DRAFT GRAND DESIGN FOR INDONESIA'S FOREST RESOURCE INFORMATION SYSTEM (FRIS)

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY 3
2. RATIONALE FOR THE FRIS 5
3. BACKGROUND TO THE FRIS 6
   3.1 National Forest Inventory (NFI) 6
   3.2 Forest Monitoring and Assessment System (FOMAS) 7
4. BACKGROUND TO INDONESIA'S DESIGNATED FORESTLAND 7
5. OVERARCHING GOAL 9
6. OBJECTIVES 9
7. SCOPE 10
8. OPERATING ENVIRONMENT 10
9. RELATIONSHIP TO THE NATIONAL CARBON ACCOUNT 11
10. THE FRIS FRAMEWORK 12
   10.1 The FRIS pillars 13
   10.2 FRIS Foundations 14
      10.2.1 Remote sensing program 14
      10.2.2 Ground based measurement program 15
      10.2.3 Geodatabase 16
      10.2.4 Modeling program 16
      10.2.5 Data sharing and exchange 17
      10.2.6 Decision support 17
11. MECHANISMS FOR SYSTEM IMPROVEMENT 18
   11.1 Regular inputs, review and evaluation 19
   11.2 Research 19
   11.3 Ongoing training and capacity building 20
12. NEXT STEPS 20
APPENDIX A—FRIS ACTIVITIES FOR EACH FOUNDATION 21

1. EXECUTIVE SUMMARY

A lack of reliable and consistent information on forest resources has been identified as a major impediment to sustainable forest management in Indonesia. Such information gaps are hampering efforts to monitor deforestation and forest degradation, sustainably manage forest resources, combat illegal logging, protect biodiversity and reduce carbon emissions from land use change.

Improving forest information is made crucial by the emerging need for the Government of Indonesia to document carbon stocks in forests and greenhouse gas emissions related to land use change and to participate in carbon markets for avoided deforestation and degradation.

Indonesia's Forest Resource Information System (FRIS) will support effective planning and forest management decision making for forest lands in Indonesia. It will provide the basis for the Ministry of Forestry to implement sustainable forest management through monitoring forest productivity, yield and growth, harvesting rates, age class, species and forest area among other things. The FRIS will enable the Ministry to compile critical information on deforestation, land use and land use change within Indonesia's forest lands to support a post-Kyoto climate protection regime that seeks to reduce emissions from deforestation and forest degradation (REDD).

Objectives

The FRIS will:

- Provide spatial information on forest extent to support planning, management and decision making.
- Provide improved tools for granting, monitoring and collating information on forest licenses.
- Provide an integrated and comprehensive system connecting data and statistics on forests with geographic maps and spatial data. The system will link the Ministry of Forestry with forest departments at the district and provincial level and interface with databases developed by other government departments, such as the Ministry of Agriculture and Ministry of Environment.
- Support transparency and disclosure of forest sector information via the intranet, internet and other information channels.
- Support the regular reporting required of the Ministry of Forestry (for the Forest Resource Assessment of the Food and Agriculture Organization and other national and international reporting requirements).
- Provide information that can be used to develop a Reference Emission Level for REDD and an emissions baseline for the United Nations Framework Convention on Climate Change.
- Provide critical forestry inputs to the National Carbon Accounting System.

Foundations

The FRIS will develop six major foundations to support sustainable forest management:

1. A remote sensing program that will provide information on forest extent and change.
2. A ground based measurement program to provide information on forest condition, growth and biomass.
3. A geodatabase that will be used to systematically archive forest sector information.

4. A modeling program that can be used to provide estimates of forest growth, carbon sinks and emissions resulting from deforestation;
5. A data sharing and exchange program that will ensure transparency and enhance cooperation and information sharing.
6. A decision support program that will ensure that information generated by the FRIS can be used and applied by decision makers.

Scope

The FRIS will generate information from Indonesia's forest estate to establish the conditions necessary to implement a workable open and accountable information system to support improved and sustainable forest management. It will be centered on open access to information and utilizing this information to make better decisions. The FRIS will also:

- Provide critical inputs for Indonesia's National Carbon Accounting System; and
- Ready Indonesia for participation in a post-Kyoto climate protection regime that seeks to reduce emissions from deforestation and forest degradation (REDD).

Regular inputs, review and evaluation

Over time, the FRIS will be expanded, improved, reviewed and evaluated to ensure it provides the range of data that is required to support sustainable forest management. The cycle of review and evaluation will be pivotal to continuous improvement and maintaining transparency.

Ongoing training and capacity building

Ongoing training and capacity building will keep Ministry of Forestry staff and their provincial and district colleagues abreast of recent developments. It will also allow them to have the in-house capacity to take advantage of the latest technologies. Training will incorporate a range of technical skills, including GIS/remote sensing analysis, database management, web-based mapping, reporting and field inventories.

2. RATIONALE FOR THE FRIS

In Indonesia there has been a history of complex forest administration with a wide range of reporting requirements and sources of information. As a result there is a mix of quality and consistency in forest information collection, and hence a lack of clarity, as to the effectiveness of forest management. This has been compounded by a decentralisation process that compromised the reporting lines from Districts and Provinces to the Ministry of Forestry.

A lack of reliable information on forest resources has been identified as a major impediment to improved forest management in Indonesia with information gaps hampering efforts to monitor deforestation and forest degradation, sustainably manage forest resources, combat illegal logging, protect biodiversity and reduce carbon emissions from land use change. Improving forest information and its analysis is made crucial by the emerging need for the Government of Indonesia to document carbon stocks in forests and carbon emissions related to land use change, and to participate in carbon markets for avoided deforestation. The underlying pivotal requirement for sustainably managed forest resources continues to be an essential goal for the collection of forest information to enable reporting, analysis and management response on everyday forestry issues.

The FRIS strives to support sustainable forest management and it will collect and analyze data and information on the key components (criteria) of sustainable forest management that relate to protection of biodiversity, maintenance of productive capacity, maintenance of ecosystem health and vitality, conservation and maintenance of soil and water resources, maintenance of forest contribution to carbon cycles, maintenance and enhancement of socio-economic benefits, and the necessary elements for sustainable forest management. These criteria form the framework for international Criteria and Indicators systems (e.g. the Montreal Process) used to describe and evaluate the sustainable management of forests (see Box 1).

Box 1: The key components of sustainable forest management

Protection of biodiversity
Information is required to describe and monitor the status of ecosystem diversity, species diversity and genetic diversity for Indonesia's forests. Change in the area of forest types over time is a broad measure of extent to which forest ecosystems and their diversity are being maintained. Reporting on forest tenure helps understand how different land management regimes may affect forest biodiversity.

Maintenance of productive capacity
This criterion describes the area of forest available for timber production, the volumes of timber harvested against the calculated sustainable yield, the volumes and types of non-timber forest products extracted, and the regeneration of harvested native forests and plantations.

Maintenance of ecosystem health and vitality
This criterion describes the scale and impact of agents and processes affecting forest health and vitality, including pests and diseases, fire, soil degradation and climate change.

Conservation and maintenance of soil and water resources
This criterion is concerned with the most fundamental resources of a forest environment; soil and water. Measures are needed of the area of forest managed primarily for protective functions, and how the risk of soil erosion and the risks to soil physical properties and water quality and quantity are managed in forests.

