INTERNATIONAL TROPICAL TIMBER ORGANIZATION

ITTO

PROJECT DOCUMENT

TITLE:	TO ESTABLISH A NATIONAL MONITORING INFORMATION SYSTEM FOR THE EFFECTIVE CONSERVATION AND SUSTAINABLE MANAGEMENT OF THAILAND'S FOREST RESOURCES
SERIAL NUMBER:	PD 195/03 Rev.2 (F)
COMMITTEE:	REFORESTATION AND FOREST MANAGEMENT
SUBMITTED BY:	GOVERNMENT OF THAILAND
ORIGINAL LANGUAGE:	ENGLISH

SUMMARY:

This proposed project aims to generate monitoring information to support informed policy decision-making by the National Park, Wildlife and Plant Conservation Department of Thailand (DNP) and other agencies involved in forest conservation and sustainable forest management (SFM). The specific project objective is to set up a national forest-resources monitoring information system to provide change and trend data on timber and non-timber forest resources. These data when linked with socio-economic data would provide a basis for policy decisions and for measuring progress toward SFM using the national Criteria and Indicators (C&I) reporting.

This project proposal builds on the completed ITTO project PD 2/99 Rev.2 (F), whose output was a set of forest-resources monitoring (THAIFORM) procedures that included techniques for establishing monitoring points, collecting and processing field data, and GIS analysis. This proposal deals with the following issues that were not addressed by the PD 2/99 Rev.2 (F) project:

1. Setting up a national baseline forest resources monitoring system to provide biophysical data from a network of permanent plots.
2. Linking the biophysical data from the forest resources monitoring with socio-economic data from other relevant institutions.
3. Linking forest resource monitoring with the reporting of the national C&I of SFM.

These issues were recommended by the Project final national workshop of stakeholders and the final Project Steering Committee meeting.

ITTO project intervention is needed to assist Thailand set up the baseline forest resources monitoring system within a relatively short time-frame (< 3years), to allow continuous monitoring. Without the project intervention, it would take longer (7-10 years) to set up the baseline system; the consequence is that it would be impossible to measure nationally the changes and trends over time. Once established, however, the monitoring system would be managed and financed by DNP since the cost of plot remeasurement would be spread over time by staggering the remeasurements.

The expected project outputs are a national baseline forest resources monitoring system, a campaign to promote use of the monitoring information, and a baseline national C&I report.

IMPLEMENTING AGENCY:	NATIONAL PARK, WILDLIFE AND PLANT CONSERVATION DEPARTMENT OF THAILAND (DNP)
DURATION:	36 MONTHS

BUDGET AND PROPOSED SOURCES OF FINANCING:

SOURCE	CONTRIBUTION IN US$
ITTO	677,743
Govt. of Thailand	382,677
TOTAL	**1,060,420**

ABBREVIATIONS

C&I:	Criteria and Indicators of sustainable forest management
CWD:	Coarse Woody Debris
DNP	National Park, Wildlife and Plant Conservation Department of Thailand
EFDR:	Electronic Field Data Recorder
GIS:	Geographic Information System
GOT:	Government of Thailand
ITTO:	International Tropical Timber organization
NFI:	National Forest Inventory
NGOs:	Non-Governmental Organizations
NTFPs:	Non-Timber Forest Products
PSC:	Project Steering Committee
RFD:	Royal Forest Department of Thailand
SFM:	Sustainable Forest Management
THAIFORM:	Thailand Forest Resources Monitoring System

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1. Origin

The Kingdom of Thailand recognizes the importance of sustainable forest management (SFM), and the need to build the necessary infrastructure to support the evaluation and adoption of proper policies towards SFM. This proposed project **is** submitted by the National Park, Wildlife and Plant Conservation Department of Thailand (DNP). **The DNP is the Thai government's new department responsible for forest conservation. The DNP mandate is to conserve, promote and rehabilitate wildlife and plant species by protecting the original conservation areas and rehabilitating the degraded forest areas, to ensure a balanced ecosystem, environment and biodiversity.**

This proposed project aims to strengthen Thailand's ability to create and manage forest resources monitoring information for better policy decision making. It builds on the International Tropical Timber Organization (ITTO) Project PD 2/99 Rev. 2 (F), whereby Thailand conducted preparatory studies for installing a national forest resources monitoring system (THAIFORM).

The outputs of the PD 2/99 Rev. 2 (F) project were:

- A statement of monitoring objectives – what forest resources Thailand should monitor and why.
- A THAIFORM system for collecting, processing and displaying forest resources data.
- An installation plan for establishing a national monitoring system.

The operational pilot of the proposed THAIFORM system that was conducted in the 175,156-ha Ngao Model Forest in northern Thailand concluded that the THAIFORM system worked well in the pilot project area, and that THAIFORM procedures could be used nationally. However, several issues that were not addressed by the PD 2/99 Rev. 2 (F) have been identified; they include:

- Setting up of a national baseline forest resources monitoring system.
- Establishing the link between the biophysical data from forest resources monitoring and socio-economic data from other relevant institutions, to provide a basis for policy decisions.
- Linking the monitoring data with the reporting of the national Criteria and Indicators (C&I) of SFM.

These issues were recommended for investigation by the PD 2/99 Rev. 2 (F) final workshop of stakeholders held in Cha-am in Phetbury Province on October 2002, and the 4th and final Project Steering Committee (PSC) meeting, where the project results were presented and discussed. The final workshop participants also suggested improvements to the THAIFORM field procedures, and expressed support for use of the THAIFORM procedures for national forest resources monitoring.

Through this project proposal, Thailand is seeking incremental financial assistance and limited technical support from ITTO to establish a national forest resources monitoring system that will address these identified new issues.

2. Sectoral Policies

The Kingdom of Thailand is located between 5° and 21° North latitude, and 98° and 106° East longitude. The total land area is 513, 115 square kilometers (51.3 million ha). To preserve the remaining forest lands, the Thai government banned logging throughout the country in 1987. As well, for nature conservation and maintenance of environmental balance, the seventh national economic and social development plan (1992-1996) designated that 40% of the country's area be forest reserve.

Twenty-five percent of the forest landbase was reserved as protection forests in the form of national parks, wildlife sanctuaries, nature conservation forests, and wild land for other environmental protective purposes. The remaining forest reserve (15%) was designated as productive forest, which would provide regular timber output, and other minor profits based on intensive forest management. To achieve this target (increase forest

reserve area from 26% to 40%) the ~~DNP and~~ Thai government launched a large-scale forest plantation effort in the encroached areas of the country.

In 1964, about 43% of the land area of the country was formally registered as national forest reserve. However, due to the high demand for land and timber products during the last three decades, the forestland has been changed to other uses, including agriculture. This has resulted in significant reduction of the forest area; the existing forest area in Thailand in 1995 was only about 26% of the total land area.

The proposed forest resources monitoring information could contribute to the evaluation of the following relevant policies:

1. Thailand National Forest Policy (Cabinet Resolution on 3 December 1985; available on the world wide web: http://www.forest.go.th):

    a) Long-term guidelines for forest management and development shall be established to maximize national social and economic benefits and national security, with sufficient measures provided for environmental protection. Emphasis shall be placed on harmonized utilization of forest resources and other natural resources.
    b) Forty percent of the country shall remain forested (25% protection forest and 15% productive forest).
    c) To conserve and protect the natural environment, the State shall accelerate the city planning process and designate specific area of forest, residential, rural and agricultural areas in each province to prevent forestland encroachment.

2. Current government natural resources and environment policy (delivered to National Assembly 26 February 2001): That aims to restore the conditions and quality of natural resources and biodiversity, to prevent degradation and depletion of natural resources and to use natural resources and biodiversity in a manner that is beneficial to the peoples' livelihood.

3.   Programs and Operational Activities

This project is in conformity with the objectives, targets and developmental guidelines for natural resources and environmental administration outlined in the 9th National Economic and Social Development Plan (2002-2006) of Thailand (*Draft Summary of the National Economic and Social Development Plan, The ninth Plan 2002-2006.* Chapter 4. The Office of the National Economic and Social Development Board, Bangkok, March 2001). This Development Plan emphasizes increasing administrative efficiency to maintain a balance between development and conservation of the natural resources and the environment. The proposed methods to achieve this balance include:

*   Use of information technology for effective management of natural resources including conservation, rehabilitation and maintenance of the environment.
*   Development of potentials and behaviors of Thai people in maintaining environmental conditions, organization structure upgrading, and strict law enforcement.
*   Participation of the people in the conservation and management of natural resources and the environment.
*   Use of the area-function-participation approach to enhance sustainable conservation and utilization of natural resources.

The Development Plan targets to, by the year 2006, conserve and rehabilitate forest reserve, covering no less than 25% of the entire Kingdom; protect biodiversity in all reserve areas as well as demarcate reserve forest zones; and conserve no less than 1.25 million rai (200,000 ha) of mangrove areas, in order to safeguard environmental balance and biodiversity.

Overall, the outputs of the proposed project will provide feedback to national policy makers on the effectiveness of current policies and the identification of modifications that will enhance these policies.

1.   Project Objectives

1.1   Development Objective

To contribute to the effective conservation and management of Thailand's forest resources and the environment.

1.2   Specific Objective

To establish a national forest resources monitoring information system to provide change and trend data on timber and non-timber forest resources.

