysia (FRIM). This was to enable the Institute to serve a Malaysia-wide clientele and interact better in an international context. FRIM is now responsible to the Malaysian Forestry Research and Development Board (MFRDB), which in turn is responsible to the Ministry of Primary Industries. FRIM has extensive linkages with national & international agencies such UNDP, FAO, IPGR. ODA, NIES, JIRCAS, CIFOR, ITTO and DANCED. FRIM today has the facilities and expertise to provide technical services to the industries in addition to the research and development activities that it was established to carry out. FRIM also has a strong workforce representing almost all fields expertise related to natural forest management, plantation forest management, forest environment and biodiversity, medicinal plant, timber technology, non-timber forest products, and economy. The total number of staff within FRIM amounts to 556, of which 151 are research officers.

The project will also benefit from an international advisory panel, which will meet to provide guidance and feedback on the progress of the research being undertaken. The terms of reference are contained in Annex I of the project brief. A national Technical Working Group will also be established to give guidance on a more regular basis to the project team on the relevance and applicability of the tools.

<u>Linkages with the Federal and State Forestry Departments</u>
Although the “designated institution” for the project is FRIM, the Ministry of Primary Industries will be the Executing Agency – assuming overall responsibility and accountability. The MPI is home to both FRIM and the Forest Department, providing a direct link between research and policy formulation that is based on existing government structures (thereby increasing sustainability). The Federal Forest Department also provides an institutional avenue to link the project research activities into the Perak State forestry planning processes.

In addition, the test site, PITC, is a subsidiary of the Perak State Government's economic arm called the State Economic Development Cooperation (SEDC). Therefore it is the expectation that the SEDC will be constantly engaged in the project activities.

The linkages with state level policy makers will be further strengthened by the fact that the Directors of the Perak State Forestry Department and the SEDC will be members of the National Steering Committee.

Furthermore the Forest Department (Federal) will be the Chair of the Technical Working Group, which also includes the State Forestry Department.

b) CONSULTATION, COORDINATION AND COLLABORATION BETWEEN IAS, AND IAS AND EXAS, IF APPROPRIATE.

In the initial stages of the project implementation, it is expected that the project team establish linkages with other GEF OP#3. Several relevant projects, from all three GEF implementing agencies have already been identified. The early involvement of other GEF OP#3 projects will increase the scope for partnerships, exchanges and replicability of the tools developed under this project.

The project has been developed in close cooperation with both the local stakeholders as well as with UNDP GEF in Kuala Lumpur. UNDP is able to be fully involved in the project through their participation in the National Steering Committee and Technical Working Committee for the project. The UNDP is also involved in all major activities such as the stakeholder consultations, technical workshops, logical framework analysis and co-financing efforts. Consultations were also made with UNDP GEF, New York during the project development phase to ensure that the project goals and objectives are in line with GEF requirements.

Linkage with UNDP Malaysia activities

Environment management is a major theme of UNDP Malaysia's Country Cooperation Framework (CCF). In the first CCF, the environment programme consisted of more than 84 per cent of committed resources, and this ratio is expected to remain at the same level for the second CCF.

In the current CCF (which is now known as the Country Programme Outline, CPO) covering the period 2003-2007, environment management is one of the three main themes of UNDP support. The Government has requested support to combine better enforcement of laws and regulations with increased use of economic instruments. Hence, this project, which has the development, fine-tuning and testing of economic valuation methods as one of the major components, fits well in the CPO and both the Government's and UNDP Malaysia's priorities.

The other main theme of Malaysia's CPO is the enhancement of South-south cooperation. This is important in the context of the proposed GEF project as the replication and dissemination of lessons learnt and best practices of the project results would ride on Malaysia's strong role in South-South cooperation. Agreement was reached in 2000 for UNDP and the Government of Malaysia to join forces to further South-South cooperation, to take advantage of the UNDP global network and capacity for

sustaining interaction between Malaysia and the many countries that value their development experience.

During the second CPO (2003-2007), a new South-South cooperation modality will be forged, whereby a multi-year, sectoral programme of cooperation between Malaysian expertise and selected developing countries will be linked to UNDP programmes in these countries, to give added value and continuity to South-South cooperation. Innovative trilateral arrangements between UNDP, the Malaysian Government and other multilateral or international organizations will facilitate South-South modalities where all parties are "learning by doing and sharing".

On the environment portfolio level, it is important to note that UNDP is the implementing agency of another GEF project, on peat swamp forest management. Significant synergies will be realized with this other biodiversity project, all the more so since FRIM is the implementing agency of the peat swamp forest project.

Moreover, UNDP's environment portfolio, for example, a project on the conservation of highlands has contributed to the outcome of improved Federal-State dialogue on use of natural resources, and hence a more enabling environment for the implementation of this proposed GEF project. At the same time, it is hoped that the GEF proposed project will contribute towards even more enhanced dialogue between decision makers on forestry matters.

ANNEXES

Annex A: Incremental Cost Analysis
Annex B: Logical Framework Analysis
Annex C: Response to External Reviews
Annex D: Information on the Perak Integrated Timber Complex (test site for some of the project activities)

ANNEX A: INCREMENTAL COST ANALYSIS

Development Goal

The goal of the project is to conserve biological diversity of tropical forest ecosystems through improved forest planning and management procedures. The project will contribute towards realisation of goals and strategies stated in the National forest policy and National Policy on Biological Diversity with emphasis on improvement of the knowledge base, strengthening of institutional framework, and integration of biological diversity considerations into sectoral planning.

Global Environmental Objective

The project will enable the conservation of globally significant biodiversity through the development of tools and methods for assessing and valuing biological diversity in a landscape that includes timber production forests. The project will also develop models to assist planners and managers to allocate those forests between production and protection categories in order to maximise biodiversity, while achieving timber management goals. The tools and models although developed in Malaysia can also be adopted and adapted by other tropical countries and thus promote the conservation of biodiversity not only in Malaysia but also globally.

Baseline Scenario

The baseline scenario for this project is that forest planning in tropical regions will continue to depend upon expensive, time- and data-intensive biodiversity assessment and valuation methods. As a consequence biodiversity values (including biodiversity of global significance) will not be incorporated into developmental decision-making in an efficient manner. Inadequate valuation of biodiversity in developmental decision-making will continue to result in inefficient (generally sub-optimal) allocation of forest resources to conservation.

At the site level the baseline scenario is that forest resources in Perak (particularly the PITC forest concession and nearby forest reserves such as Belum and Temenggor) will continue to be managed according to conventional forestry management practices in Malaysia. Biodiversity assessment activities will be limited to the existing National Forest Inventory and concession-level timber surveys undertaken by timber concessionaires. Little or no valuation analyses will be conducted, and as a result decision-making on allocation of forest areas to conservation versus production will be driven by subjective assessments and policy imperatives rather than formal, informed allocation mechanisms.

GEF Alternative

The GEF Alternative scenario builds upon baseline activities both on-site and within the research realm by facilitating the development of tools to better assess and value biodiversity in tropical forests. Development of these tools will be built upon extensive field biodiversity assessments in the project area, surveys and valuation studies of individual preferences and experimentation with varying harvesting approaches and regimes. Computer modeling and simulation will also be used.

The tools to be developed will be simple, cost-effective and easily-deployed in tropical forest countries. In situations where decisions have to be made on the basis of incomplete or inaccurate data (i.e. where the cost of collecting accurate, comprehensive data is prohibitive) the tools to be developed will allow decision-makers to understand the level of precision being sacrificed, thereby allowing informed decision-making even in the presence of inadequate baseline data.

The GEF alternative also will include activities to enhance and share knowledge between the project, other research institutions and decision makers, on the use of the tools and methodologies that will be developed. This will contribute towards the sustainability and replicability of the project outputs.

Incremental Costs

The incremental cost of the GEF Alternative is USD 5.704 million, of which the request to the GEF is for USD2.261 million. The GEF request will be used to finance project activities and outputs which contribute most directly to global benefits, particularly in the development of tools, methodologies or systems which applicable to sustainable management of tropical forests throughout the world, as well as the generation and dissemination of the tools and best planning and management practices.

USD3.443 million of the GEF Alternative will be required to address Sustainable Baseline activities, and these funds will be sourced from national sources as well as support from overseas research organisations and multilateral donors.
The Government of Malaysia, through research grants funded out of the 8th Malaysia Plan budget and the Timber Levy Fund will provide cash co-financing of $0.340 million. In addition, the Government of Malaysia will provide a total of USD 1.967 million to cover the costs of national consultants, the project support unit and the rental of office space.

A project proposal had been submitted for the consideration of the International Tropical Timber Organisation (ITTO). The proposal is currently in the second and final stage of technical screening, and a response from the ITTO Council is expected by the end of 2003.

This project has benefited from strong support from the host of the project site, the Perak Integrated Timber Complex (PITC). Much of the PITC's invaluable support has been in-kind during the preparation of the GEF project brief, and the project team has been given

assurance that this support will continue during the project itself. In addition, PITC will also provide cash co-financing of USD 0.05 million. There is a further, and more substantial contribution from PITC as they will consider the implementation of the new cutting regimes, on a pilot basis, and this could considerably affect their revenue. This 'indirect', but nevertheless crucial support has not be quantified and therefore not included in the incremental cost analysis.
The Universities of Harvard and UCSD (University of California at San Diego), which have been actively involved in the PDF B would provide co-financing of USD 0.530 million.

