

INTERNATIONAL TROPICAL TIMBER ORGANIZATION

ITTO

PROJECT PROPOSAL

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| TITLE | FOREST HEALTH MONITORING TO MONITOR THE SUSTAINABILITY OF INDONESIAN TROPICAL RAIN FORESTS |
| SERIAL NUMBER | PD 16/95 Rev.2 (F) |
| PERMANENT COMMITTEE | REFORESTATION AND FOREST MANAGEMENT |
| SUBMITTED BY | GOVERNMENT OF INDONESIA |
| ORIGINAL LANGUAGE | ENGLISH |

SUMMARY

This project is part of a series of research programs developed jointly by the BIOTROP, CIFOR, the USDA Forest Service, and the Indonesian Ministry of Forestry. It focuses on the evaluation of forest ecosystem, and more specifically indicators related to changes, trends, causal agents and mechanism of forest health.

The activity includes the establishment of forest health monitoring plots within the existing Indonesian national forest inventory plots to monitor parameters relevant to forest sustainability and biodiversity.

Invited scientists will evaluate indicators pertaining to forest mensuration (growth, regeneration, mortality, stand structure), crowns (structure, defoliation, leaf area index), damage (insects, disease, abiotic, and logging), diversity (composition, abundance, structure), aesthetics (scenic beauty, recreation), as well as socio-economic aspects. A methodology will be developed to link remote sensing techniques to ground based monitoring plots and the Ecological Classification System. It would lead to a study of relationship between the condition of a forest ecosystem, trend of biodiversity indicators and the human activities.

Various reports on establishment of monitoring plots on assessment through diverse remote sensing techniques and an early warning of changes in canopy will be produced by the project. In addition, training on the establishment of forest health monitoring plots will also be provided.

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| EXECUTING AGENCY | SEAMEO-BIOTROP SOUTHEAST ASIAN REGIONAL CENTRE FOR TROPICAL BIOLOGY | | |
| COOPERATING GOVERNMENTS | GOVERNMENT OF INDONESIA GOVERNMENT OF THE UNITED STATES OF AMERICA | | |
| DURATION | Three years | | |
| APPROXIMATE STARTING DATE | 1 July 1995 | | |
| BUDGET AND PROPOSED SOURCES OF FINANCE | | Contribution in US\$ | Local Currency Equivalent |
| | ITTO | 454,830 | |
| | USDA Forest Service | 169,000 | |
| | Gov't of Indonesia | 405,516 | |
| | TOTAL | 1,029,346 | |

PART I : CONTEXT

A. Relevance to ITTO

1. Compliance with ITTO Objectives :

This proposal will initiate cooperative research activities that will lead to the establishment of a population based Forest Health Monitoring (FHM) plot system, within ("nested") the existing Indonesian National Forest Inventory (NFI) plot. The system to be developed is hereafter referred to as the Indonesian Forest Health Monitoring System (INDO FHM). The purpose of the INDO FHM plots will be to determine the current condition of Indonesian Forest Ecosystems with respect to sustainability, and biodiversity, and subsequently to track changes and trends.

Specific objectives developed for 1995 to 1997 are :

1. To evaluate the ability of selected indicators to provide an assessment of conditions in tropical rain forests.
2. Establishment of the FHM plot systems with appropriate indicators, within the existing Indonesian National Forest Inventory plots, to address forest sustainability, biodiversity, and improvement of socio-economic conditions of local communities.
3. Use of the FHM plots in the tropical rain forests as a demonstration for future establishment of the FHM program in the Southeast Asian Tropical Rain Forests.
4. Technology transfer on linking remote sensing techniques, including videography, to ground based NFI plots, and the ecological classification systems.
5. Technology transfer on use of FHM methods and existing software for analysis of productivity data from existing NFI plots.

As mentioned above the project outputs will be a fundamental tool for sustainable forest management systems and is compliance with all of the ITTO laid down in the ITTO Agreement. Direct relationships can be pointed out with the following ones :

1. The proposed objective No 1 and 2 are related to specific objective of ITTO Agreement point 7 c, d, f and h. The indicator of well managed forest ecosystems must be equally defined by environmental, economic, and social attributes. Environmental attributes include forest biodiversity, productivity, and ecosystem processes. Economic attributes include the proper

evaluation of full range of forest product and services, and the reinvestment into the forest resources to maintain ecological, social and economic function. Social attributes include longterm incentives and benefits to local forest dependent communities, and recognition of the rights on indigenous peoples.

2. The proposed objectives No 3,4 and 5 are related to specific objective of ITTO Agreement point 7 a : To provide an effective framework for cooperation and consultation on all relevant aspects of the tropical timber economy, point 7 c : To help research and development which will improve forest management and wood use, and point 7 h : To encourage national policies which aim at sustainable use and conservation of tropical forests and their genetic resources, and at maintaining the ecological balance in the regions concern.

2. Compliance with ITTO Criteria

The proposed project will focus on technology that will **(1) support the development of sustainable forest management systems. As such, the project is related to Criteria a, b and c and Action Plan f and h of reforestation and forest management. Indirectly is also related to facilitate the establishment of demonstration area as a forum for achieving consensus on the range of policy issues which would guide the overall strategy of sustainable development of tropical forests.** (2) Global concerns for the biodiversity, and sustainability of tropical forest ecosystems. In addition, the INDO FHM system will provide an early warning of regional decline in forest ecosystems, and will link Indonesian Forests to developing global forest monitoring systems. As such the project output is in compliance with all of ITTO Criteria (Criteria a, b, c, d and e, Chapter 3, paragraph 19 of ITTO Manual).

3. Relationship to ITTO Action Plan and Priorities

Forest Health Monitoring is an ecological approach to monitor the condition and changes in the forest ecosystems. As such is basic for many aspects of the objectives formulated in the ITTO Action Plan (1990). Priority ITTO objective related to this proposed project is to arrest the decline and degradation of tropical forests by incorporating sustainable forest management. The proposed project will also assist in creating a scientific basis for sound forest management.

Use of the FHM plots in the tropical rain forests as a demonstration for future establishment of the FHM program in the Southeast Asian Tropical Rain Forest. As such the proposed project output is in relationship to ITTO Action Plan concerns the promotion of cooperation between institutes through networks.

B. Relevance to National Policy

1. Relationship to Sectoral Policies Affecting Tropical Timber

The information obtained from remote sensing and INDO FHM plots would enable the Ministry of Forestry to report annually on condition of forests, with respect to forest attributes that are of national and international concern. The data could be used in advanced planning for forest policy, and in identification of areas that could be at risk from a variety of natural and man made stressors.

2. Relationship to Subsectoral Aims and Programmes

INDO FHM utilizes a broad suite of indicators of forest ecosystem condition in order to detect early signals of changes in forest condition. The indicators utilized are specifically chosen to address social, political, and scientific concerns identified for each country. This system will complement the existing Indonesian National Forest Inventory program, which currently addresses productivity and extend of the Indonesian forest ecosystems. It is a ground-based, long term plot monitoring system that will provide population based estimates of the condition and trends in Indonesian forests, by monitoring the proportions of the forest population that are in poor, subnominal, nominal or optimal condition for each indicator.

3. Institutional and Legal Framework

The Southeast Asian Regional Centre for Tropical Biology (BIOTROP) is based in Bogor, Indonesia, where it was established 27 years ago, in 1968. Its functional role is to assist the member countries in developing experts who could identify, priorities, analyse, suggest solutions, or alternative approaches to critical biological problems in the region, especially those related to sustainable development of tropical ecosystems.

The trust of activities planned for the next five years concerns the environment. In this regard the center intends to maintain and improve the environmental condition, use natural resources for human welfare under the principle of sustained yield, and develop procedures and operations necessary to achieve the goal and accelerate development proces.

In line with those mission, BIOTROP signed the Letter of Intent with USDA Forest Service, D.G. Forest Inventory and Land Use Planning (Ministry of Forestry, GOI), and CIFOR in March 1994. Through this letter of intent, all parties agree to seek funding and support to implement and fund this studies as describes in this proposal.

Based on those information BIOTROP should be the place where those involved in Forest Health Monitoring, from USDA Forest Service, CIFOR, Ministry of Forestry (GOI), elect to come together to learn from each other. The demonstration plots will also be used as the place where training courses are conducted for the Southeast Asian Member Countries .

PART II : THE PROJECT

2.1. Origin

The USDA Forest Service and U.S. Environmental Protection Agency have initiated a multi-agency Forest Health Monitoring program. This program is known as the U.S. Forest Health Monitoring program (US-FHM). The focus of the program is to evaluate forest ecosystems for condition, changes, trends, causal agents, and mechanisms, thereby to assess the health of the U.S. forests.

