

The crops include cassava, cotton, kenaf, maize, majrice, mungbean, sorghum, soybean and sugarcane. The sectors include agriculture, crops, livestock, fisheries, forestry, mining, manufacturing, construction, transportation, banking, public administration and the service industry. Annual statistics of crop areas and production are available from the Office of Agricultural Economics, Ministry of Agriculture and Cooperatives. The GPP statistics are available from the Office of National Economic and Social Development Board. Other socio-economic data are also available from the National Rural Development Database, which provides survey data at village level every two years for over 100 socio-economic indicators.

When the time series biophysical data become available from the remeasurement of permanent plots from this ITTO project, regression analysis shall be carried out to estimate regression coefficients for the above model. The intent is that the decision-makers and planners would use the regression models to simulate various scenarios (options) on the impact of land-use change on forest resources, by varying the independent variables in the above model.



Reporting system

The integrated monitoring database (biophysical data linked to socio-economic data and the accompanying software is the main reporting tool of the monitoring information system. The outputs include thematic maps and national statistical summary tables. The reports shall include, for example, the C&I report. Thailand's current national C&I are similar to those of the ITTO, as outlined in the ITTO Policy Development Series No. 15, with some modifications.

ACHIEVEMENTS

A forest resources monitoring information system has been established and is operational. Specifically, the PD 195/03 Rev. 2 (F) project outputs have been realized:

1. Established a national network of 1,285 permanent sample plots for collecting biophysical data over time. A 'panel' approach for plot remeasurement, whereby 1/5th of the plots are remeasured per year, was also developed.
2. Identified a modeling approach for linking the biophysical data from the permanent plots with socio-economic data from other relevant institutions.
3. Developed a template to use the forest resource monitoring information for the reporting of the national C&I.
4. Conducted a national workshop of policy makers to promote use of the forest resources monitoring database, publicize the C&I report, and to provide feedback to data generators.

This project's immediate achievement is that it has provided:

- Unbiased independent data which showed that the currently reported national total forest area statistic of 32.66%, which was obtained from satellite imagery, was low (by about 5%).
- National tree volume, biodiversity and other attributes statistics, which were not previously available.

Thus, this ITTO project has strengthened Thailand's ability to create and manage forest resources monitoring information for better policy decision making. The DNP will now be responsible for plot remeasurement, development of the socio-economic models when time series data become available, and maintenance of the database.

TROF PD 376/05 Rev. 2 (F,M)



PROSPECTS

The next steps are:

1. This Project to publicize the project results among ITTO-member countries through three Project Technical Reports and a presentation to the ITTC meeting.
2. The DNP to incorporate the plot remeasurement cost its annual budget to support plot remeasurement starting possibly in 2008 or 2009.
3. The DNP to implement the new ITTO project PD 376/05 Rev. 2 (F, M), which aims to develop methods to increase the accuracy of tree volume and other attributes for small areas (sub-districts) for tree resources outside forest (TROF). The PD 195/03 Rev. 2 (F) project has shown that the tree volume in TROF areas was relatively high nationally (0.6 + 21.5% billion m³).

RESOURCES

The main responsible parties for this project activities were

Project Leader Mr. Jirajet Urasayanan
Project Coordinator Ms. Khanita Meedej
International Consultant Dr. A.Y. Omule

National Experts

Dr. Jesada Luangjame, Ms. Pornpun Jongsuksuntigul, Mrs. Wilawan Wichienopparat, Mrs. Sirirat Janmahasatien, Dr. Chawalit Niyomdham, Mr. Pongsak Phonsena, Mr. Somran Suddee, Mr. Thanongsak Jonganurak, Mr. Phonphitak Panyarat, Mr. Piyachart Trisarasri, Mr. Pachok Puudjaa, Mr. Anuchit Ratanasuwan, Mr. Jongrak Poopaiboon, Mr. Anond Soravisultra, Mr. Pairun Bhramahitadara, Mr. Somyot Saengnin, Mr. Sayan Suraparbomaitree, Mrs. Auschada Chitchote, Mr. Kamron Sungsuwan, Mr. Tawee Nootong, Mr. Prateep Rojanadilok, Mr. Kitti Kritiyutanon, Mr. Krairat Eiamampai, Mr. Kriangsak Sribuarod, Mr. Songsak Vitayaudom, Dr. Komol Pragtong, and Mrs. Teunchai Nuchdamrong.

Crew Chiefs

Mr. Kamron Sangsuwan, Mr. Sayan Suraphapmaitree, Ms. Chompunuch Sodachan, Mr. Butsarin Jindarath, Mr. Somyot Saengnin, Mrs. Auschada Chitchote, Mrs. Sutthathip Choa-mali, Mr. Nipon Nimsuk, Mr. Dejnarong Kamchaiwong, Mr. Rungsak Khunviset, Ms. Siriporn Bumrungrsin, Mr. Opas Nualmungsor, Mr. Sompon Sanyapadit, Mr. Thammanoon Temchai, Mr. Sudjit Khorthong, Mr. Yongyuth Suyana, Mr. Kamporn Kruarattanaves, Mr. Kusol Suwannaporn, Mr. Komkrit Setthabuppha, Mr. Suriya Suma, Mr. Samran Thammata, and Mr. Sermpong Nualngam.