2.   Justification

2.1   Problems to be addressed

The main problem to be addressed is the need for information to provide a basis for informed policy decisions on forest resources. The policy decisions cover several aspects, including the forest resource base, social, economic and policy areas. These aspects are discussed below:

- *Status of forest resources and the environment.* Thailand recognizes the importance of monitoring the quality and condition of forest resources and biodiversity. In order to make informed policy decisions, reliable estimates of status, changes and trends of forest resources that are consistent across the country are needed.
- *Food security for local communities.* In Thailand, many communities are dependent on the forest for daily survival. They collect mainly non-timber forest products (NTFPs) for food and to supplement their income, since there is a logging ban in the country. In most cases, however, people harvest NTFPs without permits. To ensure a sustainable supply of these resources to benefit the peoples' livelihood and formulation of policies on NTFPs, information on changes and trends in NTFPs linked to socio-economic data, is needed.
- *Economic development.* Thailand's natural forest is divided into two categories: conservation forests and production forests. In conservation forests or protected areas, use of forest areas for recreation, education and research is allowed while consumptive uses such as logging, hunting and collecting of resources are prohibited by law. On the other hand, in production forests uses of the area resources both timber and non-timber products are permitted with official permission. To ensure sustainable economic development, it is important to demonstrate nationally that these economic forests are being sustainably managed. This can be achieved, for example, through C&I reporting.
- *Natural resources and other national policy reviews.* The government of Thailand has in place natural resources policies, however, in many cases systems to monitor the effectiveness of these policies are lacking. It is, therefore, difficult to make informed decisions on forest conservation and sustainable forest management. For example, the effectiveness of the 1989 policy banning logging countrywide is difficult to evaluate without relevant information.

This need for information could be addressed if a reliable national monitoring information system that integrated forest resources data and socio-economic data was in place. If the monitoring information system is not established, it will be difficult to make informed policy decisions regarding the forest resources and the environment. This in turn would affect the quality and abundance of the forest resources, and affect the livelihoods of the people dependent on the forest for food.

Monitoring is defined here as the periodic measurement of forest resources to establish comparison baselines, and to detect and measure changes and trends of the status of forest resources over time. Typically, the monitoring information is obtained from sources such as the national forest inventory (NFI). While Thailand has conducted several national forest inventories (NFI) in the past, no reliable estimates of changes and trends that are consistent across the country are available. The main reasons for this are that:

1. The objectives of these past inventories were mainly to provide estimates of current timber volume.
2. The inventory techniques and area coverage changed over time. (Note that valid change estimates cannot always be determined as the difference between successive inventories, because erroneous information can be obtained when apparent differences arise from changes in methodology or area of coverage, or from replacing old data with new data.)
3. These past inventories lacked data on changes and trends over time in non-timber values, and did not link directly with the new national C&I.

2.2   Intended situation after project completion

After project completion, the monitoring information system would be operational and provide statistically valid measurement data of forest resources at regular intervals that are valid nation-wide. The system would help detect resource changes, and identify potential problems. These forest resources data would be integrated with socio-economic data to support policy decisions.

The expectation is that these integrated data generated by the monitoring information system would:

- Lead to informed decision-making and balanced public debate by the DNP and other agencies involved or interested in forest conservation and sustainable forest management in Thailand
- Allow for rapid detection of changes in vegetation cover condition and health, especially in forest areas that may be considered at risk.
- Provide better knowledge about the quantity and distribution of NTFPs that can be used by local communities that are dependent on the forest.
- Be used for national C&I reporting.

This way the monitoring information system would contribute to effective conservation and management of Thailand's forest resources and the environment, and also contribute to global efforts to conserve and manage the world's remaining tropical forest resources.

2.3   Project strategy

The proposed project strategy is to establish a forest resources monitoring to collect biophysical data over the entire country within a short time-frame, and to link these data with socio-economic data from other relevant institutions. This proposed strategy would involve the following steps:

- Hold a national workshop to train the field crew and crew chiefs on the use of the THAIFORM procedures developed under PD 2/99 Rev. 2 (F) for establishing permanent plots. The workshop will be followed by regional mentoring sessions by the national experts seconded to the project. The field crew will consist of temporary labor (student field assistants and local labor). The students are to be hired so as to reduce project cost (low unit cost), and to build future capacity to maintain the monitoring system. The student assistants are local senior undergraduate or graduate forestry students. They were used successfully in the PD 2/99 Rev. 2 (F) pilot project. Note that the crew chiefs, who will oversee the work of the student assistants, are seasoned and experienced field staff of the DNP. The local labor helps with plant species identification.
- Install permanent plots over the entire country in two phases (rather than start from one corner of the country). In phase 1 install plots on the 40 x 40km grid points countrywide and do a preliminary analysis of the results; in phase 2, install plots in the remainder of the 20 x 20 km grid points. This strategy may increase the overall costs slightly, however, it allows for the opportunity to make changes to procedure, and provides usable results in case the project has to stop prematurely for some reason. This approach worked well during the PD 2/99 Rev. 2 (F) pilot project.
- Prepare products (e.g. thematic maps, statistical tables) from all the permanent plot database, and link these with the socio-economic data. The socio-economic data will be imported and integrated with the forest resources monitoring data through the GIS.
- Prepare a baseline C&I report following the ITTO guidelines.
- Hold a joint national workshop of policy makers to promote use of the forest resources monitoring database, publicize the C&I report, and to provide feedback to data generators.

- Update the monitoring system taking into account the workshop feedback, and develop a strategy to address any emerging issues.

2.4   Target beneficiaries

The main beneficiaries of the proposed project are:

a) The DNP and other policy makers: The monitoring information will be used for better formulation and evaluation of forest conservation and management policies at the national level, and for national C&I reporting.

b) Non-Governmental Organizations (NGO's): The monitoring information will contribute to balanced public debate on forest conservation and sustainable forest management.

c) Local communities: The monitoring information would result in better policies regarding NTFPs, which are crucial for the communities dependent on the forest for food security and survival.

2.5   Technical and scientific aspects

Overview
The proposed continuous national forest resources monitoring information system would consist of the following three major components:

1. Baseline forest resources monitoring data. A network of unbiased permanent monitoring points, and a set of 'hidden' permanent plots established at the monitoring points, will be established over the entire country based on a 20 x 20 km grid. The data will be stored, retrieved, manipulated and updated in a GIS environment.
2. Promotion of the use of the monitoring database for policy decisions.
3. A reporting system to produce national C&I reports, and other customized user reports

The purpose of the monitoring information system is to provide data to support policy decisions and C&I reporting. It is proposed to set up the baseline forest resources monitoring data within a relatively short time frame (< 3years), to allow continuous monitoring. Without project intervention, it would take Thailand a longer period (7-10 years) to set up the baseline system, and this would make it difficult if not impossible to measure the changes and trends over time. Once established, the monitoring system would be managed and financed by the DNP as the plot remeasurement costs can be spread over time.

This forest resources monitoring system will be integrated with the country's NFI that is now used to provide national forest statistics. Unlike the monitoring system that will cover the entire country, the NFI focuses only in forested areas and is based on a 10 x 10km grid. The integration of the proposed monitoring system with the NFI would be achieved through the use of common:

- Measurement standards and procedures (THAIFORM) and database.
- Grid sample locations. The NFI's 10 km x 10 km grid will be nested within the 20 x 20 km grid for monitoring. The NFI would use the monitoring data, not vise versa.
- Plot cluster design to collect data needed for both inventory and monitoring. At each sample location, four temporary plot clusters will also be established in cardinal directions from the permanent plot for collecting extra data for NFI purposes.

This integrated approach would lead to an efficient and affordable forest resources monitoring information system that can be maintained over time by the DNP. An alternative approach would be to establish an independent monitoring system. This would require additional staff and funding, and would likely not be supported by the government given the current climate of budget reductions, or be sustainable.

Each of the monitoring information system components are described further briefly below.

Baseline forest resources monitoring data
Network of monitoring points
The most current satellite (Landsat TM) data and GIS will be used to esablish a network of unbiased permanant monitoring points on a uniform, fixed, 20 km x 20 km grid over the entire country. The grid

intersections form the monitoring points from which to collect baseline data and to detect changes over time. This grid size will result in a total of approximately 1,300 monitoring points, with approximately 425 points falling in the forested areas. The 20 km x 20km grid was adopted as the most sustainable and can provide meangingfull results; it was a balance between cost and data resolution. It provides an adequate number of plots to give acceptable national monitoring statistics for trees; for example, the sampling error of tree biodviersity (Shannon Weaver index) could be within $\pm$10% (95% probability). A uniform grid was selected, as it would be simpler to maintain plot selection probabilities over time.

The grid is generated through the image processing system onto the georeferenced image and monitoring points are referenced using UTM coordinates. The grid intersections are classified and described based on the final land use map and overlays of data from other sources. In the future, whenever new satellite data or other data are available, the GIS system is used to describe the changes in conditions at the monitoring points over time.

Permanent & temporary field plots
A 'hidden' permanent sample plot (PSP) will be established at each of the approximately 1,300 grid monitoring points using the methods developed in the Project PD 2/99 Rev. 2(F). Additional four temporary sample plots (TSPs) will also be established around each PSP in cardinal directions (see Annex F). The purpose of the TSPs is to increase precision of vegetation and coarse woody debris estimates for the baseline-monitoring database and the NFI.

For purposes of implementing the fieldwork, the country will be divided into 5 regions and use a total of 10, 13-person field crews (Table 1). Each crew will consist of 2 crew chiefs, 5 student assistants, 2 drivers, and 4 laborers who will be divided into two groups of roughly equal size each with a crew chief. One group will establish the PSP and other the temporary plots, all in one day, on average.

Table 1. Fieldwork implementation

Region	Total Area (ha)		Number of crews
	Hectares	%	
North	169,644	33	3
Northeast	168,854	33	2
South	70,715	14	2
West & Center	67,398	13	2
East	36,502	7	1
Total (Country)	*513,113*	*100*	*10*

The permanent plots will consist of concentric circular fixed-area plots and line intercepts, and measure current status and changes over time in vegetation biodiversity, tree growing stock, coarse woody debris (CWD), soil properties, impact of human activities and natural causes on site and vegetation, and wildlife habitat use (Table 2; Annex F). In the temporary plots, only the vegetation and CWD data will be measured. No soil, site disturbance, and wildlife habitat measurements will be taken in the temporary plots. The rationale for choosing circular plots and clusters is discussed in Annex E.