A similar program is being proposed to complement the data already being collected by Indonesian National Forest Inventory. **The system to be developed is hereafter referred to as the Indonesian Forest Health Monitoring system (INDO FHM).** The proposed project outlined will be implemented over a three year period with the provision that it be extended as the benefits of the research are realized.

In the Letter of Intent, all parties agree to seek funding and support to implement and fund this proposed project. Implementation of this proposed project partly will be supported by ITTO.

2.2. Project Objectives

2.2.1. Development Objective

This proposed project will focus on technology transfer on Forest Health Monitoring that will focus on application that will enable the Indonesian government to address many, if not all, of the current extent, status, changes, and trends in indicators of the condition of the nation's forest ecosystems, on a regional and a national basis, with known statistical confidence in the estimates. The proposed project also wants to be able to provide yearly statistical summaries and periodic interpretative assessment on the ecological status and trends to resource managers and the public. As such the Indonesian government will be able to address for labelling tropical timber and products as coming from sustainable forests by year 2,000.

2.2.2. Specific Objectives

Specific objectives developed for INDO FHM are :

1. To evaluate the ability of selected indicators to provide an assessment of conditions in tropical rain forests.
2. Establishment of the FHM plot systems, with appropriate indicators, within the existing Indonesian National Forest Inventory plots, to address forest sustainability, biodiversity, and improvement of socio-economic conditions of the local communities.
3. Use of the FHM plots in tropical rain forests as a demonstration for future establishment of the FHM program in Southeast Asian Tropical Rain Forests.
4. Technology transfer on linking remote sensing techniques, including videography, to ground based NFI plots, FHM plots, and the Ecological Classification system.
5. Technology transfer on use of FHM methods and existing software for analysis of productivity data from existing NFI plots.

2.3. Project Justification

2.3.1. Problem to be Address

Forest management has always been, and must be, value driven. The adoption of ecosystem management philosophy adds non traditional values, such as sustainability, and biodiversity, as well as placing new emphasis on human dimension include longterm incentive and benefits to local forest dependent communities, and the recognition of the rights on indigenous peoples.

The International Tropical Timber Organization (ITTO) guidelines, based on the 1990 International Meeting, specify 5 groups of indicators for well managed tropical ecosystems : resource security, the continuity of timber production, the conservation of flora and fauna, an acceptable level of environmental impact, and socio-economic benefit.

This proposal will provide the necessary information to managers in the short term, concurrently with the development of more powerful tools for obtaining and analyzing this information in the long term.

2.3.2. Characteristics of the Region or Area Where the Project Will be Located.

The initial activities would be started in July 1995 by establishing clusters of FHM plots in Indonesian production forests, in both natural and plantation forests. Initial focus would be on Kalimantan (East or Pulau Laut) and on Sumatera (in Jambi province). The density of plots would be determined based on appropriate ecological classifications to address specific forest types and other resource stratifications. The vegetation is dominated by the family of Dipterocarpaceae (*Shorea spp*), and the second tall canopy is dominated by members of the family of Sapotaceae and Lauraceae. The most extensive soils in the study areas are Red and Yellow Podsollic Soils. These soils are presently recognized as Ultisols. Ultisols are soils that are the most weathered and show the ultimate effect of leaching.

2.3.3. Other Relevant Aspects of the Pre Project Situation

Logging is being done using method called Indonesian Selective Cutting and Planting. Most concession holders do not obey all rules of Indonesian Selective Cutting and Planting. They only follow the diameter limit.

Sustained yield management of the forest requires a large amount of information from various field. Quality data and information are foundation for credible decision making. The output of this proposed project is designed to provide a base level of data which will truly allow data collection, analysis, and modeling across ecosystems, regardless of ownership.

2.3.4. Intended Situation After Project Completion

This proposed project will establish a demonstration of the INDO FHM plot system, with appropriate indicators to address forest sustainability, biodiversity, and improvement of socio-economic conditions of local communities. The information are required by forest managers to interact meaningfully with a large and diverse group of stakeholders to achieve consensus in choosing among a wide array of complex possible futures.

Another output is technology transfer on linking remote sensing techniques, including videography, to ground based NFI plots, FHM plots, and the Ecological Classification system.

2.3.5. Target Beneficiaries

The direct recipients of this proposed project are the Ministry of Forestry and Indonesian Forestry community. The outputs of INDO FHM will enable the Indonesian government to **develop appropriate policies for sustainable forest management and utilization of forest resources and enhance forest industry development for long term benefit to society.** The detailed information on the biodiversity of plant species, the structure of plant communities, the suitability of habitat for wildlife, soil fertility and erosion, and other FHM indicators will enable the Indonesian government to address global concerns for biodiversity, and sustainability of tropical forest ecosystems.

2.3.6. Project Strategy

2.3.6.1. Reasons for Selection

In 1989 the Indonesian government initiated the National Forest Inventory (NFI) Project which was technically assisted by the FAO. The objectives of this project were providing information on the location and extent of the main forest types, estimating standing volumes and growth, and assessing the state and change of the forest. The project includes forest resources assessment (FRA), forest resources monitoring (FRM), digital image analysis systems (DIAS), and geographic information systems (GIS).

To quantify the standing stock as the forest changes overtime, the NFI applies the remote sensing techniques and the systematic field sampling method. The field samples are plot cluster consists of 3 by 3 square plots of 100 meters in size an 500 meters apart. Of which 8 at the edges and 1 at the center are treated as temporary and hidden permanent sample plots respectively. (Annex 1).

However, the systems do not concern on biodiversity and other indicators such as suggested by ITTO guidelines, for well managed tropical ecosystems. The indicators of well managed forest ecosystem must be equally defined by environmental, economic, and social attributes.

2.3.6.2. Lessons Drawn from Past Evaluation

FHM was first developed in the U.S. in 1991. The focus of the program is to evaluate forest ecosystems for condition, changes, trends, causal agents, and mechanisms, thereby to assess the health of the U.S. forests. The field test of plot design and logistics located in New England and Virginia provided information to help plan the detection phase of forest monitoring for selected measurements. In general, the plot design and sampling recommendations are within the realm of practical possibilities.

2.3.6.3. Technical and Scientific Aspects

Attributes to be address are first identified as the most efficient method for selection appropriate indicators for monitoring forest conditions. The attributes identified are :

Environmental : biodiversity, productivity, and ecosystem processes.

Economic: proper evaluation of full range of consumable and non consumable forest products and services, and reinvestment into the forest resources to maintain ecological, social, and economic function.

Social : include long term incentives and benefits to local forest dependent communities, and the recognition of the rights of indigenous peoples.

The initial activities would include determination if any modifications were necessary in the basic FHM plot design to accommodate the high diversity found in tropical forest ecosystems.

2.3.6.4. Economic Aspects

The information obtained from this proposed project (INDO FHM combined with remote sensing techniques) would enable the Ministry of Forestry to report annually on condition of the forests, with respect to forest attributes that are nationally and international concern. This data could be used in advanced planning for forest policy, and in identification of areas that could be at risk from a variety of natural and man-made stressor.

These efforts are the important issue for the coming years as specified in the 1991 International Tropical Timber Organization (ITTO) conference. Furthermore forest ecosystem management requires managers to interact meaningfully with a large and diverse group of stakeholders to achieve consensus in choosing among a wide array of complex possible futures. Each alternative future provides a different mix of benefits and costs.

2.3.6.5. Environmental Aspects

One group of attribute to be addressed in INDO FHM is environmental attributes which will address biodiversity (composition, abundance, habitat suitability) and ecosystem processes (growth, regeneration, mortality, stand structure) and productivity.

Forest Health Monitoring is an ecological approach to monitoring the condition and changes in forest ecosystems. It is a ground-based, long-term plot monitoring system that will provide population-based estimates of the condition and trends in forests, by monitoring the proportions of forest population that are in poor, subnominal, nominal or optimal condition of each indicator.

2.3.6.6. Social Aspect

Another group of attributes to be addressed in INDO FHM is social attributes which include long-term incentives and benefits to local forest dependent communities, and the recognition of rights of indigenous peoples. The project will initiate of a trusting relationship, in which communities can speak frankly and usefully. As such the project will encourage and explain to help communities to understand and to envisage the changes that a project might cause.

2.3.6.7. Managerial Aspect

The proposed project will be undertaken by BIOTROP in cooperation with Directorate General of Forest Inventory and Land Use Planning, Ministry of Forestry (GOI). These two groups are called as the counterparts of the U.S. technical experts. The U.S. will assist in development of INDO FHM program, and will support long-term link in the areas of information management and quality assurance/control. The U.S. will be responsible for salaries and travel of the U.S. technical experts.

