FOREST COVER AND CARBON MAPPING IN THE GREATER MEKONG SUBREGION AND MALAYSIA

Project introduction

The project "Forest Cover and Carbon Mapping in the Greater Mekong Subregion and Malaysia" was Sponsored by Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet), Executed by Institute of Forest Resources Information Techniques (IFRIT), Chinese Academy of Forestry (CAF), and implemented together with

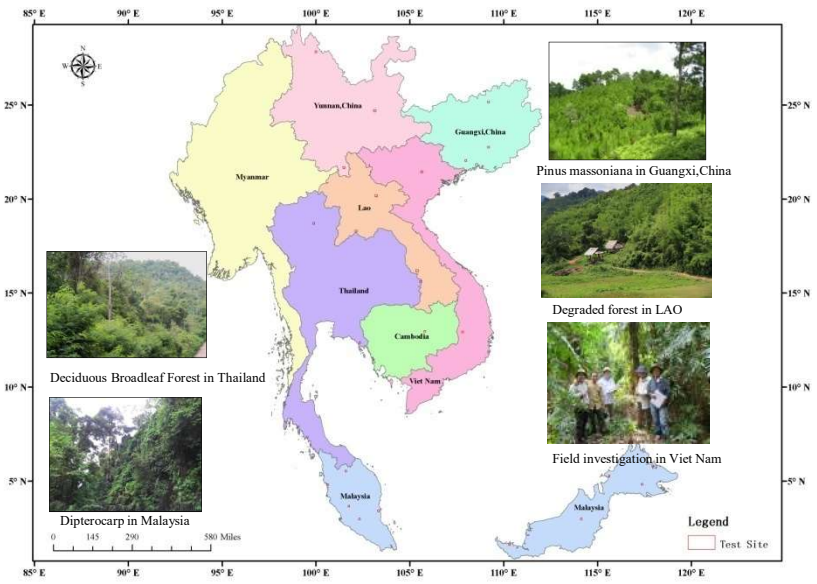
- Cambodia- Forestry Administration
- Guangxi Forest Inventory & Planning Institute (GFIPI), China
- Faculty of forestry, National University of Laos
- Forest Research Institute Malaysia (FRIM)
- Planning and Statistics Division, Forest Department, MOECAF, Myanmar
- Royal Forest Department of Thailand
- Viet Nam- Forest Inventory & Planning Institute
- Southwest Forestry University, China
- Department of Geographical Sciences, University of Maryland, USA
- Geoinformatics Center, Asian Institute of Technology (AIT), Thailand
- Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD)

The area of the GMS and Malaysia demonstration project includes Cambodia, the People's Republic of China (Yunnan province and Guangxi province), Lao People's Democratic Republic, Malaysia, Myanmar, Thailand, and Viet Nam.

The project was achieved by making intensive use of recent satellite remote sensing technology, establishing regional forest cover maps, documenting forest change processes and estimating carbon storage in the GMS and Malaysia.

The primary goal of the project is to estimate forest coverage and above-ground carbon stock in the Greater Mekong Subregion (GMS) and Malaysia. The following are the specific objectives.

- To develop pan-GMS and Malaysia forest cover mapping techniques to monitor forest cover type changes in the region, using both optical and radar remote sensing techniques.
- To develop a framework for forest carbon estimation using ground measurements, spaceborne lidar sampling data and imagery remote sensing data.
- To produce forest cover maps of 2005 and 2010 at 30 m spatial resolution and forest cover maps annually from 2005 to 2010 at 500 m spatial resolution.
- To produce a forest carbon storage map for 2005 in the GMS and Malaysia at 300 m spatial resolution.



Range of project area and test sites

Project Execution

➢ Acquisition of Remote Sensing Data

Forest coverage monitoring is based on the acquisition of remote sensing data. Each economy got relative remote sensing data through different remote sensing data sources, which laid a solid foundation for forest and carbon mapping of the economy and the entire study area.

➢ Collection of Ground Truth data

Each Implementation Agency (IA) measured 100 forest field plots centered by ICESat GLAS footprint from typical forests for biomass estimation and established classification validation plots (50 plots for each class) for forest distribution maps evaluation. These data provided fundamental training and validation data for remote sensing products.

Guangxi, China

Cambodia

Vietnam

Thailand

Malaysia

Yunnan, China

➢ Project progress conferences and Capacity building

Six training and progress workshops had been held during the implementation of the project and had made a certain progress. These workshops focused on progress exchange and training course on remote sensing data processing, forest mapping, and forest biomass/carbon estimation for project's attendees and related communities.