Table 2. Ground data gathered and sampling method

Data Gathered	Sampling Method			
	Plot Type	Number	Radius (m)	Total Area (ha)
Seedling density	Fixed-area	4	0.631	0.0005
Understory vegetation & sapling density	Fixed-area	1	3.99	0.0050
Bamboo and erect rattan length & tree stump	Fixed-area	1	12.62	0.0500

	Sampling Method			
volume; site description				
Tree attributes; human & natural disturbance; wildlife habitat use	Fixed-area	1	17.84	0.1000
CWD, rattan & climbers volume and length	17.84-m line-intersect	2		
Soil physical and chemical properties	Soil pit	1		

To reduce cost, new technology will be implemented in data collection. The data will be collected using electronic field data recorders (EFDRs), which facilitate faster data entry, verification and screening in the field. The software for these EFDRs will be developed based on the tally sheets developed under Project PD 2/99 Rev. 2 (F). Laser or eletronic measuring devises will be used to facilitate distance measurements and slope correction.

The sample data from the grid will be used to compile summary monitoring statistics for each grid intersection, or combined to provide summary statistics for the entire country or specific strata. The data summary program developed in the Project PD 2/99 Rev. 2 (F) will be used. Thematic maps displaying the summary statistics will also be produced.

The estimated average cost to establish a cluster consisting of one PSP and four temporary plots at each monitoring point is about $480. This cost includes the total cost of training and mentoring (Activity 1.2) and the actual plot establishment (Activity 1.3), averaged over all the 1,300 sample locations. The average cost per PSP in the PD 2/99 Rev. 2 (F) pilot project was about $250. The increased cost for the proposed project is mainly due to the establishment of additional four temporary plots; the expected extra travel time from base camp to plot (wider national grid spacing compared to the pilot project: 20 km versus 1.5 km); and the better quality of the data due to use of EFDRs.

Data management
Database development and proper maintenance is important, especially for the monitoring databases that will need to be kept for long periods of time. The Microsoft Access database currently used by DNP will be reviewed and updated, to ensure:

- That the Data Model blueprints are current.
- Data and referential integrity.
- Appropriate data security and access.
- Sufficient documentation for managing the database and backups, and maintaining discipline in data changes.
- The database is dynamic.

The GIS system will be upgraded to use object-oriented technology, which support new data models for geographic information. This will require use of the newly acquired software architecture (Geodatabase Data Access Objects) ArcInfo 8.1, that provide the framework to store, retrieve, manipulate, and update the values of object properties.

Promotion of use of the monitoring database
A national workshop would be held, and information kits would be produced, to promote use of the monitoring database. The monitoring database will include the biophysical data from forest resources monitoring and the socio-economic data from other institutions. The socio-economic data typically include the general characteristics of the population (e.g., income, level of education, household size, and occupation), land ownership, and financial status.

The forest resources data will be linked to socio-economic data available from other institutions through GIS overlays. For example, linkage could be formed with Thammasat University in Bangkok, which conducts village surveys every two years and these data are available on a GIS system. Additional socio-economic data may have to be collected during the baseline forest resources survey. These additional data would

include items such as forest resources utilized, knowledge about forest regulations, and suggestions for future forest management.

Reporting system

The integrated monitoring database and accompanying software will be the main reporting tool of the monitoring information system. The outputs will include thematic maps and national statistical summary tables. The reports will include the C&I baseline report, which will follow the ITTO guidelines for C&I reporting, and other customized user reports.

2.6   Economic aspects

The economic benefits of a fully operational monitoring information system from this project include sustainable income generation by local communities; securing forest products export markets; and informed forest policy reviews and interventions that result in sustainable economic growth. These aspects are discussed further below.

Many local communities in Thailand rely on collecting NTFPs to supplement their income. Thus, information on the status, changes and trends in the NTFPs from the monitoring system would help the these communities to properly plan and sustain their incomes.

Another ~~The~~ economic justification for this project lies in the connection between ~~importance of~~ sustainable forest management (SFM) and **forest products markets**. Although there is a logging ban in the country, limited logging of timber is permitted in community forests if it is prescribed in the management plan for the community forest. Thailand exports both timber and non-timber products. **According to the *Forestry Statistics of Thailand 2000,*** in 2001, for example, Thailand exported logs and sawn timber worth $128 million, other wood products worth $880,000, and non-timber products (honey, cloves, bamboo, rattan canes, etc) worth about $40 million, mostly to Europe, Canada, Middle East and Australia. Therefore, to help secure Thailand's forest products markets, it is important that a feedback monitoring system for SFM, using tools such as C&I reporting, be in place. This C&I reporting will demonstrate to the public and product markets that Thailand's forest resources and the environment are being properly managed and conserved. This would also help attract foreign investment in the forest sector.

Finally, the monitoring system would provide reliable data to ensure balanced debate on forest policies that may affect national economic development. The results of the monitoring system could result in a review of policies such as a ban on logging of timber in the country. Lifting of the logging ban, if found appropriate, could, for example, **increase timber exports and** thereby help improve the economic development of the country. **On the other hand** ~~Finally~~, the monitoring system would raise red flags in areas at risk of unsustainable forest management practices in non-timber and timber products. This would result in policy interventions leading to balanced and sustainable economic growth.

2.7   Environmental aspects

The proposed project would contribute to the monitoring of the forest health and condition since the data collected include tree condition, lichen loading on trees, impact of human/natural causes on site and vegetation, and soil data. Tree condition and lichen loadings are good indicators of pollution. The soil data would help interpret changes in forest condition. The monitoring system would raise red flags in areas where rapid changes due to human and natural causes are occurring. This ~~It~~ would ~~also~~ allow for rapid intervention in areas found to be at risk.   The monitoring system would also provide policy makers the necessary information to base conservation measures.

There are no anticipated negative project environmental impacts in terms of pollution or other harmful effects.

2.8   Social aspects

This proposed project has important social aspects because:

(a)   Local people heavily depend on the collection of natural NTFPs for food and income.

(b) The number of resource users is increasing due to the growing population and economic problems.

The monitoring system would provide the identity, location and abundance of medicinal plants, edible plants and other NTFPs. This information, as well as the link to other services and socio-economic data, is therefore very crucial in helping improve the well being of the forest-dependent communities. In addition the techniques developed in this proposed project could also be applied at community forests level, to assist the local communities sustainably manage their resources.

2.9   Risks

The proposed project outputs could be affected by the following:

1. Political will to use the project results in policy decisions. To minimize this risk, a workshop has been included as an activity, so as to build support for the project results.
2. Cooperation from other institutions in providing socio-economic data: To minimize this risk, the project has an activity to lobby the various institutions and departments for the data.
3. Commitment by another government department to provide helicopters: Some sample locations, especially in the south and north of the country where it mountainous, may be dropped for safety reasons.

3.   Outputs

The following three outputs have been defined in support of the Project Specific Objective:

- Output 1: National baseline forest resources monitoring system established. The objective of this output is to collect baseline forest resources monitoring data. The baseline forest resources data includes data on changes and trends in the quality and amount of timber and non-timber forest resources.

- Output 2: Use of the forest resources monitoring information promoted. The objective of this output is to ensure there is linkage between data generation and its use in policy decision-making, and that the forest resources monitoring information is actually used in policy decisions. One important way to ensure use of the monitoring information is to link the forest resource monitoring data with the socio-economic data.

- Output 3: National baseline C&I report prepared. The objective of this output is to produce a baseline C&I report against which subsequent changes and trends can be measured. This C&I report would be prepared following the ITTO guidelines. It would also demonstrate an immediate use of the monitoring data.

4.   Activities

For the three Project Outputs, the following activities have been identified based on discussions with the relevant DNP staff and the lessons learnt from the Project PD 2/99 Rev. 2 (F).

4.1   Output 1

Activity 1.1 – Establish a national network of monitoring points.
This activity would involve the following tasks: 1) GIS staff to conduct satellite data acquisition and processing, and image preparation and interpretation; 2) GIS staff to establish and describe the monitoring points on a fixed 20 x 20 km national grid; and 3) GIS staff and field crew to conduct ground-truthing of satellite data based on limited field work.

Activity 1.2 – Train and mentor field crews.
This activity would involve the following tasks: 1) Project manager to organize a five-day workshop to train field crews; 2) the project national experts, and Inventory Consultant to train and mentor field crews; and 3) National experts to conduct a two-day follow-up mentoring of the field crew at the start of the field work.

Activity 1.3 – Collect baseline forest resources monitoring data.
This activity would involve the following tasks: 1) Project manager to hire field crews and acquire field equipment, including electronic field data recorders (EFDR); 2) Field crews to establish the permanent and temporary plots; 3) field crews, data analyst and Inventory Consultant to edit, process and analyze data; and 4) GIS staff to load data onto GIS database and produce necessary thematic maps and overlays.

4.2 Output 2

Activity 2.1 – Upgrade existing database and GIS system.
This activity would involve the following tasks: 1) GIS staff to evaluate the existing database systems; 2) GIS staff to develop data model blueprints and GIS analysis; and 3) GIS staff to document the database and GIS system components.

Activity 2.2 – Establish linkage with institutions that collect socio-economic data.
This activity would involve the following tasks: 1) Inventory Consultant and national social/economics expert interviewing DNP policy makers, or use questionnaires, to determine how much information is necessary to make policy decisions and how the monitoring information will be used to make policy decisions; 2) Inventory Consultant and national socio-economics expert identifying important socio-economic variables and the institutions that collect the information; and 3) Project manager to lobby for the data, and prepare protocols and agreements to acquire the required data and metadata.

Activity 2.3 – Link forest resource monitoring data with socio-economic data.
This activity would involve the following tasks: 1) GIS staff to design processes for importing the socio-economic data; 2) GIS staff to build GIS-based modules for overlaying the socio-economic data over the forest resources monitoring data; 3) GIS staff to develop user-friendly interfaces for facilitate database access and reporting, and to model the relationships between socio-economic and biophysical data; and 4) GIS staff and field crew to conduct biophysical and socio-economic data quality assurance (QA). The QA of biophysical data would be based on an independent field checking of the measurements in about 5% of the plots. The QA of socio-economic data would involve reviewing the metadata and quality assurance procedures used to collect the data.

