Asia-Pacific Network for Sustainable Forest Management and Rehabilitation

Proposal for Project "Forest Cover and Carbon Mapping in the Greater Mekong Subregion and Malaysia"

Submitted by

Institute of Forest Resources Information Techniques,
Chinese Academy of Forestry, China

APFNet

Asia-Pacific Network for Sustainable Forest Management and Rehabilitation

Proposal Format for Pilot Project

Title of project: **Forest Cover and Carbon Mapping in the Greater Mekong Subregion and Malaysia**		
Project number:	Receiving date by APFNet Secretariat:	
Outline of the project: The general aim is to map forest coverage and carbon storage in the Greater Mekong Subregion (GMS) and Malaysia. Three main objectives of the project are to: i) develop a framework and methods for forest mapping and carbon estimation using remote sensing technology; ii) produce forest cover change maps from 2000 to 2010 and a forest above ground biomass map; and iii) enhance institutional capacity in GMS countries and Malaysia to perform forest mapping and assessment.		
Project commence date: Sep.1, 2011	Project completion date: Aug.31, 2013	
Total budget of proposal (US$): 1,266,900	APFNet's grant (US$): 1,028,800	Counterpart contribution*(in cash and in kind)*: 238,100
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Signature of APFNet's Focal Point		Date:

Acronyms and Abbreviations

AIT	Asian Institute of Technology
ALOS	Advanced Land Observing Satellite
APFNet	Asia Pacific Network for Sustainable Forest Management and Rehabilitation
APP	Asia Pulp & Paper Co., Ltd. (Singapore)
ASEAN	Association of South East Asian Nations
CBERS	China-Brazil Earth Resources Satellite
CAF	Chinese Academy of Forestry
CMA	China Meteorological Administration
CRESDA	China Centre for Resources Satellite Data and Application
DESDynI	Deformation, Ecosystem Structure and Dynamics of Ice Satellite (NASA)
ESA	European Space Agency
ETM	Enhanced Thematic Mapper
FAO	Food and Agriculture Organization
FRA	Forest Resources Assessment
FY	Meteorological satellite (China)
GEO-FCT	Group on Earth Observations- Forest Carbon Tracking Task
GLAS	Geosciences Laser Altimeter System
GMS	The Greater Mekong Subregion
GOFC-GOLD	Global Observation of Forest and Land Cover Dynamics
HJ	Environmental and Disaster Monitoring Satellite (China)
ICESat	Ice, Cloud and land Elevation Satellite (NASA)
IPCC	Intergovernmental Panel on Climate Change
JAXA	Japan Aerospace Exploration Agency
LANDSAT	Land Remote-Sensing Satellite (NASA)
LDCM	The Landsat Data Continuity Mission
LEAF	Lidar for Earth And Forests
LiDAR	Light Detection and Ranging
MERIS	Medium Resolution Imaging Spectrometer (Europe)
MODIS	Moderate Resolution Imaging Spectroradiometer (NASA)
MRC	Mekong River Commission

NASA	National Aeronautics and Space Administration (USA)
NDVI	Normalized Difference Vegetation Index
PALSAR	Phased Array type L-band Synthetic Aperture Radar
REDD	Reducing Emissions from Deforestation and Degradation
SAR	Synthetic Aperture Radar
SVM	Support Vector Machines
TM	Thematic Mapper
UNFCC	United Nations Framework Convention on Climate Change
USGS	United States Geological Survey
WWF	World Wild Fund for Nature

Summary

Forests play a vital role in sustainable development and provide a range of economic, social and environmental benefits, including essential ecosystem services such as climate change mitigation and adaptation. For the purposes of the project, the Greater Mekong Subregion (GMS) and Malaysia comprises Cambodia, the People's Republic of China (Yunnan province and Guangxi province), Lao People's Democratic Republic, Malaysia, Myanmar, Thailand, and Viet Nam. This region is rich in forest resources, but the forests have been undergoing rapid changes due to human activities.

Forest monitoring is important for the estimation and evaluation of the state of forest resources, carbon sequestration, and the results of forest program implementation. It provides a key source of information used to for the crackdown on illegal logging, forest fire monitoring and early warning for forest degradation, the reduction of deforestation, and the improvement of forest quality. Also, forest monitoring to support sustainable forest resources management can provide the earth observation data and technical support needed by countries to effectively fulfill their obligations arising from international environmental agreements (e.g., UNFCCC).

The project will be 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. Three main objectives of the project are to:

i) develop a framework and methods for forest mapping and carbon estimation using remote sensing technology;

ii) produce forest cover change maps from 2005 to 2010 and a forest above ground biomass map; and

iii) enhance institutional capacity in GMS countries and Malaysia to perform forest mapping and assessment.

1 Background and Rationale

This proposal comes from the discussion of the International Workshop on Forest Monitoring in Support of Sustainable Forest Management in the Asia-Pacific Region, April 29-30, 2010, Beijing, China. 35 scientists and officers from the Asia-Pacific countries, i.e., Cambodia, China, Indonesia, Laos, Myanmar, Malaysia, Thailand,

Vietnam, Australia, Canada, and USA, as well as from international organizations including FAO and GOFC-GOLD attended the workshop. Capacity building and demonstration projects were agreed activities in the workshop. In the Training Workshop on Forest Mapping using Geospatial Technology in the Asia-Pacific Region, January 3-12, 2011, Nanning, China, 16 forestry technical officers and researchers from Cambodia, China Yunnan and Guangxi provinces, Laos, Malaysia, Myanmar, Thailand, and Vietnam attended. As a follow-up activity of the International Workshop on Forest Monitoring in April 2010, the Training Workshop focused on enhancing the capacity of regional technicians in forest monitoring and promoting technical exchanges and cooperation in the proposed demonstration project. This proposal was discussed thoroughly in the 2 days in-workshop seminar. The activities and tasks were agreed.

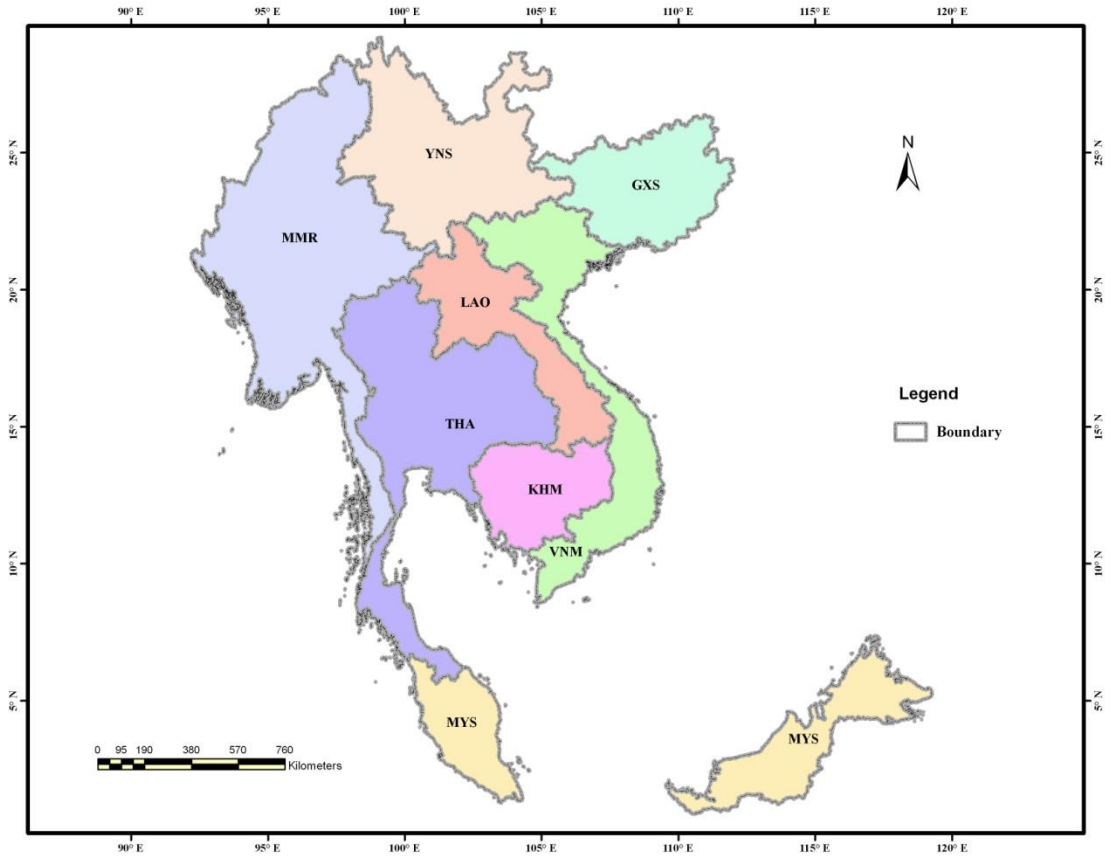


Fig. 1 Study Area of the GMS and Malaysia Demonstration Project.

The area of the GMS and Malaysia demonstration project ranges from 92.2 °to 119.3 ° east longitude and 0.8 °to 29.2 °north latitude, with total land area of 317,242,000 ha and total population of 348 million. It includes Cambodia, the People's Republic of China (Yuannan province and Guangxi province), Lao People's Democratic

Republic, Malaysia, Myanmar, Thailand, and Viet Nam. The total forest area is 148,128,000 ha reported by FRA 2010 (Yunnan & Guangxi data were from the 7th national forest inventory of China).

The project area has a diverse geographic landscape including massifs, plateaus and limestone karsts, lowlands, fertile floodplains and deltas, forests (evergreen and semi-evergreen, deciduous, dipterocarp, mangroves, and swamp), and grasslands. The region's geographic variety and consequent variety of climatic zones supports significant biodiversity, with more than 1068 new species discovered during the last ten years. The geographic region encapsulates 16 of the WWF Global 200 ecoregions. The region's biodiversity is ranked as a top-five most threatened hotspot by Conservation International. High forest coverage and rich forest resource result in large amounts of wood export from this region. The WWF states that the region is particularly vulnerable to global climate change.

The main users of the proposed project are economies in the GMS and organizations interest in the region, which include the scientific community (e.g. national forest institutes, IPCC, GEO-FCT, GOFC-GOLD), policy makers of each economies' forestry and/or environment agencies, education community (e.g. the Forestry University of Vietnam, Southwester Forestry University of China, AIT), commercial companies (e.g. pulp companies like APP), and – in the context of cooperation and scientific support – also international or regional organizations (e.g. FAO, APFNet, ASEAN or MRC).

2 Goal and Objectives

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 proposed approach will integrate multi-sources remote sensing data, ground measurements and other thematic geographic data. The outcomes of this project will help to clarify how, when and where the forests changes in the GMS and Malaysia. Our proposed approach will determine forest coverage and biomass estimates through the following specific objectives:

1) 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.
2) Develop a framework for forest carbon estimation using ground measurements,

spaceborne lidar sampling data and imaged remote sensing data.

3) Produce forest cover maps of 2005, and 2010 at 30-50m spatial resolution and forest cover maps annually from 2005 to 2010 at 300-500m spatial resolution.

4) Produce a forest carbon storage map for 2005 in the GMS and Malaysia at 300-500m spatial resolution.

3 Expected Outputs and Outcomes

The following **outputs and outcomes** will be accomplished or produced through this project:

- **Remote sensing database**

The satellite imageries from Landsat TM/ETM+, HJ-1A/1B, CBERS, MODIS, MERIS and FY-3 will be collected and processed. A remote sensing database will be created and make available to different users of the project.

- **National-institute-owned ground truth database**

We will design a distributed data structure of the ground truth database so that the corresponding work teams could follow the standards to collect the ground truth data. The database will contain previous and current landcover maps, field measurements, and forest inventories. The database will be distributed in each country with same data structure and data access portal. These data will provide fundamental training and validation data for remote sensing products.

- **Annual forest map product at coarse resolution (300~500m) during 2005～2010**

The forests in the GMS and Malaysia will be mapped using MODIS, MERIS and FY-3 at coarse resolution (300~500m) every year during 2005～2010. These annual forest coverage maps will be used to explore how the forests changed annually and what forest disaster happens in the GMS and Malaysia.