Inception Workshop, Beijing, Sep. 2011

Training Workshop, Vientiane, Jun. 2012

Mid-term Evaluation, Bangkok, Dec. 2012

Progress Workshop, Kunming, May, 2013

Training Workshop, Myanmar, Sep. 2013

Completion Workshop, Beijing, Jun.2014

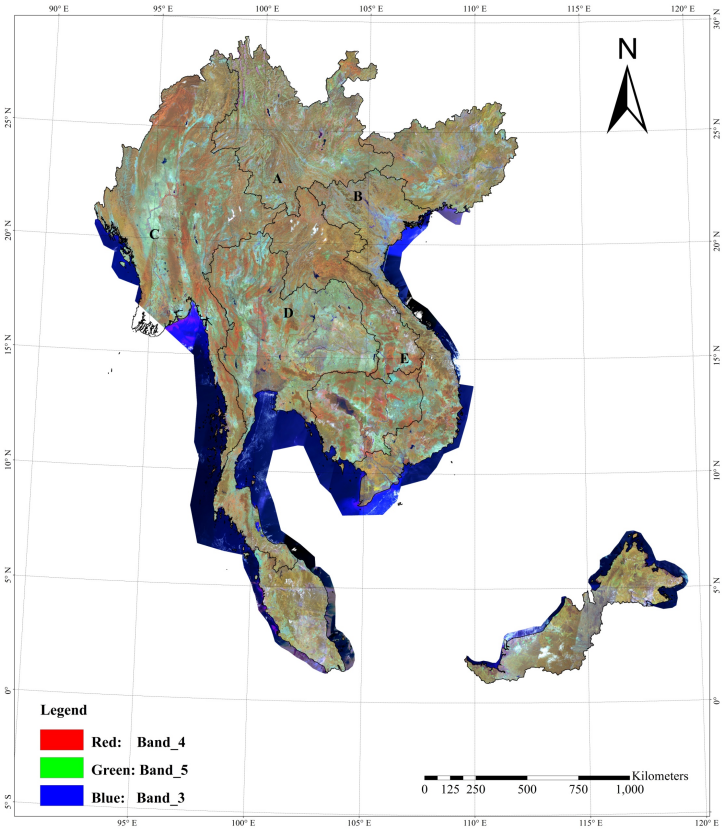
Project Outputs and Outcomes

➢ Ground Truth Database

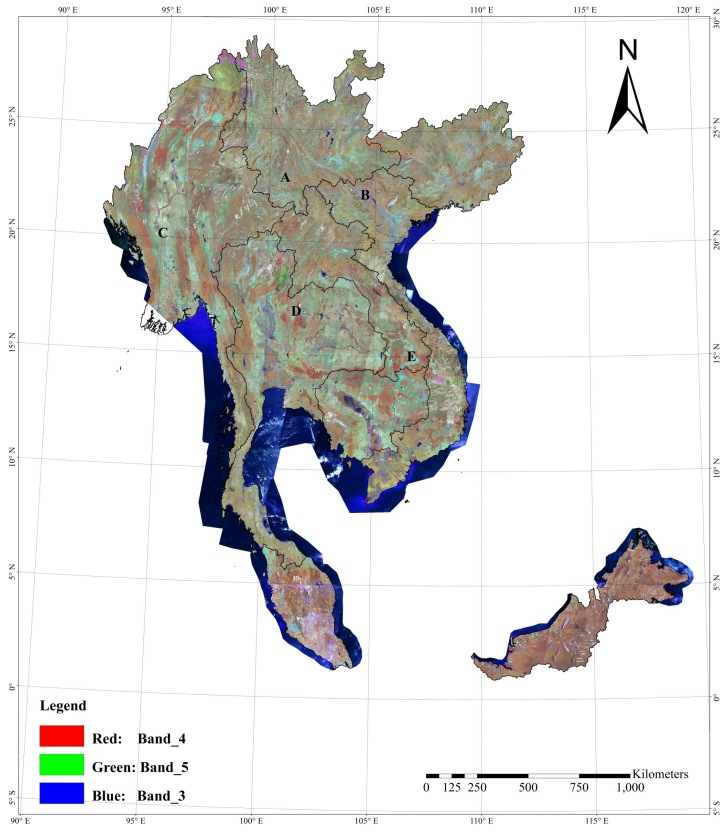
The project designed a distributed database structure of the ground truth data. Each IA followed the standards to collect the ground truth data. The database contained previous and current land cover maps, field measurements, and forest inventories.