Maintenance of forest contribution to global carbon cycles
Forests are an important component of the global carbon cycle and change in the greenhouse gas flux is a key indicator of sustainable forest management. This criterion quantifies and reports the effects of forest management and forest land use change on greenhouse gas emissions and sequestration.

Maintenance and enhancement of socio-economic benefits
This criterion is designed to measure the extent to which forests contribute to national and regional economies, benefit personal and community well-being and resilience, and support cultural values.

Creation of legal, institutional and economic framework for conservation and sustainable forest management
This criterion aims to report on the extent to which the legal, institutional and economic framework supports sustainable forest management, as well as the capacity to monitor change in forest conditions, and to conduct and apply research and development.

3. BACKGROUND TO THE FRIS

FRIS builds upon the experience of two former initiatives that sought to gather, analyze and use forest sector information for decision making, monitoring purposes and reporting—the National Forest Inventory (NFI) and the Forest Monitoring and Assessment System (FOMAS).

3.1 National Forest Inventory (NFI)

Nation wide forest resources monitoring and assessment in Indonesia has been undertaken periodically by the Ministry of Forestry since 1986 through a project called the National Forest Inventory (NFI). This system was designed to provide information on the location and extent of the main forest and land cover types, estimate the volume and growth of forest types and assess the state of forest areas and its biodiversity.

The NFI established 2,725 sample plots for collecting and monitoring commercial volumes of trees and forest growth. It also developed methodology to determine forest cover and forest cover change using Landsat data. This analysis was originally done manually scene by scene but

was later developed to make use of digital remote sensing data sources from 1992 to 1997. In the year 2000, the information was further updated involving data sources from 1999 and 2000, with the data for 2003 updated from data collected from 2002 to 2003. A three year monitoring system was also established. However, the varying approaches and the methods have meant that there was a lack of consistency between the data sets and the information derived from the analysis of them.

3.2 Forest Monitoring and Assessment System (FOMAS)

The Forest Monitoring and Assessment System (FOMAS) built upon data and information collected under the auspices of the NFI and focused on establishing the conditions necessary to implement a workable open and accountable information system to support improved and sustainable forest management. It also supported transparency and better decision making. The core components of FOMAS were:

- *An information management process* that generated and archived reliable accurate and up-to-date information on Indonesia's forests and timber resources.
- *A comprehensive disclosure policy* that clearly articulated what information can be publicly disclosed.
- *Effective disclosure mechanisms* that allowed multiple stakeholders to access reliable, accurate and up-to-date information on Indonesia's timber and forest resources.
- *An improved decision-making process* designed to use up-to-date and accurate forest sector information within daily operations in the Ministry of Forestry.

FOMAS was planned to ensure that the Ministry of Forestry is able to carry out its mandate of regulating and managing forest use and establishing an appropriate framework for a profitable forest sector in Indonesia that is socially and environmentally sustainable. Correct and timely information on the location and extent of forest resources, forest use allocation, standing volume and annual forest change, as provided by FOMAS, paved the way towards good forest governance.

FOMAS resulted in a number of achievements including: the establishment of a strong constituency of supporters; a new national reference (base map); a database of key forest sector information; improved forest cover change methodology using MODIS; a disclosure policy concept and the technical approach required to support the disclosure policy; data sharing protocols and the digitization of large-scale logging boundaries.

While FOMAS focused on creating the conditions for better information management within the Ministry of Forestry, large investments are still needed to establish an operational system that can systematically collect, record and disseminate information at national and regional scales. This investment will be made by establishing a comprehensive Forest Resource Information System, otherwise known as FRIS.

4. BACKGROUND TO INDONESIA'S DESIGNATED FORESTLAND

Indonesia's total area is estimated to be 187.913 million ha. These lands are essentially divided into two: forest lands and lands used for other purposes such as agriculture, settlement, transmigration and other land uses.

Indonesia's designated forestland (*kawasan hutan*) is administered and managed by the Ministry of Forestry. These lands cover around 133.694 million ha or 71% of the total land area. According to Landsat analysis undertaken in 2003, 85.97 million ha of forest lands was forested, while 39.091 million ha were classified as non forest (8.517 million ha of no data/clouds)[1]. Lands falling outside the forest estate are administered by other government departments, such as the Ministry of Agriculture (and estate crops), as well as district and provincial governments. The National Land Administration Agency (*Badan Pertanahan Nasional*) is responsible for land tenure, surveying and allocating freehold land entitlements.

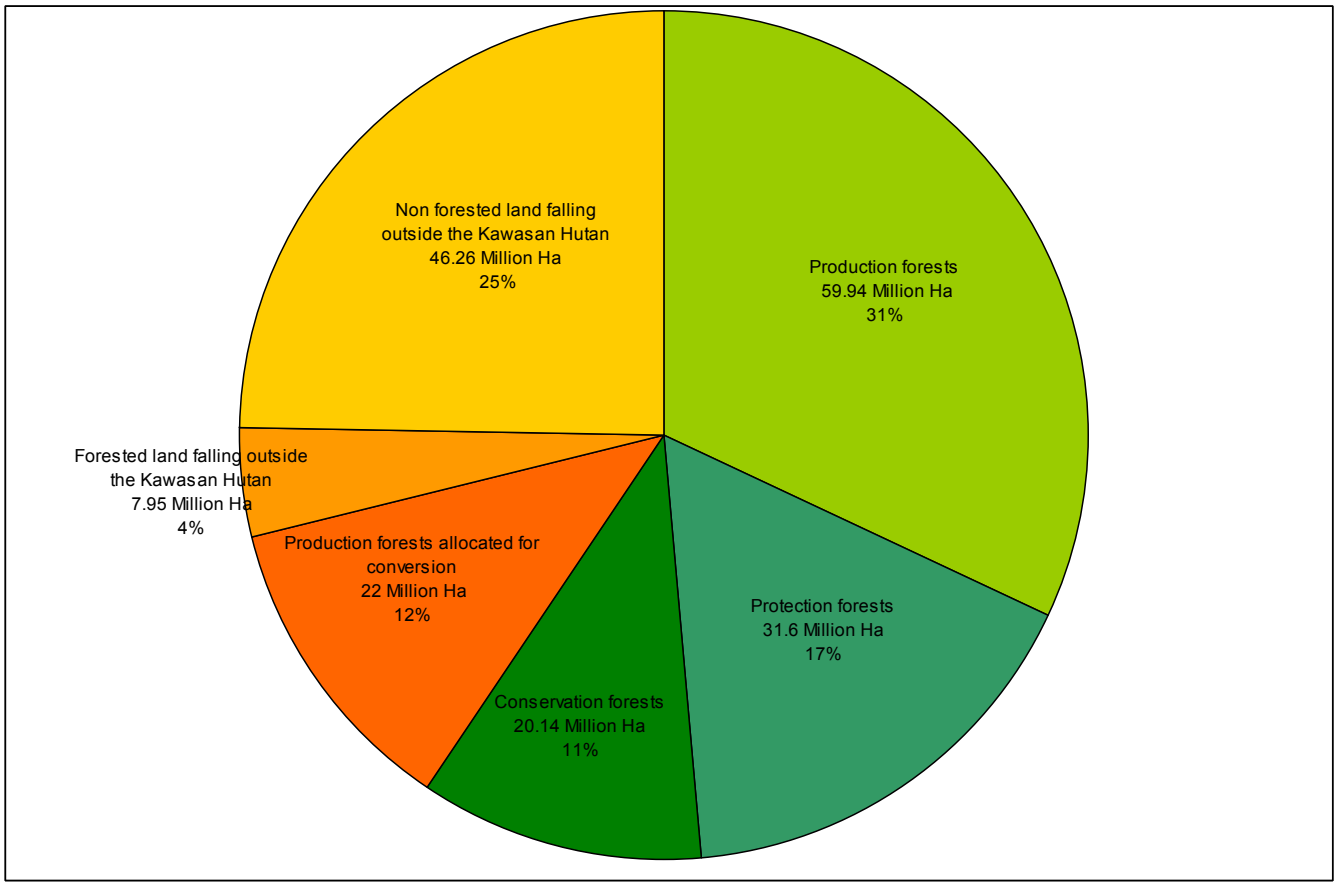
Indonesia's forest lands are divided into three categories: Production forests (81.948 million ha), conservation forests ((20.142 million ha), and protection forests (31.604 million ha) million ha) (Figure 1). Production forests are primarily allocated for sustainable forest management and can be utilized for logging and industrial forest plantations, however, over 22 million hectares of production forest have been allocated for conversion to other land uses, such as estate crops, agriculture and settlement. These lands will eventually be excised from the designated forestland (Kawasan Hutan). Conservation forests are allocated for biodiversity and wildlife conservation and protection forests have been set aside for protecting environmental services, such as watersheds, carbon stocks, steep slopes, rivers and beaches.