A breakdown of global and national benefits and attendant costs by project output is provided in the Incremental Cost Matrix below:

Incremental Cost Matrix

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
Output 1.1: Efficient statistical methods for estimating biodiversity from small samples	Baseline	0.210	Limited existing research on application of species-area relationships to the estimation of tropical forest tree diversity.	No existing research on application of species-area relationships to estimation of tropical biodiversity.
	GEF Alternative	0.627	Improved methods for extrapolating diversity from small area samples, allowing minimal variance in diversity estimates of a large area from a given number and size of smaller sample areas.	More accurate methods for diversity estimation from small sample sizes reduces cost of estimating biodiversity in tropical forest areas, and in other ecosystems more generally. Improved identification of beta-diversity allows identification of unique ecological communities for special conservation attention.
	Increment	GEF: 0.116 GoM: 0.147 Universities: 0.106	Preliminary research on estimation methods carried out. Optimal statistical models for identifying beta-diversity developed to improve sampling protocols.	Existing preliminary research on estimation methods further advanced. More accurate diversity estimation models developed. Beta-diversity identification improved to allow identification of unique ecological communities

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
Output 1.2: Improved methods for assessing biodiversity within and between forest community types	Baseline	0.181	No existing system for automated assessment of species richness.	Satellite-based forest community identification currently undertaken by visual analysis of satellite data. Identification requires skilled analysts using subjective skills and experience. No existing statistical systems for large-scale biodiversity assessment using satellite data for tropical forest areas.
	GEF Alternative	0.510	Automated species richness assessment using computerised pattern recognition reduced need for skilled staff.	Statistical procedures developed for large-scale analysis of high-resolution satellite data, allowing large-scale, low-cost biodiversity assessment of tropical forests using remote sensing technology.
	Increment	GEF: 0.020 GoM: 0.290 Universities: 0.018	Statistical procedures which can be applied to the extrapolation from selected samples	Satellite data studied and compared with field survey data using multivariate statistical methods, to develop algorithms for discriminating forest community type from remote sensing data.

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
Output 1.3: Improved understanding of the impacts of logging on biodiversity in logged forests and in adjacent or enclosed un-logged forests	Baseline	2.619	Limited understanding of biodiversity and hydrological resources within the project study area inhibits development of planning and valuation models.	Limited understanding of the role and impact of local refugia on recovery of biodiversity in logged-over forests., resulting in sub-optimal design and planning of refugia/ set-aside within production forests.
	GEF Alternative	3.717	Improved understanding of biodiversity and hydrological resources within the project study area to provide adequate data for development of planning and valuation models.	Enhanced understanding of the role of refugia in regeneration of biodiversity in logged-over forest, resulting in better planning and allocation of set-asides within logging concessions and forest landscapes.
	Increment	GEF: 0.446 GoM: 0.284 Universities: 0.055 ITTO: 0.313	Biodiversity and hydrology of the project study area (PITC concession and Temenggor and Belum Forest Reserves) assessed through plot sampling of selected taxa and hydrological monitoring at selected stations..	Biodiversity assessments of varied refugia (different-sized virgin jungle reserves and adjacent harvested areas) to determine impact of refugia on biodiversity regeneration, resulting in more efficient allocation of VJRs and other set-asides within forest management planning. Conservation monitoring system contributes to better management and understanding of forest

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
				biodiversity
Output 1.4: Manuals that explain how to implement the ecological assessment methods developed	Baseline	0	Limited manuals and training aids on how to implement the biodiversity assessment methods	Limited manuals and training aids on how to implement the biodiversity assessment methods
	GEF Alternative	0.047	Manuals produced based on the findings in Outputs 1-1-1.3	The manuals produced are targeted for GEF OP3 project managers and their host governments and will be used in the activities under Output 4 of this project, fulfilling the need for knowledge dissemination and exchange of information.
	Increment	GEF: 0.013 GoM: 0.016 Universities: 0.018	Manuals can be used to train Malaysian State Forestry Department personnel	Manuals used for dissemination of information to other GEF OP3 project managers.

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
Output 2.1: Detailed, "benchmark" models that relate economic values associated with biodiversity to ecological and socioeconomic factors that influence those values	Baseline	0.596	Limited data on socio-economic values of biodiversity resources, recreational use and existence values of tropical forests in the study area. No measurement of the impact of changes in forest cover on the hydrological regime in forest areas, or the economic costs associated with such hydrological changes. Genetic resources in forest areas not adequately valued.	Time- and cost-effective sample methods are available but their accuracy is uncertain. Lack of accurate estimates on economic costs of hydrological degradation results in non-optimal decision-making in forest and watershed management. Inaccurate estimation of value of genetic resources in tropical forest results in inefficient allocation of forest area between conservation and logging.
	GEF Alternative	0.468	Comprehensive socio-economic surveys provide baseline data for valuation studies, and allow estimation of the accuracy of periodic surveys. Landscape-level model accurately predicts economic impact of hydrological changes caused by changes in forest cover. Economic value of genetic resources in forest areas better assessed.	Small sample surveys more accurately used to assess socioeconomic values of tropical forests. Hydrological costs of loss of forest cover more accurately factored into forest management decision-making. Potential value of genetic resources in tropical forest areas more effectively estimated and factored into decision-making.
	Increment	GEF: 0.307 GoM: 0.459 Universities: 0.106	Comprehensive weigh-day samples of non-timber forest product harvesting compared with data from periodic surveys to assess accuracy of latter method. Recreational use and	Baseline socio-economic data and existing hydrological and ecological data used to develop economic models to more accurately value resources and

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
			existence values of forests valued using econometric modeling. Linked hydrological and economic models developed to predict economic impact of hydrological changes caused by forest loss.	functions of tropical forests.
Output 2.2: Simplified models that relate economic values associated with biodiversity to ecological and socioeconomic factors that influence those values	Baseline	0.068	Baseline models developed under Output 2.1 are relatively complicated and time-consuming to generate.	Baseline models developed under Output 2.1 are relatively complicated and time-consuming to generate. Applicability to other developing/ less-developed tropical countries is limited.
	GEF Alternative	0.439	Relatively few simplified, 'quick-and-dirty' models developed. Data collection therefore remains costly and time consuming	Simplified, 'quick-and-dirty' models developed and tested to enable more widespread application of valuation models by less skilled staff using simpler data, for example in less developed tropical countries.
	Increment	GEF: 0.143 GoM: 0.144 Universities: 0.084	Construct and test models based on subsets of the data used in Output 2.1	Construct and test models based on subsets of the data used in Output 2.1 Evaluate applicability in other tropical forest contexts.

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
Output 3.1: Improved models for predicting biodiversity within and between forest community types, taking into account logging status and location	Baseline	0.568	Existing models for predicting biodiversity within and between forest community types are limited and inaccurate, and require extensive survey data.	Lack of summary or surrogate measures for biodiversity in tropical forests means that biodiversity assessments are expensive and time-consuming. Data on alpha and beta diversity in tropical forest areas is therefore limited, inhibiting effective management and conservation of tropical forest areas globally.
	GEF Alternative	1.180	Development and application of the biodiversity models generates landscape-level data on alpha and beta diversity for forests in Perak state as well as estimates of forest regeneration after logging.	Development of summary measures/ surrogates for biodiversity and forest community types simplifies biodiversity assessment of tropical forests throughout the immediate region and other tropical countries. Models to predict regeneration after logging will assist in estimating the longer-term impact of logging activities on biodiversity.
	Increment	GEF: 0.225 GoM: 0.089 Universities: 0.091 ITTO: 0.206	Develop statistical methods and models to relate measures of biodiversity and forest community type to forest characteristics, and to predict regeneration rate after logging.	Develop and test summary measures of biodiversity in tropical forests as well as models to predict regeneration of forest cover and biodiversity after logging.

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
Output 3.2: Improved forest planning model for predicting the impacts on biodiversity, and associated economic benefits and costs, of different allocations of forests in Perak between production and protection categories	Baseline	0.137	No comprehensive or accurate means of incorporating biodiversity values into forest planning in Malaysia. Forest planners currently take biodiversity into account in a subjective manner, without accurate economic estimates. Allocation of forests between production and protection is therefore sub-optimal for biodiversity conservation.	Globally-significant biodiversity values not adequately incorporated into forest planning and forest allocation decisions in tropical forest areas, due to a lack of simple, cost-effective and accurate methods of valuing biodiversity versus other forest uses.
	GEF Alternative	0.338	Biodiversity values more easily and accurately incorporated into forest planning and forest resource allocation, through the development of a computer-based forest planning model which incorporates biodiversity values.	Globally-significant biodiversity values more effectively factored into decision-making in forestry management in tropical forest areas, through the use of a comprehensive, computer-based forest planning model.
	Increment	GEF: 0.04 GoM: 0.053 Universities: 0.057 Private sector (PITC): 0.047	A dynamic optimization model developed and linked to the spatial database for Perak, to maximise biodiversity conservation values for a given set of timber management constraints.	Computer-based forest planning model developed which assists in forestry management in tropical forest areas, using simple and cost-effective survey data.