Activity 2.4 – A workshop to promote use of the monitoring information.
This activity would involve a one-day national workshop. The objective of the workshop is to ensure that the data generated by the monitoring information system are accepted and used by the policy makers. The workshop program would include discussion of the forest resource monitoring system, linking of the forest resource monitoring data with the socio-economic data, and examples of the use of the monitoring information in policy decision-making. About 40 participants would attend the workshop. They shall be senior staff from the DNP (Headquarters and Regions), universities and NGOs involved in forest conservation and management. These workshop participants would then be expected to promote use of the monitoring information among their colleagues in their respective regions or institutions. They would be provided with the database on the CD-ROM, and an information kit. The resource persons at the workshop would be the project national experts and the Inventory Consultant.

4.3 Output 3

Activity 3.1 – Develop template for C&I reports.
This activity will involve the following tasks: 1) Inventory Consultant to review the Thai C&I and sample C&I reports from other countries; and 2) Inventory Consultant to develop appropriate templates for the baseline C&I report and the subsequent C&I reports for Thailand. They will be based on the ITTO guidelines.

Activity 3.2 – Prepare baseline C&I report.
This activity would involve the following tasks: 1) Inventory Consultant to map the Indicators against the database; 2) Inventory Consultant and data analyst to calculate the required statistics; and 3) Inventory Consultant to prepare the report based on the template developed in Activity 3.1.

Activity 3.3 – A workshop to publicize use of the C&I report among policy makers.

This activity would involve a one-day national workshop on the C&I report and its interpretation. About 40 participants from the DNP (senior staff from Headquarters and Regions), universities and NGOs involved in forest conservation and management would attend the workshop. The workshop program would include discussion of the importance of C&I, the Thai C&I, and the initial C&I report for Thailand. To reduce overall cost, and since the intended participants are about the same, this workshop would be held in conjunction with that proposed under activity 2.4. The resource persons at the workshop would be the project national experts and the Inventory Consultant.

5.   Logical Framework Worksheets

The logical framework matrix is presented on the following pages.

LOGICAL FRAMEWORK MATRIX

PROJECT ELEMENTS	INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
DEVELOMENT OBJECTIVE To contribute to the effective conservation and management of Thailand's forest resources and the environment.	Informed policy decisions by the **DNP** and other agencies involved in the conservation and management of Thailand's forest resources **leading to:** • **Better forest management.** • *Improved livelihoods of local people.* • **Measured progress toward SFM.** (These indicators may not be realized during the term of this project.)	Policy and development plans documents, e.g. the National Development Plan; National Forest Policy; and reports of national C&I. Change and trend data on quality and quantity of timber and non-timber resources included in the annual publication *Forestry Statistics of Thailand.* Interview senior government policy makers and non-government organizations.	There is the political will and commitment to use the project results.
SPECIFIC OBJECTIVE To establish a national monitoring information system to provide change and trend data on the quality and quantity of timber and non-timber forest resources.	**A fully operational monitoring information system that includes the baseline data, mechanisms to capture and manage change data, and tools to integrate the monitoring data with socio-economic data.** Examples of how the forest resources monitoring information system is actually used by policy makers in **DNP**, NGOs and the local communities.	Examples of policy decisions that used the monitoring information system.	
OUTPUT 1. National baseline forest resources monitoring data collected.	**Monitoring permanent plots established and baseline data**	Thematic maps and statistical tables. Satellite image maps, and progress	Helicopters from another government

LOGICAL FRAMEWORK MATRIX

PROJECT ELEMENTS	INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
	collected.	reports. Field manuals. Field plots.	department will be available for accessing the difficult-access sample plots.
	Products from the monitoring database, such as thematic maps, and statistical tables prepared.		
OUTPUT 2. Use of the forest resources monitoring information promoted.	**GIS system upgraded by developing data models and analysis tools.**	**List of workshop participants.**	Other institutions will provide socio-economic data.
	Linkages established with other institutions that provide socio-economic data.	Workshop proceedings.	
	Results of the Quality Assurance of the field data.	Information kits.	
	A workshop held to promote use of monitoring data.		
	~~Workshop recommendations.~~		
OUTPUT 3. National baseline C&I report prepared.	~~Workshop recommendations.~~	**List of workshop participants.**	
	C&I report prepared.	Workshop proceedings.	
	A workshop held to explain use of the C&I report as a tool for SFM reporting.	Baseline C&I report.	
		Brochure, poster and website.	

6. Work Plan

The work plan has been prepared by activity and is presented below. The project proposal covers a period of three years.

WORK PLAN

OUTPUTS/ACTIVITIES	YEAR 1				YEAR 2				YEAR 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Output 1. National baseline forest resources monitoring system established												
Activity 1.1	■											
Activity 1.2				■								
Activity 1.3					■	■	■					
Output 2. Use of forest resources monitoring information promoted												
Activity 2.1	■											
Activity 2.2				■	■	■	■					
Activity 2.3								■	■	■		
Activity 2.4											■	■
Output 3. Baseline national C&I report prepared												
Activity 3.1							■	■				
Activity 3.2									■			
Activity 3.3											■	■

7. Budget

The project ITTO and Government of Thailand (GOT) budgets are presented in the following sections:
Section 7.1: Overall Project Budget by Activity
Section 7.2: Yearly Budgets by Source - ITTO
Section 7.3: Yearly Budgets by Source – GOT
Section 7.4: Consolidated Total and Yearly Project Budget

The project unit costs and elaboration on major items are given in Annex C, and the project inputs are identified and quantified by activity in Annex D.

Notes on the budget:
1. Duty Travel represents about 30% of the ITTO project budget. This is attributed to the high proportion of the project being fieldwork and the centralized nature of the DNP where most of the national experts and crew chiefs seconded to the Project are based in Bangkok. According to government regulations, the DNP staff seconded to the project are entitled to Project DSA but not Project salary, and temporary labor (student field assistants, local labor and drivers) is paid Project daily wages only.
2. The Government of Thailand budget is in-kind contribution mainly in the form of salaries for the national experts seconded to the project, vehicles for fieldwork, satellite data, GIS software, and office space and supplies.

7.1 Overall project budget by activity

OUTPUTS/ACTIVITIES + Non-Activity based Expenses	BUDGET COMPONENTS*						Quarter/ Year	GRAND TOTAL
	10. Project Personnel	20. Sub-contracts	30. Duty Travel	40. Capital items	50. Consumable Items	60. Miscellaneous		
OUTPUT 1: <u>National baseline forest resources monitoring system established</u>								
Activity 1.1: Establish a national network of monitoring points	19,882 (I+E)		9,860 (I)		41,720 (I+E)	0	Q1-Q2/YR1	71,462
Activity 1.2: Train and mentor field crews	23,625 (I+E)		27,380 (I)	72,000 (E)	2,300 (I)	0	Q4/YR1	125,305
Activity 1.3: Collect baseline forest resources monitoring data	270,151 (I+E)		122,445 (I)		86,800 (I)	0	Q1-Q4/YR2; Q1/YR3	479,396
Subtotal 1	**313,658 (I+E)**	**0**	**159,685 (I)**	**72,000 (E)**	**130,820 (I+E)**	**0**		**676,163**
OUTPUT 2: <u>Use of the forest resources monitoring information promoted</u>								
Activity 2.1: Upgrade existing database and GIS system	9,897 (I+E)		1,900 (I)	0	6,300 (I)	0	Q1/YR1	18,097
Activity 2.2: Establish linkage with institutions that collect socio-economic data	2,236 (I+E)		2,070 (I)	0	0	0	Q4/YR1-Q4/YR2	4,306
Activity 2.3: Link the forest resources monitoring data with socio-economic data	26,811 (I+E)		17,455 (I)	18,000 (E)	2,300 (I)	0	Q4/Yr2; Q1-Q2/YR3	64,566
Activity 2.4: A workshop to promote use of the monitoring information	5,040 (I+E)		8,390 (I)	0	0	1,000 (I)	Q3-Q4/YR3	14,430
Subtotal 2	**43,984 (I+E)**	**0**	**29,815 (I)**	**18,000 (E)**	**8,600 (I)**	**1,000 (I)**		**101,399**
OUTPUT 3: <u>Baseline national C&I report prepared</u>								
Activity 3.1: Develop template for C&I reports	3,789 (I+E)		2,430 (I)	0	0	0	Q3, Q4/YR2	6,219
Activity 3.2: Prepare baseline C&I report	7,984 (I+E)		895 (I)	0	0	0	Q1, Q2/YR3	8,879

BUDGET COMPONENTS*

OUTPUTS/ACTIVITIES + Non-Activity based Expenses	10. Project Personnel	20. Sub-contracts	30. Duty Travel	40. Capital items	50. Consumable Items	60. Miscellaneous	Quarter/ Year	GRAND TOTAL
Activity 3.3: A workshop to publicize C&I report	2,454 (I+E)		610 (I)	0	0	1,000 (I)	Q3, Q4/YR3	4,064
Subtotal 3	14,227 (I+E)	0	3,935 (I)	0	0	1,000 (I)		19,162
NON-ACTIVITY BASED EXPENSES:								
1. Office staff & supplies	31,326 (I+E)		0	15,000 (E)	11,000 (E)		YR1-YR3 Q4-YR1, Q4-YR2, Q4-YR3	57,326
2. Auditing						6,000 (E)		6,000
Subtotal 4	31,326 (I+E)			15,000 (E)	11,000 (E)	6,000 (E)		63,326
Subtotal (ITTO)	310,025		193,435	0	100,920	2,000		606,380
Subtotal (GOT)	93,170		0	105,000	49,500	6,000		253,670
TOTAL	403,195	0	193,435	105,000	150,420	8,000		860,050

* See Annex C for resource unit costs.
(I) – Contribution of the ITTO
(E) – Contribution of the Executing Agency / Government of Thailand (GOT)

7.2 Yearly project budget by source - ITTO

Annual Disbursements / Budget Components	Total	Year 1	Year 2	Year 3
10. Project Personnel	310,025	93,008	155,012	62,005
20. Sub-contracts	-	-	-	-
30. Duty Travel	193,435	57,051	94,417	41,967
40. Capital Items	-	-	-	-
50. Consumable Items	100,920	58,416	30,360	12,144
60. Miscellaneous	2,000	0	0	2,000
Subtotal 1	606,380	208,475	279,789	118,116
80. ITTO Monitor., Evaluat. and Administ. Costs 81. Monitoring and Review Costs 82. Evaluation Costs	18,000 15,000			
Subtotal 2	639,380			
83. Programme Support Costs (6% of Subtotal 2)	38,363			
90. Refund of Pre-Project Costs	-			
ITTO TOTAL	677,743			