2.3.7. Reason for ITTO Support

2.3.7.1. ITTO Aspect

The proposed project will develop basic tools for the realization of many goals formulated in the ITTO Action Plan (1990), especially those related to sustainable forest management.

2.3.7.2. Relationships to Relevant Actions Supported by Other Donors

The general approach to implementing INDO-FHM will be to follow the techniques that have been developed and intensively reviewed in the U.S. To accomplish the transfer of technology to Indonesia and other countries, the US-FHM program has organized an international FHM groups (INT-FHM). The INT-FHM group will work closely with BIOTROP and the Indonesian Ministry of Forestry to evaluate the indicators that will be necessary for the Indonesian government to address tropical forests issues of sustainability, and biodiversity. The U. S. Forest Service will seek funding to sponsor U. S. FHM technical experts to assist the initial FHM plots establishment, data analysis and reporting, and also to establish a long-term cooperation.

2.3.8. Risks

There will be a minimum disturbance during plot establishment and remeasurement. The only disturbance may be on soil compaction due to the present of scientists for plots establishment and remeasurement. The location of FHM plots will also be chosen far from fire risks.

2.4. Outputs

2.4.1. Specific objective 1 : To evaluate the ability of selected indicators to provide an assessment of conditions in tropical rain forests.

Outputs :

1. Report on selected indicators as the most efficient to assess tropical rain forest conditions.
2. Technology for detecting changes in forest vegetations.

2.4.2. Specific objective 2 : Establishment of the FHM plot system, with appropriate indicators, within the existing Indonesian National Forest Inventory plots, to address forest sustainability, biodiversity, and improvement of socio-economic conditions of the local communities.

Outputs :

1. Report on FHM plots in productive forests, in both natural and plantation forests. Initial focus would be in Jambi province and Pulau Laut (South Kalimantan province).
2. Determination if any modifications were necessary in the basic FHM plot design to accommodate the high diversity found in tropical forest ecosystems.

2.4.3. Specific objective 3 : Use of the FHM plots in the tropical rain forests as a demonstration for future establishment of the FHM program in the Southeast Asian Tropical Rain Forests.

Outputs :

1. Training facilities for training of trainers for future establishment of the FHM program in the Southeast Asian Tropical Rain Forests.
2. Report on establishment of information management system for data exchange and reporting.

2.4.4. Specific objective 4 : Technology transfer on linking remote sensing techniques, including videography, to ground based NFI plots and FHM plots.

Outputs :

1. Report on assessment of the relationship between diverse remote sensing techniques (including videography) and ground based measurements.
2. Report on early warning of changes in canopy condition of overstory trees.

2.4.5. Specific objective 5 : Technology transfer on use of FHM methods and existing software for analysis of productivity data from existing NFI plots.

Output :

1. Report on system to produce population based estimates of productivity.

2.5. Activities and Inputs :

2.5.1. Specific Objective 1

2.5.1.1. Output 1 : Report on selected indicators as the most efficient to assess tropical rain forest condition.

2.5.1.1. Activities 1 :

- 1.1. **To invite Indonesian Scientists with expertise in: forest biometrics and mensuration to evaluate the following indicators (1995) : growth, regeneration, mortality, stand structure).**
- 1.2. **To invite Indonesian Scientists with expertise in : tree physiology and silviculture to evaluate the following indicators (1995) : crown structure, defoliation, and leaf area index.**
- 1.3. **To invite Indonesian Scientists with expertise in: entomology, phytopathology and silviculture to evaluate damages due to insects, diseases, abiotic and logging.**
- 1.4. **To invite Indonesian Scientists with expertise in : taxonomy, ecology, wildlife and soils to evaluate diversity (composition, abundance, structure and habitat suitability).**
- 1.5. **To invite Indonesian Scientist with expertise in : forest economics to evaluate economic attributes.**
- 1.6. **To invite Indonesian Scientists with expertise in : rural sociology, and agroforestry to evaluate socio attributes**

2. Remeasure indicators (1996 and 1997) which were established in 1995. All scientists indicated above will conduct remeasurement.

Inputs needed :

- * U.S Scientists with the same expertise as Indonesian, as mentioned in activity No 1 will become Indonesian counterpart. They will be shouldered by USDA Forest Service.
- * Inputs needed to support Indonesian Scientists with expertise as mentioned in activity 1. These inputs are proposed to be shouldered by ITTO.
- * FHM field equipment as indicated in Annex 4.
- * Those Indonesian Scientists will be helped by foresters and workers who will be shouldered by Ministry of Forestry GOI.

2.5.1.2. Output 2 : Technology for detecting changes in forest vegetations.

2.5.1.2. Activities :

1. To investigate relationships between the status and trend of biodiversity, and structure indicators with natural and human-induce stresses (1996).
2. Continued investigation (1997)

Commentary :

- The vegetation structure indicators enhance this effort because individual plant species and plant species assemblages are sensitive to environmental gradients, anthropogenic stresses such as logging. Thus, the collective response of vegetation may be used as early-warning system of stress and help identify effects of natural and anthropogenic stress.

Inputs needed:

- US Scientists will be shouldered by USDA Forest Service
- Indonesian Scientists with expertise as indicated in inputs 2.5.1.1. need to be supported by ITTO.
- Foresters from Ministry of Forestry will be supported by Ministry of Forestry

2.5.2. Specific Objective 2 :

2.5.2.1. Output 1 : Report on the FHM plots establishment in productive forests in both natural and plantation forests Initial focus will be located in Jambi province and Pulau Laut.

2.5.2.1. Activities :

1. Sites selection for FHM plots establishment in Jambi province and Pulau Laut (South Kalimantan province). These plots will be located in both natural and plantation forests, and would be on bottom land, slope, and ridge positions to address a range of forest conditions found at different sites (1995).
2. Continued establishment of FHM plots (1996)

Inputs needed :

Travels and per diem for Indonesian Scientists.

2.5.2.2. Output 2 : Determination if any modifications were necessary in the basic FHM plot design to accomodate the high diversity found in tropical forest ecosystems.

2.5.2.2. Activities :

1. Initial evaluation of modification of FHM vegetation quadrates to address tropical diversity of trees (1995).
2. Initial evaluation of logging damage to modify FHM procedure if necessary (1995) .
3. Finalize any modifications to FHM plot size (1996)

Inputs needed :

Indonesian Scientists with expertise in forest biometrics, ecology, taxonomy and logging damage, need support for their travels and per diem.

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2.5.3. Specific Objective 3 :

2.5.3.1. Output 1 : Training facilities for training of trainers for future establishment of the FHM program in the Southeast Asian Tropical Rain Forests.

2.5.3.1. Activities :

1. Establish FHM of training plots (1995)
2. Initial training of Indonesian trainers (1995).
3. Organize training for Southeast Asian Scientists in FHM technology to become trainers in their respective countries (1997).
4. Indonesian trainers train Indonesian crews (1996, 1997).

Inputs needed:

FHM training plots establishment, and training of trainers

2.5.3.2. Output 2: Report on Establishment of information management system for data exchange and reporting.

2.5.3.2. Activities :

1. Standardize data collection, management, and analysis procedures (1995)
2. Produce database on FHM (1995, 1996, 1997).
3. An Improved information flow within and between INDO FHM units and their cooperators (1996, 1997).

Inputs needed:

- Technology and equipment

2.5.4. Specific Objective 4

2.5.4.1. Output 1 : Report on assessment of relationship between diverse remote sensing techniques (including videography) and ground-based measurement.

2.5.4.1. Activities :

1. Field testing of FHM plots and indicators to evaluate the effectiveness, logistics, and reproducibility of combined NFI-FHM system (1995, 1996)
2. To compare of remote sensing data to ground-based NFI-FHM plots (1995, 1996)
3. Completion of one full rotation of plots should be completed in 1998/1999.
4. Final sampling problems should be resolved (1998)

Inputs needed:

Landsat, Spot, Radar, and other available imagery from all sources before selection of sample sites for FHM plots.

2.5.4.2. Output 2 : Report on early warning of changes in canopy conditions overstory trees.

2.5.4.2 Activities :

1. Collect data on crown damage due to logging (1995,1996).
2. Collect and evaluate of plot level value for each element of heterogeneity and complexity of vegetation (species richness, evenness, diversity, equitability, pattern of diversity) in logged over forests and natural forests (1995, 1996, 1997).
3. Detection of changes will be conducted in 1997.

Inputs needed :

- Travels and per diem to collect data

2.5.5. Specific Objective 5 :

2.5.5.1. Output 1 : Report on system to produce population based estimates of productivity.

2.5.5.1 Activities :

Seminar among US Scientists and Indonesian Scientists on statistical program to make population estimates of NFI measurement data (1996)

Inputs needed :

Funding to organize seminar.