This project was overseen by a Project Steering Committee that included representatives from the DNP, ITTO and the donor countries (Japan, Switzerland and Australia).



For further information, please contact:

Mr. Jirajet Urasayanan
 Project leader PD 195/03 Rev. 2 (F)
 National Parks, Wildlife and Plant Conservation Department of Thailand (DNP)
 61 Phaholyothin Road, Chatujak
 Bangkok 10900 Thailand
 E-mail: meedejk@hotmail.com

ITTO PROJECT PD 195/03 Rev. 2 (F)

"TO ESTABLISH A NATIONAL MONITORING INFORMATION SYSTEM FOR THE EFFECTIVE CONSERVATION AND SUSTAINABLE MANAGEMENT OF THAILAND'S FOREST RESOURCES"

Project Objectives:

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

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



NATIONAL PARKS, WILDLIFE AND PLANT CONSERVATION
 DEPARTMENT OF THAILAND (DNP)
 AND
 INTERNATIONAL TROPICAL TIMBER ORGANIZATION (ITTO)



THE MONITORING SYSTEM

BACKGROUND

The Kingdom of Thailand recognizes the importance of sustainable forest management (SFM), which now focuses on conserving the remaining natural forests, maintaining ecological balance, and increasing forest cover through tree planting. The Kingdom also recognizes the need to build the necessary information infrastructure to support the evaluation and adoption of proper policies towards SFM.

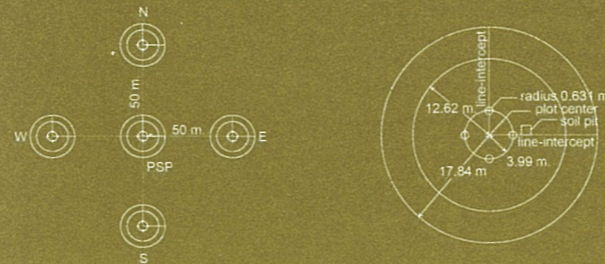
With the support of the International Tropical Timber Organization (ITTO) Project PD 195/03 Rev. 2 (F), and building on the earlier ITTO Project PD 2/99 Rev. 2 (F), the National Parks, Wildlife and Plant Conservation Department of Thailand (DNP) has established a national forest resources monitoring information system.

This system will provide data of forest resources at regular intervals that are statistically valid nation-wide. These monitoring data when linked with socio-economic data shall provide a basis for policy decisions, and for the reporting of the national forest statistics and Criteria and Indicators (C&I) of SFM.

The total cost of this 3-year project that started in June 2004 is \$1,060,420, of which ITTO contributed \$677,743. The project involved several activities including permanent sample plot establishment, linking of biophysical monitoring data and socio-economic data, development of a C&I reporting template, and a campaign to promote use of the monitoring data and template.

Permanent Plots

The sampling design is a single systematic sample of points on a 20 km x 20 km uniform grid, covering all Thailand's land mass, whether vegetated or not, including fresh water bodies. A 'hidden' permanent sample plot (PSP) is established at each of the 1,285 grid intersections using the methods developed in the earlier Project PD 2/99 Rev. 2 (F). Four temporary plots were also established around each PSP in cardinal directions for Thailand's national forest inventory (NFI) purposes.



Plot design: a cluster of circular plots and line transects

Data Gathered	Sampling Method			
	Plot Type	Number	Radius	Total Area
Seedling density	circular	4	0.631	0.0005
Understory vegetation & sapling density	circular	1	3.990	0.0050
Bamboo & erect rattan length & tree stump volume, site description	circular	1	12.620	0.0500
Tree attributes: human & natural site disturbance; wildlife habitat use	circular	1	17.840	0.1000
Coarse woody debris (CWD) rattan & climbers volume and length	17.84 m. line intersect	2	-	-

radius in meters; area in hectares

Of the total 1,285 plot locations that were selected, 1129 plot clusters were established and 156 were not established due to unsafe conditions. The average total cost of plot-cluster establishment was approximately \$260/plot-cluster. Data quality was assured through a one-week training/mentoring program, and a quality assurance (QA) program. The QA program involved remeasurement by independent crews of a random subset of 80 plots (60 forested and 20 non-forested). The results of the remeasurements were compared with those of the original crew using residual statistical analysis.