COMPONENT	COST COMPONENT	COST (USD MILLION)	DOMESTIC BENEFIT	GLOBAL BENEFIT
Output 4.1: Enhance the knowledge and capacity to assess impacts on biodiversity and modelling changes due to human intervention on forest stands.	Baseline	0.126	No formal mechanisms to disseminate the tools, methods and approaches developed by the project within the forest management sector in Malaysia	No formal mechanisms to disseminate the tools, methods and approaches developed by the project to forestry sector stakeholders regionally and globally.
	GEF Alternative	1.739	Training and capacity-building activities undertaken to disseminate project developments to forestry managers throughout Malaysia.	Formal counterpart training and information dissemination program developed and implemented to share project successes with all interested parties involved in managing tropical forests, especially GEF OP 3 projects.
	Increment	GEF: 0.948 GoM: 0.826 Universities: 0.039	On-the-job training and formal instruction programmes designed and implemented, research fellowship scheme established for local counterparts	On-the-job training and formal instruction opportunities provided for regional counterparts. Project website established and maintained to disseminate project information and outputs.
Total	Baseline Increment GEF Altern. PDF B	4.508 5.704 10.212 0.196		

ANNEX B: PROJECT LOGICAL FRAMEWORK

Project Strategy	Indicators of success:	Means of Verification:	Assumptions:
Goal: To conserve forest biodiversity resources and to use them in a sustainable manner	Independent evaluation of PITC and one other GEF OP3 pilot project concludes that the biodiversity value of the areas as a whole is significantly higher than those of comparable sites that have not applied the methodology, while the net financial benefits derived from the concession are equal to or greater than those from comparable sites.	Ex-post evaluation of PITC and one other GEF OP3 site undertaken in year 7	PITC and one other GEF OP3 project show continuous interest and support in implementing the tools developed
Development Objective: To strengthen the inclusion of biodiversity conservation considerations into tropical forest management decision-making	The tools developed for improved tropical forest management decision-making are being recommended by relevant international bodies by the end of the project. Tools are incorporated into the Government of Malaysia'sforest management policies by the time of the ex-post evaluation	International organisations' policy papers, web-pages, meeting reports GoM policy documents, 5-year plan, medium-term plan	Project has sufficient influence and reach to appropriate international bodies Project impacts and outputs coordinate with the policy-making cycle of GoM and can be incorporated.

Project Strategy	Indicators of success:	Means of Verification:	Assumptions:
Immediate Objective 1: To improve and disseminate biodiversity assessment tools	Tools are disseminated to all GEF OP3 (Forest ecosystem) projects. Tools are applied by 50% of relevant GEF OP3 projects by the end of the project	Survey undertaken as part of the terminal evaluation to assess the application and applicability of the tools developed under the project.	Capacity , willingness and budgetary capacity of GEF OP3 project teams to work together with their respective host governments to implement the tools, where relevant, and have sufficient funding to do so.
Develop the data collection, storage and reporting system that will be the foundation for ecological and planning models	Data management system developed by the end of Year 1. Number of agencies accessing the data management system	Software, database and manuals	Computerised system is implemented by the State Forestry Department
Enter existing data on biodiversity in Perak and other relevant sites into the system such as forest inventory and land use maps, detailed topographical and geological maps, using a standard data recording system	Standard data format used by 30% of relevant GEF OP3 projects by the end of Year 3. GIS database developed having all relevant information on Perak State, by end of Year 2.	GIS database and reports Feedback survey results from other GEF OP3 projects	State Government guarantees free and unlimited access to data. Universities and research institutions share data and co-ordinate on research activities Capacity and willingness of GEF OP3 project teams to use the data format, in accordance to their specific needs.
Output 1.1: Efficient statistical methods for estimating			

Project Strategy	Indicators of success:	Means of Verification:	Assumptions:
biodiversity from small samples developed			
Develop method that minimizes the variance in an estimate of diversity of a large area from a given number and size of smaller sample areas.	Methodology developed and used by at least 1 other GEF OP3 or other forestry research project, on a pilot basis by year 4.	Reports and evaluation from the PITC, Lambir and Pasoh and the other pilot site	Existing state of knowledge is sufficient to enable the project team to accurately prioritise biodiversity values. Need to identify early in the project the other GEF OP3 or other forestry research project having the funds and interest to apply these procedures on a pilot basis
Develop optimal statistical methods for identifying beta-diversity, the differences in species composition among several sample areas	Statistical methods developed and used by at least 1 other GEF OP3 or other forestry research project, on a pilot basis by year 4.	Reports and evaluation from the PITC, Lambir and Pasoh and the other pilot site	Existing state of knowledge is sufficient to enable the project team to accurately prioritise biodiversity values.
Output 1.2: Methods for assessing biodiversity within and between forest community types improved			
Develop a statistical procedure that can discriminate forest community types from satellite data.	Statistical procedures developed by year 3.	Test results from PITC concession and other project survey plots	High resolution satellite image data acquired
Output 1.3: Biodiversity on a			

Project Strategy	Indicators of success:	Means of Verification:	Assumptions:
landscape level assessed and understanding of the impacts of logging on biodiversity improved			
To assess the utility of local refugia of limited size contiguous with harvested sites for biodiversity recovery	Evaluation criteria for utility assessment developed by Year 2. Utility of local refugias for biodiversity recovery assessed. Research paper on the assessment method and results receives favorable peer review (in research seminar or similar) after the statistical analysis of data (i.e. by early Year 5)	Evaluation criteria Peer review of results of the assessment method and results	State Governments will establish local refugias.
Assess biodiversity in environmentally-sensitive areas	Biodiversity in environmentally-sensitive areas assessed	Assessment report on biodiversity in environmentally-sensitive areas	Existing knowledge will enable us to identify indicator group(s)
Integrate results of biodiversity assessment in both priority and environmentally-sensitive areas	Results of biodiversity in both priority areas and environmentally-sensitive areas integrated	Report on conservation areas	Existing knowledge will enable us to identify indicator group(s)
To assess the existing biodiversity of the study area and adjacent undisturbed areas	Biodiversity of study areas assessed	Assessment reports	Existing knowledge will enable us to identify indicator group(s)

Project Strategy	Indicators of success:	Means of Verification:	Assumptions:
Output 1.4: Manuals that explain how to implement the ecological assessment methods developed	User-friendly manuals developed and disseminated to all relevant GEF OP3 project teams. Tools are applied by 50% of relevant GEF OP3 projects by the end of the project	Software and manuals. Feedback from other GEF OP3 project teams	Manuals are used in to guide decision making by State Authorities Capacity and willingness of GEF OP3 project teams to use the data format, in accordance to their specific needs.
Immediate Objective 2: To improve and disseminate economic valuation tools	Tools are disseminated to all GEF OP3 (Forest ecosystem) projects. Tools are applied by 50% of relevant GEF OP3 projects by the end of the project	Survey undertaken as part of the terminal evaluation to assess the application and applicability of the tools developed under the project.	Capacity and willingness of GEF OP3 project teams to work together with their respective host governments to implement the tools, where relevant.
Output 2.1: Improved tools for rapid, accurate assessment of biodiversity developed			
Develop practical methods for estimating values of non-timber goods and services	Guidelines on practical methods for estimating values of non-timber goods and services developed, and disseminated to all relevant GEF OP3 projects by year 4. Guidelines used by at least 20% of GEF OP3 projects working in similar conditions.	Guidelines on practical methods Feedback from recipients and users of the guidelines	Respondents interviewed in the process of developing methods to evaluate values of NTFPs give reliable information. Valuation methods are used in decision making
Develop probability-based models for valuing genetic resources in Perak's forests as a source of	Probability-based models developed by Year 3.	Software and manuals. Version of the model results	Models are used in decision making by State Authorities.

Project Strategy	Indicators of success:	Means of Verification:	Assumptions:
"leads" for new pharmaceutical products.	Simplified version of the results of the models developed for decision makers, and presented to at least 5 Malaysian State Forestry Departments. Favorable peer review by at least 50% of relevant GEF OP3 project teams on the model by mid Year 4.	specifically tailored for decision makers Feedback from relevant GEF OP3 project teams.	
To compile data for constructing a landscape-level, statistical model that predicts the economic consequences of changes in hydrological functions caused by changes in forest cover	Landscape-level models developed Simplified version of the results of the models developed for decision makers, and presented to at least 5 Malaysian State Forestry Departments. Favorable peer review by at least 50% of relevant GEF OP3 project teams on the model by mid Year 4.	Software and manuals. Version of the model results specifically tailored for decision makers. Feedback from relevant GEF OP3 project teams.	Models are used in decision making by State Authorities Capacity and willingness of GEF OP3 project teams to use the data format, in accordance to their specific needs.

Project Strategy	Indicators of success:	Means of Verification:	Assumptions:
Output 2.2: Manuals, data sets, and software developed	User-friendly manuals developed and disseminated to all relevant GEF OP3 project teams. Tools are applied by 50% of relevant GEF OP3 projects by the end of the project	Software and manuals. Feedback from other GEF OP3 project teams	Manuals are used in to guide decision making by State Authorities Capacity and willingness of GEF OP3 project teams to use the data format, in accordance to their specific needs.
Immediate Objective 3: To improve and disseminate tools for integrating ecological and economic aspects of biodiversity into forest planning decisions at a landscape level	Tools are disseminated to all GEF OP3 (Forest ecosystem) projects. Tools are applied by 30% of relevant GEF OP3 projects by the end of the project The models are integrated into Malaysia's forest management practices and in at least five other countries where GEF is supporting forestry projects.	Survey undertaken as part of the terminal evaluation to assess the application and applicability of the tools developed under the project.	Capacity and willingness of GEF OP3 project teams to work together with their respective host governments to implement the tools, where relevant. Government of Malaysia will implement tools developed in the project
Output 3.1: Models for predicting biodiversity within and between forest community types improved			
Develop statistical models that relate measures of biodiversity and forest community type to forest characteristics (e.g., area, topography, geology, climate,	Statistical models developed by end Year 2. Spatial diversity map produced by end Year 5	Software and manuals Diversity map	Models are used in the decision making process

Project Strategy	Indicators of success:	Means of Verification:	Assumptions:
canopy structure, years since logging in production forests).	Results of models shared with all relevant GEF OP3 projects		
Output 3.2: Models for predicting impacts on biodiversity and associated economic costs and benefits developed			
To develop a model that will predict the regeneration of the forest structure and biodiversity in harvested forest.	Prediction models developed Tools are applied by 30% of relevant GEF OP3 projects by the end of the project	Software and manuals Feedback from other GEF OP3 project teams	Models are used in the decision making process Capacity and willingness of GEF OP3 project teams to work together with their respective host governments to implement the tools, where relevant. Interested GEF OP3 project teams are involved in the final stages of the development of the tool.
To develop a computer-based forest-planning model that will assist forest planners in practical decision-making, especially decisions about the allocation of forests between production and	Forest planning models developed Tools are applied by 30% of relevant GEF OP3 projects by the end of the project	Software and manual Feedback from other GEF OP3 project teams	Models used by State Authorities in decision making Capacity and willingness of GEF OP3 project teams to

Project Strategy	Indicators of success:	Means of Verification:	Assumptions:
protection categories.			work together with their respective host governments to implement the tools, where relevant. Interested GEF OP3 project teams are involved in the final stages of the development of the tool.
Immediate Objective 4: To enhance and disseminate knowledge and capacity in biodiversity conservation through improved forest planning procedures	Extent to which knowledge and capacity on tools are disseminated in the region, and outside the region.		Tools are used by other countries
Output 4: Knowledge disseminated and capacity built with the view of replicating improved forest planning procedures			
Hands on training for State and Federal Forestry Department counterparts, members of other research institutions and GEF OP3 projects internationally, to cover all the research tools being developed	Number of training courses undertaken Proportion of Malaysian participants should be > 50% Number of follow up measures undertaken in Malaysia as a result of the training	Training reports Post training evaluation	Strategic identification of trainees Follow up strategy drafted and implemented.