PROJECT DESIGN SUMMARY

LOGICAL FRAMEWORK WORKSHEET

Project Title: Forest Health Monitoring to Monitor the Sustainability of Indonesian Tropical Rain Forest

| PROJECT ELEMENTS | OBJECTIVELY VERIFIABLE INDICATORS | MEANS OF VERIFICATION | IMPORTANT ASSUMPTIONS |
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| <p><u>Development Objectives:</u> The broader programme or sector goal to which the project contribute. To determine the current condition of Indonesian forest ecosystems with respect to sustainability, biodiversity and aesthetics and subsequently to tract changes and trends.</p> | <p><u>Measures of Development Objective achievement</u> Appropriate indicators to address well managed forest with known statistical confidence in the estimates. The interpretability, index-period-stability regional accuracy are very with number of FHM plots be established</p> | <p><u>Sources of data</u> Report on FHM plots establishment</p> | <p>Use this space for comments on the forestry sector policies and plans, intersectoral linkages, relative priorities, etc. - Information provided: (a) Compliance with ITTO's mandates for labelling tropical timber products as coming from sustainable forest by year 2,000. (b) Could be used in advances planning for forest policy. (c) Global concerns for biodiversity, sustainability and aesthetics values of tropical forest.</p> |

| PROJECT ELEMENTS | OBJECTIVELY VERIFIABLE INDICATORS | MEANS OF VERIFICATION | IMPORTANT ASSUMPTIONS |
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| <p>1. To evaluate the ability of selected indicators to provide an assessment of conditions in tropical rain forest.</p> <p>2. Establishment of the FHM plot system, with appropriate indicators, within the existing Indonesian National Forest Inventory plots, to address forest sustainability, biodiversity, aesthetics and improvement of socio-economic conditions of the local communities.</p> | <p>The accuracy and precision variation of selected indicators due to:</p> <ul style="list-style-type: none"> * within cre variability * between cre variability * local within-plot spatial variability * bias <p>FHM plot design and logistics will be adjusted within the realm of practical possibilities.</p> <p>The element of logistics include: Staffing and personnel, training, communication and safety.</p> | <p>Report on selected indicators of FHM. Data gathered from FHM plots.</p> <p>Report on plot establishment.</p> | <p>Global Concerns for biodiversity, sustainability and aesthetics values of tropical forests.</p> <p>FHM plots system will provide an early signals of changes in forest condition and will link the Indonesian forests to a developing global forest monitoring system.</p> |
| <p>3. Use of the FHM plots in tropical rain forests as a demonstration for future establishment of the FHM program in the Southeast Asian Tropical Rain Forests.</p> <p>4. Technology transfer on linking remote sensing techniques including videography to ground based NFI plots an FHM plots.</p> | <p>More training exercise on FHM in Southeast Asian Countries will be available.</p> <p>The relationships established between remote sensing techniques- and ground-based forest data may be used as surrogate for ground- based monitoring in remote region, to scale-up estimates of forest conditions from plot level to landscape level, and will save a lot of funds and time.</p> | <p>Report on FHM training program.</p> <p>Report on linking remote sensing techniques to ground based NFI plots and FHM plots.</p> | <p>World concerns for well managed forest requires skilled foresters who trained in FHM.</p> <p>Linking remote sensing to detailed ground-based measures of diverse forest ecosystem indicators will enable the Indonesian Government to make estimates of forest condition over broad geographical areas, and in remote locations.</p> |

| PROJECT ELEMENTS | OBJECTIVELY VERIFIABLE INDICATORS | MEANS OF VERIFICATION | IMPORTANT ASSUMPTIONS |
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| <p>5. Technology transfer on the use of FHM methods and existing software for analysis of productivity data from existing NFI plots.</p> | <p>Economy of effort is analyzing existing NFI data for population estimates of productivity.</p> | <p>Report on the use of FHM methods and existing software for analysis of productivity data from existing NFI plots.</p> | <p>Potential collaborators (USDA Forest Service, US Environmental Protection Agency, and USDA Soil Conservation Service) will enable to begin determination of the applicability of existing FHM data analysis methods to address the needs of the NFI system for population estimates.</p> |

| PROJECT ELEMENTS | OBJECTIVELY VERIFIABLE INDICATORS | MEANS OF VERIFICATION | IMPORTANT ASSUMPTIONS |
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| <p><u>Outputs</u></p> <p>1.1. Report on selected indicators as the most efficient to assess tropical rain forest condition.</p> | <p><u>Magnitude and timing of Outputs:</u></p> <p>Report on selected indicators will be available by December 1995.</p> | <p><u>Sources of data:</u></p> <p>The indicator development process that illustrates the indicator selection, performance criteria, and management considerations.</p> | <p><u>Assumptions for achieving Outputs</u></p> <p>Selected indicators as the most efficient to assess tropical rain forest will be provided on schedule.</p> |
| <p>1.2. Technology for detecting exchanges forest vegetations.</p> | <p>Report on the technology for detecting changes in forest vegetation will be available by December 1997.</p> | <p>Detection of changes is best done with repeated measurements of the same FHM plots over time, with the internal between observations chosen on the basis of signal-to-noise ratio of the measurements.</p> | <p>Report will be provide on schedule.</p> |
| <p>2.1. Report on FHM plots establishment in productive forests, in both natural and plantation forests. Initial focus will be in Jambi and Pulau Laut.</p> | <p>Report on FHM plots establishment will be available by December 1995 and 1996.</p> | <p>The field sampling involves the collection of FHM Detection Monitoring Measurement that will be used to calculate values for forest condition indicators. One key feature is the statistical selection of ground plots so that the data represent a probability sample.</p> | <p>Report will be provided on schedule.</p> |
| <p>2.2. Determination if any modifications were necessary in the basic FHM plot design to accommodate the high diversity found in tropical forest ecosystems.</p> | <p>Report will be available by December 1995.</p> | <p>Initial evaluation of modification of FHM vegetation quadrates to address tropical diversity of trees.</p> | <p>Report will be provided on schedule.</p> |

| PROJECT ELEMENTS | OBJECTIVELY VERIFIABLE INDICATORS | MEANS OF VERIFICATION | IMPORTANT ASSUMPTIONS |
|---------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3.1. Training facilities for training of trainers for future establishment of the FHM program in the Southeast Asian Tropical Rain Forests. | Report on establishment of FHM training plots will be available by December 1995. | Initial establishment will be conducted in collaboration with US INT-FHM team. | Training facilities will be available on schedule. |
| 3.2. Establishment of information management system for exchange and reporting | Report on establishment of information management system for exchange and reporting will be available by December 1996. | Data will be hierarchically nested, going to the highest resolution needed for the design case, then extrapolating to increasingly smaller and smaller scales. | Information management system on FHM will be available on schedule. |
| 4.1. Report on assessment of the relationship between diverse remote sensing techniques and ground-based measurements. | Report on assessment of the relationship between diverse remote sensing techniques and ground-based measurements will be available by December 1997. | Data collected from remote sensing will be correlated and tested with ground-based plot data. | The relationship established remote sensing techniques and ground-based data may be used as a surrogate for forest condition in remote region, to scale up estimates of forest condition from plot level to landscape level. The report will be available on schedule. |
| 4.2. Report on early warning of changes in canopy condition of overstory trees. | Report on early warning of changes in canopy condition of overstory trees will be available by December 1977. | Testing, development, and evaluation of techniques and technologies to detect and determine change in, and the causes of change to, forest vegetation. | The report will be available on schedule. |
| 5.1. Report on system to produce population based estimates of productivity. | Report on system to produce population based estimates of productivity will be available by December 1996. | Analysis techniques will be determined and evaluated by technical experts from US and Indonesia. | The report will be available on schedule. |

| PROJECT ELEMENTS | OBJECTIVELY VERIFIABLE INDICATORS | MEANS OF VERIFICATION | IMPORTANT ASSUMPTIONS |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| <p><u>Activities</u></p> <p>1995</p> <p>Invite Indonesian</p> <p>1.1. Forest biometrics and mensuration</p> <p>1.2. Tree physiology and silviculture</p> <p>1.3. Entomology, phyto-pathology and silviculture</p> <p>1.4. Taxonomy, ecology wildlife and soils</p> <p>1.5. Forest economics</p> <p>1.6. Rural sociology and agroforestry</p> <p>2. Selection of FHM plots sites in Jambi and Pulau Laut</p> <p>3. Initial evaluation of modification of FHM vegetation quadrates to address tropical diversity of trees</p> | <p>Use this space for listing the necessary inputs (ex-ante evaluation) or the inputs which have been provided (mid-term and ex-post evaluation)</p> <ul style="list-style-type: none"> - Indonesian scientists will be supported by ITTO - US scientist will be shouldered by US Forest Service - Foresters from Ministry of Forestry will be shouldered by Ministry of Forestry <p>(USFS + EPA + UNIVERSITY) Coordinator together with BIOTROP coordinator and Ministry of Forestry responsible for this selection</p> <ul style="list-style-type: none"> - US and Indonesian scientists in ecology, taxonomy and biometrics responsible for this topic | <p>Use this space for indicating the Input categories.</p> <p>duration 3 weeks</p> <ul style="list-style-type: none"> - BIOTROP coordinator will be supported by ITTO - Duration 2 week (Jambi and Pulau Laut) - Indonesian scientists will be supported by ITTO - Duration 2 week (Jambi and Pulau Laut) | <p>It is not necessary to complete.</p> |