- **Mid-resolution (30m) forest map product in 2005 and 2010**

The forests in the GMS and Malaysia will be mapped at fine resolution (30~100m) in 2005 and 2010 using Landsat TM/ETM+, HJ-1A/1B, CBERS, ALOS PALSAR. These forest maps will contain more details land cover classes information. This information is useful to discover the driving forces of the forest changes and can provide policy decision supporting information to the local relevant government in the GMS and Malaysia.

- **Forest carbon storage mapping product (300~500m) of 2005**

The forest carbon storage in the GMS and Malaysia will be mapped using ICESat GLAS, MODIS, MERIS at coarse resolution (300~500m) in 2005. This wall-to-wall forest carbon baseline map will be used to analyze forest quality and its distribution in the GMS and Malaysia.

- **Training workshops**

Training courses and study tours on remote sensing data processing, forest mapping, and forest biomass/carbon estimation will be conducted for project's attendees and related communities.

- **The analysis report of forest coverage and carbon storage in each GMS economies and Malaysia**

The forest resource analysis report will be prepared using the map products for each GMS economy and Malaysia. These reports will emphasis how the forest coverage changes and what the forest carbon storage is, which links to the objectives of the APFNet.

4 Main Activities Plan

4.1 Main activities

Activities to be undertaken to achieve individual results are as following:

4.1.1 Project design and management (including training)

A project steering committee comprised of national representatives and international experts will be established. This committee will communicate and make top-level design for the whole project. One recommended national representative is expected. Milestones and main deliverables will be discussed by this steering committee.

4.1.2 Methods development (including Algorithms)

Institutes with intensive remote sensing technologies or forest resources will be organized as an algorithm development and training group. The common data processing and forest information extraction methods will be explored and developed. Technical progress and innovative methodologies will be regularly synthesized and feed to support operational data processing through training workshops and progress meetings.

4.1.3 Remote sensing data acquisition and pre-processing

The ways and links to get geospatial data that are available will be built. The satellite imageries include Landsat TM/ETM+, HJ-1A/1B, CBERS, MODIS, MERIS, FY, PALSAR and ICESat GLAS. The preprocessing work including radiometric correction, atmospheric correction, geo-referencing or geo-correction, cloud retrieving, multi-temporal composite, reprojection and mosaic will be carried out. A standard workflow of data processing will be developed. Multi-scale satellite data will be transferred to the corresponding working teams of GMS and Malaysia.

4.1.4 Ground truth database development (compiling existing data)

The data structure of ground truth database will be determined at the beginning of the launch of the project so that the corresponding work teams could follow the standards to collect the ground truth data. The fields of the database should include location (latitude and longitude, altitude), landcover type, photos, investigators, point/route/polygon, etc. For data validation, the database should cover data of all kinds of landcover types. Previous and current landcover maps or forest inventories will be collected.

4.1.5 Coarse-resolution forest mapping

The coarse-scale forest map will be generated annually using MODIS, MERIS, and FY-3 images. These images are available for free download through the internet. Some composition and reprojection will be performed. Then the classification will be done by several key groups with training data from fine-scale mapping products.

4.1.6 Mid-resolution forest mapping

The core of the image classification process is the training data selection and extraction process. The core activities include: (1) Regional forest cover mapping – at regional scales and based on satellite imagery of high spatial resolution (30-50m) for year 2005, 2010; (2) Forest cover change assessment – based on a statistical sample of satellite imagery of high spatial resolution (10m) and ground truth data for the reference. For this study on forest cover mapping, CBERS, TM/ETM data around 2005 and HJ-1 data around 2010 will be used. Orthorectified TM/ETM images for 2005 have been produced by USGS and NASA, and are available for free download through the internet. The images for 2010 are been produced, and will be available for this project by 2011. It is also free to get the HJ-1 images. For HJ-1 images, it needs to do the radiometric correction and geometric correction. Orthorectified TM/ETM will be used as the references for HJ-1's geometric correction.

4.1.7 Forest carbon storage mapping product

We will estimate forest biomass and carbon storage for each ICESat GLAS footprint with the aid of ground measurements and other reference data. Then these discrete footprint data will fuse with image data like MODIS/MERIS/FY-3 to estimate a spatial continuously biomass/carbon storage map in GMS and Malaysia.

4.1.8 Reporting and dissemination

After each forest coverage and carbon storage map generated, they will be evaluated by a validation team. Then the steering committee will do analysis with other related information. A report will be prepared for APFNet and released to related communities.

4.2 Show the coherence of the related activities.

To increase forest cover and improve forest quality are main objectives of the APFNet. And the APFNet puts many efforts towards forest rehabilitation, reforestation and afforestation in the region. The forest coverage map from this project will reflect where and when the increased forests are. Our forest coverage map will give a detail reference of forest types for the Global Land-Cover by the Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD) and Global Forest Cover Change by the University of Maryland and U.S. Geological Survey, which is only focus on the change of forest and non-forest. The carbon storage product will show how the forest quality in this region. Some of attendees of this project attend the FAO Global Forest Resources Assessment 2010 and REDD projects, which could share some remote sensing and ground reference data. Our carbon storage map is also links to the activities of Forest Carbon Tracking task of GEO.

4.3 Potential risks and uncertainties

Field data access and Validation data are potential risks. To invite the national forest institutes and universities as the main participants of each country, each participant will build ground truth database and validate the mapping products using the ground reference data for the achievement of this project.

Data availability is another potential risk. For SAR data, the data of year 2007, 2009 are already freely available, so the forest and none-forest mapping and change mapping of these two year has no risk. However, there are uncertainties of the data availability in the future and JAXA's data policy. The data cost will increase if the data are not free in the future. For mid-resolution optical data like LANDSAT TM/ETM+, CBERS, and HJ, they are available for achieves and new routinely

collection from USGS and CRESDA. For Lidar data, all the ICESat GLAS data are freely available from NASA. The data from its successor ICESat-II will also be freely available. The coarse resolution optical data like MODIS, MERIS and FY-3 are available with geometric and radiometric correction products from NASA, ESA and CMA. But according to the trend of GEO's activities, more and more data free mid-resolution remote sensing data will be available (GEO, 2010).

5 Management Structure

A project steering committee comprised of national representatives and international experts will be established. This committee will communicate and make top-level design for the whole project. One recommended national representative was recommended. Milestones and main deliverables will be discussed by this steering committee.

Institutes with intensive remote sensing technologies and forest resources will be organized as an algorithm development and training group. The common data processing and forest information extraction methods will be explored and developed. Technical progress and innovative methodologies will be regularly synthesized and feed to support operational data processing through training workshops and progress meetings. Some funds for visiting scientists are planned for attendees to visit or study at CAF.

The reference database and middle resolution forest mapping activities will be carried out by each country's organizations. Annual forest map of coarse resolution and forest carbon storage map will be done by the methods development team. After each forest coverage and carbon storage map generated, they will be evaluated by a validation team. Then the steering committee will do analysis with other related information. A report will be prepared for APFNet and released to related communities.

The working packages are as

WP1: Project design and management (including training)
WP2: Methods development (including Algorithms)
WP3: Remote sensing data acquisition and pre-processing
WP4: Ground truth database development (compiling existing data)
WP5: Mid-resolution forest mapping product

WP6: Coarse-resolution forest mapping product

WP7: Forest carbon storage mapping product

WP8: Reporting and dissemination

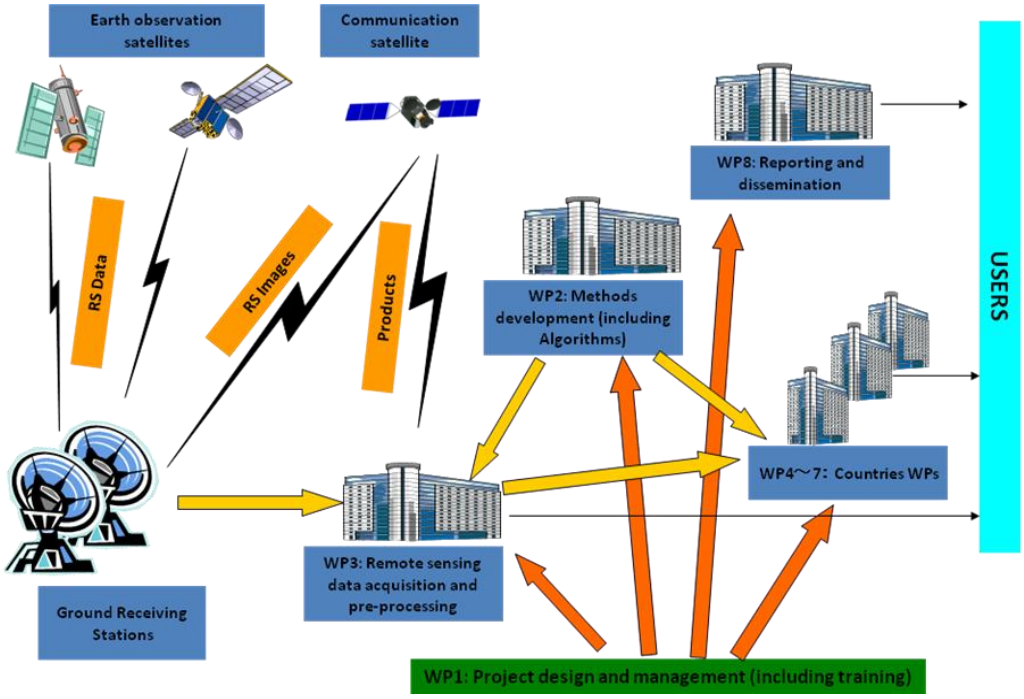


Fig. 2 Project Structure

Fig. 2 shows roles of different partners for project implementation and product distribution system. WP1, WP2, WP7 and WP8 will lead by the Chinese Academy of Forestry, GOFC-GOLD and the University of Maryland with inputs from involved countries. The data of WP4 will be distributed in each country but serve for this project. WP4, WP5, WP6 and WP7 will be carried out by the national forest institute or university of each country in the GMS and Malaysia. Relevant forest mapping techniques and software tools will be developed into a streamlined production system in WP1 and WP2. And the production system will be distributed to the team of each country through training courses/workshops. The data will be distributed to each team, who will do the mapping and validation by themselves. Classification and mapping activities are proposed to be done by each county's team for their country task.

6 Financial System

China Audit International Certified Public Accountants LTD will be identified as the accountant institution. Every year the internal auditing activity will be arranged.

APFNet's grant including counterpart fund in cash and in kind will be used for project activities defined in the project agreement. Totally, there are $1.0288 million grant in cash which includes the following category such as consultants, management assistants, study tour & travel expenses, survey/case study & sub-contracts, training & workshops, equipments, flowing materials and administration. As for the disbursement of the grant, the following points will be strictly guaranteed in order to achieve a better result for the project:

1) Eligible indirect cost includes regular administrative management expenses for the implementing the project, usually no more than 7% of the APFNet's grant.
2) Administrative management expenses will be disbursed according to the actual incurred expenses and should be specified in the contract signed by the applicant and partners.
3) Science and research institution can be partner of the applicant, but APFNet's grant is not allowed to use for pure scientific and researching activities.
4) The salaries paid for the staff from the applicant's partners and collaboration agencies in order to fulfill the project task can be disbursed as counterpart fund in cash.

7 Reliability and Reproducibility

This proposal came from the discussion of the International Workshop on Forest Monitoring in Support of Sustainable Forest Management in the Asia-Pacific Region, April 29-30, 2010, Beijing, China. In the Training Workshop on Forest Mapping using Geospatial Technology in the Asia-Pacific Region, January 3-12, 2011, Nanning, China, 16 forestry technical officers and researchers from Cambodia, China Yunnan and Guangxi provinces, Laos, Malaysia, Myanmar, Thailand, and Vietnam attended. This proposal was discussed thoroughly in the 2 days in-workshop seminar. The activities and tasks were agreed in the Nanning workshop.

Field data access and Validation data are potential risks. To invite the national forest institutes and universities as the main participants of each country, each participant will build ground truth database and validate the mapping products using the ground reference data for the achievement of this project. For some countries who do not attend the project officially, the forest mapping activities will be done by the algorithm development team with the help of scientists of these countries and project attendees of their neighbor countries.