Project Strategy	Indicators of success:	Means of Verification:	Assumptions:
Develop a web-site, publications, scientific exchanges, fellowships, etc. to disseminate results of research, tools, manuals and procedures/techniques developed by the project at national, regional and international levels	Results of research, tools, manuals and procedures/techniques developed are disseminated Number of times the website is visited. Number of searches performed on the website. Number of queries on the project tools (target 30) and maximum delay before an information request is satisfied (target value 3 days)	Web-site, publications and reports on workshops, conferences, scientific exchanges, fellowships etc.	Website is adequately publicized.
Cross project learning visits	Number of visits from other GEF OP3 projects to Perak. Number of visits of project team to other GEF OP3 projects	Post visit report and report on follow up measures	Follow up strategy drafted and implemented.

ANNEX C: RESPONSE TO EXTERNAL REVIEWS

- **a)** Council
- **b)** Convention Secretariat
- c) Review by expert from STAP Roster
- d) Review by the STAP

REVIEW BY EXPERT FROM STAP ROSTER:

Note 1: Prior to the STAP review, a peer review was carried out. Mr. William Maynard was commissioned to do the said review, based on his previous experience at the PITC concession as well as his tropical forest management experience. The comments made by Mr. Maynard as well as the responses to those comments informed the STAP reviewer, and have been incorporated into the brief. Further follow up will be done during the formulation of the project document.

Note 2: The response to the STAP review, as well as the revised project brief and executive summary was sent to the STAP reviewer on 11 July 2003, as requested by the GEF Secretariat. The second review received from the STAP reviewer is attached to this annex.

June 10, 2003

To: UNDP-GEF Regional Service Unit Asia and the Pacific

From: Roger A. Sedjo, Consultant

Subject: STAP Review of the proposed project **"Conservation of Biological Diversity Through Improved Forest Planning."** Special Service Agreement (SSA) for UNOSP project INT95R71

Introduction

This paper provides a Review of the proposed project **"Conservation of Biological Diversity Through Improved Forest Planning,"** which is of 5 year duration, implemented by the GEF and UNDP, and to take place in Malaysia with a focus on biodiversity.

The basic idea is a good one: to try to formally integrate biodiversity consideration into forest management, both for protected and for periodically harvested forest. To do this the researchers will develop tools that will enable forest planners in tropical countries to make more informed decisions about the allocation of forests between biodiversity

protection and timber production categories and about way to integrate biodiversity conservation measures into timber management systems. Given this information more biodiversity friendly system of forest production and production forests may be developed in the future.

The choice of Malaysia as the country in which the work is to be undertaken appears to a good one. Malaysia has tropical forests that have both significant timber and biodiversity values. Also the country has a history of research in forestry and a literature that is probably as rich as any tropical country in the world. Additionally, there are high level in country human resources to work with, including FRIM. Finally, it appears that the project has substantial in country support.

The project is sensibly constructed for addressing its questions. It has three components: one ecological, one dealing with valuation or economics, and one integrating these factors into "computer based forest-planning models"

Although, as suggested above, many of the features of this proposal are positive, this project is not without substantial challenges. I view the objectives of this proposal as extremely ambitious. It appears to me that the likely outputs have probably been overstated in the proposal, especially when the authors talk about new "methodologies," and widespread applications beyond the region in which the "tools" are developed. The notion of developing "quick and dirty" short-cut guides to appropriate decision making that include timber, biodiversity and other forest values, while appealing, may not be attainable at this time.

I know of no area of the world where the types of "tools" that the proposal for development for the tropical forests of Malaysia have been developed and are commonly in use. I am familiar with a recent attempt (within the past 20 years) of a similar nature for the public lands of the U.S. The project objective was to develop simple rules to determine the appropriate multiple-use mix of outputs on the forest lands. The researchers eventually gave up on the idea of simple "rules of thumb," conceding that the complexities and heterogeneous nature of the full complement of relevant considerations made such an approach unworkable. The tropical forests of the developing world are likely to be even more complicated than the well studied forests of the US. This is not to say that the development of such an approach ought not be tried again, but it should be recognized that such an approach is likely to be very difficult and probably has not been successfully implement anywhere in the world. If the investigators know of a working paradigm, then that paradigm should be cited and it certainly should be used to inform the development of this project and should probably be used as a conceptual and working model for this project.

Overall, this project also appears to be a bit of a fishing expedition. Many interesting questions are raised and the additional data collected and analyzed are likely to yield some useful findings, which may lead to better decisions in the forests. This effort may be well worth doing if done be competent focused people and given sufficient time. Nevertheless, I find the notion that this project can generate a broadly operational system

of easy to use low data requirement tools for evaluation biodiversity and trade-offs in tropical forests unlikely and oversold in this proposal.

Some Specific Points

Most of these points were raised by going through the approximately 17 pages of matrix in the proposal.

1. The proposal commonly its objectives as the development of methodologies. Throughout, however, the proposal actually calls for the using of existing methodologies to ask researchable questions or develop operational tools. I see little of what I would call the "development of methodologies" although tool development is a likely result.

2. The proposal regularly makes statements like "the tools developed by the project will be applicable to forests throughout Southeast Asia and in other tropical countries."
I doubt this. The critical component will be the empirical relationships that will be found via the data collection and analysis. The area of investigation in Malaysia is characterized in the proposal as somewhat unique. It will probably be inappropriate to generalize these findings to other sites and conditions. Note here that the data and observations are drawn almost entirely from one somewhat unique site. It is problematical whether these findings from one site can creditably be extended to different sites, especially outside of the dipterocarp forests and in forests beyond SE Asia. Furthermore, the ecological issue, which is complex even within the traditional ecological perspective, becomes even more complex within the context of an ecological view such as that of Botkin's *Discordant Harmonies: A New Ecology for the 21st Century* (1990, Oxford University Press). I should note that Botkin's view of a much more complex and therefore more difficult to predictable forest ecological system has become widely accepted.

3. Ecological processes occur over time. The long term equilibrium relationship between a logging regime and local biodiversity cannot achieved in the 5 year time period of the project. Thus the time frame of the project is likely to provide a "snapshot" while the relevant phenomena that we need to understand is dynamic and intertemporal.
However, by utilizing the rather large volumes of earlier data together with data generated currently, it might be possible to make some useful long term inferences. I note that the proposal is somewhat dismissive of much of the earlier data.

4. Administratively, it is difficult to see how all the parts of this project fit. GTZ and NIES are mentioned and their expertise cited including satellite imagery. How would they be used? Through consultancy arrangements?

5. The discussion many places of the proposal concerning reducing the sample variance is perplexing and obscure. One way to do this would be to increase the sample size. Another is to use a priori information, e.g., in a rationale for data stratification. Is this what is envisioned? If so, it should be stated, if not, the approach needs clarification.

6. Simple, cost-efficient and easily deployed tools. Much of the proposal is really about collecting and storing new and more data. New approaches for storing and to some extent collection data are an excellent idea, but inadequate in itself of improving decisions.

7. There are places where the proposal seems to suggest that models will substitute for data. One needs data to determine how the world works. Abstract models alone are not sufficient. Models need verification.

8. Much of what is called "developed of methods" is simply the application of existing methods to data sets for a new sites.

9. Some tasks are asserted without much indication of how this might be done. For example "the utility of local refugias for biodiversity recovery will be assessed." Is there really a widely accepted scientific way to do this?

10. There are a number of well know techniques for valuing nonmarket outputs, most of these remain somewhat controversial and often the estimates obtained are not taken very seriously by policy makers. As described in the proposal, the physical volumes of many of the nontimber values will be measured, however, how the economic values will be estimated remains vague. In many cases local markets exist and would provide appropriate prices. However, valuation for nonmarket outputs is likely to be more difficult. Are existence values to be determine by a Malaysian survey or a global survey? The literature suggests that the pharmaceutical values of the biodiversity is likely to be very modest. It may be more efficient to simply try to find least cost ways to prevent biodiversity destruction.

11. The statistical models that will related "biodiversity to the forest community" are likely to be of limited value when applied outside of the particular forest area in question. Recall, this forest area was characterized as somewhat unique.

12. Regeneration of the forest structure and biodiversity is largely an empirical question
A statistical model to predict regeneration is no better than the data. Also, regeneration of both trees and other forest biodiversity has an important intertemporal dimension. As noted above, it is not clear that the time period of the project, 5 years, is sufficient to give a adequately complete picture of regeneration over time.