Outside the forest estate, approximately 7.959 million ha of land is forested (Landsat interpretation, 2003). These forested lands can also be allocated for conversion to agriculture and are under the jurisdiction of district and provincial governments.

The FRIS will primarily collect, archive and analyse data for Indonesia's forest estate, however, it will carry out wall to wall remote sensing analysis that will analyse forest cover change in all of Indonesia's lands. Indonesia's National Carbon Accounting System will also monitor land cover change in all of Indonesia's lands and provide a comprehensive and credible account of all of Indonesia's land based emissions profile and sinks capacity.

[1] Departemen Kehutanan, 2007. Statistik Planologi Kehutanan Tahun 2006, Badan Planologi Kehutanan, Jakarta.

Figure 1: Land cover and land use categories in Indonesia



5. OVERARCHING GOAL

FRIS will be a comprehensive and transparent information management system that will support effective planning and forest management decision making for forest lands in Indonesia. Among other things, FRIS will:

- Make relevant, reliable, accurate and up-to-date forest sector information continuously available to decision makers and the general public
- Assist decision makers in better decision and policy making based on regular use of better-managed forest sector information.

6. OBJECTIVES

The FRIS will:

- Provide spatial information on forest extent to support planning, management and decision making.
- Provide improved tools for granting, monitoring and collating information on forest licenses.
- Provide an integrated and comprehensive system connecting data and statistics on forests with geographic maps and spatial data. The system will link the Ministry of Forestry with forest departments at the district and provincial level and interface with databases developed

by other government departments, such as the Ministry of Agriculture and Ministry of Environment.

- Support transparency and disclosure of forest sector information via the intranet, internet and other information channels.
- Support the regular reporting required of the Ministry of Forestry (i.e. for the Forest Resource Assessment of the Food and Agriculture Organization and others).
- Provide information that can be used to develop a Reference Emission Level for REDD and an emissions baseline for the United Nations Framework Convention on Climate Change (UNFCCC).
- Provide forestry inputs to the National Carbon Assessment System.
- Provide policy makers with up-to-date, accurate and reliable information which will enable them to make informed decisions.

7. SCOPE

The FRIS will generate information from Indonesia's forest estate to establish the conditions necessary to implement a workable open and accountable information system to support improved and sustainable forest management. It will be centered on open access to information and utilizing this information to make better decisions. The FRIS will also:

- Provide critical inputs for Indonesia's National Carbon Accounting System; and
- Ready Indonesia for participation in a post-Kyoto climate protection regime that seeks to reduce emissions from deforestation and forest degradation (REDD).

8. OPERATING ENVIRONMENT

A FRIS task force will be established in the Ministry of Forestry to develop, establish and implement the FRIS. The FRIS task force will be comprised of Ministry of Forestry officials who represent all of the Directorate Generals—the Forestry Planning Agency (Baplan), the Directorate General of Forest Protection and Nature Conservation (PHKA), the Directorate General of Land Rehabilitation and Nature Conservation, the Directorate General of Land Rehabilitation and Social Forestry, the Directorate General of Forest Production and the Directorate General of Forestry Research and Development (FORDA). The task force members will be multi-disciplinary and have knowledge and skills in the area of remote sensing, geographic information systems, information management and disclosure, geodatabase establishment, modeling, and ground based measurement collection. Key policy makers will also be on the Task Force to ensure that information generated by the FRIS is relevant and can be used by decision makers.

A FRIS support team will also be established to provide strategic advice, guidance and assistance with technical and policy related issues, such as remote sensing, geodatabase design, carbon modeling and geographic information systems. The support team will also assist the Ministry of Forestry to develop Reference Emissions Level scenarios and to ready itself for participation in a post-Kyoto climate protection regime that seeks to reduce emissions from deforestation and forest degradation (REDD). The FRIS support team will also be multi-disciplinary and be comprised of members of researchers, technicians and policy analysts.

9. RELATIONSHIP TO THE NATIONAL CARBON ACCOUNT

Indonesia is developing a National Carbon Accounting System (NCASI). The NCASI will be modeled off Australia's National Carbon Accounting System but tailored to Indonesia's unique circumstances.

The NCASI will provide a comprehensive and credible account of Indonesia's land based emissions profile and sinks capacity. It will also support Indonesia's reporting requirements under the United Nations Framework on Climate Change (UNFCCC) and the Reduced Emissions from Deforestation and Forest Degradation post-Kyoto global climate protection regime.

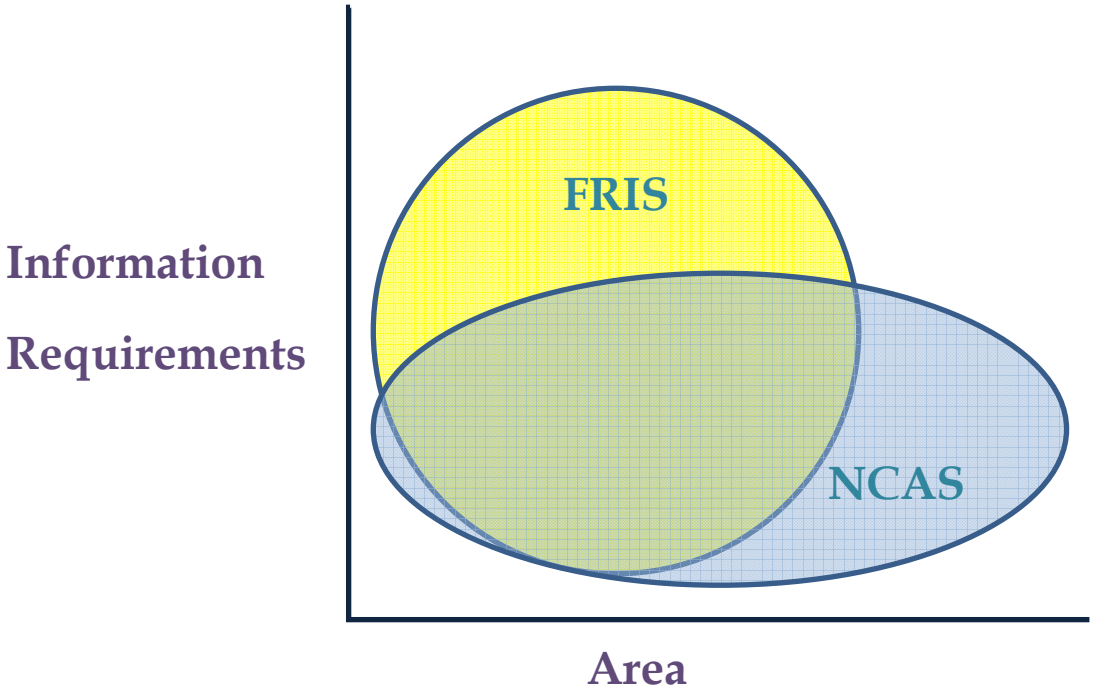
The NCASI will be a highly integrated system that will compile information from Indonesia's forestry and agricultural sectors to provide a robust emissions profile from:

- Remotely sensed land cover change data
- Land use and management data
- Climate and soil data
- Growth and biomass data and
- Spatial and temporal ecosystem modeling.

The FRIS will provide critical inputs to Indonesia's National Carbon Accounting System (NCASI). 70% of Indonesia's lands fall within the designated forestland (*kawasan hutan*) which is administered by the Ministry of Forestry, so these lands are set to be a major part of the National Carbon Account when it is operating and reporting. However, the FRIS will not only generate information needed to provide estimates of land based carbon emissions and sinks from Indonesia's forest estate for it will also generate information on critical forestry issues, such as biodiversity, logging operations, illegal logging, law enforcement operations and forest fires.

The different scope of the FRIS and the NCASI are portrayed below in Figure 2. This figure indicates that the FRIS will generate information on Indonesia's designated forestland (*Kawasan Hutan*), including information on biodiversity, carbon stocks and sinks, forest fires and other information needed to implement sustainable forest management. The NCASI will generate information on all of Indonesia's lands, including lands falling outside Indonesia's designated forestland (*Kawasan Hutan*). However, the NCASI will only compile information that is relevant required for providing a comprehensive and credible account of Indonesia's land based emissions profile and sinks capacity.

Figure 2: Overlap between the FRIS and the NCASI



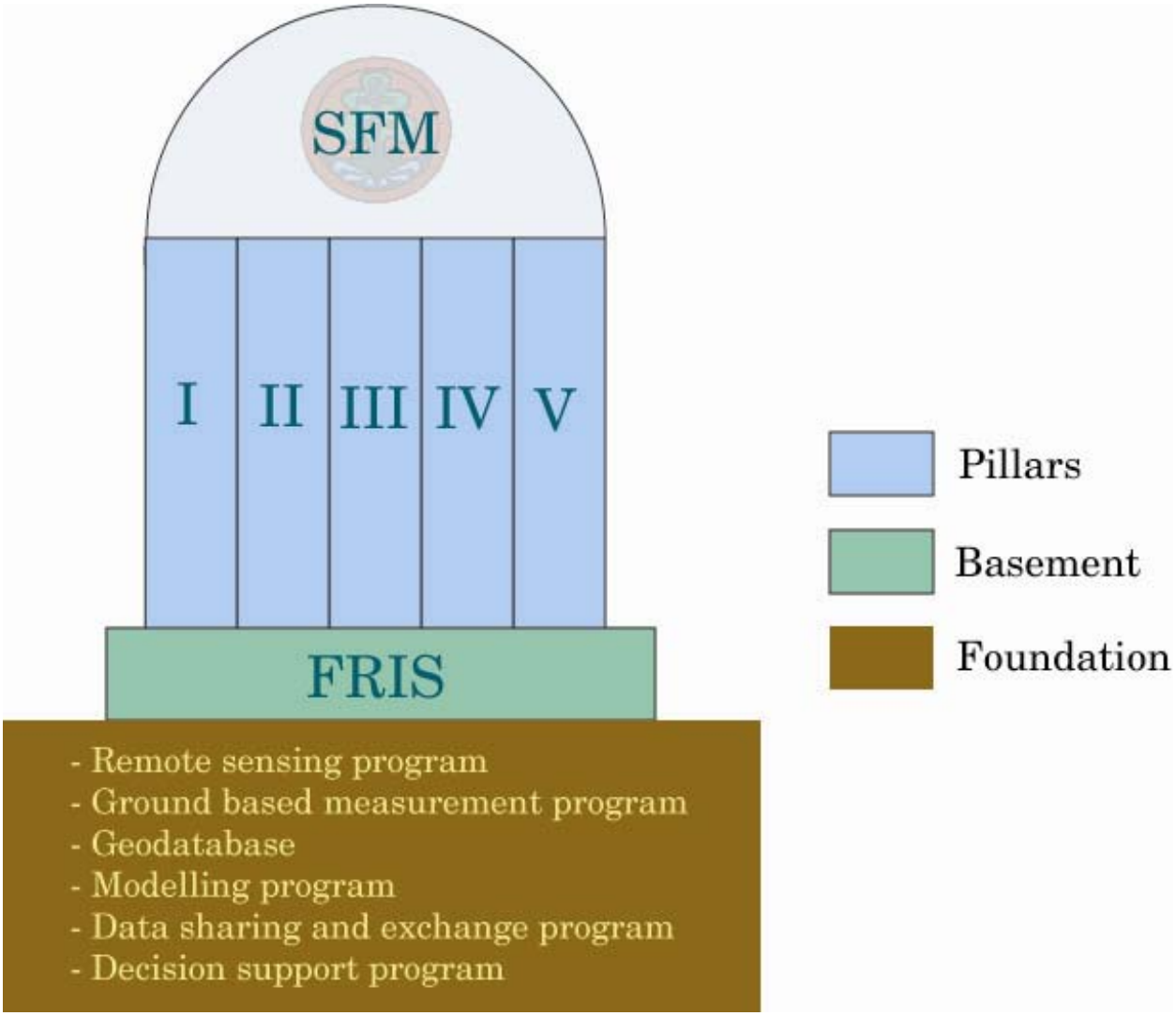
Nevertheless, to ensure consistency, efficiency and effectiveness the FRIS will be consistent with the NCASI and seek to:

- Meet international reporting requirements of the UNFCCC.
- Address market norms, standards and information needs.
- Create a consistent, complete fine scale time-series of land cover change.
- Provide estimates of carbon stocks and GHG emissions for forests through modeling and calibration.
- Promote and support transparency and auditability.

10. THE FRIS FRAMEWORK

The FRIS will allow the Ministry of Forestry to implement its primary objective—sustainable forest management. This sustainable forest management "roof" is supported by five pillars (the Directorates of the Ministry of Forestry) and five foundations (the tools that will enable MoF's Directorates to achieve SFM) (See Figure 3).

Figure 3: The FRIS framework



10.1 The FRIS pillars

FRIS will provide the five directorate generals of the Ministry of Forestry with the information and tools needed to implement sustainable forest management. These directorates are the pillars of the FRIS and their main tasks and responsibilities are summarized below.