Data availability is another potential risk. For SAR data, the data of year 2007, 2009 are already freely available, so the forest and none-forest mapping and change

mapping of these two year has no risk. There are uncertainties of the data availability in the future and JAXA's data policy. The data cost will increase if the data are not free in the future. For mid-resolution optical data like LANDSAT TM/ETM+, CBERS, and HJ, they are available for achieves and new routinely collection from USGS and CRESDA. And we are committed that we will get these data for free as a contribution to this project from USGS and CRESDA. For Lidar data, all the ICESat GLAS data are freely available from NASA. The data from its successor ICESat-II will also be freely available. The coarse resolution optical data like MODIS, MERIS and FY-3 are available with geometric and radiometric correction products from NASA, ESA and CMA. And according to the trend of GEO's activities, more and more data free mid-resolution remote sensing data will be available such as LDCM and Sentinel-2 (GEO, 2010).

The Landsat TM/ETM+, CBERS, HJ, and ALOS PALSAR mosaic data are available for the whole southeast region, so the achievements of this project can be applied to the other APFNet member countries. The ICESat GLAS will be used as lidar data source for the period of 2005. There are several spaceborne lidar missions like ICESat-2, DESDynI, LEAF, are being planning, which will provide updating data for our next phase carbon storage estimation work around 2016. The imagery data from MODIS/MERIS/FY-3 and their successors are freely available through internet.

8 Annexes:

Annex A: Logframe

Annex B: Budget Summary & Budget of Each Country/Organizations

Annex C: Work Plan

Annex D: Project Area and Site Description

Annex E: Support Letters

Annex F: Participants List

Annex G: Participating Organizations

Annex A: Logical Framework Matrix (Logframe)

Program Elements	Indicators	Means of Verification	Assumptions
Goal: to estimate forest coverage and above-ground carbon stock in the Greater Mekong Subregion (GMS) and Malaysia.	Clarify how, when and where the forests changes in the GMS and Malaysia.	Forest resource inventory The ground truth database built by this project	
Specific Objective : 1. develop a framework and methods for forest mapping and carbon estimation using remote sensing technology 2. produce forest cover change maps from 2000 to 2010 and a forest above ground biomass map 3. enhance institutional capacity in GMS countries and Malaysia to perform forest mapping and assessment	1.Algorithm document 2. forest coverage dynamic and carbon storage maps 3. Training guide, workshop documents, trainees' reports	1. Project design and implementation documents Forest resource inventory 2. Existing remote sensing data and products. The method is to integrate multi-sources remote sensing data, ground measurements and other thematic geographic data. 3. Existing forest remote sensing training materials and publications. The method is to adapt developed forest mapping methods to this project area and make training workshops.	
OUTPUT 1: Remote sensing database: The satellite imageries from Landsat TM/ETM+, HJ-1A/1B, CBERS, MODIS, MERIS and FY-3 will be collected and processed. A remote sensing database will be created and make available to	At least two times coverage of mid-resolution and five times coverage of coarse-resolution satellite data.	Data geographic coverage and image quality	Supports from related remote sensing ground stations and agencies

different users of the project. Implementation partner (IP): CAF & UMD			
Activity 1.1: A standard workflow of data processing will be figured out.	Some developed routines with commercial software of ENVI	Data processing algorithm development and efficiency	
Activity 1.2: Remote data collection and database construction and distribution	Some standard about data archives and distribution	Data archives and distribution	
OUTPUT2: National-institute-owned ground truth database: A distributed database contains previous and current landcover maps, field measurements, and forest inventories. Implementation partner: CAF & GOFC GOLD & each countries participants	The database will be distributed in each country with same data structure and data access portal of ground references information. These data will provide fundamental training and validation data for remote sensing products.	Data geographic coverage, acquired date and attributes	Supports from related forest institutes and forest inventories organizations.
Activity 2.1: database structure design, data collection, database construction and distribution	Some standard about data archives and distribution	Data archives and distribution	
Output 3: Coarse resolution forest map product Annual forest map product at coarse resolution (300~500m) during 2005～2010 Implementation partner: CAF & GOFC GOLD & each countries participants	Forest coverage dynamic maps at coarse resolution (300~500m) every year during 2005～2010.	Data geographic coverage, accuracy, and image date	
Activity 3.1 Forest information extraction methods from coarse resolution (300~500m) will be developed.	Some developed routines with commercial software of ENVI	Data processing algorithm development and efficiency	

Activity 3.2 Forest classification for each country.	Some developed routines with commercial software of ENVI	Image classification accuracy	
Output 4: Mid-resolution forest map product: forest map product at mid-resolution (30~50m) of 2005 and 2010 Implementation partner: CAF & UMD & each countries participants	Forest map product at mid-resolution (30~50m) of 2005 and 2010	Data geographic coverage, accuracy, and image date	
Activity 4.1 Forest information extraction methods from mid-resolution (30~50m) will be developed.	Some developed routines with commercial software of ENVI	Data processing algorithm development and efficiency	
Activity 4.2 Forest classification for each country.	Some developed routines with commercial software of ENVI	Image classification accuracy	
Output 5: Forest carbon storage map product Forest carbon storage map product at coarse resolution (300~500m) in 2005 Implementation partner: CAF & UMD & each countries participants	Forest carbon storage map product at coarse resolution (300~500m) in 2005	Data geographic coverage, accuracy	
Activity 5.1 Forest carbon storage estimation methods from multi-sources remote sensing data will be developed.	Some developed routines with commercial software of ENVI	Data processing algorithm development and efficiency	

Activity 5.2 Forest carbon storage estimation for each country.	Some developed routines with commercial software of ENVI	Estimation accuracy	
Output 6: Training workshops Training courses and study tours on remote sensing data processing, forest mapping, and forest biomass/carbon estimation Implementation partner: CAF & GOFC GOLD & UMD & each countries participants	Training documents	Training times and attendees	
Activity 6.1 Institutes with intensive remote sensing technologies or forest resources will be organized as an algorithm development and training group. Technical progress and innovative methodologies will be regularly synthesized and feed to support operational data processing trough training workshops and progress meetings.	Training documents and algorithms development.	Training times and attendees.	
Output 7: Reports Reports of forest coverage and carbon storage in each GMS economies and Malaysia. Implementation partner: CAF & GOFC GOLD & each countries participants	The forest resource analysis report will be prepared using the map products for each GMS economy and Malaysia.	Report for each country in the GMS and Malaysia	
Activity 7.1 After each forest coverage and carbon storage map generated, they will be evaluated by a validation team. Then the science team will do analysis with other related information.	A report will be prepared for APFNet and released to related communities.	Report for each country in the GMS and Malaysia	

Annex B.1 Budget Summary

Budget Summary (US$)

NO.	Country/Organization	Budget		TOTAL
		Grant	Counterpart fund	
1	Chinese Academy of Forest. University of Maryland, GOFC-GOLD, USGS	341,160	238,100	579,260
2	Cambodia	96,900		96,900
3	Guangxi, China	50,800		50,800
4	Laos	90,640		90,640
5	Malaysia	95,600		95,600
6	Myanmar	98,600		98,600
7	Thailand	96,200		96,200
8	Viet Nam	108,100		108,100
9	Yunnan, China	50,800		50,800
TOTAL		**1,028,800**	**238,100**	**1,266,900**

Annex B.2

Annex B.2.1

Budget for the Project in Chinese Academy of Forestry (US$)											
Expenses	**Unit**	**Grant**			**Counterpart fund in cash**			**Counterpart fund in kind**			**TOTAL**
		# of units	**Unit rate**	**Costs**	**# of units**	**Unit rate**	**Costs**	**# of units**	**Unit rate**	**Costs**	
1. Inception funds	Lump Sum										
Subtotal											
2. Consultants											
2.1 Please list all consultants employed under this project	Per person-month	66	900	59400							
Subtotal				**59400**							59400
3. Management assistants											
3.1 Please list all management assistants employed under this project	Per person-month										

salary	Per -month	24	500	12000	96	600	57600				
stipend of scientists	Per - month	120	125	15000							
stipend of graduate students	Per - month	120	125	15000							
per-diem	Per -day	120	15	1800							
Travel cost	Per-mission	10	1000	10000							
Subtotal				**53800**			**57600**				111400
4. Study tour & travel expenses											
4.1 Please list separately all missions to be undertaken	Per mission										
Data acquisition in the pilot area		2	6000	12000							
International Remote Sensing Symposium		2	2600	5200							
Progress meeting of the project		2	10000	20000							
Study in aboard (visiting scientist grant)		7	2500	17500							
Attending the domestic symposium		2	640	1280							
Subtotal				**55980**							55980
5. Survey/ case study & sub-contracts											
5.1 Please list separately all sub-contracts to be issued	Per contract										
sub-contracts											
GOFC-GOLD		1	10000	10000							
USGS		1	10000	10000							
UMD		2	10000	20000							
Subtotal				**40000**							40000
6. Training & workshops											
6.1 Please list separately all	Per event										

training/workshops to be organized											
2011 workshop		1	20000	20000							
2012 training workshop		1	20000	20000							
2013 workshop		1	20000	20000							
Subtotal				**60000**							60000
7. Equipment											
7.1 Please list separately all equipments to be purchased	Per Unit										
Envi/ERDAS Software		2	10000	20000							
Subtotal				**20000**							20000
8. Flowing Materials											
8.1 List separately all materials to be purchased	Per category										
High Resolution Optical Satellite Data		3	8650	25950				1	7600	7600	
High Resolution Radar Data		3	2700	8100				1	2700	2700	
Topographic Map(100Km*100Km)		70	95	6650				80	95	7600	
TM								150	580	87000	
ENVISAT								120	450	54000	
Subtotal				**40700**						**158900**	199600
9. Office accommodation and administration											
9.1 Office rental costs	Per month							24	900	21600	
9.2 Local transportation costs	Per month	24	220	5280							
9.3 Office supplies & expenses (stationery, utilities, phone etc.)	Per month	24	250	6000							

Subtotal				**11280**							32880
TOTAL				**341160**			**57600**			**180500**	**677860**

Annex B.2.2

Budget for the Project in Cambodia (US$)											
Expenses	**Unit**	**Grant**			**Counterpart fund in cash**			**Counterpart fund in kind**			**TOTAL**
		# of units	**Unit rate**	**Costs**	**# of units**	**Unit rate**	**Costs**	**# of units**	**Unit rate**	**Costs**	
1. Inception funds		1	3000	3000							
Subtotal		**1**	**3000**	**3000**							**3000**
2. Consultants											
2.1 Please list all consultants employed under this project											
Subtotal											
3. Management assistants											
3.1 Please list all management assistants employed under this project											
Salary	/person/month	24	250	6000							
Travel cost		7	2181	15267							
Subtotal				**21267**							**21267**
4. Study tour & travel expenses											
4.1 Please list separately all missions to be undertaken	/mission										
-Data acquisition in the field area		24	1500	36000							
-Progress meeting of the project		2	5500	11000							
Subtotal				**47000**							**47000**

5. Survey/ case study & sub-contracts											
5.1 Please list separately all sub-contracts to be issued	/mission										
-Re-measurement each plots		1	12633	**12633**							**12633**
Subtotal											
6. Training & workshops											
6.1 Please list separately all training/workshops to be organized											
-Training workshop for forester and related technicians(in office)		1	5000	5000							
- Training workshop for forester and related technicians(in the field)		1	5000	5000							
Subtotal		**2**	**5000**	**10,000**							**10,000**
7. Equipment											
7.1 Please list separately all equipments to be purchased											
Subtotal											
8. Office accommodation and administration											
8.1 Local transportation costs	/month	24	62.5	1500							
8.2 Office supplies & expenses (stationery, utilities, phone etc.)	/month	24	62.5	1500							
Subtotal				**3000**							**3000**
TOTAL				**96900**							**96900**

Annex B.2.3

Budget for the Project in Guangxi, China (US$)											
Expenses	**Unit**	**Grant**			**Counterpart fund in cash**			**Counterpart fund in kind**			**TOTAL**
		# of units	**Unit rate**	**Costs**	**# of units**	**Unit rate**	**Costs**	**# of units**	**Unit rate**	**Costs**	
1. Inception funds	Lump Sum										
Subtotal											
2. Consultants											
2.1 Please list all consultants employed under this project	Per person-month	36	120	4320							
Subtotal				**4320**							**4320**
3. Management assistants											
3.1 Please list all management assistants employed under this project	Per person-month										
salary	Per -month	4	500	2000							
per-diem	Per -day	15	30	450							
Travel cost	Per-mission	4	500	2000							
accommodation cost	Per -day	10	45	450							
Subtotal				**4900**							**4900**
4. Study tour & travel expenses											
4.1 Please list separately all missions to be undertaken	Per mission										
Data acquisition in the field area	Per person-month	6	1000	6000							