Summary and Recommendations

Overall, I like many of the ideas found in this proposal. The ideal of trying to formally integrate biodiversity consideration into forest management, both for protected and for periodically harvested forest has a great deal of appeal. The notion of the development of tools that are broadly applicable in various tropical forests is also appealing and enhances the attractiveness of the proposal.

However, I doubt that many of these objectives can be achieved in the context of the proposed research. The proposal simply promises too much. While the activities of this proposal should add substantially to our knowledge of a specific tropical forest, and indeed probably provide very useful insights to many tropical forests generally, it is unlikely to provide tools of broad applicability without recalibrating them to the data (conditions) of other forests and regions.

Given this very major caveat, I still recommend proceeding with the project, particularly if very qualified professionals are involved.

Amendments made following the STAP review

Response to the STAP Technical Review Matrix

	STAP review issue	Response	Mention in amended project brief
	Introduction		
1	(page 1) I view the objectives of this proposal as extremely ambitious. It appears to me that the likely outputs have probably been overstated in the proposal, especially when the authors talk about new "methodologies," and widespread applications beyond the region in which the "tools" are developed. The notion of developing "quick and dirty" short-cut guides to appropriate decision making that include timber, biodiversity and other forest values, while appealing, may not be attainable at this time.	For the most part, we are indeed proposing to use well-established research methods to develop new tools, as the reviewer implies here and in point 1 below. Our use of the term "new methodologies" could thus be confusing. We note, however, that in the ecological literature it is common to refer to the development of "methodologies" (e.g., for assessing biodiversity) that can then be calibrated for use in different settings on the basis of small data samples in each different setting. This is exactly one of the project's goals, and is certainly attainable. Indeed, recent work (Plotkin et al, 2000, PNAS) has already improved our ability to predict tropical tree diversity on the basis of small samples in tropical forests ranging from Malaysia, to India, to Panama. To avoid confusion, in the rest of our	Page 21 first paragraph under Output 1.2: Efficient statistical methods for estimating biodiversity from small samples. The term "tool" has been now used throughout the brief to avoid any confusion.

		comments we will use "tools" instead of "methodologies."	
2	(page 2) The tropical forests of the developing world are likely to be even more complicated than the well studied forests of the US. This is not to say that the development of such an approach ought not be tried again, but it should be recognized that such an approach is likely to be very difficult and probably has not been successfully implement anywhere in the world. If the investigators know of a working paradigm, then that paradigm should be cited and it certainly should be used to inform the development of this project and should probably be used as a conceptual and working model for this project.	Pertinent citations include Plotkin et al. (*PNAS*, 2000), Plotkin et al. (*J. Theor. Biol.*, 2000), and Plotkin & Muller-Landau (*Ecology*, 2003). These cutting-edge works are representative of the paradigm within which we will develop tools for assessing biodiversity.	Page 21 first paragraph under Output 1.2: Efficient statistical methods for estimating biodiversity from small samples
3	(page 2) Overall, this project also appears to be a bit of a fishing expedition. Many interesting questions are raised and the additional data collected and analyzed are likely to yield some useful findings, which may lead to better decisions in the forests. This effort may be well worth doing if done be competent focused people and given sufficient time.	As noted above, we are not claiming that we will be able to create a single system with low data requirements that is applicable in all tropical forests. Quite the contrary: we are proposing to develop a hierarchical set of tools, whose sophistication, data requirements, costs, and reliability will vary. Because we are seeking to develop <u>procedures</u> for assessing biodiversity, valuing biodiversity, and	Paragraph 2 and 3 under Project Strategy in page 15 Two activities, Activity 1.3.2 and 1.3.4 (old numbering), on the development of a telemetered digital photo trapping and the establishment of a

		evaluating timber production-biodiversity conservation tradeoffs, not to identify guidelines that are universally applicable (such as, say, "always protect x% of the landscape," or "the value of NTFPs is always $X per hectare"), the results of the research should be broadly applicable. That is, although in developing and evaluating these procedures we will collect and analyze data from a small number of specific sites, we are not in the end interested in those data or the findings that come from applying the procedures at those sites. Instead, we are interested in the procedures themselves, and what we learn about their reliability by pilot-testing them at specific sites. We do not believe we have "oversold" the research. Instead, we believe we may not have described it clearly	genetic market database respectively have been excluded from the current brief
	Some Specific Points		
4	(para 1, page 2) The proposal commonly its objectives as the development of methodologies. Throughout, however, the proposal actually calls for the using of existing methodologies to ask researchable questions or develop operational tools. I see little of what I would call the "development of methodologies" although tool development is a likely result.	We have addressed this point above. The issue to some degree revolves around semantics and lack of clarity on our part. By "methodology," we refer, for example, to the development of new ways to sample forests for estimating biodiversity: how much area to sample?	Project Strategy in pp 14 – 15 has been rewritten in order to clarify the scope of the proposed research. The section on Research

	(para 8, page 3) Much of what is called "development of methods" is simply the application of existing methods to data sets for new sites.	where? when? We will answer these questions by collecting data in ways that are consistent with existing theory. The "tools" will be the practical, on-the-ground ways of implementing these methodologies Preliminary versions of these types of tools for estimating diversity of tree species have *already* been shown to be widely applicable throughout Southeast Asia as well as India and Panama! See Plotkin et al. (*PNAS*, 2000). As noted above, we are not interested in the "empirical relationships" developed in Malaysia, by which we understand the reviewer to mean such things as the relationship between the area of refugia within the PITC concession and the number of species in a particular taxonomic group with viable populations being maintained. Such a relationship may be of interest to Malaysian stakeholders, but the project aims at products that are of global value, not at products of value to Malaysia, since it is a GEF project. So instead, we are interested in the	methodology (pg. 15) has been added for further clarification. Throughout the brief, wording has been revised to refer to "tools".

		procedures—the tools—that yield these empirical relationships. If, in some tropical country, a forestry department wanted to know the relationship between area of refugia and biodiversity conservation, what kinds of data should it collect, and how should it analyze the data? These are the sorts of questions we hope to answer, and we hope to provide a range of answers (i.e., suggested procedures) from quick-and-dirty guidelines to more elaborate procedures.	
5	(para 2, page 2) The area of investigation in Malaysia is characterized in the proposal as somewhat unique. It will probably be inappropriate to generalize these findings to other sites and conditions. Note here that the data and observations are drawn almost entirely from one somewhat unique site. It is problematical whether these findings from one site can creditably be extended to different sites, especially outside of the dipterocarp forests and in forests beyond SE Asia.	We would agree if our goal was to generalize findings about empirical relationships, but as noted above that is not our goal. What is unique about the Temenggor site is that it has a number of characteristics that make it ideal for the research: an unusually cooperative concessionaire, examples of a range of important nontimber values (NTFPs used by local people, hydrological functions, existence values, etc.), available data from earlier biodiversity assessments, etc. Its uniqueness is thus a good thing, not a bad thing. The site is in hill dipterocarp forest, which is the principal type of forest subject to	

		logging in Southeast Asia (now that the lowlands have been extensively cleared), so from a policy standpoint the site is representative, not unique.	
6	Furthermore, the ecological issue, which is complex even within the traditional ecological perspective, becomes even more complex within the context of an ecological view such as that of Botkin's *Discordant Harmonies: A New Ecology for the 21st Century* (1990, Oxford University Press). I should note that Botkin's view of a much more complex and therefore more difficult to predictable forest ecological system has become widely accepted.	There are universal dynamics to tropical rainforests, such species-area relationships and the effects of dispersal limitations. Our aim is to develop tools that include the key sources of complexity as variables, which can be quantified for different forest types by following procedures we will develop. In this sense, in generic terms the empirical relationships we develop will be robust, although the specific form of those relationships will vary from forest to forest.	
7	(para 3, page 3) Ecological processes occur over time. The long term equilibrium relationship between a logging regime and local biodiversity cannot achieved in the 5 year time period of the project. Thus the time frame of the project is likely to provide a "snapshot" while the relevant phenomena that we need to understand is dynamic and intertemporal.	We are not dismissive of earlier data. The existence of such data is, as mentioned in the proposal, a reason for conducting the project in Malaysia. In developing tools for assessing biodiversity, the project will draw upon data from long-term, large-scale forest research plots elsewhere in Malaysia (Pasoh and Lambir), and to a certain extent similar plots in other areas of the tropics (e.g., Barro Colorado Island). One of the proposed activities involves using data	References to literature have been incorporated throughout the proposal, and a list of references added on p. 58

		from VJRs established over several decades, to permit the analysis of biodiversity recovery over a longer time frame, and the development of forest growth models will draw data from forest regeneration plots in Pahang.	
8	(para 4, page 3) Administratively, it is difficult to see how all the parts of this project fit. GTZ and NIES are mentioned and their expertise cited including satellite imagery. How would they be used? Through consultancy arrangements?	The involvement of GTZ and NIES will be collaborative in nature where the research activity will be undertaken by these agencies as part of their work programme. The information and results of the activity will be used by this GEF project. GTZ has an on-going collaboration with the Forestry Department Peninsular Malaysia on Sustainable Forest Management and Conservation while NIES has an on-going research programme with the Forest Research Institute Malaysia. Some of the objectives and planned activities of these agencies are similar to what is being proposed in this project. Implementation arrangements and contractual bases for collaboration will be clarified in the Project Document	Item ii) page 16 under Project Strategy
9	(para 5, page 3) The discussion many places of the proposal concerning	As noted earlier, we will evaluate a hierarchical set of tools. The effects of	Page 21 first paragraph under Output 1.2:

	reducing the sample variance is perplexing and obscure. One way to do this would be to increase the sample size. Another is to use a priori information, e.g., in a rationale for data stratification. Is this what is envisioned? If so, it should be stated, if not, the approach needs clarification.	sample size and stratification on the accuracy and precision of estimates of biodiversity and forest values are indeed among the issues we will consider in evaluating the tools, along with other statistical considerations (e.g., the incorporation of a priori information and learning, i.e. Bayesian updating)	Efficient statistical methods for estimating biodiversity from small samples
10	(para 6, page 3) Much of the proposal is really about collecting and storing new and more data. New approaches for storing and to some extent collection data are an excellent idea, but inadequate in itself of improving decisions.	As noted above, the project is not about collecting and storing more data. The reason for collecting new data is to permit the development and evaluation of new tools. Yes, we will collect data on biodiversity in Temenggor, but not for the sake of knowing more about biodiversity in Temenggor. The purpose is rather to determine whether more data-intensive procedures are worth the extra time and effort; does more data improve estimates of biodiversity very much?	
11	(para 7, page 3) There are places where the proposal seems to suggest that models will substitute for data. One needs data to determine how the world works. Abstract models alone are not sufficient. Models need verification.	We agree that models need verification. Hence the emphasis on data collection is reflected in the proposal.	
12	(para 9, page 3) Some tasks are asserted without much indication of how	The description of Activity 1.4.1 actually contains an extended discussion of how we will conduct this	

	this might be done. For example “the utility of local refugias for biodiversity recovery will be assessed.” Is there really a widely accepted scientific way to do this?	assessment. We quote: “We will pick 4 or 5 intact VJRs ranging in size from 20 to 500 hectares, each with adjacent harvested area. The harvested areas may differ in time since harvest. If possible, several harvested plots with different time histories around a single VJR will be selected. The potential flaw in this experimental design is that there is no control for the previous state of the harvested plot. Using the VJR as a control, that is as an estimate of the diversity of the harvested plot, is inappropriate because the VJR may have lost species by the species-area effect. It might also have been more directly affected by the adjacent harvesting (e.g., illegal logging). To overcome this problem, we propose to sample a third plot near, but not next to th VJR that was harvested at about the same time as the contiguous plot. It will be selected to be as similar as possible with regard to topology, soil type and distance from other major sources of recolonisatio This will permit an analysis of the VJR's effect on recolonisation of the contiguous plot. Any differences in recovery of	

		biodiversity between the adjacent and mo distant point may be interpreted as the rol of the VJR in the process. Tree species, small mammals, and several other taxa's diversity will be estimated for each set of three plots. The species-area relationship for the taxonomic groups will be estimate in the VJRs, and a multivariate analysis o effects of VJR size, time since harvest, et will be made for the logged sites." Relevant citations for this particular study include (Laidlaw 1994) and Laurance & Bierregaard, 1997).	
13	(para 10, page 4) Are existence values to be determined by a Malaysian survey or a global survey? The literature suggests that the pharmaceutical values of the biodiversity is likely to be very modest. It may be more efficient to simply try to find least cost ways to prevent biodiversity destruction.	All these issues are addressed in the proposal. For example, the first sentence of Activity 2.1.4 states, "This activity will survey Peninsular Malaysian [emphasis added] households to generate data necessary for estimating two important nonextractive nontimber values: recreation and passive use.	Page 31 last paragraph under Output 2.1
14	(para 11, page 4) The statistical models that will related "biodiversity to the forest community" are likely to be of limited value when applied outside of the particular forest area in question. Recall, this forest area was characterized as	Again, it is unique from the standpoint of being ideal for the research—which does not mean it is unrepresentative of Southeast Asian dipterocarp forests from ecological, economic, or policy standpoints. Moreover, it is not the	

	somewhat unique.	empirical relationships in the statistical models that will applicable elsewhere, but rather the generic form of those relationships and the procedures for quantifying variables and parameters included in them	
15	(para 12, page 4) It is not clear that the time period of the project, 5 years, is sufficient to give a adequately complete picture of regeneration over time.	As noted above, we will draw upon data from other sites in Malaysia, in particular VJRs and logged-over forests surrounding the VJRs, which will give us a time span of several decades to analyze	
	Summary and Recommendations	Our goal is to develop tools—procedures—that are broadly applicable across different forest types, requiring only recalibration of parameters on the basis of small samples. As noted earlier, this paradigm has already been proven to be extremely effective for (the limited goal) of predicting tropical tree diversity in a wide range of forests ranging from Southeast Asia, to India, to Panama (Plotkin et al., *PNAS*, 2000).	

SECOND REVIEW BY STAP REVIEWER, DR ROGER SEDJO

July 13, 2003

To: Tim Clairs

Regarding: UNDP-GEF Regional Service Unit Asia and the Pacific

From: Roger A. Sedjo, Consultant

Subject: Re-review of the STAP proposed project **"Conservation of Biological Diversity Through Improved Forest Planning."** Special Service Agreement (SSA) for UNOSP project INT95R71

As before, I continue to be quite positive toward this proposal. As now revised, I view the proposal as somewhat less ambitious and certainly more doable. In this context I agree with the writers that the project, as clarified, is not oversold.

I have examined the main review points of the proposal and particularly the "Amendments made following the STAP review as found in the "Response to the STAP Technical Review Matrix." Overall, I find that the Response was forthright and generally addressed adequately many of my concerns.

A major confusion in the original proposal related to the use of the term "methodologies." In the Response the proposal writers indicate that this means, what I would call, a "tool" or a "procedure." The writers have revised the proposal to substitute the term (and concept) tool for what was earlier called methodologies (which I view as involving a more ambitious concept). I find this rearticulation using the term tool much less theoretical and more reflective and accurate in terms of what the proposal actually appears to be proposing to accomplish.

Many of the comments throughout the "Response" relate to clarification of the project objectives, where some of the confusions resulted from definitional differences between the term "methodologies" and "tools." Additionally, the writers have now provided some references of recent work that can provide a conceptual and perhaps empirical basis for the undertaking of their new efforts. This suggests the research is building upon some serious recent work in the area. This is reassuring.

Also, one of my earlier criticisms related to the "unique" nature of the major forest site. The Response indicates that much of the uniqueness relations to a unique degree of cooperation and unique existing data for certain site ecological and economic variables. Of course, this is useful. Similarly, the writers stress the use of some of the data obtained in earlier research and reporting efforts.

The hypothesis that there are universal dynamics to tropical rainforests, such as species-area, relationships, is useful. However, these relationships may be quite different across forest types. One of the important outputs of this study could be to clarify the stability or variability of such relationships, at least within the dipterocarp forests. Comparisons with other plots in Malaysia and elsewhere in the tropics, e.g., Barro Colorade Island, would be most enlightening.

The Responses also clarified my questions, e.g., regarding statistical considerations for increasing precision and approaches to estimating nontimber values.

Overall, I found the Response discussion useful and responsive to my inquiries. As before, I believe this is a useful project. The extent to which tools and protocols that are broadly useful across numerous forests remains an open question. However, it is reasonable to posit that there are likely to be broad similarities in underlying ecological relationships across forests of similar types and these similarities can be characterized.

A major limitation that remains in the study is that ecological processes occur over time. The long term equilibrium relationship between a logging regime and local biodiversity cannot achieved in the 5 year time period of the project. Thus the time frame of the project is likely to provide a "snapshot," while the relevant phenomena that we need to understand are dynamic and intertemporal. As noted, by utilizing the rather large volumes of earlier data together with data generated currently, it might be possible to make some useful long term inferences. One approach would be to determine the extent to which species noted in earlier inventories are still present. Can the earlier species all be located? How many are lost? This investigation might provide very useful perspectives as to the degree that many of these species are truly threatened, as opposed to being hypothetically threatened.

Summary and Recommendations

As before, I like much of what is found in this proposal. The ideal of trying to formally integrate biodiversity considerations into forest management, both for protected and for periodically harvested forest, has a great deal of appeal. The notion of the development of tools that are broadly applicable in various tropical forests is also appealing and enhances the attractiveness of the proposal.

I am now more sanguine than before, based on the review dialogue, that many of these objectives can be achieved in the context of the proposed research. The proposal, while it still promises much, is in the range of the achievable. The activities of this proposal should add substantially to our knowledge of a specific tropical forest, and indeed probably provide very useful insights to many tropical forests generally.

Hence, I recommend proceeding with the project.

REVIEW BY STAP:

	POINTS RAISED BY STAP	RESPONSES
1	Improved biodiversity assessment – I can see the spatial aspect (including habitat) being considered, is there any temporal assessment and can this be built in? The information from Pasoh forest may be able to provide the temporal data as I am sure the FRIM people in particular are aware of this extremely important aspect of tropical rainforests.	The temporal aspect of the assessment is built in the activity were the bioversity assessment studies will also be carried out on areas adjacent to VJRs, which had been logged decades ago, and would therefore provide information on biodiversity recovery over a medium to long term time scale.
2	Ecological communities fine, but also need to link it with functionality of the species or communities for the different ecosystem services they provide[1]. It may be possible to then link this up with the economic valuation.	This suggestion will be addressed during the implementation of the project.
3	Improved economic valuation –may need to decide the good and services more specifically. I assume you will use contingency valuation, willingness to pay and it would be interesting to see what kind of results come out. I assume that all stakeholders would be included in the sample for the valuation of the forest services.	The goods and services form the forest that the project proposes to valuate are non-timber forest products, hydrological services, genetic resources as sources of leads for new pharmaceutical products, and recreation and passive use.
4	Improved forest planning models. It would be interesting to see if simulation models that incorporate the main economic, ecological and social "indicators" can be developed. It is a challenge. Also a lot of timber products estimates depend on the presumed growth rates of forests and thus simulation models that can vary the growth rates and the curves for specific	The project team will take this suggestion into consideration during the implementation of the project.