1. The Directorate General of Forest Planning

The Forestry Planning Agency undertakes macro planning to support sustainable forest management. It prepares long term and mid term plans, compiles annual statistics on forestry, is responsible for spatial planning, undertakes periodic forest inventories, designates forest management areas, designates forest management unit areas, monitors forest cover change and prepares periodical national and regional forest maps.

2. Directorate General of Forest Protection and Nature Conservation
This Directorate is is responsible for forest protection and nature conservation. It monitors and prevents fire, is responsible for biodiversity conservation and the development of ecotourism and payments for environmental services.

3. Directorate General of Land Rehabilitation and Social Forestry
This Directorate is responsible for reforestation, re-greening of non forest areas and the economic empowerment of communities living in and around forest areas.

4. Directorate General of Forest Production
This Directorate is responsible for planning the utilization of production forest, issuing licenses for forest use and monitoring logging activities within the production forest area.

5. Directorate General of Forestry Research and Development
This Directorate is responsible for conducting research on forestry. It is also responsible for formulating policies, implementing and evaluating research on nature conservation, biotechnology, forest tree improvement and forestry socio-culture and economics. FORDA is presently responsible for conducting research on REDD and for formulating policies on this topic.

10.2 FRIS Foundations

Six foundations will support the FRIS and make it operational. These foundations are: 1) a remote sensing program that will provide time-series analysis of land cover change; 2) a ground based measurement program that will improve the national forest inventory data and provide a basis for estimating carbon emissions from land use change; 3) a geodatabase that will systematically store and archive spatial data; 4) a modeling program that can be used to provide estimates of forest growth, carbon sinks and emissions resulting from deforestation; 5) a data sharing and exchange program that will distribute information in accordance with a disclosure policy; and 6) a decision support program that will ensure that information generated by the FRIS is delivered to policy makers and used to inform decision making processes.

10.2.1 Remote sensing program

A combination of active and passive remote sensing data (low, medium and high resolution) and methodologies will be acquired and used to provide a comprehensive and historic picture of Indonesia's forests—extent, condition and change. Among other things, the remote sensing program will provide time series analysis of deforestation dating back to 1990 if possible and wall to wall annual tree cover change maps. It will also strive to develop methodologies for identifying and monitoring forest degradation.

The remote sensing program will support sustainable forest management by providing measures of temporal change in forest cover and condition. These measures will provide critical information about forest health, timber yields and the potential for forests to support biodiversity. These measures will also provide key inputs to models that estimate greenhouse gas uptake and

emissions and allow Indonesia to consider Reference Emissions Level options based on historical analysis of land cover change.

Objectives:

- To provide a base set of spatial information on forest extent and status to support planning, management and decision making.
- To provide long-term monitoring of land cover change starting with the oldest year possible.
- To provide a multi-temporal, fine resolution data series identifying through time, for any land unit, land cover change (removal of forest cover and forest regrowth) that is attributable to direct human actions.
- To develop methodologies for monitoring forest degradation.

10.2.2 Ground based measurement program

A field inventory program (NFI) has been used to collect a range of measures about forest condition, growth and biomass. A set of permanent plots (2,735) were established in 1990 and re-measured in 1996 and 2002. Measurements include description of forest type, basal area and height, commercial bole height, disturbance history (fire, cyclone, harvesting, replanting), seedlings, saplings, soil description (including peat) to 50cm in depth, color and stones, and coarse woody debris and volume.

While the field plots provide an excellent base for the FRIS, additional data is likely to be required to report under all of the key criteria. Additional data is required on measures of forest biodiversity (to be defined), measures of forest health (e.g. damage from pests or diseases), timber production capacity and additional soil information (e.g. depth, degradation, carbon content and water holding capacity) to support sustainable forest management. Field observations are also needed for the calibration and testing of remote sensed measures and other modeling approaches.

This data can also be used in combination with other information (i.e. remote sensing information about forest cover change and allometric equations) to produce estimates of carbon emissions and removals from forests. There is also the potential to use some of these plots for more detailed measurement and research. Such data collection must be guided by the requirements of the criteria reporting and the frameworks for the FRIS. Protocols are required to ensure consistent measurements are taken throughout the Indonesian archipelago.

Objectives

- To obtain, store and analyse existing field inventory data.
- To expand and improve the NFI datasets with new information and data on measures of forest biodiversity, forest health and additional soil information.
- To provide estimates of the amount of carbon stored in trees, litter, soils, roots, and debris.
- To associate land cover change events with relevant forest types.
- To understand partitioning of tree biomass into different components to allow for differential rates of growth, turnover and decomposition and management impact.
- To derive estimates of stem volume for comparison to available stem volume based plot data.
- To calibrate and test remote sensed data and measurements.

10.2.3 Geodatabase

A geodatabase will be developed to provide an integrated information system that can be used to share information within the Ministry of Forestry and with other government departments. The geodatabase will integrate data and statistics on forests (ownership, status, activity, production) with geographic maps and data. The database will also incorporate information obtained from provincial and district forestry offices.

The geodatabase will systematically store and archive spatial information which can be used to support sustainable forest planning, monitoring and harvesting. It will also provide a basis for reporting to a variety of stakeholders and thus increase transparency. It provides a way of assembling diverse information in a compatible form.

The geodatabase will also interface with other databases developed by other land management agencies, such as the Ministry of Agriculture, the Ministry of Environment and the National Spatial Data Infrastructure coordinated by the National Mapping and Survey Coordination Board (*Badan Koordinasi Survei dan Permetaan Nasional*—BAKORSURTANAL).

Objectives

- To provide an integrated system connecting data and statistics on forests with geographic maps and spatial data in a comprehensive spatial system linking departments across the Ministry of Forestry.
- To create an interface with databases developed by other land management agencies, such as the Ministry of Agriculture and the Ministry of Environment.

10.2.4 Modeling program

A modeling program will be established to develop a range of models using spatial modeling software such as GEOMODE and a range of economic, biomass and social variables. Among other things, these models will be used to estimate: forest carbon sinks and emissions resulting from deforestation and degradation; planned and unplanned deforestation; the physiological growth of forests and soil carbon change resulting from forestry activities. Some of these models will provide critical inputs for a FullCAM model that will be developed under the auspices of the NCASI to establish estimates and predictions of carbon flows associated with all biomass, litter and soil carbon pools in forest and agricultural systems.

Objectives:

- To estimate forest carbon sinks and emissions resulting from deforestation and degradation
- To estimate the physiological growth of forests
- To estimate soil carbon change resulting from forestry activities
- To provide critical modeling inputs from forests to the FullCAM model developed under the auspices of the NCASI.
- To estimate planned and unplanned deforestation.

10.2.5 Data sharing and exchange

A comprehensive disclosure policy will be developed and implemented in line with Indonesia's Freedom of Information Act (UU No 14 2009 *tentang Keterbukaan Informasi Publik*) to provide clear guidelines on the types of information that can be made available to the general public. This disclosure policy will promote transparency and increase confidence in Indonesia's commitment to sustainably manage forests and to reduce carbon emissions from deforestation and forest degradation.

A major effort will also focus on harmonizing and sharing data within the Ministry of Forestry and with provincial and district forestry offices. Standard operating procedures will be developed to ensure that information is collected and archived in a systematic and similar fashion.

Objectives

- To provide the means for implementing a disclosure policy that is in line with Indonesia's Freedom of Information Act.
- Enable the distribution of forest sector information deemed appropriate for the general public.
- Ensure harmonizing and sharing of data within the Ministry of Forestry and with provincial and district forestry offices.