International Remote Sensing Symposium	per person										
Progress meeting of the project	per person	1	1000	1000							
Study in aboard											
Attending the domestic symposium	per person	4	1000	4000							
Subtotal				**11000**							**11000**
5. Survey/ case study & sub-contracts											
5.1 Please list separately all sub-contracts to be issued	Per contract										
sub-contracts											
Survey study	per person-month	10	1000	10000							
case study	per person-month	2	1000	2000							
Subtotal				**12000**							**12000**
6. Training & workshops											
6.1 Please list separately all training/workshops to be organized											
2011 workshop	Per event	1	2000	2000							
2012 workshop	Per event	1	2000	2000							
2011 training workshop	Per event	1	3000	3000							
2012 training workshop	Per event	1	3000	3000							
Subtotal				**10000**							**10000**
7. Equipment											
7.1 Please list separately all equipments to be purchased	Per Unit										
Lenovo computer											

Laptop		2	1800	3600							
Seagate Hard Disk(1000GB)		3	300	900							
Envi Software				0							
Scanner		1	300	300							
Electrograph		1	400	400							
HP LaserJet Printer		1	500	500							
Subtotal				**5700**							**5700**
8. Flowing Materials											
8.1 List separately all materials to be purchased	Per category										
SPOT5 Satellite Data											
Radarsat-2 Data											
Topographic Map(100Km*100Km)											
Subtotal											
9. Office accommodation and administration											
9.1 Office rental costs	Per month										
9.2 Local transportation costs	Per month	36	50	1800							
9.3 Office supplies & expenses (stationery, utilities, phone etc.)	Per month	36	30	1080							
Subtotal				2880							**2880**
TOTAL				**50800**							**50800**

Annex B.2.4

Budget for the Project in Laos (US$)											
Expenses	**Unit**	**Grant**			**Counterpart fund in cash**			**Counterpart fund in kind**			**TOTAL**
		# of units	**Unit rate**	**Costs (USD)**	**# of units**	**Unit rate**	**Costs**	**# of units**	**Unit rate**	**Costs**	
1. Inception funds	Lump Sum			3000							
Subtotal				**3000**							**3000**
2. Consultants											
2.1 Two consultants are required (forest inventory and carbon accounting team leaders)	Per person-month	3	2000	6000							
Subtotal		**3**	**2000**	**6000**							**6000**
3. Management assistants											
3.1 Please list all management assistants employed under this project	Per person-month										
salary	Per -month	48	300	14400							
per-diem	Per -day	180	25	4500							
Travel cost	Per-mission	3	1000	3000							
accommodation cost	Per -day			0							
Subtotal				**21900**							**21900**
4. Study tour & travel expenses											

4.1 Please list separately all missions to be undertaken	Per mission										
Data acquisition in the field area		3	2000	6000							
International Remote Sensing Symposium		2	3000	6000							
Progress meeting of the project		2	2000	4000							
Study in aboard											
Attending the domestic symposium		2	500	1000							
Subtotal				**17000**							**17000**
5. Survey/ case study & sub-contracts											
5.1 Please list separately all sub-contracts to be issued	Per contract										
sub-contracts		3	3000	9000							
Survey study		2	2500	5000							
case study		2	2500	5000							
Subtotal				**19000**							**19000**
6. Training & workshops											
6.1 Please list separately all training/workshops to be organized	Per event										
2011 workshop		1	2000	2000							
2012 workshop		1	2000	2000							
2011 training workshop		1	2000	2000							
2012 training workshop		1	2000	2000							
Subtotal		**4**	**8000**	**8000**							**8000**

7. Equipment											
7.1 Please list separately all equipments to be purchased	Per Unit										
Desktop computer		1	2000	2000							
Laptop		2	2000	4000							
Seagate Hard Disk(1000GB)		1	90	90							
Envi Software		2	600	1200							
Scanner		1	600	600							
Electrograph		1	400	400							
HP LaserJet P4515n Printer		1	250	250							
Subtotal				**8540**							**8540**
8. Flowing Materials											
8.1 List separately all materials to be purchased											
SPOT5 Satellite Data											
Radarsat-2 Data											
Topographic Map(100Km*100Km)											
Subtotal											
9. Office accommodation and administration											
9.1 Office rental costs	Per month										
9.2 Local transportation costs	Per month	24	100	2400							

9.3 Office supplies & expenses (stationery, utilities, phone etc.)	Per month	24	200	4800							
Subtotal				7200							7200
TOTAL				**90640**							**90640**

Annex B.2.5

Budget for the Project in Malaysia (US$)											
Expenses	**Unit**	**Grant**			**Counterpart fund in cash**			**Counterpart fund in kind**			**TOTAL**
		# of units	**Unit rate**	**Costs**	**# of units**	**Unit rate**	**Costs**	**# of units**	**Unit rate**	**Costs**	
1. Inception funds	5,000										
Subtotal	**5,000**										**5,000**
2. Consultants											
2.1 Please list all consultants employed under this project	1500/person/month										
Subtotal	**24,000**										**24,000**
3. Management assistants											
3.1 Please list all management assistants employed under this project	**300/person/months**										
Subtotal	**4,800**										**4,800**
4. Study tour & travel expenses											
4.1 Please list separately all missions to be undertaken	1000/Per mission										
Subtotal	**15,000** (5 sites x 3 x 500)										**15,000**
5. Survey/ case study & sub-contracts											
5.1 Please list separately all sub-contracts to be issued	10,000 Per contract										
Subtotal	**10,000**										**10,000**

6. Training & workshops											
6.1 Please list separately all training/workshops to be organized	8,000 (Per event)										
Subtotal	**8,000**										**8,000**
7. Equipment											
7.1 Please list separately all equipments to be purchased	4000 (Per Unit)										
Subtotal	**4000**										**4000**
8. Flowing Materials											
8.1 List separately all materials to be purchased	4000 (Per category)										
Subtotal	**4000**										**4000**
9. Office accommodation and administration											
9.1 Office rental costs											
9.2 Local transportation costs	1000 (Per month)										
9.3 Office supplies & expenses (stationery, utilities, phone etc.)	300 (Per month)										
Subtotal	**20,800**										**20,800**
TOTAL	**USD 95,600**										**95,600**

Annex B.2.6

Budget for the Project in Myanmar (US$)											
Expenses	**Unit**	**Grant**			**Counterpart fund in cash**			**Counterpart fund in kind**			**TOTAL**
		# of units	**Unit rate**	**Costs**	**# of units**	**Unit rate**	**Costs**	**# of units**	**Unit rate**	**Costs**	
1. Inception funds	Lump Sum										5000
Subtotal											
2. Consultants											
2.1 Please list all consultants employed under this project	Per person-month	3	1500	4500							
Subtotal				**4500**							4500
3. Management assistants											
3.1 Please list all management assistants employed under this project	Per person-month										
assistant	Per -month	5	500	2500							
stipend of scientists	Per - month	10	125	1250							
per-diem	Per -day	10	15	150							
Travel cost	Per-mission	5	1000	5000							
Subtotal				**8900**							8900
4. Study tour & travel expenses											
4.1 Please list separately all missions to be undertaken	Per mission										
Data acquisition in the pilot area		3	5000	15000							

International Remote Sensing Symposium		2	3000	6000							
Progress meeting of the project		3	5000	15000							
Attending the domestic symposium		3	800	2400							
Subtotal				**38400**							38400
5. Survey/ case study & sub-contracts											
5.1 Please list separately all sub-contracts to be issued	Per contract										
Subcontract- Ground truth survey for mapping and carbon storage estimation		1	32000	32000							
Subtotal				**32000**							32000
6. Training & workshops											
6.1 Please list separately all training/workshops to be organized	Per event										
Training workshop for forester and related technicians		2	5000	10000							
Subtotal				**10000**							10000
7. Equipment											
7.1 Please list separately all equipments to be purchased	Per Unit										
Subtotal											
8. Flowing Materials											
8.1 List separately all materials to be purchased	Per category										
High Resolution Optical Satellite Data											
High Resolution Radar Data											

Subtotal											
9. Office accommodation and administration											
9.1 Office rental costs	Per month										
9.2 Local transportation costs	Per month	24	100	2400							
9.3 Office supplies & expenses (stationery, utilities, phone etc.)	Per month	24	100	2400							
Subtotal				**4800**							4800
TOTAL				**98600**							**98600**

Annex B.2.7

Budget for the Project in Thailand (US$)											
Expenses	**Unit**	**Grant**			**Counterpart fund in cash**			**Counterpart fund in kind**			**TOTAL**
		# of units	**Unit rate**	**Costs**	**# of units**	**Unit rate**	**Costs**	**# of units**	**Unit rate**	**Costs**	
1. Inception funds	5,000	1	5,000	5,000							
Subtotal	**5,000**	**1**	**5,000**	**5,000**							**5,000**
2. Consultants											
2.1 Please list all consultants employed under this project	1000/person/month										
- Dr. Vivarad Phonekeo, AIT		1	19,200	19,200							
Subtotal	**19,200**	1	19,200	19,200							**19,200**
3. Management assistants											
3.1 Please list all management assistants employed under this project	**300/person/months**										
- Assistant 1 (Forest Survey)		1	300	4,800							
-Assistant 2 (Geo-informatics system operator)		1	300	4,800							
Subtotal	**9,600**	**2**	**300**	**9,600**							**9,600**
4. Study tour & travel expenses											
4.1 Please list separately all missions to be undertaken											
-Data acquisition in the field area	22,500	45	500	22,500							

Subtotal	**22,500** (5 persons x 3 times x 3 sites)	**45**	500	**22,500**							**22,500**
5. Survey/ case study & sub-contracts											
5.1 Please list separately all sub-contracts to be issued	6,000 Per contract										
-Satellite data processing and analysis		1	6,000	6,000							
-Ground survey		1	6,000	6,000							
Subtotal	**12,000**	2	6,000	12,000							**12,000**
6. Training & workshops	10,000										
6.1 Please list separately all training/workshops to be organized	10,000 (Per event)										
-Training workshop for forester and related technicians		1	10,000	10,000							
Subtotal	**10,000**	1	10,000	10,000							**10,000**
7. Equipment											
7.1 Please list separately all equipments to be purchased											
-Computer Desktop		1	1,200	1,200							
-Computer Notebook		2	1,500	3,000							
-External data storage		1	1,000	1,000							
-Digital camera		1	1,500	1,500							
Subtotal	**6,700**										**6,700**
8. Office accommodation and administration											
8.1 Local transportation costs	300 (Per month)	16	300	4,800							
8.2 Office supplies & expenses (stationery,	400 (Per month)	16	400	6,400							

utilities, phone etc.)											
Subtotal	**11,200**										**11,200**
TOTAL	**USD** 96**,200**										96**,200**

Note:

Assumptions: **a) Project duration is for 16 months**

b) Excludes cost to buy satellites images

Annex B.2.8

Budget for the Project in Viet Nam (US$)											
Expenses	**Unit**	**Grant**			**Counterpart fund in cash**			**Counterpart fund in kind**			**TOTAL**
		# of units	**Unit rate**	**Costs**	**# of units**	**Unit rate**	**Costs**	**# of units**	**Unit rate**	**Costs**	
1. Inception funds	Lump Sum			1,000							
Subtotal				**1,000**							**1,000**
2. Consultants	Per person-month										
2.1. RS data processing consultants		1	400	400							
2.2. Ground truth database consultants		1	400	400							
2.3.Mid resolution forest mapping consultants		1	400	400							
2.4. Carbon storage baseline estimation		1	400	400							
2.5. Algorithm development and training		1	400	400							
Sub total				**2000**							**2000**
3. Management assistants	Per person-month										
3.1- Project Director	‘’	12	1,000	12,000							
3.2- Project Technical Assistants	‘’	12	800	9,600							
3.3- Accountants	‘’	12	300	3,600							
3.4-Driver, office assistants…	‘’	12	200	2,400							
Subtotal	**“**	**48**		**27,600**							**27,600**
4. Study tour & travel expenses											