| PROJECT ELEMENTS | OBJECTIVELY VERIFIABLE INDICATORS | MEANS OF VERIFICATION | IMPORTANT ASSUMPTIONS |
|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------------------------------------------------|-----------------------|
| 4. Initial evaluation of logging damage | One Indonesian scientist, foresters and US experts. | - Indonesian scientists will be supported by ITTO - Duration 2 week (Jambi and Pulau Laut) | |
| 5. Establish demonstration of FHM plots | The same as in activity 1. | - Duration 3 weeks | |
| 6. Organize training exercise | BIOTROP and US coordinator. | Duration 5 days | |
| 7. Initial training of Indonesian trainers | USDA and BIOTROP. | 20-25 trainees duration 2 weeks | |
| 8. Standardize data collection, management, and analysis procedures | USDA, Ministry of Forestry and BIOTROP | Duration 5 days | |
| 9. Produce data-base on FHM | USDA, Ministry of Forestry and BIOTROP | Duration 5 days | |
| 10. Field testing of FHM plots and indicators to evaluate the effectiveness, logistics and reproducibility combined NFI - FHM system | The same as in activity 1. | Duration 3 weeks (Jambi and Pulau Laut) | |
| 11. To compare of remote sensing data to ground-based NFH-FHM plots | USDA, Ministry of Forestry and BIOTROP. | Duration 10 days | |

| PROJECT ELEMENTS | OBJECTIVELY VERIFIABLE INDICATORS | MEANS OF VERIFICATION | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <p>12. Collect data on crown damage</p> | <p>USDA, Indonesian Scientist on logging damage and forester from Ministry of Forestry</p> | <p>Duration 2 weeks (Jambi and Pulau Laut)</p> | |
| <p>13. Collect and evaluate of plot level value for each element of heterogeneity and complexity of vegetation</p> <p>1996</p> <p>1. Remeasure indicators which were established in 1995</p> <p>2. Investigate relationships between the status and trend of biodiversity indicators with natural and human induce stresses.</p> <p>3. Continued establishment of FHM plot size</p> <p>4. Finalize any modification to FHM plot size</p> <p>5. Produce database on FHM</p> <p>6. Improved information flow within and between INDO FHM units and their cooperators.</p> | <p>USDA, Indonesian Scientists in ecology, wildlife, taxonomy and foresters.</p> <p>The same as in activity 1, 1995.</p> <p>USDA and Indonesian scientists in ecology, wildlife, taxonomy and biometrics</p> <p>The same as in activity 1, 1996.</p> <p>The same same as in activity 3, 1995.</p> <p>The same as in activity 9, 1995.</p> <p>USDA, Ministry of Forestry and BIOTROP.</p> | <p>Indonesian, scientists will be shouldered by ITTO</p> <p>Duration 3 weeks (Jambi and Pulau Laut)</p> <p>Duration 3 weeks (Jambi and Pulau Laut)</p> <p>Duration 10 days</p> <p>Duration 2 weeks (Jambi and Pulau Laut)</p> <p>Duration 2 weeks (Jambi and Pulau Laut)</p> <p>Duration 5 days</p> <p>Duration 5 days</p> | |

| PROJECT ELEMENTS | OBJECTIVELY VERIFIABLE INDICATORS | MEANS VERIFICATION | |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------|--|
| 7. Field testing of FHM plots and indicators to evaluate the effectiveness, logistics and reproducibility of combined NFI-FHM system. | The same as in activity 10, 1995. | Duration 3 weeks (Jambi and Pulau Laut) | |
| 8. To compare of remote sensing data to ground based NFI-FHM plots. | The same as in activity 11, 1995. | Duration 10 days. | |
| 9. Collect data on crown damage due to logging. | The same as in activity 12, 1995. | Duration 2 weeks (Jambi and Pulau Laut) | |
| 10. Collect and evaluate of plot level value for each element of heterogeneity and complexity of vegetation in logged over and natural forests. | The same as in activity 13, 1995. | Duration 3 weeks (Jambi and Pulau Laut) | |
| 11. Organize seminar on statistical program to make population estimate of NFI mensuration data. | Experts from US, CIFOR, BIOTROP, Universities and Ministry of Forestry (50 persons) | 3 days seminar | |
| 1997 | | | |
| 1. Remeasure indicators which were established in 1995. | | duration 3 weeks | |
| 2. Continued evaluation on relationships between the status and trend of biodiversity indicators with natural and human induce stress. | The same as in activity 2, 1996. | Duration 1 week | |

| PROJECT ELEMENTS | OBJECTIVELY VERIFIABLE INDICATORS | MEANS OF VERIFICATION | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <p>3. Organize training for Southeast Asian Scientists in FHM technology to become trainers in their respective countries.</p> <p>4. Indonesian trainers train Indonesian crews.</p> <p>5. Collect and evaluate of plot level value for each element of heterogeneity and complexity of vegetation in logged over and natural forests.</p> <p>6. Collect data on crown damage due to logging.</p> | <p>US and Indonesian Scientists responsible to organize this training.</p> <p>Ministry of Forestry responsible to organize this training.</p> <p>The same as in activity 10, 1996.</p> <p>The same as in activity 9, 1996.</p> | <p>Duration 2 weeks (18 trainees (2 trainees/country) be supported by ITTO</p> <p>Duration 2 weeks</p> <p>Duration 3 weeks</p> <p>Duration 2 weeks</p> | |

8. Institutional arrangements for execution and operation

8.1. Management structure

BIOTROP, the Regional Center for Tropical Biology, is one of the twelve Regional Centers/ Project of SEAMEO (Southeast Asian Ministers of Education Organization), Hosted by the Minister of Education and Culture of the Republic of Indonesia.

For the Fifth Five-Year Phase of Operation, 1993 - 1998, BIOTROP continues to be directly under the Directorate General for Higher Education of the Ministry of Education, the Republic of Indonesia. The management structure is indicated in the Organogram on the following page.

BIOTROP serves as coordinating activities of this project at national level and, at the same time, are the elements linking the participating institutions to Southeast Asian Member Countries and international organization (USDA Forest Service).

During the project period, the director of BIOTROP will be active according to ITTO regulations.