[1] In terms of the ecosystem services to consider, there is a conceptual framework that is to be published by the Millennium Ecosystem Assessment in mid August that could help with overall link between ecosystem services, their valuation. More details at www.millenniumassessment.org

	species can be useful. Same would apply for any other type of harvesting. I am sure that this type of information would be available from FRIM, which as the project states have long history of research and I am sure the information from their work in Pasoh forest would be very valuable for this.	
5	In terms of forest planning, one of the tools that is being used is community mapping. Assuming there is non-timber product use by local communities, this might be an important aspect to consider.	The project team will take this suggestion into consideration during the implementation of the project.
6	I have not see if the project intends to look at the effect of large scale fires which may or may not be an issue in this area. If they are and are linked to the El Nino events and even perhaps climate change, it would be an important aspect to consider in forest planning.	The proposed project at present has not extended the research to cover large-scale fires, as they are not an issue in this area and this type of forest.
7	It would also be useful to see if there was a hierarchy of planning tools to deal with strategies/policies at the national level, how they impact at the state level and then the landscape level at which the forest is being considered.	The project team will take this suggestion into consideration during the implementation of the project.
8	In terms of the tools development, I assume that the researchers would in fact do extensive literature survey to see what has been done in other tropical forest areas. The rapid assessment biodiversity assessment is being conducted in various tropical rainforest, there is some information coming for valuation techniques etc and hopefully the project will build on this, improve them and disseminate them to a wider audience.	This is indeed an important point and the institutional framework within which the proposed project will be managed will ensure the linkages with on-going relevant work. Firstly, FRIM, which would be the implementing agency of the project, would most likely be involved in, and or least aware of other relevant research projects in the country, as it is the national institute that conducts forest research. Secondly, the International Advisory Panel of the project would be able to guide the

		project team to build on other research work being done outside of the country, as well as ensure that knowledge management and dissemination activities reach a global audience/
9	Overall an interesting project. I hope that there has been and will be a full engagement of the stakeholders both in terms of the research that would be done but also the implementation of the outcomes. I look forward to the results.	The project team, under the guidance of the executing agency, will ensure that there is continued engagement of the stakeholders. At the international level, the project will identify, in the early stages of the project, those existing GEF-funded projects most likely to benefit from exchange of lessons learnt.

ANNEX D: INFORMATION ON THE PERAK INTEGRATED TIMBER COMPLEX (TEST SITE FOR SOME OF THE PROJECT ACTIVITIES)

Introduction

The Perak Integrated Timber Complex Sdn Bhd (PITC) is a subsidiary of the Perak State Government's economic arm called the State Economic Development Cooperation (SEDC) The concession area consist of rich and highly diverse tropical rain forest, although some parts of it has been logged in the past. The entire concession area constitutes part of Temengor Forest Reserve within Hulu Perak district, Perak Darul Ridzuan, Malaysia. It lies in the northeastern corner of Perak between latitudes 5°24'40" to 5°34'15" North and longitudes 100°33'0" to 101°39'30" East covering a total area of 9,765 hectares of rich and pristine lower and upperhill dipterocarp forest. To its north is the Belum State Nature Park while not far to the east is the Perak-Kelantan border .

The entire forest has been found to be generally rich in various types of flora and fauna including giant Meranti bukit (*Shorea platyclados*), Keruing Kipas *(Dipterocarpus constulatus*.), Keruing mempelas (*Dipterocarpus crinitus*) and Merbau (*Intsia palembanica*) trees as well as large mammals and birds. On the other hand there are also patches of areas dominated by bamboos which are good for the elephants. According to the records of the State Forestry Department of Perak, Temengor Forest Reserve was officially gazetted as a permanent forest estate (PFE) in 1991 covering an area totaling 148,670.00 ha. The latter represents about 14.93 per cent of the total area of PFE in the state – by far the largest contiguous PFE in Perak after Belum FR (134,167.00ha) and Bintang Hijau FR (118,860.00 ha).

Administratively, the PITC concession forest falls under the ambit of the forest district of Hulu Perak which has its office in Gerik town. The forest district is headed by a District Officer (DFO) who reports directly to the State Director of Forestry in Ipoh. The DFO is being assisted by an Assistant DFO (ADFO) and several Forest Rangers and Foresters.

The composition of the stakeholders within PITC is as follows:

- Perak SEDC 60%
- Ivory Pearl Sdn Bhd (IPSB) 30%
- Etika Mekar Sdn Bhd (EMSB) 10%

For a start PITC has been granted a 30-year license to log and manage, under the sustainable forest management (SFM) principles, the concession forest now being described in this report. Round timbers from this forest concession and other sources will be fed and processed at PITC sawmill before being sent to vendors for further processing

into furniture parts. Upon a stringent quality control procedure, these furniture parts will be subsequently taken to Ivory Pearl Sdn Bhd.'s (IPSB) factory for final assembly, finishing and packaging before going for export. The strategic alliance between PITC and IPSB (and its associate Home & Leisure International (HLI)) is critical by virtue of the latter's vast experience and extensive access to export market outlets in the United Kingdom and Europe.

Management Mission, Strategy and Objectives

PITC's mission has been stated thus "to develop an environmentally appropriate, socially responsible and economically viable sustainable integrated timber based industry in the State of Perak that fulfils Perak State economic policy".

The company's corporate objectives are:

g) to develop a sustainable vertically integrated timber based industry,
h) to continuously improve processing of timber resources and enhancing the value of downstream activities
i) to promote export of high value-added forest products,
j) to manage the forest resources in compliance to internationally recognised criteria & indicators for continuous production of forest products,
k) to enhance public awareness on the environmental and conservational roles of forests, and
l) to seek internationally recognised and accredited FSC and ISO 14001 certifications.

Climate

Hulu Perak District has a typical tropical monsoon climate characterised by uniformly high temperatures and high humidity. The northeast monsoon occurs during the months of November to March whereas the southwest monsoon occurs during the months of May to September. In between these two monsoons there are two doldrums which are characterised by heavy precipitation especially in April and October. It is not surprising therefore when Temengor FR receives rains in excess of 3,000 mm per year at times.

Geology, Topography and Site Conditions

The forest concession area forms part of Peninsular Malaysia Titiwangsa Main Range. The topography is very variable ranging from riverine plains of lower hill dipterocarp forest to rolling hills with long slopes and seemingly endless, knife-edge narrow ridge tops, with the much of the area lying between 400 meter asl to about 1,000 meter asl. However, the hills close to the rivers tend to be lower with short but steep slopes. On

general the terrain gets higher and steeper as one moves towards the eastern and southern borders.

The geology is composed mostly of metamorphic arecaceous rock/carbonaceous slate especially on the lower grounds which evolve into acid igneous rock on the hills and steep slopes. These parent materials yield the fertile alluvial soils on the lower grounds and sandy clay loam respectively thus enabling them to support lush tropical forest vegetation. However, due to an extremely visible presence of animal activities (especially elephants), much of the soils on the slopes are disturbed leading to severe erosion, and loss of top soil. The presence of thick bamboo growth in many locations may also contribute to the lack of humus layer, exposure of the top soil rendering it prone to erosion and hence a below average fertility.

Site conditions such as site sensitivity risk, slope steepness and presence of fast flowing rivers have significant influence on the choice of harvesting methods, logging intensity (species, size, and number of trees cut and removed as well as logging damage), road alignment, bridge and culvert design, size and positioning, working condition, degree of supervision and control required as well as rehabilitation approaches. Table 1 shows the analyses of slope classes in the concession area which can be categorised into gentle, moderately steep, steep, very steep and extremely steep.

Table 1 Summary of Slope Classes in the Concession Forest Area

Slope Class	**Gradient (as observed at centre of circular plot)**	**Total Area, ha**	**Proportion of total area, %**
Gentle	0 - 10° (0 – 18%)	2,099.96	21.51
Moderate Steep	11 - 20° (19 – 37%)	3,116.80	31.92
Steep	21 - 30° (38 – 59%)	3,364.00	34.45
Very Steep	31 - 40° (60 – 84%)	1,053.00	10.78
Extremely Steep	> 40° (>84%)	131.20	1.34
Total		9,764.96	100.00

Hydrology

Several large and fast-flowing rivers run along and form natural boundaries for the northern and eastern perimeters of the concession area. For example, Sungai Selaur which meets Sungai Mangga forms the concession's northern boundary, before flowing to the west to meet Sungai Singor at the area's western extremity. A good part of the latter constitutes more than half of the western boundary before splitting into Sungai

Sengeh and Sungai Talong. Sungai Sengeh which cuts the concession area into two unequal halves (northern and southern portions) has its origin in the high mountains along the Kelantan border. On the other hand, Sungai Talong which runs through the southern portion of the concession forest area are equally unique with rapids and cascading water and flowing in between creeks. During heavy rains all of these rivers quickly swell up and flow dangerously fast. In other words, this situation implies the need for an extreme caution during planning for roads, bridges, culverts and other infrastructure which in turn calls for a need to carefully consider the local site peculiarity and variability. The rather high densities of river and stream networks inside the three major watersheds of Singor, Sengoh and Talong signify the need for meticulous control of water flow and soil stabilisation measures.

Wildlife

Besides the multitudes of flora species of all kinds, the virgin stand of tropical forest within the concession area is also rich in fauna. These include large mammals such as elephant, bear, deer, mountain goat, tiger, birds, insects as well as aquatic life. This is not surprising since the area is located not too far from Belum State Nature Park and the Temengor dam area which are popular destinations for wildlife relocation scheme conducted by the Department of Wildlife and National Parks. In view of this, the concession forest therefore holds promise as a potential destination for ecotourists, scientists and nature lovers.