Data acquisition in the field area		2	3000	6,000							
International Remote Sensing Symposium		2	810	1,620							
Progress meeting of the project		2	1,400	2,800							
Attending the domestic symposium		2	540	1,080							
Sub total				**11,500**							**11,500**
5. Survey/ case study & sub-contracts											
5.1- Survey/ case study & sub-contracts: Mid-resolution satelite image classifiction and Pilot site forest types mapping 2005 and 2010	Per contract	1	25,000	25,000							
5.2-Survey/ case study & sub-contracts: Timber Volume and carbon storage estimation on test site.	Per contract	1	25,000	25,000							
Subtotal				**50,000**							**50,000**
6. Training & workshops											
Domestic workshop to be organized	Workshop	1	5,000	5,000							
Subtotal				**5,000**							**5,000**
7. Equipment											
7.1. PC	Per Unit	1	1000	1000							
7.2. Laptop	Per Unit	1	2000	2000							
7.3. GPS	Per Unit	2	500	1000							
7.4. Other (Table; telephone; fax…)				1000							
Subtotal				**5,000**							**5,000**
8. Flowing Materials											
Paper A4	ram	50	5	250							

Ink set for black laser printing	set	5	100	500							
Color Ink for Field maps printing	set	3	150	450							
Subtotal				**1,200**							**1,200**
9. Office accommodation and administration											
9.1 Office rental costs	Per month										
9.2 Local transportation costs	Per month	12	200	2,400							
9.3 Office supplies & expenses (stationery, utilities, phone etc.)	Per month	12	200	2,400							
Subtotal				**4,800**							**4,800**
TOTAL				**108,100**							**108,100**

Notes:

Assumptions: a) Project duration is for 24 months

b) Excludes cost to buy satellites images

Annex B.2.9

Budget for the Project in Yunnan, China (US$)											
Expenses	**Unit**	**Grant**			**Counterpart fund in cash**			**Counterpart fund in kind**			**TOTAL**
		# of units	**Unit rate**	**Costs**	**# of units**	**Unit rate**	**Costs**	**# of units**	**Unit rate**	**Costs**	
1. Inception funds	Lump Sum										
Subtotal											
2. Consultants											
2.1 Please list all consultants employed under this project	Per person-month	36	120	4320							
Subtotal				**4320**							**4320**
3. Management assistants											
3.1 Please list all management assistants employed under this project	Per person-month										
salary	Per -month	4	500	2000							
per-diem	Per -day	15	30	450							
Travel cost	Per-mission	4	500	2000							
accommodation cost	Per -day	10	45	450							
Subtotal				**4900**							**4900**
4. Study tour & travel expenses											

4.1 Please list separately all missions to be undertaken	Per mission										
Data acquisition in the field area	Per person-month	6	1000	6000							
International Remote Sensing Symposium	per person										
Progress meeting of the project	per person	1	1000	1000							
Study in aboard											
Attending the domestic symposium	per person	4	1000	4000							
Subtotal				**11000**							**11000**
5. Survey/ case study & sub-contracts											
5.1 Please list separately all sub-contracts to be issued	Per contract										
sub-contracts											
Survey study	per person-month	10	1000	10000							
case study	per person-month	2	1000	2000							
Subtotal				**12000**							**12000**
6. Training & workshops											
6.1 Please list separately all training/workshops to be organized											
2011 workshop	Per event	1	2000	2000							
2012 workshop	Per event	1	2000	2000							
2011 training workshop	Per event	1	3000	3000							
2012 training workshop	Per event	1	3000	3000							

Subtotal				**10000**							**10000**
7. Equipment											
7.1 Please list separately all equipments to be purchased	Per Unit										
Lenovo computer											
Laptop		2	1800	3600							
Seagate Hard Disk(1000GB)		3	300	900							
Envi Software											
Scanner		1	300	300							
Electrograph		1	400	400							
HP LaserJet Printer		1	500	500							
Subtotal				**5700**							**5700**
8. Flowing Materials											
8.1 List separately all materials to be purchased	Per category										
SPOT5 Satellite Data											
Radarsat-2 Data											
Topographic Map(100Km*100Km)											
Subtotal											
9. Office accommodation and administration											
9.1 Office rental costs	Per month										

9.2 Local transportation costs	Per month	36	50	1800							
9.3 Office supplies & expenses (stationery, utilities, phone etc.)	Per month	36	30	1080							
Subtotal				**2880**							**2880**
TOTAL				**50800**							**50800**

Annex C: Work plan

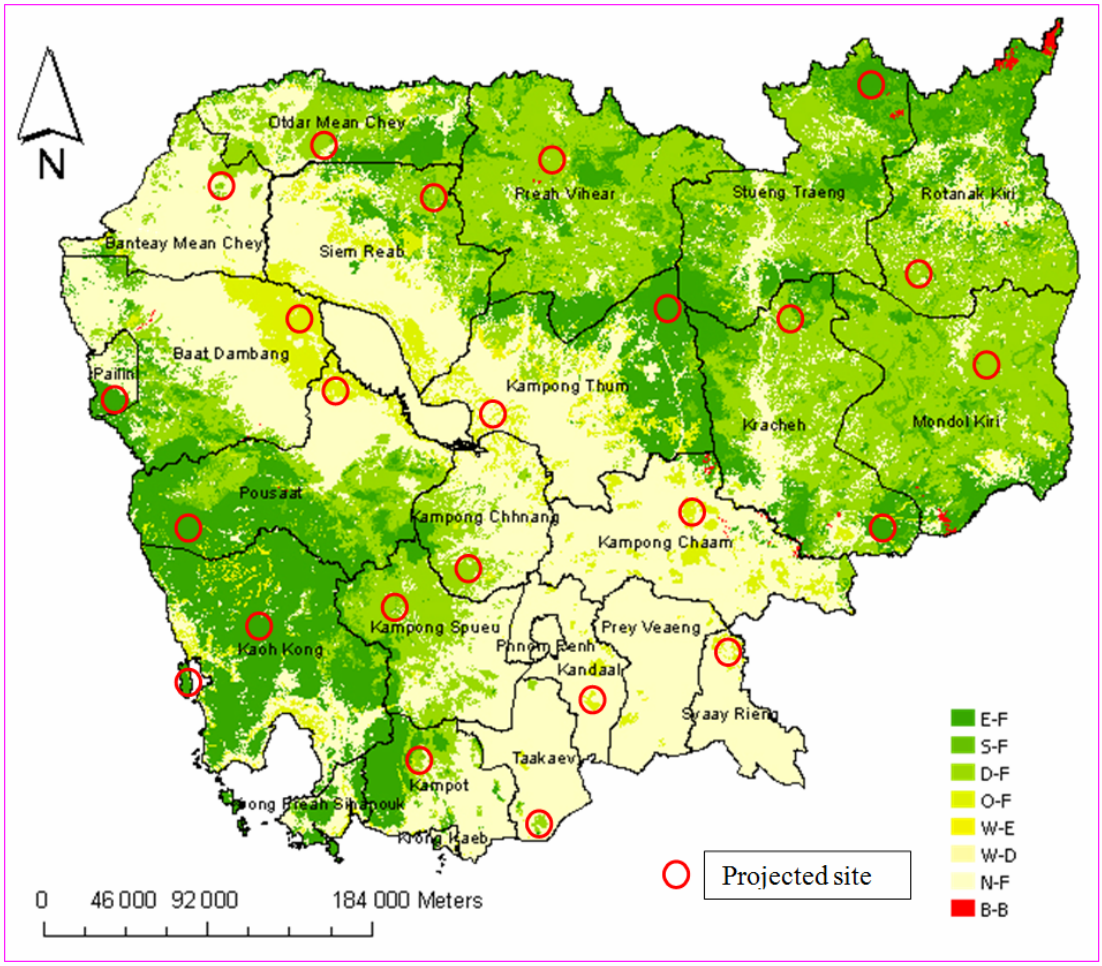
Project Title:																									
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	Leading partner
Output 1																									
Activity 1																									CAF & UMD
Activity 2																									CAF
Output 2																									
Activity 1																									CAF & GOFC GOLD
Output 3																									
Activity 1																									CAF
Activity 2																									each countries participants
Output 4																									
Activity 1																									CAF & UMD
Activity 2																									each countries participants

Output 5																									
Activity 1																									CAF & UMD
Activity 2																									each countries participants
Output 6																									
Activity 1																									CAF
Output 7																									
Activity 1																									CAF & GOFC GOLD
…….																									

Cambodia

Description of selected site

Cambodia lies between 10° and 16° north and 102° and 108° east. The climate is tropical monsoon; the rainy season extends from May to October and the dry season from November to April. Between 1996 and 2000, the mean annual rainfall and temperature were 1,700 mm and 28°C. The selected site will be 24 permanent sample plots for monitoring forest canopy change in 24 different provinces as shown in the cycle red in the below figure. Each plot consist 2 hectares. 24 plots were located in different forests. Some of them will select in disturbed and non-disturbed forests. Some of all plots may change the position depending the level of disturbance and clear cutting. Each main plot will be 200 × 100 m and contained a 20 × 20 m sub-plot. All trees with diameter at breast height (DBH) of 10-29.9 cm in the sub-plot and ≥30 cm in the main plot will be measured and recorded. New trees in each of the main plot and sub-plot with DBH ≥30 cm and ≥ 10 cm will also measure for the second time measurement. Missing or dead trees will record as natural death or human disturbance (illegal logging).



	Forest Types	Forest Area	%
1	Evergreen forest (E-F)	3,668,902	20.20
2	Semi evergreen forest (S-F)	1,362,638	7.50
3	Deciduous forest (D-F)	4,692,098	25.80
4	Other forest (O-F)	1,007,143	0.20
Total Forest Area		10,730,781	59.09
Non Forest		7,429,893	40.91
TOTAL AREA		18,160,674	100

Guangxi

Ground Sites Description for the Pilot Project in Guangxi Province, China

Three sites were chosen in Guangxi province for the pilot project. These sites could to represent the different and typical forest types available in this area. Table 1 shows the summary of information of the different sites and map in Figure 1 indicates their location. Further site description for each site is highlighted in the following section.

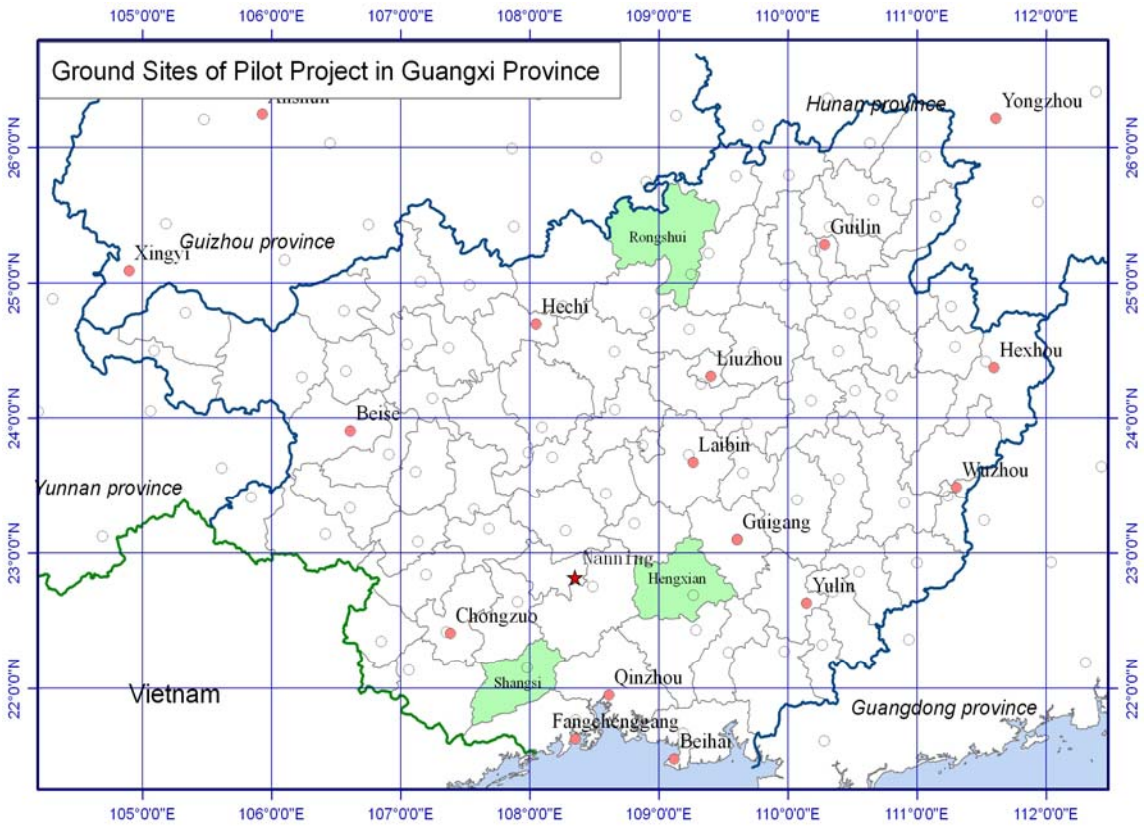


Figure 1. Location of the pilot project sites in Guangxi province, China

Table 1. Brief Information of Ground Sites in Guangxi province for Pilot Project

Name	Location (Lat, Lon) of 4 corners	Forest types and percent coverage	Area/ hectares	administration designation
Shangsi county	Lat:21°43'39"~22°22'36" Long:107°32'16"~108°16'36"	North tropical evergreen broad-leaved forest, 48.36%	282,900	Commercial forest and protected forest
Hengxian county	Lat: 22°29'15"~23°8'6" Long:108°47'37"~ 109°36'57"	South subtropical evergreen broad-leaved forest, 46.27%	344,900	Commercial forest and protected forest
Rongshui county	Lat:24°49'5"~25°44'1" Long:108°35'36"~109°28' 37"	Subtropical evergreen broad-leaved forest, 75.88%	436,500	commercial forest and protected forest

A. Shangsi County

1. Description of the study area

Shangsi county is located in the south part of Guangxi province, between 21°43′39″ N to 22°22′36″N and 107°32′16″W to 108°16′ 36″W. The county has an area of 282,900 ha, from which about 187,400 ha of forest land, and the forest coverage is about 48.36%. In addition, the forest land is composed of 119,700 ha commercial forest and 67,700 ha protected forest (Field inventory, 2009).