8.2. Project Governance

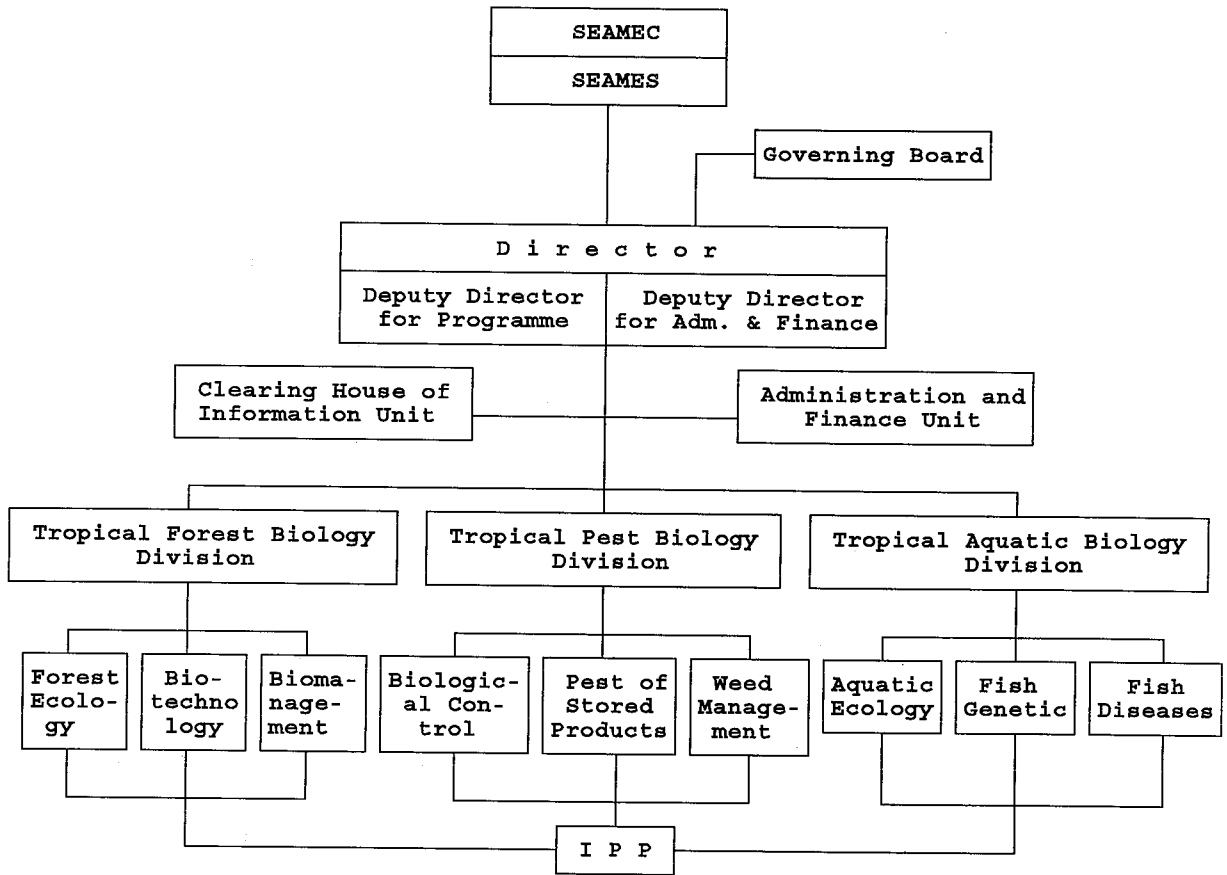
A project Steering Committee (PSC) will be established to give policy guidance for the Project. The PSC will be chaired by Director of Bureau KLN, Ministry of Forestry, and its membership will include : representatives of Directorate General of Forest Inventory and Land Use Planning, International Tropical Timber Organization, USDA Forest Service and Director of SEAMEO BIOTROP.

The PSC will meet as required, but at least one annually, to consider and advise on progress and problems in Project implementation.

The PSC will determine the policies for Project implementation and provide policy guidance to the project staff and consultants.

8.3. Project Management

Project management will be established in Bogor, within two months of the effective funds being released, for a period of three years to ensure adequate time for the administration of the initiation and conclusion of the project.



Functional Organization of BIOTROP

To implement the project, a core team consists of representatives of D.G. Forest Inventory and Land Use Planning, (Dr. Burhanuddin Sarbini and Mr. Transtoto Handadhari, M.Sc) and SEAMEO BIOTROP(Prof.Dr. Soekotjo) will be responsible for the management of the project. This team will be headed by Prof.Dr. Soekotjo, as a project leader. Additional staff (finance and administration) will be appointed. The Head of the Team will be responsible to the Project Steering Committee for effective implementation of the project.

The project management core team will meet as required, but at least twice annually to solve the problems and monitor the progress of project implementation.

8.4. The role of each participating institution

The U.S. technical experts will assist in development of Indonesian Forest Health Monitoring Program (INDO FHM program) and will support long-term link in the areas of information management and quality assurance/control. During FHM plots establishment and remeasurement, the U.S. technical experts will train Indonesian Scientists in the areas of assessment, design, analysis and reporting the FHM program. The U.S. will seek fundings to sponsor U.S. FHM technical experts to assist the initial FHM plots establishment, data analysis and reporting, and also to establish a long term cooperation.

Using the support from ITTO, BIOTROP will be responsible to invite Indonesian Scientists to participate and become the counterparts of the U.S. technical experts in FHM program. They will become trainers of Indonesian crews. In the future they will train of trainers for interested the Southeast Asian member countries.

The D.G. Forest Inventory and Land Use Planning will provide foresters in field-level forestry, inventory, mapping, and photo-interpretation, and salaries, travel for these personnels.

CIFOR will participate in biodiversity indicators. CIFOR will provide scientist in this field and support his or her salary and travel.

8.5. Consultants/Scientists Services

A team of National Scientists/Consultants will be recruited.

They will provide specific services as detailed in terms of reference (Annex 3) . They will also report to Head of project management.

8.6. Future Operation and Maintenance

The asset will become Government of Indonesian property and will be managed by the Government of Indonesia.

8.7. Key Staff of Project Management

BIOTROP Prof.Dr. Soekotjo, Director of BIOTROP, Coordinator

Ngawi, 01-01-1934, Indonesia

Forest Ecology, Michigan State Univ., U.S.A.

Ministry of Forestry, Government of Indonesia

Dr.Burhanuddin Sarbini, Directorate of Forest Inventory and Land Use Planning, Coordinator

Ph.D. in Forest Management, University of Washington, U.S.A.

Ir. Transtoto Handadhari , M.Sc, Directorate of Forest Inventory and Land Use Planning.

M.Sc. in Forest Economics, University of Wisconsin, USA

USDA Forest Service, Forest Health Monitoring Program

Dr.Kenneth W. Stolte, Coordinator

Deputy Program Manager, Research Forest Health Monitoring,

USDA Forest Service

Southeastern Forest Experiment Station, USA

PART III: MONITORING, REPORTING AND EVALUATION

- Project Progress Report

Annual reports will be submitted by BIOTROP to ITTO and the Ministry of Forestry of the Republic of Indonesia.

- Project Completion Report

A final report shall be submitted within three months of completion of the project, with due consideration of the provisions within ITTO Project Cycle.

- Monitoring, Reviews and Steering Committee's Visit

Project Leader should prepare a report annually, and submit the report to Steering Committee, ITTO and Government of Indonesia. He will also meet annually in the U.S. to discuss review, evaluate, and analysis of the FHM plots. Indonesian Scientists and Foresters who work for this project should meet in BIOTROP annually to discuss, evaluate, analysis and report their results. Remeasures and Reviews indicators which were established before will be conducted annually.

Project Steering Committee will meet annually to discuss the annual report.

- Evaluation

The project will be subject to evaluation in accordance with the ITTO procedures. The organization, terms preference, and timing of the evaluation should be decided by ITTO, the Ministry of Forestry of the Republic of Indonesia and BIOTROP in mutual consultation. The evaluation will take place one year after commencement of the project and at its termination.

PART IV: BUDGET

The total proposed budget for the period of July 1995 to June 1998 (3 years) amount to US\$ 860,346 plus US experts (US contribution).

The estimate financial sources to the amount of US\$ 454,830, is requested from ITTO, and to the amount of US\$ 405,516, is requested from Ministry of Forestry, GOI.

The estimate costs based on activities and cost components requested from ITTO is shown in Table 1 - 2. These tables are based on activities, work plan and element for calculating budget as shown in Annex 2.

Budget supported by GOI is shown in Table 3 - 4, and estimate contributions from USDA is shown in Table 5.

For project personnel, ITTO will support Indonesian experts/scientists and project administration, GOI will support foresters who will assist national experts, and USDA will support the U.S. experts.

For travel, ITTO will support air tickets and per diem for Indonesian experts/scientists, GOI will support air tickets and per diem for foresters who assist Indonesian experts, and USDA will support the U,S. experts.

For training component, ITTO will support the Southeast Asian Regional training in 1997 or Year 3, GOI will support training for Indonesian crews in 1995, 1996, 1997 or Year 1, 2 and 3, and USDA will provide advisers and trainers.

Consolidated yearly project budget from ITTO and GOI is shown in Table 6.