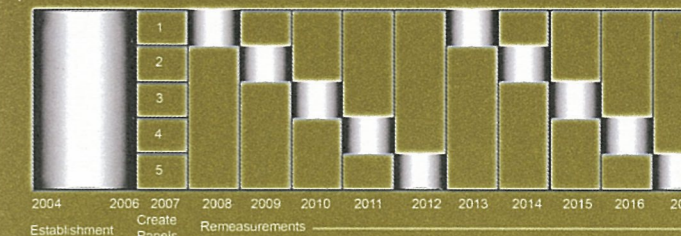
The sample data from the plot clusters have been compiled into plot statistics, and analyzed to provide summary statistics for the entire country and for specific strata (land use type, watershed, forest complex and region). Similarly, estimates of periodic changes in the attribute totals are to be produced annually and reported formally every 5 years in standard reports. User-defined reports can also be produced upon request.



Preliminary results from the 1129 permanent plots established in this project produced the following national statistics (the confidence intervals are at the 95% probability):

- The total forest area is approximately 19.5 + 7.4% million ha (or 38% of the country's total land area of 51,311,502 ha). These statistics will be confirmed when the land use types of the plots that were not established due to unsafe conditions (about 12%) are interpreted from high resolution satellite imagery. The forest area includes the Evergreen, Tropical Evergreen, Dry Evergreen, Hill Evergreen, Pine forest, Fresh Water Swamp forest, Mangrove, Beach, Deciduous, Mixed Deciduous, Dry Dipterocarp, Bamboo forest, disturbed forest, unhealthy forest, secondary forest, and plantations (teak, eucalyptus, pine and Casuarina).
- The tree total volume is approximately 2.4 + 10.1% billion m³ of which about 1.8 + 12.3% billion m³ are in forest (natural forests and plantations) and the remaining 0.6 + 21.5% billion m³ are from trees outside forest (TROF).
- The total area of natural forest is about 18.3 + 37.3% million ha and of plantations is about 1.2 + 7.8% million ha.
- The tree volume in natural forests is approximately 1.77 + 12.6% billion m³ and in plantations 0.05 + 54.2% billion m³.
- The highest volume per hectare in natural forests was in the Evergreen Forest (315 m³/ha) followed by the Tropical Evergreen Forest (201 m³/ha) and the Hill Evergreen Forest (130 m³/ha). The lowest volume was in the fresh water swamp forest (9 m³/ha).
- The highest tree volume per hectare was in the Mae Nam Tapi watershed (151 m³/ha) followed by the Peninsular-West watershed (102 m³/ha). The lowest volume was in the Mae Nam Tha Chin watershed (6 m³/ha). The volume in the Mae Nam Ping watershed was 82 m³/ha.
- The Evergreen and Tropical Evergreen forests were the most tree species-rich (Index 6.1 - 6.2) and the Secondary, disturbed and unhealthy forests were the least tree species-rich (Index 1.8 - 2.0).

- The highest tree Importance Value Index (IVI) – a measure of the dominance and ecological success of a species in an area – was highest in *Hevea brasiliensis* (129), followed by *Pterocarpus macrocarpus* (50), *Shorea obtusa* (41), and *Azadirachta indica var. siamensis* (40). The IVI of *Tectona grandis* was 32. (The highest possible value of IVI is 300.) These species, except for *Azadirachta indica var. siamensis*, also had the highest total volume in the country (top 10), ranging from 42 million m³ (*Tectona grandis*) to 97 million m³ (*Shorea obtusa*).
- The permanent plots will be re-measured every 5 years based on a 'panel' design that measures 1/5th of the plots (or 257 plots) per year. The panels are constructed such that the sample plots in each panel provide a complete systematic sample of the entire country. The estimated annual re-measurement total cost is \$66,820 (or 2.2 million baht).



Plot re-measurement based on 5-year re-measurement cycle and panel design

Linking biophysical data with socio-economic data

Achieving SFM in Thailand involves forest (land) cover change, which in turn depends on socio-economic and other factors. Thus, the biophysical data from this ITTO project (e.g., change in forest cover, volume, biomass, carbon mass, and biodiversity) will ultimately be used to develop relationships between forest cover change and socio-economic variables in particular the demands on land for cultivation. In Thailand, the only models relating forest cover dynamics to socio-economic variables are the empirical national and regional models developed in 2001 by Adisorn Noochdamrong, Suchat Kalyawongsa, Teunchai Noochdamrong, and Komol Pragtong in their report Factors of Mechanism of Deforestation: Model of Forest Area Change.

These models take the form:

$$Y \text{ (or } \Delta Y) = f \{GPP, AGRI_AREA, AGRI_PRO\}$$

where:

- Y = % forest area (or any other variables such as volume, biomass or biodiversity)
- ΔY = change in forest area (or any other variables such as volume, biomass or biodiversity)
- GPP = Gross Provincial Product in each sector
- AGRI_AREA = Cultivated area of each crop
- AGRI_PRO = Production of each crop