10.2.6 Decision support

Information provided under the FRIS will enable better decision making and planning of forest management activities. Effective decision making tools are needed for:

- *Improved tracking of forest licenses*, including timber production, taxes, management plans etc.
- *Improved processes for granting forest licenses* and entering information into the forest information system.
- *Better map-based planning applications*, allowing access by non-experts to spatial data, including overlaying datasets, performing queries of spatial databases and basic analyses.
- *Timber tracking systems and chain-of-custody systems* to support forest law enforcement and timber certification.
- *Information sharing mechanisms*, such as web-based mapping and reporting, to make forest management data available to the general public and easily accessible.
- *Regular reporting* to ensure frequent information updates are released.

The decision making tools described above will help the Ministry of Forestry and other stakeholders to carry out informed spatial planning that provides environmental, social, and economic benefits. Better information management will support forest licensing with less land tenure conflict, as well as support more effective law enforcement operations that result in the prosecution of forest crimes. Many additional benefits would likely result—see box for more examples.

Benefits of improved monitoring and better forest information

- Informed policy decisions that support better forest governance and sustainable forest management.
- Improved capacity for performance measurement and reporting on forest management goals.
- Reduction in forest use conflicts and land tenure disputes.
- Detection of accessible land for biofuel plantations.
- Determination of suitable annual allowable cut volumes for sustainable timber production.
- Efficient detection of illegal logging and improved law enforcement.
- Detection of forest and improved fire management strategies.
- More efficient timber tax revenue collection and more equitable revenue sharing.
- Legal timber production and trade certification.
- Enhanced international confidence in Indonesia's forest sector, leading to a better investment climate.
- Increased capacity to measure, monitor and manage carbon stocks in forests, enabling Indonesia to benefit from potential carbon markets.

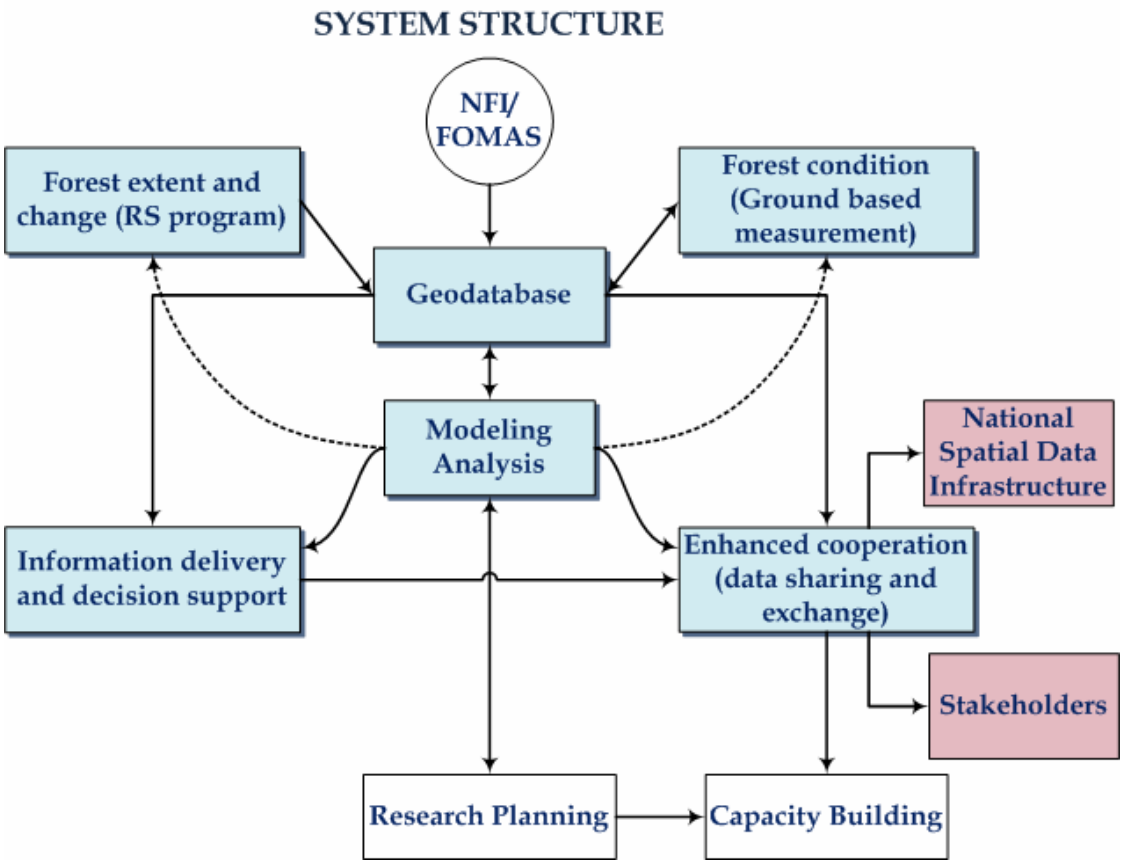
Objectives

Utilize improved, accurate and up-to-date information to:

- Make informed decisions about spatial planning, concession allocation and utilization of forest resources.
- Develop effective strategies that will reduce deforestation and degradation throughout the archipelago and offset leakage.
- Develop effective strategies to curb illegal logging and improve law enforcement.

11. MECHANISMS FOR SYSTEM IMPROVEMENT

The FRIS will be improved, updated and expanded on a regular basis. System improvement will arise from: regular inputs, review and evaluation; research and on-going training and capacity building. These mechanisms will complete the FRIS system structure and ensure that the FRIS is regularly updated, maintained and able to generate accurate information that can inform decision making processes.



11.1 Regular inputs, review and evaluation

Over time, the FRIS will be expanded, reviewed and evaluated to ensure it provides the range of data that is required to support sustainable forest management. The cycle of review and evaluation will be pivotal to continuous improvement and maintaining transparency.

11.2 Research

The FRIS and its components will each benefit from ongoing research and related research that will improve forest sector data, information and analysis. Over the next few years, research effort will be driven by Indonesia's need to develop:

- Reference emissions levels for REDD that will meet international requirements/guidelines.
- A comprehensive remote sensing methodology for monitoring deforestation and forest degradation on an annual basis throughout the archipelago.
- Methods that can be used to measure and monitor carbon stocks, pools and emissions resulting from deforestation, forest degradation and peat degradation.
- Models that can be used to estimate GHG emissions resulting from land use change.
- Effective strategies that can be used to reduce deforestation, forest degradation and greenhouse gas emissions resulting from land use change.

11.3 Ongoing training and capacity building

Ongoing training and capacity building will keep Ministry of Forestry staff and their provincial and district colleagues abreast of recent developments. It will also allow them to have the in-house capacity to take advantage of the latest technologies. Training will incorporate a range of technical skills, including GIS/remote sensing analysis, database management, web-based mapping, reporting and field inventories. Capacity to use, apply and analyze forest sector information will also be supported to enable and support informed decision making.

12. NEXT STEPS

Once this FRIS Grand Design is agreed and approved the activities identified and prioritized in Appendix A will become the focus of work with collaborators, donors, potential providers of expertise and services. Concept notes for each activity will be developed and these notes will set out the objective of each task and provide detailed activities, timeframes and budgets.