Most of the study area is Hilly land with the altitude 40-850 m. The natural forest type is North tropical evergreen broad-leaved forest, among dominant tree species are Pinus massoniana, yunnanensis, P. yunnanensis var. tenuiformis, eucalypt and broad-leaved trees. The area of pine species, eucalypt and broad-leaved trees are approximate to 48,000 ha, 29,700 ha and 10,000 ha respectively.

The study area also including a part of nature reserve namely Shiwandashan National nature Reserve which specially protects the forest ecosystem. The nature reserve is located at the southern part of the County. It currently occupies an area of approximately 38,200 ha in the County. And the core zone of the nature reserve is located in the study area entirely.

2. Partners working in the area

Local partners

GXFIPI (Guangxi Forest Inventory and Planning Institute): Institution under the supervision of forest department of local government.

Activities: Research Project called "The study of key technologies for forest resource monitoring and inventory based on RS, GIS and GPS"

Presence: since 2007

3. Field works

○**NFI:** 54 permanent plots with 0.667 ha in this area, established in 1977. The national government organizes re-census every 5 years and trees with dbh 5 cm and above identified and measured.

○**Planning and Management Inventory:** The local government organizes re-census every 10 years. It measures every sub-compartment with the average dbh, height, basal area, etc.

4. GIS and Remote Sensing information

· **GIS:** complete. Sub-compartment layers covered the whole county based on field inventory in 1999 and 2009.

· **Satellite imagery:**

○SPOT 5 - 2007

B. Hengxian county

1. Description of the study area

Hengxian county is located in the south of Guangxi province, between 22°29′15″ N to 23° 8′6″N and 108°47′37″W to 109°36′ 57″W. The county has an area of 344,900 ha, from which about 169,100 ha of forest land, and the forest coverage is about 46.27% . In addition, the forest land is composed of 151,100 ha commercial forest and 18,000 ha protected forest (Field inventory, 2009).

Most of the study area is Hilly land and plain with the altitude 40-500 m. The natural forest type is southern subtropical evergreen broad-leaved forest, but now the entire area is almost covered by planted vegetation. among dominant tree species are Pinus massoniana, eucalypt and broad-leaved trees. The area of pine species, eucalypt and broad-leaved trees are approximate to 69,000 ha, 48,500 ha and 8,600 ha respectively.

Especially, eucalypt as a very fast-growing tropical tree species is used for forest plantations broadly in this area. In common sense, the harvest cycle of eucalypt in this region is less than 5 years. Currently, more and more farmers and companies are planting eucalypt like agriculture activities in the forest land because of its high productivity and economic benefits.

2. Partners working in the area

Unknown.

3. Field works

○**NFI:** 75 permanent plots with 0.667 ha in this area, established in 1977. The national government organizes re-census every 5 years and trees with dbh 5 cm and above identified and measured.

○**Planning and Management Inventory:** The local government organizes re-census every 10 years. It measures every sub-compartment with the average dbh, height, basal area, etc.

4. GIS and Remote Sensing information

· **GIS:** complete. Sub-compartment layers covered the whole county based on field inventory in 1999 and 2009.

· **Satellite imagery:**

○ALOS - 2007

C. Rongshui county

1. Description of the study area

Rongshui county is located in the northern part of Guangxi province, between 24°49′5″ N to 25° 44′1″N and 108°35′36″W to 109°28′ 37″W. The county has an area of 436,500 ha, from which about 341,900 ha of forest land, and the forest percent coverage is about 74.30%. In addition, the forest land is composed of 261,700 ha commercial forest and 80,200 ha protected forest (Field inventory, 2009).

Most of the study area is Hilly land. The forest type is Northern tropical evergreen broad-leaved forest, among dominant tree species are Pinus massoniana, Chinese fir and broad-leaved trees.

The study area also including a part of nature reserve namely Jiuwanshan National nature Reserve which specially protects the forest ecosystem. The nature reserve is located at the southwest part of the County. It currently occupies an area of approximately 25,212 ha, and the core zone of the nature reserve is located in the study area.

2. Partners working in the area

Unknown.

3. Field works

○**NFI:** 98 permanent plots with 0.667 ha in this area, established in 1977. The national government organizes re-census every 5 years and trees with dbh 5 cm and above identified and measured.

○**Planning and Management Inventory:** The local government organizes re-census every 10 years. It measures every sub-compartment of the average dbh, height, basal area, etc.

4. GIS and Remote Sensing information

· **GIS:** complete. Sub-compartment layers covered the whole county based on field inventory in 1999 and 2009.

· **Satellite imagery:**

○SPOT 5 – 2007

Laos

Ground Sites Description for the Pilot Project in Laos

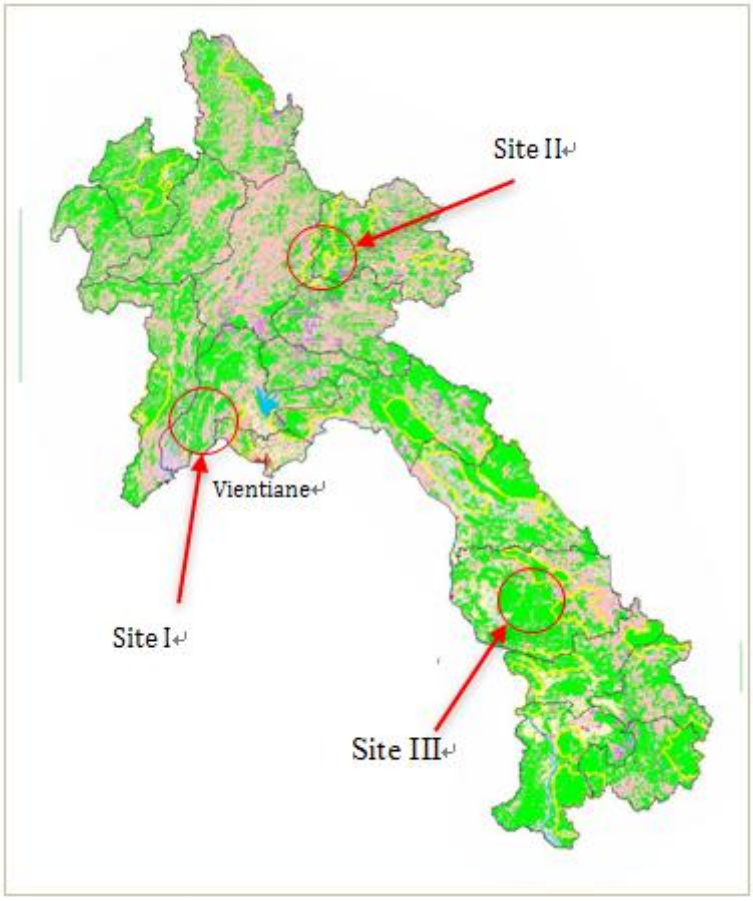
1 INTRODUCTION

Under the Forest Cover and Carbon Mapping in the GMS and Malaysia Project of the APFNet, the Faculty of Forestry as a partner prepared this proposal to get funding support for the implementation. We propose to conduct study in three sites to be reprehensive of forest cover types of Lao PDR.

Site I: Sangthong District, the district located in the central part of the country approximately 70 Kilometer from Vientiane. The forest type is mainly mixed deciduous and bamboo. The forest cover types can be representative of the forest cover in the central part of the country. Currently, there are a number of projects under the government and international organization such as Nam Thone Watershed Management Project, Participatory Land Use Planning by LMNA and so forth.

Site II: Nam Et Protected Area, this site is part of the Nam Et–Phou Luey National Protected Area, it was established in 1993 under the decree No.164/PMO. This study site is one of the top three most biologically important protected areas in Lao PDR and among the top ten in the South East Asia region. Though there have been no detailed flora and fauna surveys, it is initially estimated that about 314 plant species, 243 genera and 106 families exist in the area. There are also many plant species are known as economical valuable. Major forest cover types include upper evergreen, mixed evergreen and deciduous. Many parts of the area contain mosaic of bamboo and fallow forest. The topography of the study area is hilly and steep mountain. The altitude ranges between 336 and 2257 meters above mean see level.

Site III: Songkhone District in Savanakhet province is the third site proposes to conduct study under this project. The forest types can be representatives of the forest cover types in the southern part of the country. The forest covers in this area are mainly dipterocarpus and savanna. Presently, the forest is managed by the Sustainable Forest Management and Rural Development Project (SUFORD).


Site II
Vientiane
Site I
Site III

Malaysia

Location and Site Description for The Proposed Demonstration Sites in Peninsular Malaysia

1 Introduction

The proposed demonstration sites in Malaysia were chosen primarily to represent the different forest types available in this country namely the inland hill dipterocarp forest, the lowland dipterocarp forest, the peat swamp forest and the mangrove forest. Table 1 shows the summary of information of the different sites.

Table 1. Summary of information for the proposed demonstration sites in Peninsular Malaysia.