7.3 Yearly project budget by source – E. Agency/Government of Thailand (GOT)

Annual Disbursements / Budget Components	Total	Year 1	Year 2	Year 3
10. Project Personnel	93,170	27,952	46,585	18,633
20. Sub-contracts	-	-	-	-
30. Duty Travel	-	-	-	-
40. Capital Items	105,000	95,000	5,000	5,000
50. Consumable Items	49,500	41,800	5,500	2,200
60. Miscellaneous	6,000	2,000	2,000	2,000
70. Executing Agency Management Costs (15% of Total of *Overall Project Budget by Activity*)	129,007	38,702	64,504	25,801
EXECUTING AGENCY/GOT TOTAL	382,677	205,454	123,589	53,634

7.4 Consolidated total and yearly project budget (by source)

	Budget Components	TOTAL		YEAR 1		YEAR 2		YEAR 3	
		ITTO	GOT	ITTO	GOT	ITTO	GOT	ITTO	GOT
10.	**Project Personnel**								
	11. National Experts	32,225	93,170	9,668	27,956	16,112	46,585	6,445	18,633
	13. Other Labor	233,000		69,900		116,500		46,600	
	16. International Consultant	44,800		13,440		22,400		8,960	
	19. Component Total	310,025	93,170	93,008	27,952	155,012	46,585	62,005	18,633
20.	**Sub-contracts**								
	29. Component Total	0	0	0	0	0	0	0	0
30.	**Duty Travel**								
	31. Daily Subsistence Allowance	182,035		53,531		89,217		35,687	
	32. International travel	3,000		1,000		1,000		1,000	
	33. Transport costs	8,400		2,520		4,200		1,680	
	39. Component Total	193,435	0	57,051	0	94,417	0	41,967	0
40.	**Capital Items**								
	41. Premises		15,000		5,000		5,000		5,000
	43. Vehicles		90,000		90,000				
	49. Component Total		105,000		95,000		5,000		5,000
50.	**Consumable Items**								
	51. Raw materials	40,200	38,500	40,200	38,500				
	52. Spares	31,680		9,504		15,840		6,336	
	53. Fuel and Utilities	29,040		8,712		14,520		5,808	
	54. Office Supplies		11,000		3,300		5,500		2,200
	59. Component Total	100,920	49,500	58,416	41,800	30,360	5,500	12,144	2,200
60.	**Miscellaneous**								
	61. Sundry	2,000						2,000	
	62. Auditing		6,000		2,000		2,000		2,000
	69. Component Total	2,000	6,000		2,000		2,000	2,000	2,000
70.	**Executing Agency Management Cost**								
	79. Component Total		129,007		38,702		64,504		25,801
	SUBTOTAL	606,380	382,677	208,475	205,454	279,789	123,589	118,116	53,634

	Budget Components	TOTAL		YEAR 1		YEAR 2		YEAR 3	
		ITTO	GOT	ITTO	GOT	ITTO	GOT	ITTO	GOT
80.	ITTO Monitoring, Evaluation and Administration								
	81. Monitoring and Review Costs	18,000	--						
	82. Ex-post Evaluation Costs	15,000	--						
	83. Program Support Costs (6%)	38,363	--						
	89. Component Total	71,363	--						
90.	Refund of Pre-Project Costs	--	--						
100.	GRAND TOTAL	677,743	382,677						

PART III: OPERATIONAL ARRANGEMENTS

1.   Management Structure

The project will be managed by a Project Leader and monitored by a Project Steering Committee. The Project Leader will be senior staff from the DNP (see the DNP organization chart in Annex A). The project organizational chart is shown below:
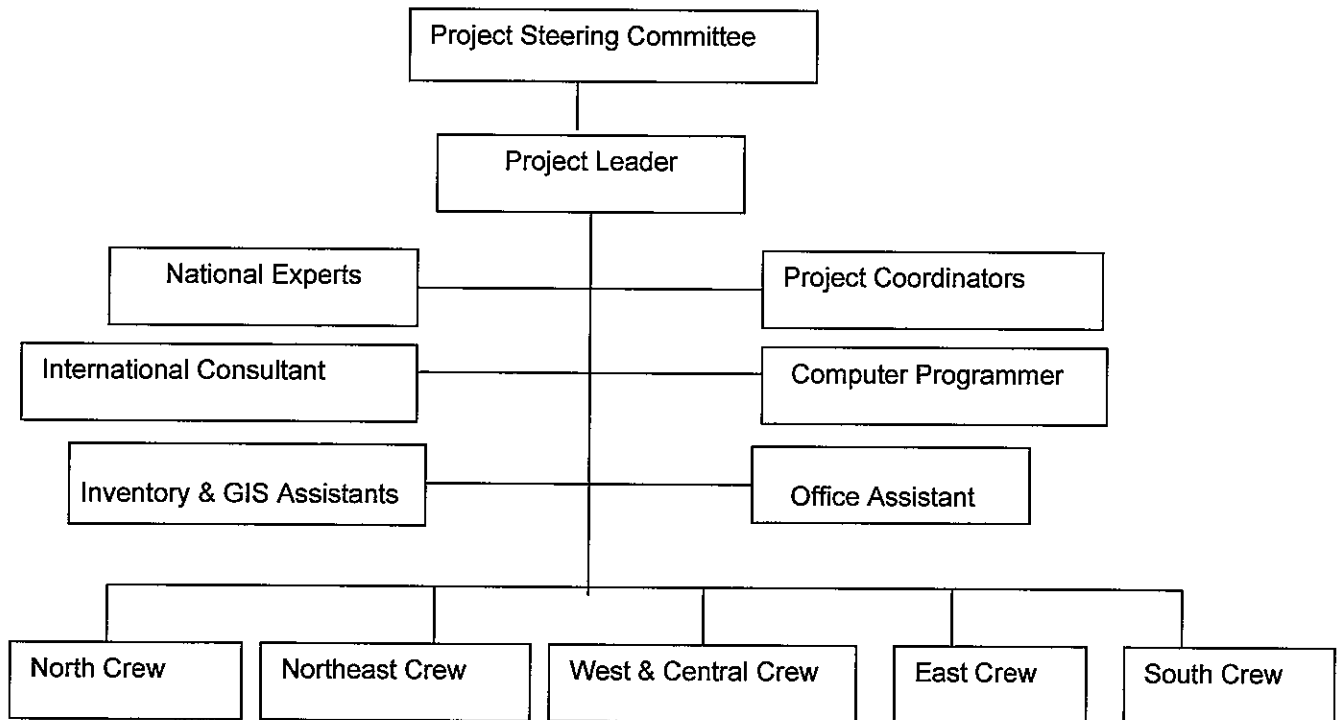
Figure 1. Project organizational chart.

The main staff of the proposed project are (see Annex B for terms of reference for key staff):

Title	Number	Designation
Project Leader	1	DNP staff
Project Coordinators	6	DNP staff
Inventory Experts	6	DNP staff
GIS/Remote Sensing/Database Experts	5	DNP staff
Biodiversity Experts	2	DNP staff
Wildlife Experts	5	DNP staff
Botanists	5	DNP staff
Soil Experts	3	DNP staff
Site/vegetation disturbance Expert	1	DNP staff
Crew Chiefs	20	DNP staff
Helicopter pilots	2	DNP staff
International Consultant	1	Contract staff
Computer Programmer	1	Contract staff
Office Assistant	1	Contract staff
Social science expert	1	Contract staff
GIS Assistants	2	Contract staff
Inventory Assistants	2	Contract staff
Drivers	20	Temporary labor
Local labor	40	Temporary labor
Student field assistants	50	Temporary labor

2.   Monitoring, Reporting and Evaluation

(a) Project Progress Reports – Project progress reports will be prepared by the International Consultant every 6 months. They will be submitted to the Project Leader for approval.

(b) Project Completion Report - Within 3 months of project completion the International Inventory Consultant shall prepare and submit to the Project Leader the project completion report.

(c) Project Technical Reports – Upon completion of the various main outputs, technical reports will be prepared by the International Consultant and National Experts. They will be submitted to the Project Leader.

(d) Monitoring, Review and Steering Committee Visits – The best time for monitoring visits will be outside of the field season (June-September). It is at this time that the Yearly Plans of Operation will be tabled, modified as required, and approved.

(e) Evaluation – Ex-post evaluation.

3.   Future Operation and Maintenance

The intent is to ensure that the project (final phase) is quickly and seamlessly absorbed within the DNP. The DNP will inherit the project equipment to assist with plot remeasurement over time. This forest resources monitoring system will be updated, managed and financed by the DNP. The monitoring system will be an-going process, and will require long-term inputs. Therefore, two factors could affect the monitoring system once it is in place: 1) poor database maintenance, and 2) financial sustainability (high cost of plot remeasurement).

The DNP can mitigate the first factor by ensuring that there is a qualified database administrator on staff. The database administrator would keep the data model blueprints current, ensure data and referential integrity, and ensure appropriate data security and access. The DNP has a qualified pool of database/GIS staff to take on this role.

Future financial sustainability of the project could be assured by:

- Spreading the plot remeasurement costs over time. This could be done by adopting an annual sampling plan, where a small portion of the plots is measured every year, rather than measuring all the plots in a single batch. The annual plot remeasurement cost would be more manageable, and could then be built into the annual budget allocation for the monitoring/NFI project, subject to usual budgetary procedures of the Thai government and the DNP. Occasional omission of a remeasurement in a given year would not jeopardize the credibility the database.
- Reviewing the remeasurement intervals. This could be done by considering the baseline data to determine if remeasurements over longer intervals of some plots (e.g. where there no rapid changes, or slow growth) will suffice, or concentrating on areas where site disturbance activities are more frequent
- Number of variables collected. Consider collecting data on only indicator fauna/flora (rather than measuring all plants). Also, the data variables should be reviewed periodically to ensure that only the data used in decision-making are collected.
- Distribution of Plots. The sampling intensity (at remeasurement) could be varied depending on physiographic conditions.