TABLE 1 : PROJECT BUDGET BY ACTIVITY SUPPORTED BY ITTO
(in 1,000 US \$)

| Output Activities | Budget components | | | | | | | |
|-----------------------|-------------------|--------------|-------------|---------------|------------------|--------|---------------|-------------|
| | Project per | Sub contract | Duty travel | Capital items | Consumable items | Micel | Adm onite val | Grand total |
| Out 1 | | | | | | | | |
| A 111 | 3.0 | 0 | 2.5 | | 0.1 | | | 5.6 |
| A 112 | 6.0 | 0 | 5.0 | | 0.2 | | | 11.2 |
| A 113 | 6.0 | 0 | 5.0 | | 0.3 | | | 11.2 |
| A 114 | 12.0 | 0 | 10.0 | | 0.4 | | | 22.4 |
| A 115 | 3.0 | 0 | 2.5 | | 0.1 | | | 5.6 |
| A 116 | 6.0 | 0 | 5.0 | | 0.2 | | | 11.2 |
| Subtotal | 36.0 | 0 | 30.0 | | 1.2 | | | 67.2 |
| A 12 | 36.0 | 0 | 60.0 | | 6.0 | | | 102.0 |
| Subtotal | 36.0 | 0 | 60.0 | | 6.0 | | | 102.0 |
| Out 2 | 36.0 | | | | | | | |
| A 21 | 3.0 | 0 | 2.5 | | 0.1 | | | 5.6 |
| A 22 | 30.0 | 0 | 2.5 | | 0.1 | | | 5.6 |
| Subtotal | 6.0 | 0 | 5.0 | | 0.2 | | | 11.2 |
| Out 3 = | Objective 2 | output 1 | | | | | | |
| A 31 | 6.0 | 0 | 3.0 | | 0.1 | | | 9.1 |
| A 32 | 6.0 | 0 | 3.0 | | 0.1 | | | 9.1 |
| Subtotal | 12.0 | 0 | 6.0 | | 0.2 | | | 18.2 |
| Out 4 = | Objective 2 | output 2 | | | | | | |
| A 41 | 6.0 | 0 | 5.0 | | 0.2 | | | 11.2 |
| A 42 | 6.0 | 0 | 2.5 | | 0.1 | | | 8.6 |
| A 43 | 6.0 | 0 | 5.0 | | 0.2 | | | 11.2 |
| Subtotal | 18.0 | 0 | 12.5 | | 0.5 | | | 31.0 |
| Out 5 = | Objective 3 | output 1*) | | | | | | |
| A 51 | 18.0 | 0 | 30.0 | | 2.0 | | | 52.6 |
| A 53 | 40.0 | 0 | 0 | | 6.0 | | | 46.0 |
| Subtotal | 58.0 | 0 | 30.0 | | 8.0 | | | 98.6 |
| Out 6 | Objective 3 | output 2 | | | | | | |
| A 61 | 3.0 | 0 | 1.5 | | 0.2 | | | 4.7 |
| A 62 | 3.0 | 0 | 4.0 | | 0.4 | | | 10.4 |
| A 63 | 3.0 | 0 | 2.5 | | 0.3 | | | 5.8 |
| Subtotal | 12.0 | 0 | 8.0 | | 0.9 | | | 20.9 |
| Out 7 = | Objective 4 | output 1 | | | | | | |
| A 71 | 3.0 | 0 | 5.0 | | 0.5 | | | 8.5 |
| A 72 | 3.0 | 0 | 5.0 | | 0.4 | | | 8.4 |
| A 73 | 3.0 | 0 | 2.0 | | 0.2 | | | 5.2 |
| A 74 | 3.0 | 0 | 2.0 | | 0.3 | | | 5.3 |
| Subtotal | 12.0 | 0 | 14.0 | | 1.4 | | | 27.4 |
| Out 8 = | Objective 4 | output 2 | | | | | | |
| A 81 | 3.0 | 0 | 2.5 | | 0.4 | | | 5.9 |
| A 82 | 6.0 | 0 | 5.0 | | 1.0 | | | 12.0 |
| A 83 | 3.0 | 0 | 2.5 | | 0.4 | | | 5.9 |
| Subtotal | 12.0 | 0 | 10.0 | | 1.8 | | | 23.8 |
| Overhead | | | | | | 7.0 | | 7.0 |
| Adm & Commu. | | | | | | 7.865 | | 7.865 |
| ITTO (eval & monit) | | | | | | | 18.0 | 18.0 |
| ITTO (admin cost)= 5% | | | | | | | 18.0 | |
| Subtotal | 0 | 0 | 0 | | 0 | 21.665 | | 21.665 |
| Grand total | 202.0 | 0 | 175.5 | 2.6 | 20.2 | 36.530 | 18.0 | 54.530 |
| | | | | | | 36.530 | 18.0 | 454.830 |

TABLE 2 : PROJECT BUDGET FROM ITTO BY COMPONENT AND YEAR
(in 1,000 US \$)

| Components | Year 1 | Year 2 | Year 3 | Total |
|---------------------------------|--------|--------|---------|---------|
| 10. PROJECT PERSONNEL | | | | |
| 11. National experts | 75.0 | 46.5 | 80.5 | 202.0 |
| 19. Component total | 75.0 | 46.5 | 80.5 | 202.0 |
| 30. DUTY TRAVEL | | | | |
| 31. Daily subsistence allowance | 48.0 | 38.5 | 53.0 | 139.5 |
| 32. Transport cost | 12.0 | 12.0 | 12.0 | 36.0 |
| 39. Component total | 60.0 | 50.5 | 65.0 | 175.5 |
| 40. CAPITAL ITEMS | | | | |
| 41. Capital equipment (Annex 4) | 2.6 | 0 | 0 | 2.6 |
| 49. Component total | 2.6 | 0 | 0 | 2.6 |
| 50. CONSUMABLE ITEMS | | | | |
| 53. Utilities | 4.0 | 4.0 | 4.0 | 12.0 |
| 54. Office supplies | 3.0 | 2.2 | 3.0 | 8.2 |
| 59. Component total | 7.0 | 6.2 | 7.0 | 20.2 |
| 60. MISCELLANEOUS | | | | |
| 61. Sundry | 2.5 | 2.5 | 2.865 | 7.865 |
| 62. overhead | 2.0 | 2.0 | 3.0 | 7.0 |
| 69. Component total | 4.5 | 4.5 | 5.865 | 14.865 |
| 70. ITTO ADMIN. MONIT & EVAL | | | | |
| 71. Administrative cost | 7.22 | 7.22 | 7.225 | 21.665 |
| 72. Monitoring & evaluation | 6.0 | 6.0 | 6.0 | 18.0 |
| 79. Component total | 13.22 | 13.22 | 13.225 | 39.665 |
| 99. GRAND TOTAL | 162.32 | 120.95 | 171.590 | 454.830 |

TABLE 3. PROJECT BUDGET BY ACTIVITY SUPPORTED BY GOI
(in 1,000 US \$)

| Output Acti- ities | Budget components | | | | | | | |
|--------------------------|--------------------------|---------------------|----------------|------------------|----------------|-----------------|---------------|------------------------|
| | project per sonnel | Sub con tract | Duty travel | Capital items | Consu mable | Miscel items | Admin mont | Grand total eval |
| Objective 3 Output 1 | | | | | | | | |
| A5.2 | 0 | 0 | 20.162 | 0 | 0 | 0 | 0 | 20.162 |
| A5.4 | 0 | 86.20 | 0 | 0 | 0 | 0 | 0 | 86.2 |
| Objective 4 output 1 | | | | | | | | |
| A7.1 | 0 | 0 | 12.313 | 0 | 0 | 0 | 0 | 12.313 |
| A7.2 | 0 | 0 | 13.0 | 150.0 | 0 | 0 | 0 | 163.0 |
| Objective 4 output 2 | | | | | | | | |
| A8.20 | 0 | 0 | 0 | 93.841 | 0 | 0 | 0 | 93.841 |
| Objective 5 | | | | | | | | |
| A9.1 | 0 | 30.0 | 0 | 0 | 0 | 0 | 0 | 30.0 |
| Grand total | 0 | 116.2 | 45.475 | 243.841 | 0 | 0 | 0 | 405.516 |

Notes : GOI plan to procure 20 units of GPS equipment to support objective 4 output 1 activity 2. The estimate cost is at the amount of US \$ 150,000. GOI also plan to procure i unit of airborne vidiography equipment to support objective 4 output 2 activity 2.

TABLE 4. PROJECT BUDGET BY COMPONENT AND YEAR SUPPORTED BY GOI
(in 1,000 US \$)

| Components | Year 1 | Year 2 | Year 3 | Total |
|----------------------------------------------------------|---------|--------|--------|---------|
| 20. SUB-CONTRACT | | | | |
| 21. Subcontract for organizing training Indonesian crews | 0 | 40.0 | 46.2 | 86.2 |
| 23. Subcontract related to organize seminar | 0 | 0 | 30.0 | 30.0 |
| 29. Component total | 0 | 40.0 | 76.2 | 116.2 |
| 30. DUTY TRAVEL | | | | |
| 31. Daily subsistence | 16.242 | 9.36 | 8.673 | 34.275 |
| 32. Transport costs | 3.920 | 3.640 | 3.640 | 11.2 |
| 39. Component total | 20.162 | 13.0 | 12.313 | 45.475 |
| 40. CAPITAL ITEMS | | | | |
| 41. Capital equipment | 243.841 | 0 | 0 | 243.841 |
| 49. Component total | 243.841 | 0 | 0 | 243.841 |
| 99. GRAND TOTAL | 264.003 | 53.0 | 88.513 | 405.516 |

The period July 7 to July 25, 1995, Five U.S. experts will begin planning FHM training exercise. If additional funds become available 5 other experts will participate in this exercise. Therefore, total funds contributed by USDA Forest Service is still difficult to be estimated.