Name	Location (Lat, Lon) of 4 corners		Forest types	Administration designation
	Upper left (UL)	Lower Right (LR)		
1.Pasoh Forest Reserve, Negeri Sembilan	Lat: 3° 00' 39" Long: 102°16' 44"	Lat : 2° 57'38" Long : 102° 20'04"	Lowland Dipterocarp	Permanent Forest Reserve
2. Semangkok Forest Reserve, Selangor	Lat: 3° 37'25" Long: 101° 43'55"	Lat : 3° 36'54" Long : 101° 44"33"	Hill Dipterocarp Forest	Permanent Forest Reserve
3. Perak Integrated Timber Complex (PITC), Perak	Lat: 5°32'11" Long: 101°34'45"	Lat : 5° 30'26" Long : 101° 36'55"	Hill Dipterocarp forest	Permanent Forest Reserve
4. Pekan Peat Swamp Forest,	Lat: 3°31'36" Long: 103°07'26"	Lat : 3° 12'38" Long : 103° 26'20"	Peat swamp forest	Permanent Forest Reserve

Pahang				
5. Matang Mangrove forest, Perak	Lat: 4°57'55" Long: 100°27'47"	Lat : 4° 31'29" Long : 100° 43'16"	Mangrove forest	Permanent Forest Reserve
6. Loagan Bunut National Park, Sarawak	Lat: 3°0' 00'' Long: 114°09' 00''	Lat: 3°44' 00'' Long: 114°17' 00''	Peat swamp forest	Permanent Forest Reserve
7. Klias Peninsular, Sabah	Lat: 5°12' 00'' Long: 115°22' 00''	Lat: 5°30' 00'' Long: 115°42' 00''	Peat swamp forest	Permanent Forest Reserve
8. Danum Valley Conservation Area (DVCA), Sabah	Lat: 4° 50' 10" Long: 117° 22' 11"	Lat: - Long: -	Inland Forest	Permanent Forest Reserve
9. Kuching Wetlands National Park (KWNP), Kuching	Lat: 1° 38' 24.2" Long: 110° 17' 59"	Lat: - Long: -	Mangrove forest	Permanent Forest Reserve
10. Sepilok Forest Reserve, Sabah	Lat: 5° 48' 0" N Long: 117° 57' 0" E	Lat: - Long: -	Mangrove forest	Permanent Forest Reserve

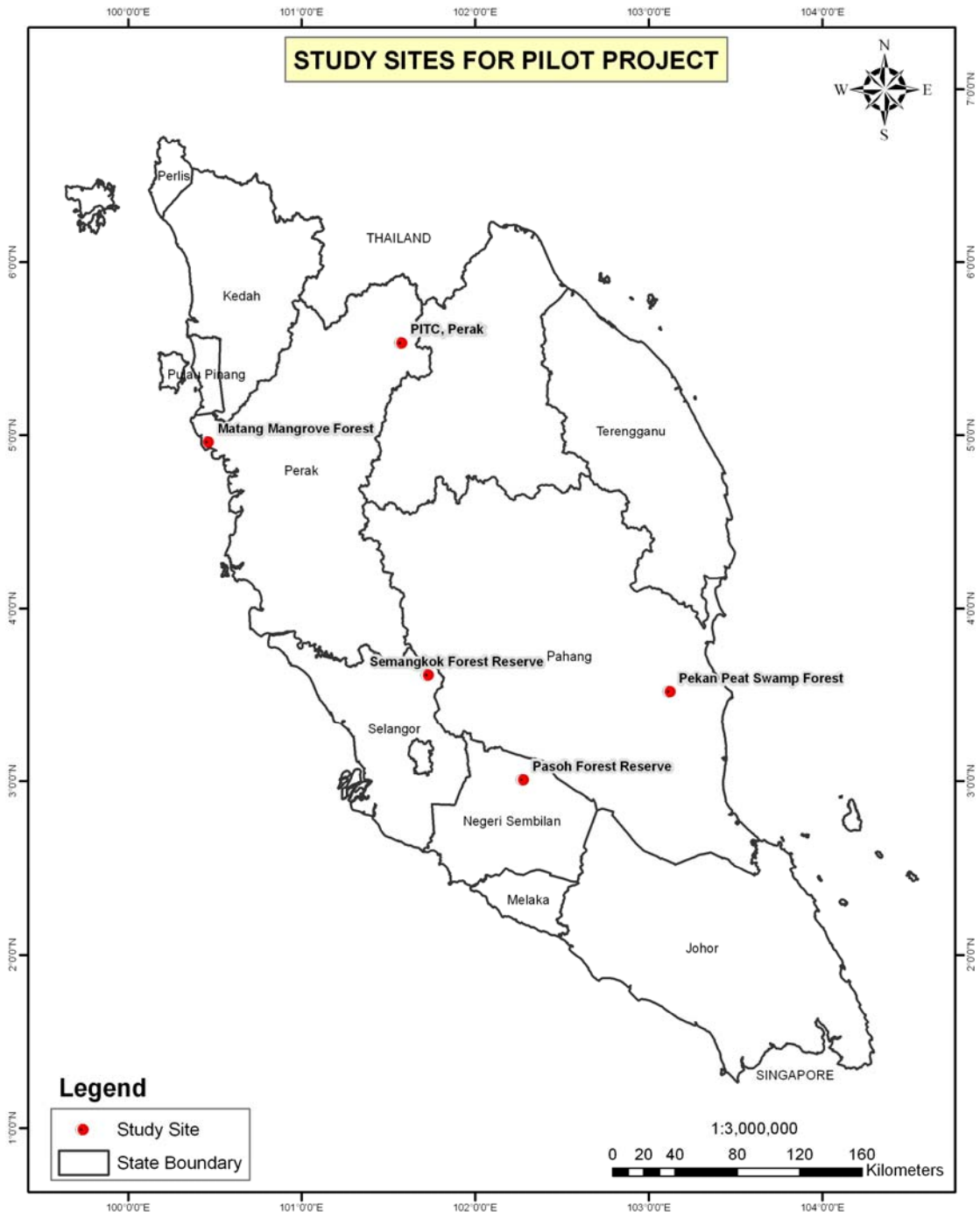


Figure 1-a. Location of the proposed demonstration sites in Peninsular Malaysia

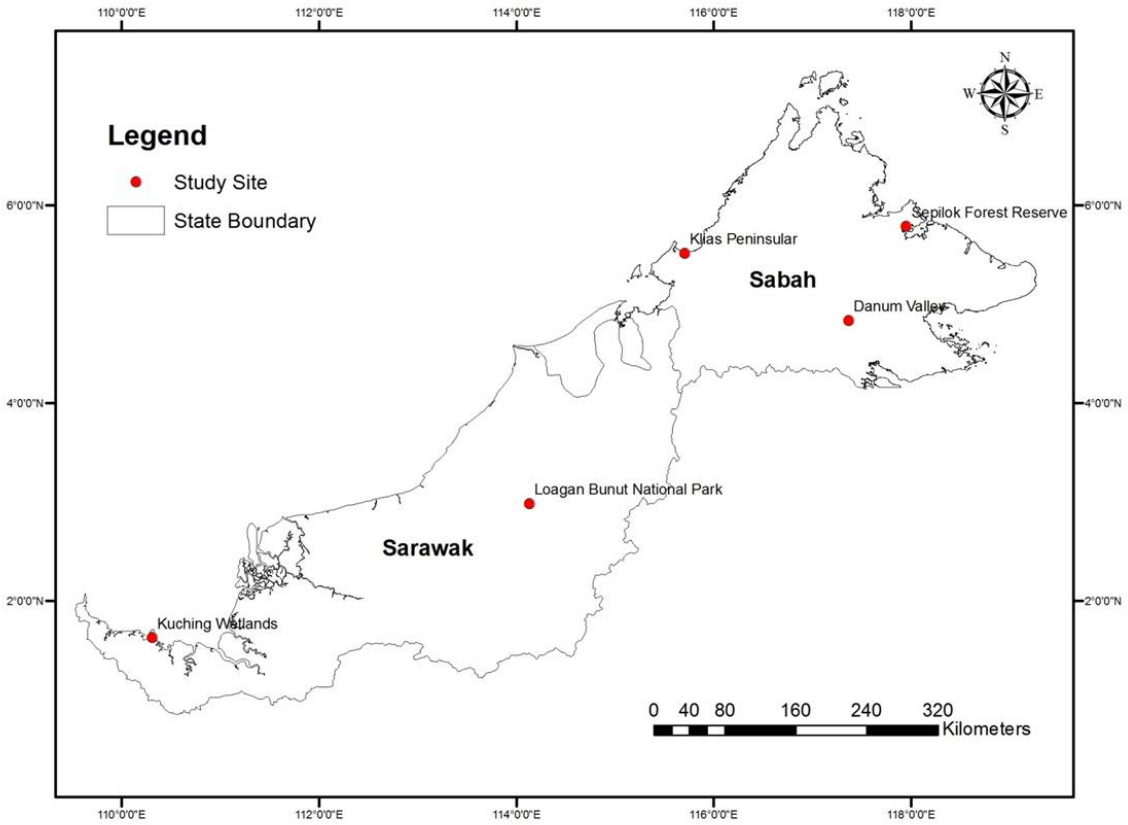


Figure 1-b. Location of the proposed demonstration sites in Peninsular Malaysia

2 Site Descriptions

i. Pasoh Forest Reserve, Negeri Sembilan

The Pasoh Forest Reserve in Negeri Sembilan is under the management of Negeri Sembilan Forestry Department, located at the southeast of Kuala Lumpur. It is a lowland Dipterocarps forest characterized by family dominance of Dipterocarpaceae, and by three tree layers (emergent, main-storey and understorey trees). In 1985, a joint FRIM and Smithsonian Tropical Research Institute (STRI) study on plant population dynamics was initiated. A 50-ha permanent plot contains 814 species, 290 genera and 78 families. This forest reserve has attracted many local and foreign scientists to conduct long term collaborative studies of which some are still on going on biodiversity sustainable management of tropical forests and the role of tropical forests as carbon sinks. Today the Pasoh research plot co-managed by FRIM and the Centre for Tropical

Forest Science CTFS is part of a global network of over 40 forest research plots around the world for study of tropical and temperate forest function and diversity

ii. Semangkok Forest Reserve, Selangor

The Semangkok Forest Reserve is located in the state of Selangor, about 60 km north of Kuala Lumpur, Malaysia. It is a hill dipterocarps forest characterized by family Dipterocarpaceae and by three layers of tree ((emergent, main-storey and understorey trees). One notable emergent trees of found in the forest is *Shorea curtisii.*

iii. Perak Integrated Timber Complex (PITC) , Perak

The PITC is a FSC-certified logging concession located within Temenggor Forest Reserve in the state of Perak, Malaysia. It consists of lower and upper hill dipterocarp forest. The landscape is varied, with riverine plains, gentle and steep slopes, ridges and several large and fast flowing rivers on the northern and eastern boundaries.

iv. Pekan Peat Swamp Forest, Pahang

The Pekan Peat swamp forest is located in the state of Pahang , about 300 km from Kuala Lumpur. The area has been the subject of global conservation interest as it contains an outstanding example of one of the world's most threatened wetland habitats. Ecologically it has diverse ecosystems includes not just peat swamp forest but the full spectrum of habitats from shallow coastal waters to the mosaic of wetland and dryland habitats.

v. Matang Mangrove Forest, Perak

Covering an area of more than 36,000 hectares and lying on the northern coast of Perak it has been recognised as one of the most well managed expanse of

mangrove swamps in the world. Within this mangrove swamp are found multitudes of tree species, birds and marine life which are a haven for nature lovers.

vi. Loagan Bunut National Park, Sarawak

Loagan Bunut National Park is a national park in Borneo, Malaysia. It is in the state/region of Sarawak. The Loagan Bunut National Park, Sarawak is located some 120 km southeast of Miri between the Tinjar and Teru rivers. The 10,736 ha area was logged in the 1970s before being gazetted as a national park in 1990. Initiated some 7,000 years ago, the peatland is predominantly covered by peat swamp forest (PSF) with a complex mosaic of wetland habitats including the 650 ha scenic lake, Loagan Bunut, at the centre. The PSF is mainly rain-fed with the water table close to or above the peat surface throughout the year, fluctuating with the intensity of rainfall, and the rate at which water is removed as governed by hydraulic conductivity.

vii. Klias Peninsular, Sabah

The Klias Peninsula is located on the coast of south-western Sabah, forming the north-eastern shore of Brunei Bay, the south-western shore of Kimanis Bay and bounded on the inland side by Banjaran Crocker and on the western side by a ridge on a higher ground. Four major natural vegetation types occur in the area namely mangrove forest in coastal area, nipa swamp, freshwater swamp forest and peat swamp forest. From the total of 90,000 ha of Klias peninsula area, A continuous flat area of peat swamp (60,700 ha), freshwater alluvium (14,500 ha) and coastal transitional swamp (28,500 ha) including 8,700 ha of largely undisturbed mangrove.

viii. Danum Valley Conservation Area (DVCA), Sabah

Covering almost 45,000 hectares (450 km2), DVCA is one of the largest and most important areas of protected primary lowland rainforest in Southeast Asia. The forest of DVCA is dominated by enormous dipterocarp trees that can reach heights of 80 m or more and, being so well protected and buffered (DVCA) is surrounded on all sides by natural forest), it has fully intact fauna comprised by some of Borneo's most iconic (and threatened) species including orang-utan, Asian Pygmy Elephant, Sumatran Rhino, and Clouded Leopard. Bird diversity is exceptionally rich with over 340 recorded species in the Danum Valley. Flora and fauna are typical of the everwet Southeast Asian tropics. The lowland forests of Danum Valley are dominated by canopy trees of the family dipterocarpaceae, but have a highly diverse flora consisting of approximately 7,000 species of flowering plant. On the eastern border of DVCA is the Danum Valley Field Centre, which is probably the leading tropical forest

ix. Kuching Wetlands National Park (KWNP), Sarawak

Kuching Wetlands National Park (KWNP) is a national park in Malaysia. It is the remains of the former Sarawak Mangrove Forest Reserve which covered 170 km².Located 30 km from Kuching, the Wetlands National Park was gazetted in 1992 and covers an area of 66.1 km² on the estuarine reaches of the Sibu Laut and Salak rivers. The park is composed of coastal, marine and freshwater ecosystems. The predominantly saline and deltaic mangrove system includes an extensive network of marine waterways and tidal creeks, formed by the interconnecting rivers of Sungei Sibu-Laut, Batang Salak and Sungei Santubong that form the boundary of the park. Some small patches of heath forest are found within the park.

x. Sepilok Forest Reserve, Sabah

Sepilok Forest Reserve, situated in the state of Sabah in East Malaysia on Borneo island, was established in 1931 for experimenting forestry techniques. In 1964 the

Sabah Forestry Department set up the orang-utans sanctuary, and in 1988 the Wildlife Department of Sabah took over the administration and management of the sanctuary. It has 4,300 hectares of forest land which is at the edge of the Kabili-Sepilok Forest Reserve. The region is comprised of mangrove and dipterocarp forest, hill forest and tropical heath forest.