PART IV: TROPICAL TIMBER FRAMEWORK

1.   Compliance with ITTA 1994 Objectives

This project will contribute to the effective conservation and management of Thailand's forest resources, by installing an efficient and effective system for continuous monitoring of these resources, to support policy decisions. It will supplement the global efforts to ensure sustainable management of the remaining tropical forest resources. Both these goals are consistent with ITTO Objective (c), as outlined in Article 1 of the ITTA, 1994.

This project relates to the operational activity of natural forest management:

a) It is related to conservation and management of timber in Thailand.

b) Thailand and its foreign buyers of forest products will both benefit from forests that are effectively managed with due care for the environment and also provide social and economic benefits.

c) It may expand or maintain markets for timber and other products from community forests (where logging is permitted), by providing monitoring information that will assure concerned segments of these markets that purchasing Thailand forest products is not detracting from the goal of sustainable forest management.

d) The monitoring system will contribute to public confidence that Thailand is committed to sustainable forest management. This will have positive economic spin-offs in the forestry sector as well as other sectors of the economy.

2.   Compliance with ITTO Action Plan

This project conforms to Cross Cutting Actions (a) and (m) stated in the ITTO Yokohama Action Plan 2002-2006. It will help establish a forest resource information system, which can be used to evaluate conservation and sustainable forest management policies for Thailand. This project is also consistent with ITTO's Goal 2, Actions 1 and 10 of Reforestation and Forest Management, which promote the application of C&I and implementation of forest inventories. Using the ITTO framework, Thailand has developed a set of national Criteria & Indictors for sustainable forest management and is keen to collect data for their reporting. **The outcomes of** this project will assist in **the national reporting of the C&I, which is a tool for** as this effort **measuring Thailand's progress toward SFM. In particular:**

- **The established monitoring system will generate monitoring data needed to assess the indicators of the state and condition of the forest resources using the C&I tools.**
- **Promoting the use of the monitoring information linked to socio-economic data will make policy- and decision-makers aware of this information and how to use it effectively to make informed policies and decisions regarding SFM.**
- **A baseline C&I report will be produced against which future trends can be based. It can also be used to demonstrate to policy and decision-makers on how to communicate progress towards SFM to the public and other stakeholders.**

As well, the NFI component of the project will contribute to the production of national forest inventory statistics.

ANNEX A - Profile of the Executing Agency

As the executing agency, the Thailand National Park, Wildlife and Plant Conservation Department (DNP) of the new Ministry of Environment and Natural Resources and Environment (MoNRE), will be responsible for providing the key project staff. The project staff, with support from DNP, will ensure that the project is supported so as to ensure its smooth implementation. Short-term expertise and staff will be provided from various divisions and sections of the DNP or MoNRE, or outside of the MoNRE.

The Protected Area Management and Rehabilitation Office **within the DNP (shaded box in Figure 2)**, in which the forest inventory staff is located, will be key in the project implementation. **This Office is responsible for the NFI, which is to be integrated with the monitoring system to be developed from this proposed project. It is for these reasons that the DNP was chosen as the Executing Agency for this project**. However, all of the relevant offices, divisions and sections from the DNP will also be required to be full participants in the project.. The organizational chart of the DNP is shown in the next page, Figure 2.

Figure 2. Organizational chart of the National Park, Wildlife and Plant Conservation Department of Thailand (DNP)
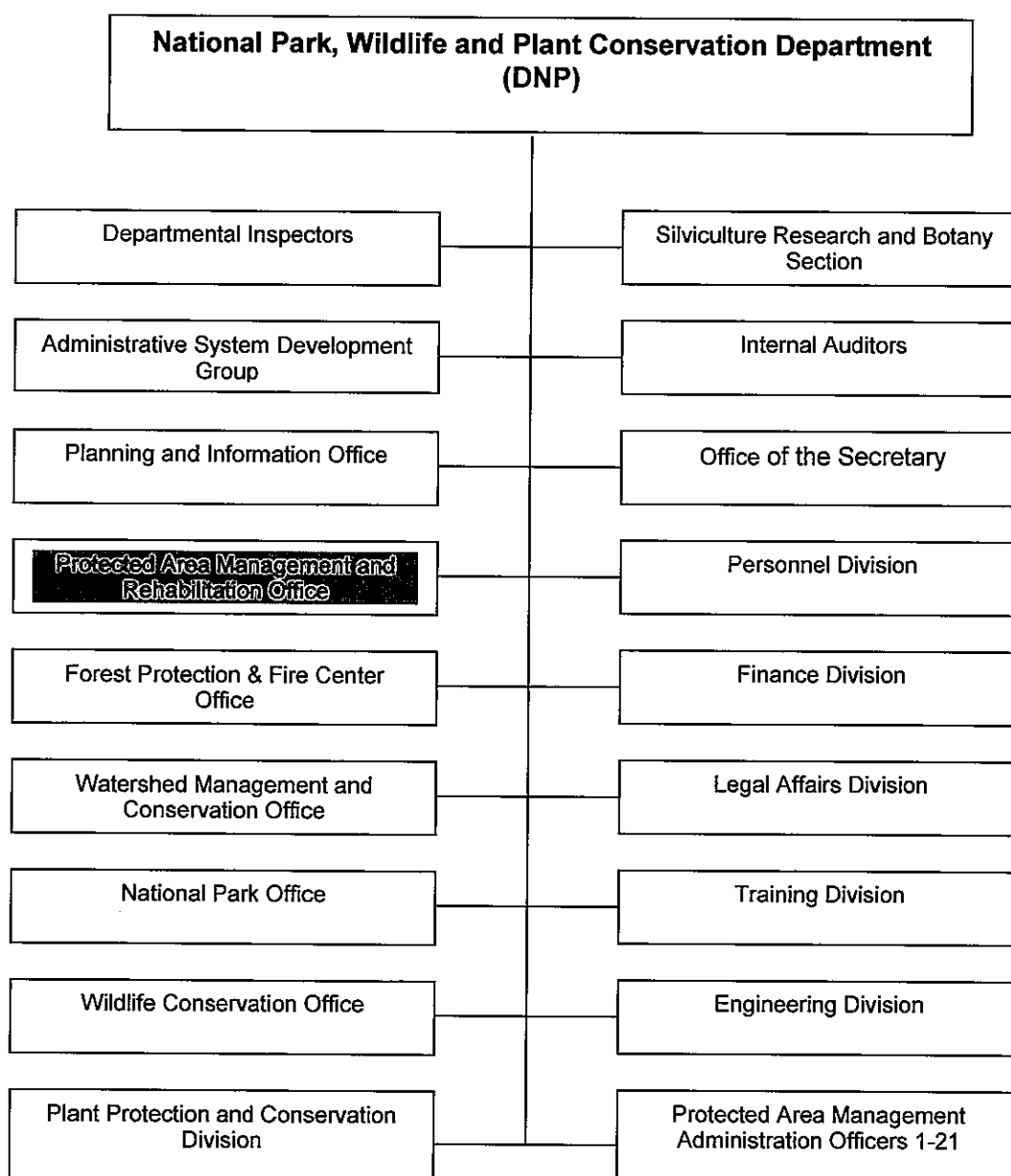
The key staff of the Project includes the Project Leader, the Project Coordinator, National Experts, Computer Programmer, and International Consultant. The terms of reference for these individuals are as follows:

1.   Project Leader

The Project Leader liases with ITTO. He/she will be a senior staff within **DNP** with relevant experience in project management. He/she will assume the general responsibility of overseeing project implementation.

To this end, the Project Leader's duties will include:

- Overall responsibility for the supervision, management and monitoring of the project and project budgets;
- Supervision of the development of detailed Yearly Plan of Operation;
- Organize PSC meetings.

2.   Project Coordinators

The Project Coordinators reports to the Project Leader. They will be senior staff within **DNP** with relevant experience in project coordination. They will assume the general responsibility of liaising with the project experts and field staff, so as to ensure the effective and efficient coordination of the project.

To this end, the Project Coordinators duties will include:

- Coordinate the development of detailed Yearly Plan of Operation;
- Coordinating and implementing the necessary activities to ensure the full project implementation;
- Preparing and submitting periodic reports to the relevant institutions/authorities;
- Coordinating the preparation of documents and publications on the results obtained by the project;
- Other duties as directed by the Project Leader.

3.   National Experts

The national experts will be **DNP** staff with experience in their respective fields, including GIS/Remote sensing/Database, Inventory, Biodiversity, Soil, wildlife, and Site/vegetation disturbance. They will

- Train and mentor field crews in their areas of expertise.
- Prepare or translate the field manuals in the Thai language.
- Conduct quality assurance.

4.   Computer Programmer

The Computer Programmer will:

1. Revise, test and make operational the TFS software for compiling the field data, to take into account the changes in the plot cluster design.
2. Write software for EFDRs, displaying the data, producing statistical reports, and updating the monitoring information.
3. Provided on-the-job training for technicians to implement the revised TFS program and the reporting software.
4. Prepare manuals on the use of the developed software,

The successful candidate will have a B.Sc. in Forestry or Computer Science. Considerable experience developing software is essential. Previous experience in working on the ITTO Project PD 2/99 Rev. 2 (F) is preferable. In addition, the following skills and knowledge are required:

- Proven experience in providing effective training services.
- Excellent English oral, written and presentation skills.

5.   International Consultant

The International Consultant will be:

1.   Responsible for the statistical integrity of the implementation of the project.
2.   Provide, as required, technical advice in the areas of sampling design, statistical analysis, and use of GIS and image analysis for monitoring.
3.   Recommend additional technical experts, when needed.
4.   Provided on-the-job training for field crew in forest inventory and monitoring techniques.
5.   Preparation of technical reports and presentations.
6.   Prepare Project Progress Reports and Completion Report
7.   Participate in preparation of the Yearly Plan of Operation.