TABLE 5. ESTIMATE USDA CONTRIBUTION TO SUPPORT US EXPERTS
(ASSUME 10 EXPERTS PER YEAR FOR 3 YEARS PERIOD)
(in 1,000 US \$)

| Component | Year 1 | Year 2 | Year 3 | Total |
|-----------------------|--------|--------|--------|-------|
| 30. DUTY TRAVEL | | | | |
| 31. Daily subsistence | 40.0 | 40.0 | 40.0 | 120.0 |
| 32. Transport costs | 24.5 | 24.5 | 24.5 | 73.5 |
| 39. Component total | 64.5 | 64.5 | 64.5 | 193.5 |

Table 5 is minimum US contribution.

TABLE 6. CONSOLIDATED YEARLY PROJECT BUDGET
BASED ON TABLE 2 AND 4
(in 1,000 US \$)

| Components | Year 1 | Year 2 | Year 3 | Total |
|----------------------------------|---------|--------|---------|---------|
| Project Personnel | 75.0 | 46.5 | 80.5 | 202.0 |
| Sub-contract | 0 | 40.0 | 76.2 | 116.2 |
| Duty Travel | 80.162 | 63.5 | 77.313 | 220.975 |
| Capital Items | 246.441 | 0 | 0 | 246.441 |
| Consumable Items | 7.0 | 6.2 | 7.0 | 20.2 |
| Miscellaneous | 4.5 | 4.5 | 5.865 | 14.865 |
| ITTO Administration & Monitoring | 13.22 | 13.22 | 13.225 | 39.665 |
| GRAND TOTAL | 426.323 | 173.92 | 260.103 | 860.346 |

ANNEX 1 : SUMMARY OF NFI

1. The primary objective of this project would be to strengthen planning and management efforts in forestry sector for maximizing long term contributions from forest resources for the welfare of the Indonesian people.
2. In view of the outdated and inaccurate forestry resource information and the need to monitor changes in forestry resources on a regular basis, the NFI project would assist GOI in carrying out a national forestry resource survey. The survey would provide reliable estimates of standing volumes by major forest types, species and marketing groups, and mark their location on small-scale low-cost maps for use by both MOF and the private sector in planning and administering proposals for forest utilization. The forest resource information would also be used to develop longer range forest management plans and policies.
3. To minimize the cost of forest inventory for Indonesia's vast forest area extending over 144 million ha, a sampling approach be adopted with more emphasis given to areas that are important either because of high potential for development or because of problems and pressures on the forestry resources. A stratified sampling design be adopted, with strata defined on a basis of existing remote sensing images. In high priority areas, new 1 : 20,000 areal photography be obtained at systematically spaced intervals with line spacing varying between 10 to 20 km. It is estimated that 7,500 line km be flown. Field sampling be done for calibrating remote sensing and aerial photography data. It is expected that the number of samples per million ha will range between 17 to 64.
4. D.G. for Forest Inventory and Land Use Planning be responsible for carrying out the national forest inventory component, using existing organizational structure. The Director of Forest Inventory will act as Project Director.

ANNEX 2 : ELEMENT FOR CALCULATING BUDGET

1. National experts

The duration for service is 3 months/year with proposed salary at the amount of U.S. \$ 1,000/month. For expert who conducts with more than one indicator the duration for service will be adjusted based on activities (see p 13 to 17 and work plan).

2. Administrative and finance will consist of 3 personnels, each will work for 3 months/year, with proposed salary at the amount of U.S. \$ 250/month/person.

3. Air ticket

Jakarta - Jambi - Jakarta = US \$ 180/person

Yogya - Jakarta - Yogya = US \$ 100/person

Jakarta - Pulau Laut - Jakarta = US \$ 270/person

4. Per diem = U.S. \$ 75/day/expert

ANNEX 3 : TERMS OF REFERENCE FOR PROPOSED CONSULTANTS/
NATIONAL EXPERTS/SCIENTISTS

1. During the project implementation, the following consultants/ national experts/scientists are needed :
 - 1.1 Forest biometrics and mensuration
 - 1.2 Tree physiology and silviculture
 - 1.3 Entomology, phytopathology and silviculture
 - 1.4 Taxonomy, ecology, wildlife and soils
 - 1.5 Forest economics
 - 1.6 Rural sociology and agroforestry
2. Each scientist is responsible for selecting and testing candidate indicator(s) of Forest Health Monitoring (FHM) based on literature, peer reviews, and expert opinion. Each indicator address at least one assessment question pertaining to certain values that can be easily interpreted by other scientists, policy makers, and the general publics. The selected indicators provide quantitative or qualitative links to the key ecosystems processes and components.
3. He or she will serve as the U.S.expert counterpart in FHM program.
4. The minimum qualifications of national expert/consultant is Ph.D holder. He or she is also to have experience in the development and evaluation of programs of advanced level of research.
5. He or she will work for two months in the field and one month in the office to write report finding per year.

ANNEX 4: MENSURATION EQUIPMENT LIST

| TOTAL | ITEM | CO | CAT | QU | WEIGHT PRICE | UNIT PRICE |
|----------------------------------------------|------|---------|-----|-------|-----------------|---------------|
| Compasses | FS | 37010 | 4 | 4 oz | 62.95 | 251.80 |
| | BM | 101968 | | | 72.50 | 290.00 |
| Clinometer | FS | 43830 | 4 | 10 oz | 75.00 | 300.00 |
| | BM | 102200 | | | 82.85 | 331.40 |
| Cruiser Vest | FS | 94580 | 4 | 4 lbs | 49.50 | 198.00 |
| | BM | | | | 52.50 | 210.00 |
| Increment Borers 14" 3 thread style | FS | 63280 | 2 | - | 143.00 | 572.00 |
| | BM | 104152 | | | 167.35 | 669.40 |
| Replacement extractors | FS | 63284 | 4 | - | 17.50 | 70.00 |
| | BM | 104125 | | | 17.84 | 71.36 |
| Diameter tapes | FS | 63415 | 4 | 24 oz | 8.95 | 35.8 |
| | BM | 122470 | | | 9.95 | 39.8 |
| Sheath | FS | 63415 | 4 | 6 oz | 8.95 | 35.80 |
| | BM | 105090 | | | 9.95 | 39.80 |
| Refills | FS | 5559526 | 4 | 8 oz | 29.95 | 119.80 |
| | BM | 122471 | | | 22.95 | 91.80 |
| Holders | FS | 37300 | 4 | 8 oz | 5.95 | 23.8 |
| | BM | 121105 | | | 4.50 | 18.00 |
| Loggers Tapes | FS | 39379 | 4 | | | |
| | BM | 121580 | | | 66.50 | 255.00 |
| Refills | BM | 121586 | 4 | | 19.95 | 79.8 |
| Compass protectors | FS | 47954 | 4 | | .95 | 3.80 |
| | BM | 040118 | | | .85 | 3.40 |

| | ITEM | CO | CAT | QU | WEIGHT PRICE | UNIT PRICE |
|---------------------------|------|--------|-----|----------|-----------------|---------------|
| Multiscale quadrangles | FS | 47208 | 4 | 4 oz | 9.50 | 38.00 |
| | BM | 030133 | | | 9.45 | 37.8 |
| Bark scribes | FS | 57400 | 10 | 7 oz | 25.00 | 250.00 |
| | BM | 231002 | | | 27.00 | 270.00 |
| First Aid Kits | FS | 25159 | 2 | 35 lbs | 38.75 | 77.5 |
| | BM | 130014 | | | 16.20 | 32.4 |
| Hard Hats | FS | 24383 | 4 | 2 lbs | 6.00 | 24.00 |
| | BM | 131586 | | | 5.75 | 23.00 |
| WD-40 | FS | 57822 | 4 | 12 oz | 3.15 | 12.6 |
| | BM | 270002 | | | 3.25 | 13.00 |
| Hatches | FS | 33292 | 2 | 25 lbs | 29.95 | 59.90 |
| Sheaths | FS | 33130 | 2 | 8 oz | 6.70 | 13.40 |
| Clipboards | FS | 53426 | 2 | 1.25 lbs | 18.75 | 37.5 |

* FS = FORESTRY SUPPLIERS, Inc. 800-647-5363

The estimated funds needed to procure equipment is in the amount of US \$
2,247.30 + US\$ 345.80 = US\$ 2,593.10

BM = BEN MEADOWS COMPANY 800 - 241 - 6401

The estimated funds needed to procure equipment is in the amount of US \$
2,545.26 + US \$ 110.8 = US \$ 2,655.96