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Appendix A—FRIS activities for each foundation

Over the next three to five years, the FRIS will provide information that will:
1) Support sustainable forest management
2) Provide critical inputs for Indonesia's National Carbon Accounting System; and
3) Ready Indonesia for participation in a post-Kyoto climate protection regime that seeks to reduce emissions from deforestation and forest degradation (REDD).

These outcomes will be supported by six foundations:
1) Remote sensing
2) Ground based measurement
3) Modeling
4) Geodatabase
5) Data sharing and exchange;
6) Decision making support.

Activities listed below are structured accordingly to reveal how each foundation will support sustainable forest management, provide critical inputs for Indonesia's NCAS and support REDD.

Establish operating environment

Objectives:

- To establish a team of skilled personnel that will develop, implement and improve the FRIS in the Ministry of Forestry.
- To establish a multi-disciplinary support team that can assist the Ministry of Forestry to develop, implement and improve the FRIS.

No	FRIS activities	Responsible Unit	Priority	Estimated Cost US$
1	Establish a FRIS task force comprised of MoF staff from relevant Directorate Generals, such as Baplan, PHKA, Forda and Pusat Informasi. Legitimate with a Surat Keputusan.	BAPLAN to initiate	Critical	$250,000
2	Establish a FRIS support team that can assist the Ministry of Forestry to develop, implement and improve the FRIS.	BAPLAN to initiate	Critical	$300,000
	TOTAL			**$550,000**

Foundation Number 1: Remote sensing program[2]

Objectives:

- To provide a base set of spatial information on forest extent and status to support planning, management and decision making
- To provide long-term monitoring of land cover change starting with the oldest year possible.
- To provide a multi-temporal, fine resolution data series identifying through time, for any land unit, land cover change (removal of forest cover and forest regrowth) that is attributable to direct human actions.

No	FRIS activities	Responsible Unit	Priority	Estimated Cost US$
Sustainable Forest Management				
1*	Review the classification of land cover for different purposes. Ensure all classes, developed for different purposes, are integrated and consistent; rationalize where possible.	BAPLAN		150,000
2*	Obtain a comprehensive data set of (low, medium and high resolution optical data and radar data) images as required	BAPLAN	Critical <Dec 2009	4,000,000
3*	Define remote sensing capacity, hardware, software and infrastructure needed to meet the range of information requirements consistent with appropriate norms, standards & guidelines.	BAPLAN		3,000,000
4*	Nominate geographic remote sensing test site for use as a reference site(s) for refining and confirming different monitoring and measuring approaches including new sensors such as Alos Palsar and algorithms.	BAPLAN	High	100,000
Forest input to NCASI				
1*	Review relevant literature, IPCC Guidelines and other relevant literature to identify system requirements for establishing a credible NCASI	BAPLAN	Critical < Dec 2009	5,000
2*	Provide (annual) time series analysis of all forest cover change (starting date depending on data availability and the need, e.g. year 1990 using Landsat, JERS, MODIS-NOAA etc).	BAPLAN	Critical <Dec 2009	400,000
REDD support				
1*	Review relevant literature, IPCC Guidelines and other relevant literature to identify potential requirements for setting a National Reference Emission Level	BAPLAN	Critical <Dec 2009	5,000
2*	Use time series spatial data to establish or test options for a Reference Emission Level that meets IPCC guidelines and potential negotiation options.	BAPLAN FORDA	Critical <Dec 2009	300,000
	TOTAL			**$7,960,000**

[2] "Critical <Dec 2009" refers to activities that are essential, critical and required as inputs to the consideration of the world at the UNFCCC meeting in Copenhagen Dec 2009 and in forming the policy settings and deliberations of the Government of Indonesia for that meeting.
* Indicates activities that will overlap with activities listed in the NCASI design or activities that will support the development of the NCASI.

Foundation number 2: Ground based measurement program

Objectives:

- To obtain, store and analyse existing field inventory data
- To expand the NFI data sets with appropriate new information and additional data on measures of forest biodiversity, forest health and additional soil information and integrate that into the FRIS.
- To provide inputs for a carbon accounting model for forestry
- To provide estimates of the amount of carbon stored in forest carbon pools (trees, roots, debris, litter, soil).
- To associate land cover change events with relevant forest types
- To understand partitioning of tree biomass into different components to allow for differential rates of growth, turnover and decomposition and management impact.
- To derive estimates of stem volume for comparison to available stem volume based plot (measured) data.

No	FRIS activities	Responsible Unit	Priority	Estimated Cost US$
Sustainable Forest Management				
1*	Review and test the National Forest Inventory datasets	BAPLAN	**High**	50,000
2*	Develop sampling and measurement protocols for systematic biomass collection	BAPLAN	**High**	50,000
3*	Improve the National Forest Inventory methodology (frequency, stratification etc)	BAPLAN	**High**	20,000
4*	Analyze plot data and report consistently, including visualization of stock and changes in plots from the improved field data.	BAPLAN	**High**	400,000
5*	Review growth and yield modeling systems and current available data in Indonesia. Recommend and implement a growth and yield modeling systems as required.	BAPLAN FORDA		400,000
6*	Review and identify current system outputs, gaps and needs and recommend appropriate changes in forest parameters collected and spatial or temporal resolution. (Consider requirements for existing international and national reporting – FRA & MAR of FAO, IPCC, UNFF, UNFCCC, Annual reporting.)	BAPLAN FORDA	**High**	150,000
7*	Define and establish a quality control mechanism, including data validation	BAPLAN		100,000
	TOTAL			**$1,170,000**

* Indicates activities that will overlap with activities listed in the NCASI design or activities that will support the development of the NCASI.

No	FRIS activities	Responsible Unit	Priority	Estimated Cost US$
Forest input to NCASI				
1*	Review literature to identify algorithms and methodologies for assessing forest biomass, carbon and modeling options.	FORDA BAPLAN	**Critical <2009**	100,000
2*	Develop allometric equations and models to estimate biomass using NFI plot data and other research data sets	FORDA BAPLAN	**Critical <2009**	100,000
3*	Review and develop algorithms for tree or stand biomass calculation (noting for example, buttressed trees) including review of existing allometric equations for Indonesian tree species and models of forest growth and C uptake (carbon sequestration) using published and unpublished data.	FORDA	**Critical <Dec 2009**	300,000
4*	Measure above ground and below ground biomass in several sites (including peatlands) throughout Indonesia using NFI plot data and other research sites.	FORDA BAPLAN	**Critical <Dec 2009**	300,000
5*	Develop models to estimate soil carbon change using remote sensing and improvement of field data measurement to model transfer change from other carbon pools to soil following land cover change.	FORDA BAPLAN	**Critical <Dec 2009**	300,000
6*	Develop indirect methods for estimating biomass growth (e.g. Forest Productivity Index)	FORDA BAPLAN	**Critical <Dec 2009**	250,000
REDD support				
1*	Use recommended inventory system (Remote Sensing and field-measurements with biomass algorithms) to estimate biomass change in appropriate pools and at required scales. (Concentrating on locations where deforestation/degradation is relatively high.)	BAPLAN	**High**	100,000
	TOTAL			**1,450,000**

* * Indicates activities that will overlap with activities listed in the NCASI design or activities that will support the development of the NCASI.

Foundation number 3: Geodatabase

Objectives:

- To provide an integrated system connecting data and statistics on forests with geographic maps and spatial data in a comprehensive spatial system linking departments across the Ministry of Forestry.
- To create an interface with databases developed by other land management agencies, such as the Ministry of Agriculture and Ministry of Environment.