The successful candidate will have a B.Sc. in Forestry and a Ph.D. specializing in forest resource inventory and monitoring. Considerable experience working in the area of forest inventory and monitoring is essential. Previous experience in working on the ITTO Project PD 2/99 Rev. 2 (F) is preferable. In addition, the following skills and knowledge are required:

- Thorough knowledge of monitoring techniques.
- Thorough knowledge of forest inventory and monitoring, use of GIS and image analysis in forest inventory, and methods of multiple resource inventories.
- Proven experience providing effective consulting and training services.
- Excellent written and presentation skills.
- Sensitivity to working in a cross-cultural environment.

ANNEX C – Project Unit Costs

Budget Item & Resource	Description (Some items only)	Unit cost (US$)	
		ITTO	GOT
Project Personnel (Salary/day)			
11. National Experts:			
11.1 Project Leader			22
11.2 Project Coordinator			22
11.3 Expert			22
11.3 Crew Chief			22
11.5 Helicopter pilots			22
11.6 Office Assistant		15	
11.7 GIS Assistant		7	
11.8 Inventory Assistant		7	
11.9 Computer Programmer		25	
13. Other Labor:			
13.1 Student field assistant		20	
13.2 Local labor,		10	
13.3 Driver		20	
16. International Consultant		350	
Duty Travel			
31. Daily Subsistence Allowance (DSA):			
31.1 International Consultant		95	
31.2 National Experts		45	
31.3 Project Leader		45	
31.4 Project Coordinator		45	
31.5 Helicopter pilot		45	
31.6 Crew Chief		45	
31.7 Workshop participants		45	
32. International air ticket (economy)	Return air ticket between Thailand and North America.	1,000	
33. Domestic air ticket (economy)		120	
Capital Items			
41. Project Offices (per year)			500
43. Used Vehicles (per vehicle)	4-wheel drive truck		5,000
Consumable Items			
51. Raw materials:			
51.1 GIS Ink (unit)	GIS ink for printing maps	700	
51.2 GIS Paper (roll)	GIS paper for printing maps.	70	
51.3 Arc Info software (unit)	One license for ArcInfo V8 GIS software.		23,500
51.4 LaserDist. (unit)	A DISTO Hand-held laser meter for measuring distances.	700	
51.5 Diameter tape (unit)	Cloth 100-cm diameter tape	50	
51.6 EFDR (unit)	Palm top 64MB electronic field data recorder	600	
51.7 Soil equipment (8 units)	Field equipment for testing soil physical properties, including soil color chart, soil core, and sampling set.	2,300	

Budget Item & Resource	Description (Some items only)	Unit cost (US$)	
		ITTO	GOT
51.8 Chemicals/Glass (8 units)	Chemicals (N, P, K and pH test kits) and glassware (test tubes, stoppers, mortars, etc.) for testing soil chemical properties	5,000	
52. Spares (truck maintenance/truck/day)		12	
53. Fuel (Gasoline/truck/day)		11	
Miscellaneous			
62. Auditing (yr)			2,000

Activities	Inputs	No.	Unit cost (US$)	Budget Component
	Units and Quality			
Output 1. National baseline resource monitoring system established				
1.1 Establish a national network of monitoring points	Days – Int. Consultant fees	10	350	16
	Days – Int. Consultant dsa	10	95	31
	Days – labor wages	400	10	13
	Days – Driver wages	200	20	13
	Days – Project Leader (PL) dsa	3	45	31
	Days – Project coordinators (PC) dsa	18	45	31
	Days – GIS experts dsa	110	45	31
	Travel – return domestic ticket	3	120	33
	Travel – return int. ticket	1	1,000	32
	Days - Vehicle maintenance (20 vehicles for 7 days)	140	12	52
	Days – Gasoline (20 vehicles for 7 days)	140	11	53
	Days – national experts salary	366	22	31
	ArcInfo license	1	23,500	54
	Satellite data	1	15,000	54
1.2 Train and mentor field crews	Days – Students wages	100	20	13
	Days – Int. Consultant fees	10	350	16
	Days – Int. Consultant dsa	10	95	31
	Days – labor wages	200	10	13
	Days – Driver wages	100	20	13
	Days – PL dsa	5	45	31
	Days – PC dsa	30	45	31
	Days - national experts dsa	407	45	31
	Travel – return domestic ticket	17	120	33
	Days – Computer Prog. wages	5	25	11
	Days - Vehicle maintenance (20 vehicles for 7 days)	100	12	52
	Days – Gasoline (20 vehicles for 7 days)	100	11	53
	Days – crew chiefs dsa	100	45	31
	Days – national experts salary	109	22	31
1.3 Collect baseline forest resources monitoring data	Days – Students wages	5,750	20	13
	Days – Int. Consultant fees	18	350	16
	Days – Int. Consultant dsa	18	95	31
	Days – labor wages	4,600	10	13
	Days – Driver wages	2,300	20	13

Activities	Inputs	No.	Unit cost (US$)	Budget Component
	Units and Quality			
	Days – PL dsa	31	45	31
	Days – PC dsa	186	45	31
	Days - pilot dsa	86	45	31
	Travel – return domestic ticket	30	120	33
	Days – Computer Prog. wages	45	25	11
	Days - Vehicle maintenance (20 vehicles for 7 days)	2,300	12	52
	Days – Gasoline (20 vehicles for 7 days)	2,300	11	53
	Days – crew chiefs	2,300	45	31
	Days – national experts salary	2,533	22	31
	Number – Vehicles (Trucks)	18	5,000	43
	Laser distance meter	15	700	51
	Cloth diameter tape	22	50	51
	Soil equipment	8	2,300	51
	Palmtop EFDR	25	600	51
	Soil chemicals/glassware	8	5,000	51
Output 2. Use of the forest resources monitoring information system promoted				
2.1 Upgrade existing database and GIS system	Days – Int. Consultant fees	20	350	16
	Days – Int. Consultant dsa	20	95	31
	Bottles - GIS ink	5	700	54
	Rolls – GIS paper	40	70	54
	Days – Computer Prog. wages	5	25	11
	Days – national experts salary	126	22	31
2.2 Establish linkage with institutions that collect socio-economic data	Days – Int. Consultant fees	4	350	16
	Days – Int. Consultant dsa	4	95	31
	Travel – return domestic ticket	3	120	33
	Travel – return int. ticket	1	1,000	32
	Days – national expert dsa	10	45	31
	Days – national experts salary	28	22	31
2.3 Link forest resource monitoring data with socio-economic data	Days – Students wages	250	20	13
	Days – Int. Consultant fees	23	350	16
	Days – Int. Consultant dsa	23	95	31
	Days – labor wages	200	10	13
	Days – Driver wages	100	20	13
	Travel – return domestic ticket	14	120	33
	Days – Computer Prog. wages	5	25	11
	Days - Vehicle maintenance (20 vehicles for 7 days)	100	12	52
	Days – Gasoline (20 vehicles for 7 days)	100	11	53

Activities	Inputs	No.	Unit cost (US$)	Budget Component
	Units and Quality			
	Days – crew chiefs	100	45	31
	Days – national experts salary	438	22	31
	Days – national experts dsa	202	45	31
2.4 A workshop to promote use of the monitoring information	Days – Int. Consultant fees	10	350	16
	Days – Int. Consultant dsa	10	95	31
	Days – PC/PL dsa	21	45	31
	Travel – domestic tickets	2	120	33
	Days – national experts dsa	65	45	
	Days – national experts salary	126	22	31
	Days – workshop participant days	80	45	31
	Miscellaneous – room rental for workshop	1	1,000	63
Output 3. Baseline national C&I report prepared				
3.1 Develop template for C&I reports	Days – Int. Consultant fees	10	350	16
	Days – Int. Consultant dsa	10	95	31
	Days – Computer Prog. fees	1	25	11
	Ticket – Int. Consultant	1	1,000	32
	Domestic ticket – PL, PC	2	110	33
	Days – PL, PC, expert dsa	21	45	31
3.2 Prepare baseline C&I report	Days – Int. Consultant fees	18	350	16
	Days – Int. Consultant dsa	18	45	31
	Days – Social science expert dsa	3	45	31
	Days – Computer Prog. wages	4	25	11
3.3 A workshop to publicize use of the C&I report among policy makers	Days – Int. Consultant fees	5	350	16
	Days – Int. Consultant dsa	5	95	31
	Days – Social science expert dsa	3	45	31
	Miscellaneous – publications	1	1,000	63

Technical methods

Setting up of the national forest resources monitoring information system would involve establishment of baseline forest resources monitoring data, and linking it with soci-economic data. A network of unbiased permanent monitoring points, and a cluster of 'hidden' permanent plots and temporary plots established at the monitoring points, would be established over the entire country based on a 20 x 20 km grid, based on a single-stage sampling design. The data would be stored, retrieved, manipulated and updated in a GIS environment. The rationale for use of the GIS and the permanent plots is discussed in the project PD 2/99 Rev. 2 (F) final technical report, and is outlined briefly in the following Tables 3 and 4, for easy reference.