Forest Resource Base

The forests in this area belong to the lower and upper hill dipterocarps forest types rich in commercial species such as Meranti (Shorea spp.) Mersawa (Anisoptera spp.), Keruing (Dipterocarpus spp.), Kempas (Koompassia malaccensis), Merbau (Intsia palembanica), Medang (Lauraceae) and Perah (Elateriaspermum tapos). The average total standing volume of trees of 30.0cm dbh and above has been estimated at 231.86m^3/ha which is above average by Peninsualr Malaysian standard. The timber trees which grow luxuriously exhibit their own peculiarities in terms of population structure, growth habit and distribution. Merbau, Meranti tembaga, Meranti sarang punai, Balau and Damar hitam for example can be found both by the river sides as well as on the higher plains and low hills whereas Keruing tends to locally colonise high, steep and narrow ridges is much the same way as Meranti bukit.

Table 2: Distribution of trees by diameter classes

Diameter Class (cm)	***Number of trees/ha***		
	Non- Dipterocarps	***Dipeterocarps***	***All species***

30-39	*23.28*	*11.11*	*34.93*
40-49	*20.71*	*12.22*	*32.93*
50-59	*18.02*	*11.89*	*29.91*
60-69	*17.61*	*11.09*	*28.70*
70-79	*13.15*	*12.07*	*25.22*
80-89	*12.55*	*12.81*	*25.36*
90-99	*11.2*	*12.22*	*23.42*
>100	*10.8*	*13.53*	*24.33*

Upon studying their habitats and population structures it was clear that the timber stands which have achieved their climax formation are dominated by emergent trees of large dbh's (diameters and breast height) with abundant of seedlings on the forest floor. On the other hand, the representation of the pole sized trees are poor by comparison which gives rise to the question**:** whether the selective felling system of management (SMS) is appropriate to this concession forest or not. This is by virtue of the fact that a successful implementation of the SMS is contingent upon an adequate presence of pole sized trees and advanced regeneration of good quality and commercial value. With the controlled opening and release provided by a reduced impact logging operation to be judiciously conducted by the company, these advanced regeneration are expected to be able to put on a reasonably high growth rates and achieve timber sizes in about 30-40 years before being logged again during the following cutting cycle. Now with the poor presence of the pole sizes and advanced regeneration, the vest approach to regenerate the logged stands would be through the longer-cycle seedling based system such as the Modified Malayan Uniform System (MMUS) which takes about 60 – 70 years for the tress to reach maturity.

The forest is also rich in non-timber resources such as medicinal plants, palms, wild orchids apart from bamboo and rattan which can be found in abundance. The rich presence of wildlife especially elephants, monkeys, sambar deer, birds and insects as well as aquatic life is unmistakable.

Forest Reserve and Compartments

As mentioned earlier, the whole concession area of about 9,765 ha lies within Temengor Forest Reserve and covers a total of 26 forest compartments whose delineation follow the boundary demarcation system normally adopted in Peninsular Malaysia for inland forests. In other words, compartment boundaries follow as much as possible natural physical features/boundaries such as permanent rivers, ridge-tops, watersheds, roads, etc.. However, due to the way the concession area has been delineated such that only areas below 1,000m asl were leased out, several compartments had their boundaries cut

through by the concession boundary. As a result the extents of the respective forest compartments in the concession vary form very small as 18 ha to as large as 688 ha.

Forest Management

Although its parent Organisation the Perak State Economic Development Corporation (SEDC) has had a considerable experience in logging and timber trading in the past through its various subsidiaries, PITC being a new entity, has no such advantage to fall back on. Everything needs to start afresh with no precedence to follow. Moreover all of the forestry operations conducted by the various Perak SEDC's previous subsidiaries were mainly short-term leases. PITC's operations will be different in that; through a 30-year concession agreement with the State Forestry Department, the company will be responsible for managing the forest sustainably, in addition to being an anchor company to selected groups of vendor entrepreneurs in the state in the furniture industry.

PITC fully acknowledges this heavy responsibility and the high expectation placed on it by the parties concerned despite all its shortcomings. The company therefore views these responsibilities very seriously as a challenge to be tackled and overcome effectively and in a professional way. The successful implementation of this project and hence the realisation of the state's industrialisation objectives are certainly contingent upon the full cooperation of the various related agencies including the state and district forest offices, MTIB, MTC, FRIM and NTCC, etc whose experiences and expertise PITC aspires to draw on. The agreement on the technical cooperation signed between Perak SEDC and the Regional Centre for Forest Management (RCFM) in June 1999 was a case in point. Under the agreement, RCFM has agreed to extend its consultation and technical expertise in various aspects of forest management and information technology (IT) to PITC in order to help the latter to successfully manage the forest concession under consideration over a stipulated period of time.

Conservation Of Biodiversity And Genetic Resources

Biological diversity or biodiversity is the variety and variability among living organisms and the ecological environment in which they occur. It can be defined as the number of different items and their relative frequencies. Biodiversity is usually considered at three levels namely, genetic diversity, species diversity and ecosystem diversity.

The objectives of biodiversity conservation within PITC area have been determined as follows:

e) to ensure that sufficient areas are protected for the conservation of biodiversity (flora and fauna)
f) to maintain and perpetuate genetic diversity represented by populations of selected (i.e. target) species within the areas where such genetic diversity is at risk of erosion

g) to use source-pedigreed populations for collection of seed for enrichment planting programme
h) to maintain essential ecological services provided by this forest reserve

The removal of genotypes of the best trees from selected species through selective cutting has led to genetic erosion of these species. Logging activities also affect wildlife, from frogs to elephants, to varying degrees. Birds and primates that are dependent on primary forests receive the greatest impact. Forest understorey birds such as babblers are significantly reduced in logged forest because they cannot tolerate changes in the microclimate, while fruit-eating canopy birds are significantly reduced owing to a reduction in certain types of fruit-bearing trees. On the other hand logging may also cause a slight increase in the numbers of some species of mammals and birds. In other words, logging has the tendency to influence and subsequently alter local population structure and demographic composition of wildlife in the forest under management. This in turn calls for an in-depth understanding of the respective animal's behaviour and their response to different intensities of logging. There is also a need to understand the lingkages these animals play in the overall forest ecosystem and how changes in their structure and population will effect the integrity of the ecosystem in the long run.

Other than timber trees, the concession forest also houses non-timber forest produces including rattan, bamboo, ornamental plants (including palms such as fan palms (Daun Sang) and wild orchids as well as plants of medicinal value such as ginger, tongkat ali, kacip fatimah, ubi jaga which need to be wisely managed and conserved.

Conservation of Species

The conservation of selected tree and other species in the PITC area can be affected by adopting stringent conservation and mitigation measures through the practice of reduced impact logging (RIL) and establishment of in situ conservation plots.

Habitat conservation is especially vital for the in situ conservation and preservation of species. In this respect, a few areas can be kept as small unlogged forest areas within the concession area based on the following criteria:-

- areas adjacent to totally protected area (Belum Forest Reserve)
- areas of rare or endangered species
- areas of exceptional species richness
- areas with unique landscape.

Among the natural processes involving forests worthy of conservation is the links and interactions many of which are unique in particular in the tropics i.e. ecosystem-ecosystem relationship (forest and rivers). Any change to a forest ecosystem may influence other nearby ecosystems, for example logging and increased soil erosion can cause siltation of rivers.

An important step towards realising the strategies and objectives of biodiversity and genetic resource conservation in the area is through the implementation of harvesting that is least damaging to the environment.

In carrying out logging steps should be taken to ensure that the detrimental effects on the biodiversity are kept to the minimum. Forest harvesting and all related infrastructure development will be properly coordinated and regulated in accordance with the prescribed forest management so as to minimise damage to younger regeneration, safeguard environmental quality and maintain ecological balance.

The compartments to be logged in a particular year should be spread out. Compartments adjacent to the one being logged should not be logged within a period of three to five years. A mosaic of undisturbed forests in close proximity to logged forests will help maintain biodiversity. It is axiomatic that logging damage increases proportionately with logging intensity. PITC will therefore endeavour to minimise damage through strict observance of sound forestry practices whereby intensity of logging will be tied against original stocking and risk of stand degeneration.

It is important to note that on 1st July 2002 Scientific Certification Systems (SCS) certified PITC under the FSC scheme – a major breakthrough as it is only the third FSC certified natural forest in Asia.

Local communities

As for the legal and customary use-rights in PITC, there is no *orang asli* community in PITC concession, except for about ten families, which have been employed by PITC to work in the logging operations within PITC. As of last year, PITC has allowed these *orang asli* to establish a village inside the concession area.

There are nine villages of indigenous communities scattered outside the concession area. These local communities around the concession consists of around 700 people. These local communities are traditionally dependent on the forest for their livelihood, with hunting and collection of non-timber forest products as the main activities.

The villagers continue to depend on the nearby forest for their livelihood, as not much agriculture land has been developed, besides small areas planted with hill paddy, maize, tapioca and yam. In addition, the Jahai community moves from place to place, unlike the other local communities, called the Temiar and Semai, which do practise some agriculture for subsistence. Around 50% of the villagers are involved in rattan harvesting or fruit harvesting from the forest. Harvesting rattan for cash income is the main income-generating economic activity of the villagers.

However, the *orang asli* do not find adequate forest resources to sustain livelihood from the surrounding area. As they are located relatively far from the urban centre and agricultural estates, there is an acute shortage of employment opportunities. The residents mainly depend

on the harvesting of non-timber forest produce (NTFP) for subsistence needs and cash income generation. These NTFP resources are depleting over the years.

Under the project, activities have been planned to generate data necessary for comparing alternate methods of quantifying the amounts of NTFPs collected by the indigenous *orang asli* households. It will also generate data necessary for constructing models that relate NTFP collection to household characteristics (age, income, education, proximity to markets and wage employment, etc.). This data will feed into the economic valuation models that will be developed.