➢ Remote Sensing Database

The project collected the satellite images of Landsat TM/ETM+ at mid-resolution 30 m in 2005 and 2010 covering the whole study area, RapidEye imageries with 5 m spatial resolution in 2010 for 18 test sites, ICESat GLAS waveform data for test sites, and time series of MODIS data from 2005 to 2010 for the whole study area.



Landsat TM database in 2005

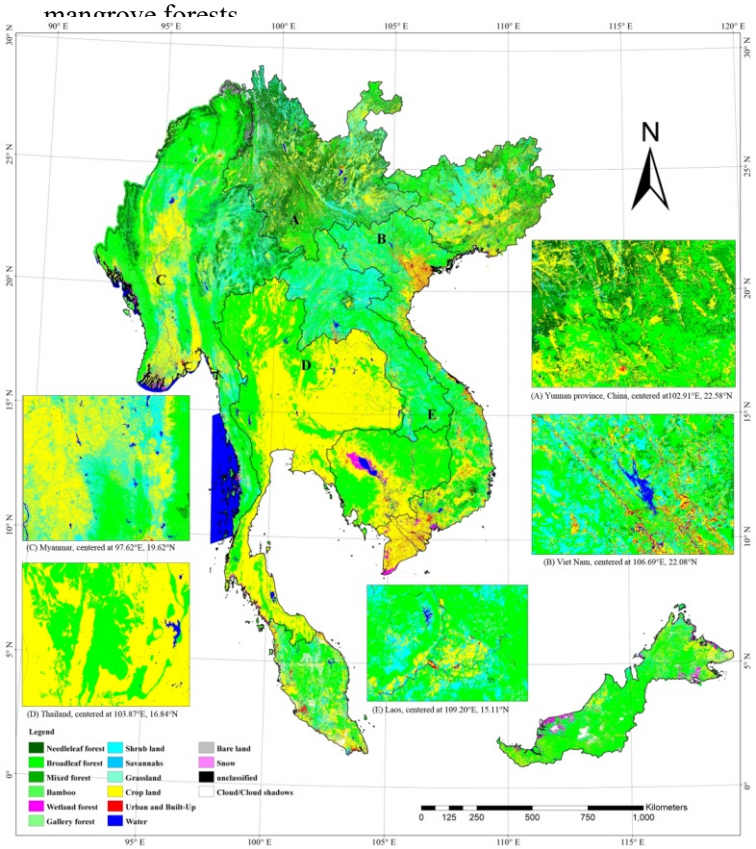


Landsat TM database in 2010

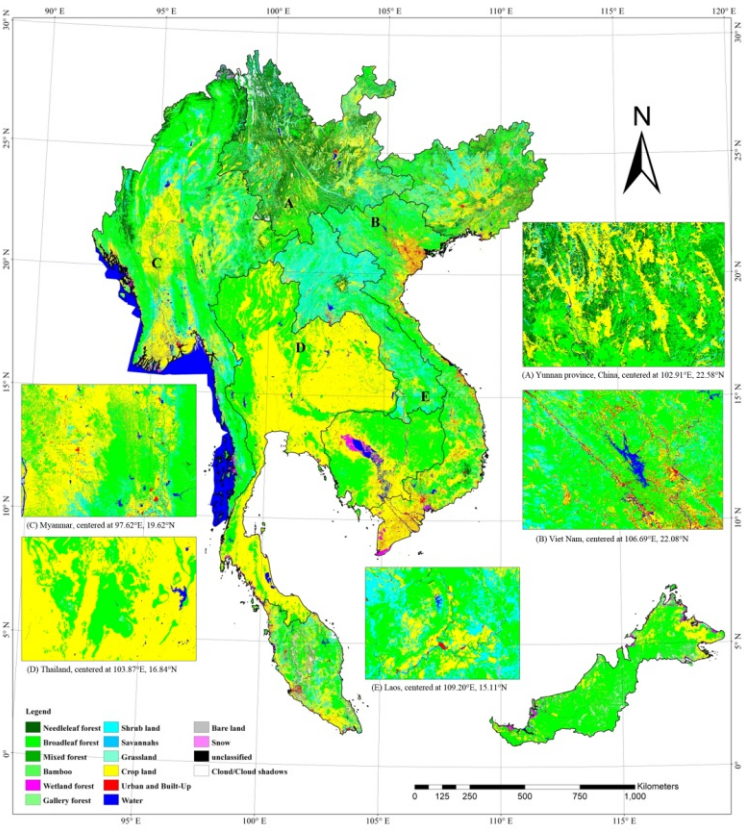
➢ Forest Coverage Map in 2005 and 2010

The forests in the GMS and Malaysia were mapped at a fine resolution of 30 m in 2005 and 2010 using Landsat TM/ETM+ data. Different economy contained different number of forest cover classes. To make a compatible forest distribution map of the whole region, we recoded the map legend into 16 classes.