No	FRIS activities	Responsible Unit	Priority	Estimated Cost US$
Sustainable Forest Management				
1*	Review approach of Geosciences Australia, CSIRO and others on database design, management, information provision and maintenance.	BAPLAN	**High**	50,000
2*	Develop quality assurance systems, including procedures to keep the database reliable, up-to-date and accurate.	BAPLAN	**High**	100,000
3*	Review databases of other land management agencies to ensure compatibility and enable sharing of information. Ensure that the Geodatabase is compatible with the National Spatial Data Infrastructure coordinated by BAKORSURTANAL across 14 Ministries and among provincial and district governments	BAPLAN	**High**	50,000
4	Recommend and implement revised Geodatabase Information System for the Ministry of Forestry.	BAPLAN	**High**	100,000
5*	Develop a custodian matrix of relevant spatial data.	BAPLAN	**High**	50,000
6*	Collect and input spatial data into the geodatabase including spatial data on logging boundaries, boundaries of industrial timber plantations, forest category boundaries, forestland boundaries, forest types, land cover, satellite data, Digital Elevation Models, soil data, tenure and cadastral data. Data should be collected from multiple sources including the Ministry of Forestry, other central government departments, provincial government departments and district government departments, research organizations and NGOs.	BAPLAN	**High**	2,000,000
7*	Improve, adjust and harmonise spatial data collected from central, provincial and district government offices, NGOs and research organizations	BAPLAN	**High**	500,000
Forest input to NCASI				
1*	Collate and archive relevant spatial data required to establish the NCASI and estimate forest growth such as monthly climate data and data on biomass of different forest types and agroforestry systems.	BAPLAN	**High**	100,000
REDD support				
1*	Update the database with REDD related data collected from REDD demonstration projects.	BAPLAN		100,000
	TOTAL			**$3,050,000**

* Indicates activities that will overlap with activities listed in the NCASI design or activities that will support the development of the NCASI.

Foundation number 4: Modeling

Objectives:

- To estimate forest carbon sinks and emissions resulting from deforestation and degradation
- To estimate the physiological growth of forests
- To estimate soil carbon change resulting from forestry activities
- To provide critical modeling inputs from forests to the FullCAM model developed under the auspices of the NCASI.

No	FRIS activities	Responsible Unit	Priority	Estimated Cost US$
Sustainable Forest Management				
Forest input to NCASI				
1*	Review carbon accounting models developed by the Australian Greenhouse Office (Department of Climate Change)	BAPLAN		100,000
2*	Develop a carbon accounting model for forests CAMFor	BAPLAN		100,000
3*	Develop a carbon accounting model to estimate soil carbon change resulting from forestry activities, such as logging	BAPLAN		100,000
4*	Develop a model to estimate they physiological growth of trees	BAPLAN		100,000
5*	Collaborate with other government departments, such as the Department of Agriculture, to develop a Full Carbon Accounting Model under the auspices of NCASI	BAPLAN		100,000
REDD support				
1*	Use spatial modeling software, such as GEOMODE to estimate planned and unplanned deforestation for Reference Emission Level setting	BAPLAN		100,000
	TOTAL			**$600,000**

* Indicates activities that will overlap with activities listed in the NCASI design or activities that will support the development of the NCASI.

Foundation Number 5: Data sharing and exchange program

Objectives:

- To provide the means for implementing the comprehensive disclosure policy for the Ministry of Forestry that will be developed in line with Indonesia's Freedom of Information Act based on clear guidelines on the types of information that can be made available to the general public.
- Enable the distribution of the information deemed appropriate for public access
- Ensure harmonizing and sharing of data within the Ministry of Forestry and with provincial and district forestry offices.

No	FRIS activities	Responsible Unit	Priority	Estimated Cost US$
Sustainable Forest Management				
1*	Review the ANZLIC model or other similar models as an approach for data sharing and exchange, disclosure etc [Geosciences Australia is the home of the ANZLIC] and recommend the improvement of existing (internal, external, bottom up and top down) procedures.	BAPLAN	**High**	30,000
2*	Prepare the metadata description and characteristics to enable sharing, protocols for exchange, searching for the approach that is agreed to.	BAPLAN	**High**	60,000
3	Continue to develop a disclosure policy and guidelines for disclosing forest sector information that are in line with Indonesia's Freedom of Information Act. Determine which data can be publicly disclosed.	Pusat Informasi	**Critical <Dec 2009**	80,000
4	Develop intranet, internet and web based GIS for sharing generated by the FRIS	Pusat Informasi		100,000
5*	Develop standards and protocols for sharing and updating information within the Ministry of Forestry and with other central government departments as well as with district and provincial government offices	BAPLAN	**High**	100,000
Forest input to NCASI				
1*	Establish a systematic mechanisms for sharing and gathering relevant spatial data needed to develop an NCAS among relevant government departments (central, provincial and district)	BAPLAN	High	200,000
REDD support				
1*	Facilitate the use of regular reporting system using forestry data and information for REDD readiness.	BAPLAN, FORDA, SECJEN	**High**	30,000
2*	Review the requirements and likely requirements for reporting emissions and changes to emissions under IPCC, UNFCCC and to meet public and market needs and standards.	FORDA		20,000

* Indicates activities that will overlap with activities listed in the NCASI design or activities that will support the development of the NCASI.

	TOTAL			**$720,000**

Foundation Number 6: Decision support

Objectives:

Utilize improved, accurate and up-to-date information to:

- Make informed decisions about spatial planning, concession allocation and utilization of forest resources.
- Develop effective strategies that will reduce deforestation and degradation throughout the archipelago and offset leakage.
- Develop effective strategies to curb illegal logging and improve law enforcement.

No	FRIS activities	Responsible Unit	Priority	Estimated Cost US$
Sustainable Forest Management				
1	Analyse spatial data to identify data discrepancies such as overlapping boundaries, different administrative boundaries and data gaps.	BAPLAN	**High**	200,000
2	Use FRIS data to develop effective law enforcement strategies that can effectively curb illegal logging	BAPLAN and PHKA	**High**	200,000
3	Use FRIS data to develop informed spatial plans that support sustainable development	BAPLAN	**High**	200,000
4	Use FRIS data to make informed decisions about concessions allocations and forest category boundary allocation	BAPLAN	**High**	200,000
5	Identify and develop suitable decision models and reports to support forest management purposes and the needs of decision makers, including identification of forest status and significant change (fires, forest change and forest loss) and ongoing monitoring of key issues and elements. (e.g. FMU, open access, social economic modeling, forest disturbance, biodiversity, critical land, land position map, land suitability etc).	BAPLAN & Entire MoF	**Critical <Dec 2009**	500,000
Forest input to NCASI				
1*	Ensure that FRIS data is used to report on carbon sinks and emissions resulting from land use change in the forestland	BAPLAN		100,000
REDD support				
1*	Analyse FRIS data to develop strategic and effective strategies to curb deforestation and degradation throughout the archipelago	FORDA	**High**	100,000
2*	Enable FRIS support for REDD international reporting and auditing.	BAPLAN	**High**	30,000
	TOTAL			**$1,530,000**

* Indicates activities that will overlap with activities listed in the NCASI design or activities that will support the development of the NCASI.

Overall total budget: $US 16,480,000