Table 3. Justification of THAIFORM methods and approaches

Method or Approach	Rationale
Fixed grid	The systematic grid was preferable to, say, random selection, because: • The systematic layout lends itself easily to GIS modelling since a monitoring point (plot cluster) represents a specific area whose attributes can be included in the GIS database. The planned GIS modelling involves creating thematic maps for various resources over time. • Systematic sampling is simple to implement and maintain over time. • It is easier to re-locate the permanent plots over time.
GIS system	The GIS system would be used to describe in detail, at any time, the past and present conditions at the monitoring points. These descriptions, including forest cover change, demographic data, socio-economic data and be obtained as GIS overlays. The GIS would allow for rapid detection of changes in forest condition, especially in areas at risk. Ground sampling alone would not achieve this efficiently. Thailand's DNP has a well-developed GIS system with experienced staff. For example, in 2000, the GIS group successfully completed a land use (forest type) classification for the entire country. The DNP GIS group, who will be involved in this proposed project, is familiar with the issues typically associated with GIS/Remote sensing, including mis-classification problems, pixel sizes, appropriate data analysis methods, and augmenting satellite data with aerial photographs and DEM (digital elevation models).
Installation of permanent sample plots	Ground sampling was needed to collect information especially on those resources that cannot be easily seen on traditional aerial photographs or other remote sensing media. The single-stage ground sampling design was preferable to, say, a two-phase design involving remote sensing phases, because: • The ground sample is not affected by errors in classification of remote sensing data. • There is no reliance on aerial photographs, etc. There are practical and statistical reasons to using circular plots. The practical reasons are that: • Circular plots were preferable to rectangular or square plots because it is easier to apply slope correction in circular plots in regard to plot boundary demarcation and checking of borderline trees. • Thailand has a long and successful history of using circular plots, dating back to 1955 when Professor F. Loetsch working for FAO introduced the methods. There was considerable discussion among the national experts during the PD 2/99 Rev. (2) pilot project about use of circular or rectangular plots. At that time Thailand found no compelling advantages to introducing new approaches, and a decision was made to stay with circular plots. Circular plots have also been used in neighboring Peninsular Malaysia by the FAO to set up a monitoring system during the early 1990's.

Method or Approach	Rationale
	• The circular plots were successfully used in the PD 2/99 Rev. 2(F) pilot project. The statistical reasons include the fact that circular plots have a smaller potential edge effect bias than rectangular or square plots since they have a smaller perimeter for the same area. Permanent plots were used because they are better for estimating changes and trends over time than temporary plots. The temporary plots are to improve precision of vegetation and CWD estimates for better baseline monitoring database and for NFI purposes. The plots are "hidden" so as to avoid or minimize deliberate biasing of the results by humans. The cluster-plot design depended on the amount of work that could be accomplished by one, 13-person crew in one day, on average. The selected cluster design may not be optimal in terms of minimizing variance estimates of the attributes of interests.

Table 4. Rationale for data collected in THAIFORM

Data gathered	Rationale
Plant lists	Quantify plant biodiversity, including presence of rare or endangered flowering plants.
Lichen	Indicator of environment quality.
Trees	Estimate timber volume.
Seedlings & saplings	Estimate potential forest regeneration.
Tree stumps	Estimate total forest biomass and number of trees lost to illegal logging.
Other forest crops	Estimate quantity of other forest crops (e.g. bamboo, and rattan).
Soil characteristics	Basic information needed to interpret the health and condition of vegetation and other forest resources.
Human/natural causes impact	Quantify factors (indicators) affecting the health and condition of forest resources.
CWD	Estimate structural diversity of forests and potential habitat for plants, insects, mushrooms, etc.
Wildlife habitat use	Identify wildlife that uses the forest as habitat, including rare and endangered species.

Challenges in the areas outside the closed forest

The Expert Panel remains to be convinced whether the actual magnitude of the complexity of tasks intended to be undertaken had been considered and whether they would constitute a solution to the problems to be addressed in areas outside the closed forests.

Recall that the main problem to be addressed is to create a monitoring and socio-economic database to support informed policy decision-making. In this respect, the challenges and the proposal considerations in the areas outside closed forest include:

1. Problems associated with data collection (e.g. scattered vegetation resources, plant species identification; GIS/remote sensing issues). The project proposal plans to collect ground monitoring data in the areas outside of the closed forests as well since timber and non-timber products include products from off-forest areas. The resolution of the data in areas outside of closed forest may be inadequate, however, the intent of the monitoring is to raise red flags in high-risk areas. More detailed sampling can then be done in the high-risk areas, if needed.

2. Complexity and dynamics of the socio-economic data. Thailand conducts village socio-economic surveys every two years nationally, and these data are available in GIS format. The project plans to hire a social scientist national expert to assist in the analysis, interpretation and linking of the soci-economic data with the monitoring data.

ANNEX F – Plot cluster design

A cluster of plots consisting of one permanent plot (PSP) and four temporary plots in cardinal directions from the PSP (N, E, W, and S) will be established at each of the 1,300 grid monitoring points (F) (Figure 3). Vegetation, human/natural disturbance, wildlife habitat, coarse woody debris (CWD), and soil data will be collected at the PSP. Only vegetation and CWD data will be collected in the four temporary plots. The PSP and temporary plot designs are similar, except no soil pit in the temporary plot.

Figure 3. Cluster design (top) and permanent plot (PSP) design (bottom) established at a monitoring point.
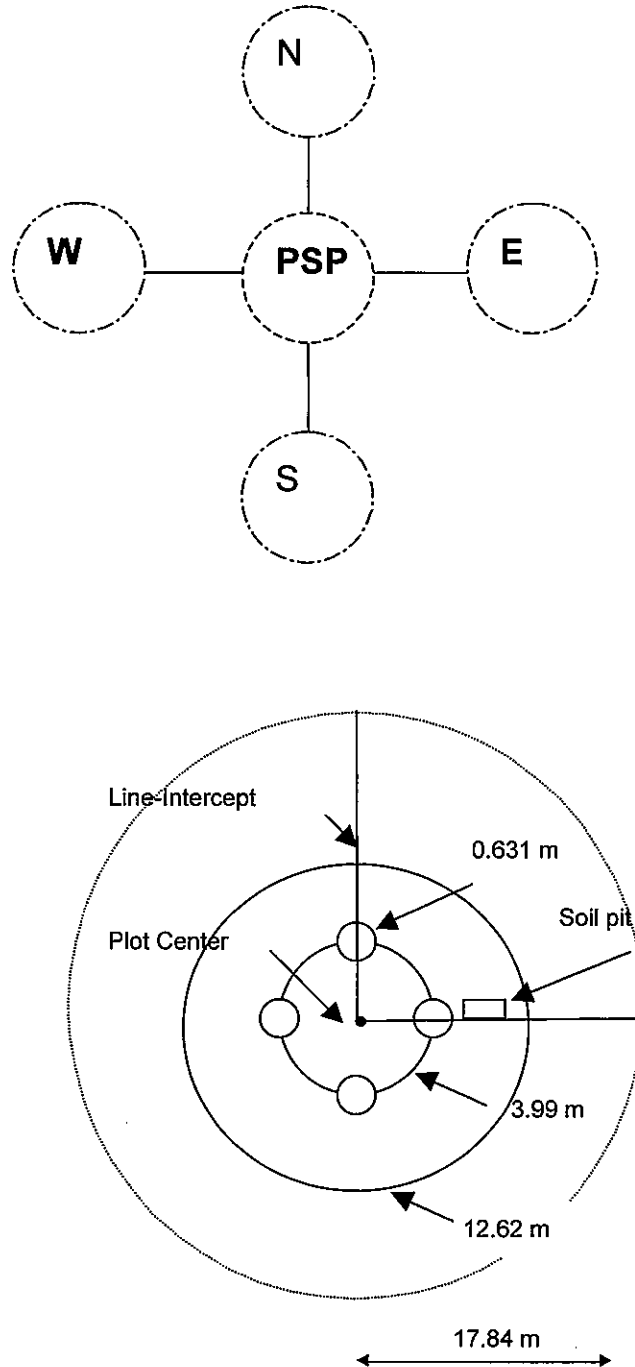
After the assessment by the Twenty-sixth Expert Panel of the International Tropical Timber Organization (ITTO) of the Thailand National Monitoring Information System proposal, the National Park, Wildlife and Plant Conservation Department (DNP) of Thailand has modified the proposal PD 195/03 Rev. 1 (M). The modifications have been made to address the Expert Panel's comments and recommendations. In the revised proposal [PD 195/03 Rev. 2 (F)], the additions are highlighted in **bold** and deletions have a strikethrough line (~~strikethrough~~). These modifications are summarized in the table below. As well, as recommended by the 25th Expert Panel, the project has been moved from the Committee of Economic Information and Market Intelligence to the Committee on Reforestation and Forest Management.

Twenty-sixth Expert Panel Recommendations	Modifications
1. Improve the quality of the Logical Framework Matrix by the incorporation of appropriate indicators in order to facilitate assessment and follow-up of the project.	Additional indicators have been incorporated into the Logical Framework Matrix in the "Indicator" and "Means of Verification" columns.
2. Clarify the correlation between project outcomes and national reporting of the ITTO Criteria and Indicators for Sustainable Forest Management.	The project outputs will provide inputs to the national C&I reporting for SFM process. This relationship between the project outputs and national C&I reporting has been expounded on in Part IV Section 2.
3. Clarify the role of the National Park, Wildlife and Plant Conservation Department (DNP) of Thailand, and the choice of this Department as the Executing Agency.	The DNP is the Thai government's new department responsible for forest conservation. This role of the DNP is explained further in Part I, section 1. The DNP is in charge of the national forest inventory, which is to be integrated with the proposed national monitoring system. The reasons for the choice of DNP as the Executing Agency are further explained in Annex A. Please note that a major re-organization of the government of Thailand that started last year saw the creation of a new Ministry of Natural Resources and the Environment, the transfer of the Royal Forest Department (RFD) from the Ministry of Agriculture and Cooperatives to this new ministry, and the splitting of the RFD into two departments: the DNP and a smaller new RFD. The DNP is responsible for forest conservation, while the new RFD is responsible for production forestry.
4. Elaborate the economic aspects more fully.	The economic benefit of income generation by local people had been omitted. This benefit and other economic aspects have been elaborated further in Section 2.6.
5. Revise the budget tables in order to be fully consistent with the requirements of the Manual, especially for the Table of detailed yearly budget by source and component.	The formats of the budget tables (7.1 to 7.4) have been revised to conform to the requirements of the ITTO manual on project formulation. Tables 7.1, 7.2, 7.3 and 7.4 are all new, however, there are no changes to actual budget numbers.
6. Include an Annex, which shows the recommendations of the Panel and the respective modifications in tabular form.	A summary of the modifications to the proposal PD 195/03 Rev. 1 (M) are given in this Annex G.

We trust that these modifications respond fully to the Twenty-sixth Expert Panel's comments and recommendations, and look forward to the re-assessment of our proposal and potential ITTO support for its implementation.