Most economies had high forestry coverage over 50%. The needle-leaf forests were mainly distributed in Northern Myanmar, Yunnan and Guangxi of China. The forests in Malaysia, Cambodia, Laos, Viet Nam, Thailand and middle-south of Myanmar were dominated by broadleaf forests. The crop lands were mainly distributed in the Mekong Delta, Central-Eastern of Thailand, Central-South of Myanmar and central part of Guangxi of China. Along the coasts, there were some mangrove forests.



2005 forest cover map in the GMS & Malaysia

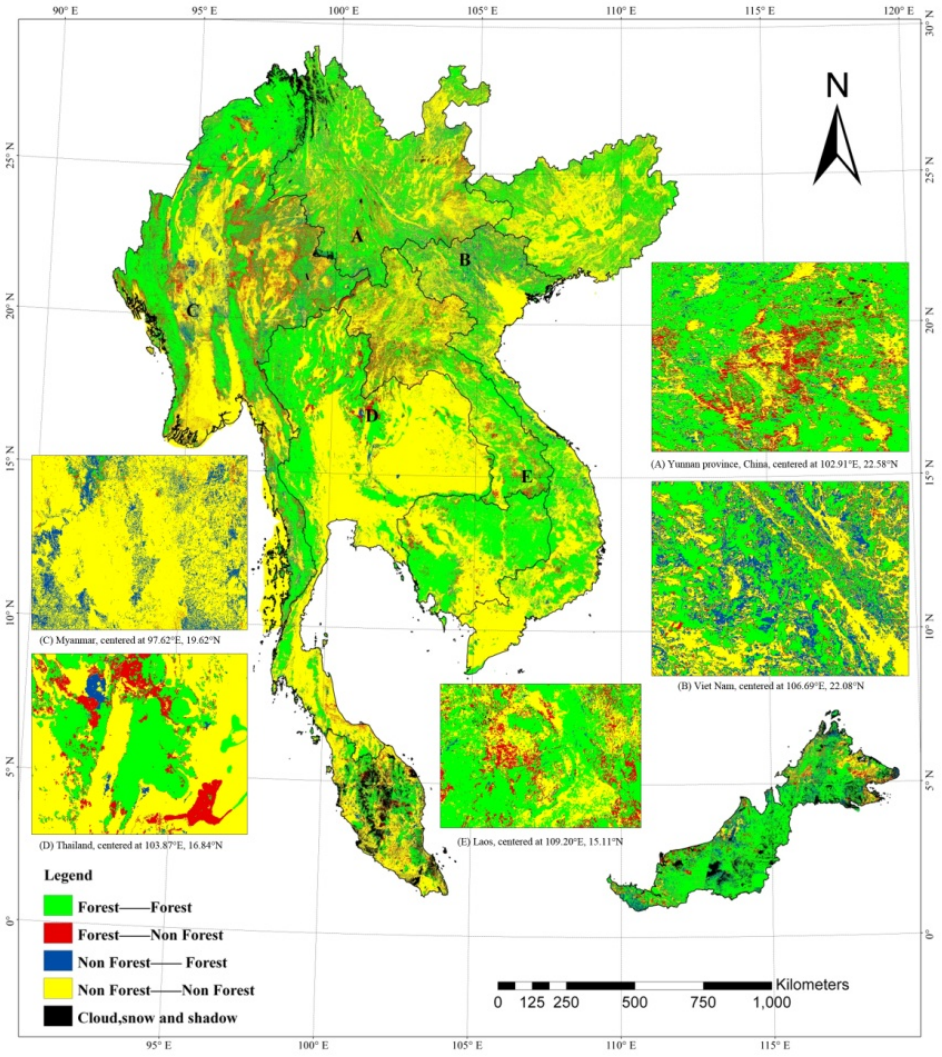


2010 forest cover map in the GMS & Malaysia

➢ Forest change map between 2005 and 2010

To make a compatible forest distribution map of the whole region, we recoded the map legend into three classes of forest, non-forest, and other (including cloud, snow, shadow and no-data).

Forest coverage was 48.4% and 46.2% in 2005 and 2010 respectively for the whole region. The forest net loss was 2.2% from 2005 to 2010. The forest loss were mainly located in northeast of Myanmar, Laos, Malaysia, and Yunnan province of China. The Forest gain were mainly occurred in east Malaysia, northern of Viet Nam, central-north of Myanmar, and Yunnan of China. The most forests and non-forests were stable during this period.



Forest change map of 2005 -2010 in the GMS & Malaysia

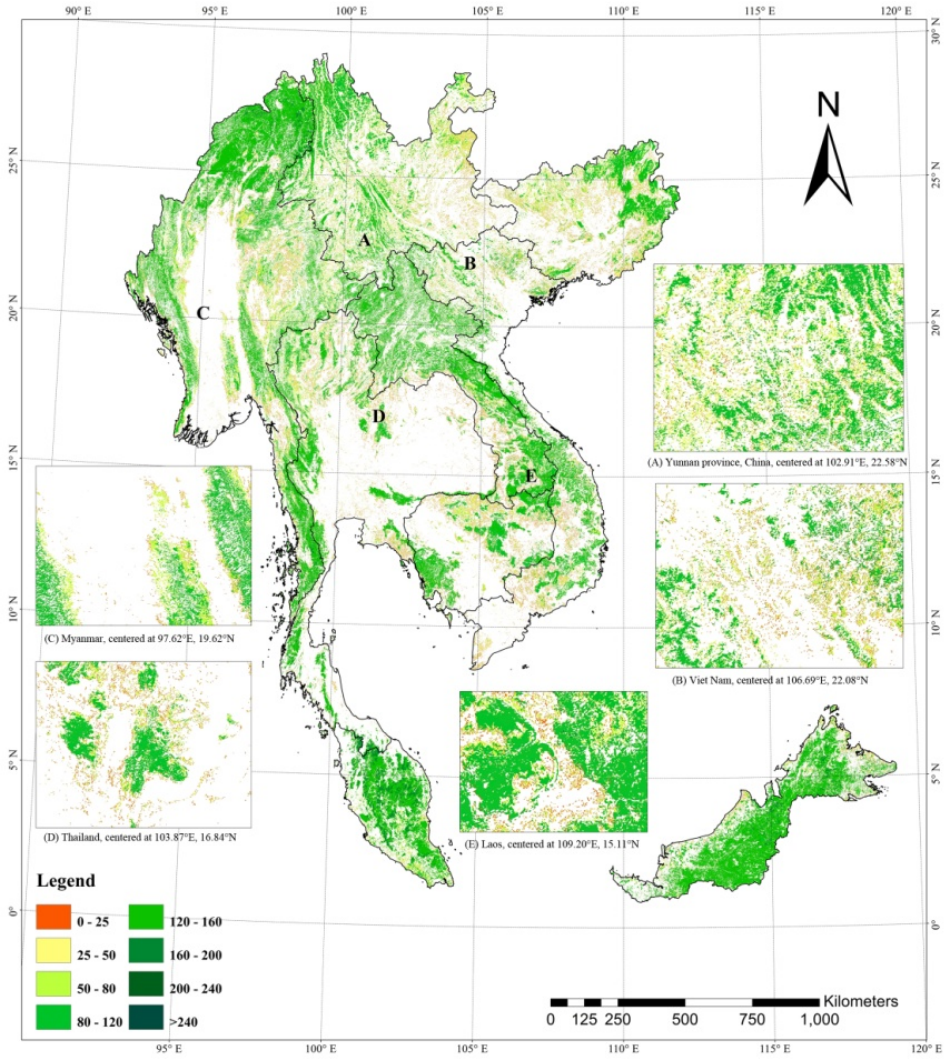
➢ Annual Forest Coverage Map during 2005～2010

The forests in the GMS and Malaysia were mapped using MODIS at coarse resolution of 500 m every year during 2005 ～ 2010. These annual forest coverage maps were used to explore how the forests changed annually and what forest disaster happened in the GMS and Malaysia.

➢ 2005 Forest Carbon Storage Mapping

The project used field measurements and airborne Lidar to train the sapceborne Lidar data, then extended these discrete carbon estimations to a continuous map after fusion with imagery remote sensing data.

The forest carbon storage map had a spatial resolution of 300 m in the epoch of 2005. The high carbon density forests were mainly distributed in the Northern Myanmar and the Northwest Yunnan, the Northeast of Guangxi, border regions of Myanmar-China-Laos and the southern part of Myanmar-Thailand, the center and south of Laos and border regions with Viet Nam, a large part of Malaysia forest.



Forest carbon storage map in 2005 in the GMS & Malaysia