3 Current dataset and product information for demonstration sites

Table 2 Available remote sensing data over selected test site

Site Name	Sensor type	Year	Resolution
1.Pasoh Forest Reserve	SPOT 5	2008	20 m
2. Semangkok Forest reserve	SPOT 5	2008	20 m
3. PITC, Perak	SPOT 5	2008	20 m
4. Pekan Peat Swamp Forest	SPOT 5 LIDAR	2008 2010	20m
5. Matang Mangrove Forest	Landsat SPOT 5	2002 2008	20 m
6. Loagan Bunut National Park, Sarawak	Landsat	2005	30m
7. Klias Peninsular, Sabah	Landsat	2005	30m
8. Danum Valley Conservation Area (DVCA), Sabah	Landsat	2005	30m
9. Kuching Wetlands National Park (KWNP), Kuching	Landsat	2005	30m
10. Sepilok Forest Reserve, Sabah	Landsat	2005	30m

Table 3 Existing forest cover maps of Ground Sites for Pilot Project – Malaysia

Year	Scale	Classification type	Validation method	Availability to demonstration project
Matang – 2009	1:50,000	Supervised classification	Field survey	available
Pekan – 2005	1:50,000	Supervised classification	Field survey	available
Pasoh – 2002	1:50,000	National forest inventory	Field inventory	available
Semangkok – 2002	1:50,000	National forest Inventory	Field inventory	available
PITC – 2002	1:50,000	National forest Inventory	Field inventory	available

Table 4 National forest mapping – Peninsula Malaysia

Year	Remote Sensing data	Scale/ Resolution	Ground plots	Availability to demonstration project	Note
National Forest Inventory NFI (1 and 2) (1972 and 1982)	Aerial photographs	(1:20,000)	Random cluster sampling on 11 forest stratum	Final map with scale of 1:250,000	Cover the entire Peninsular Malaysia. Random cluster sampling, each cluster included twelve sample plots of 50 x 20 m, In order to select sampling points, a five minute grid was superimposed on broad forest type maps of scale 1:250,000. All trees having a minimum Dbh of 30 cm were enumerated in all twelve sample plots while trees of Dbh between 15 cm and 30 cm were enumerated in three special plots of 50 m x 50 m. Parameters recorded: stump height, diameter at breast height, log quality, log length. Additional measurements, as well as the occurrence of bamboos and rattans, were also recorded in smaller special plots
NFI 3 (1991)	LANDSAT TM	30 m resolution	Random cluster sampling on 11 forest stratum	Final map with scale of 1:250,000	Cover the entire Peninsular Malaysia
NFI 4 (2002)	LANDSAT TM AND SPOT 5	30 m and 20 m resolution	Random cluster sampling on 11 forest stratum		The sampling design consists of permanent sample units (satellites) of square shape with one sample plot in each corner. Each sample plot consists of a sample circle for small size trees and a point sample. Each sample unit consists of four (4) sample plots and three (3) sample strips. Each sample plot is a combination of a fixed sample circle of 4 m in radius and a point reference. The distance between the sample plot is 100 m. The total sample area is 0.12 hectare. Within the sample

					circle only commercial trees <10 cm Dbh and >1.5 m in height and some key medicinal plants are assessed.

Table 5 Ground measurements in Ground Sites for Pilot Project – Malaysia

Site Name	Year	Type of ground measurements*	Sampling approach	Plot size	Measured parameters	On-going research
1.Pasoh Forest Reserve	2005	Permanent sample plot (PSP)	Systematic sampling	50 ha	All trees 1 cm dbh and above identified, measured and mapped	On-going and re-census every 5 years
2. Semangkok Forest reserve	1993-2005	Long term ecological plot	Systematic sampling	4 ha	Tree with 10 cm dbh identified and measured	On-going
3. PITC, Perak	2008	Temporary plot	Systematic sampling	2 ha	Trees with dbh 10 cm and above identified and measured	
4. Pekan Peat swamp forest	2010	Temporary plot	Systematic sampling	100 ha	Ramin Trees with dbh 20 cm and above measured and mapped	
5. Matang mangrove forest	2005	Temporary plot	Random sampling	Plot less sampling	Trees identified and dbh measured	

*NFI plot, permanent plot, temporary plot ……

Thailand

Thailand is located in a tropical and temperate zone and is essentially a forest country. The forests are divided into 2 main categories such as tropical evergreen forest and deciduous forest.

The evergreen forests are divided into 4 main types such as tropical evergreen forest, coniferous forest or pine forest (PN), swamp forest (SW) and beach forest (BC). The tropical evergreen forest can be classified into 4 types such as moist evergreen forest (ME), dry evergreen forest (DE) and hill evergreen forests (HE). The SW can be further classified into 2 types such as peat swamp forest (PSW) and mangrove forests (MG). The Deciduous forests are classified into 3 types such as mixed deciduous forests (MD), dry Dipterocarp forests (DD) and savannah (SV).

The ME forests are mainly distributed in the southern and eastern region of Thailand. The forest consists of 3 stories such as upper, lower and undergrowth. The upper storey is composed of large trees, the lower storey is composed of grasses and various kinds of palms, climbers, shrubs and bamboos. A most prominent feature in these forests is the widespread occurrence of the family Dipterocarpaceae.

The DE forests are mainly distributed from Chumporn province, the upper southern region of Thailand, towards the north at the altitude of 100 to 800 metres. The dominant species are *Dipterocarp* trees. The DE characteristic is same as ME, there are only species composition within the forest and moisture different.

The HE forests are distributed mainly in northern Thailand at an elevation of 1,000 metres and upward. The forest consist of many kinds of oaks and chestnuts (*Quercus, Lithocarpus*, and *Castanopsis*), which almost always form an important part of the forests.

The PN forests are generally distributed all over northern and central Thailand at the elevation from 700 to 1,000 metres and upward and are occasionally found mixed with the DD. This kind of forest also can be found in north eastern Thailand in a flat plain mixed with the DD. There are only 2 species of pine found in Thailand such as *Pinus kesiya* and *P. merkusii*.

The MG occurs on thick muddy tidal swamps at the estuaries located on both coastal area the Andaman Sea and Gulf of Thailand. The dominant species of this forest are *Rhizophora mucronata* and *R. speciosa*. The MG plays an important role as it is nursery and shelter for aquatic animals and at present it is recognized as a wind and tidal break since the tsunami hit many countries in Asia.

The PSW occurs both in central and southern Thailand, it can be found landward next to MG where litters and organic matters composite in the fresh water swamp.

Table 1 Brief Information of Ground Sites for Pilot Project

Name	Location (Lat, Lon) of 4 corners	Forest types and percent coverage	area	administration designation*
Ngao Demonstration Forest, Lampang Province	UL 19.08°, 99.74° LL 18.33°, 99.74° UR 19.50°, 100.50° LR 18.33°, 100.08°	Dry Dipterocarp Forest Mixed Deciduous Forest Dry Evergreen Forest	1,751 sq.km	Demonstration Forest designated under Department of National Park, Wildlife and Plant Conservation
Mangrove Community Forest at Mount of Vein River, Chantaburi Province	UL 12.36°, 102.33° LL 12.33°, 102.33° UR 12.36°, 102.36° LR 12.33°, 102.36°	Mangrove Forest	6 sq.km	Community Forest designated under Royal Forest Department
Pha Taem National Park, Ubon Ratchathani	UL 15.73°, 105.45° LL 15.38°, 105.48° UR 15.73°, 105.63° LR 15.38°, 105.63°	Dry Dipterocarp Forest Mixed Deciduous Forest Dry Evergreen Forest	340 sq.km	Protected Forest designated under Department of National Park, Wildlife and Plant Conservation

* protected forest, private forest, commercial forest

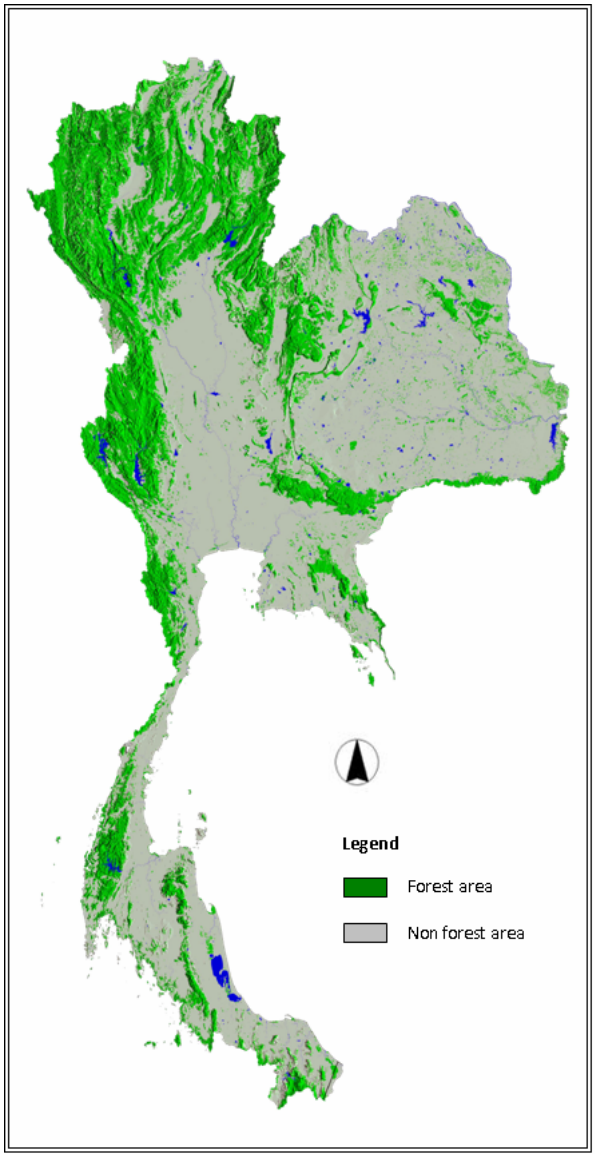
The MD forests are generally distributed from central toward northern Thailand. The most famous tree, teak, can be found in this forest. It is normally composed of bamboos and many kinds of shrubs.

The DD forests are mainly distributed in northern, central and northeastern Thailand, where the latteristic soil occurs. It has a great similarity in general type throughout the country due to the same soil. Every year forest fire hit and destroys the undergrowth such as grasses and herbs, but it causes only little damage to the trees because their bark is very thick and hard. There is a conflict in opinions that forest fire will destroy or maintain this kind of forest.

The SV forest occurs in the area where soil is poor in fertility or had been destroyed by forest fire. Only a few big trees appear in this type of forest. Grass dominates the

undergrowth. This forest is found in only a few places and preservation is required as it is a wildlife grazing area.

The BC forests are distributed mainly along the seacoasts on sandy beaches. The long strip shape distribution can reduce hazards from strong wind and tidal wave. The dominant tree is *Casuarina equisetifolia*.



Viet Nam

Details of the Project Proposal-Viet Nam

1. Summary

Project name: Forest Cover and Carbon Mapping in pilot project (4 test site) of Viet Nam

2. Description of project area

The proposed demonstration sites in Viet Nam were chosen primarily to represent the different forest types available in this country namely the inland hill dipterocarp forest and the mangrove forest. Table 1 shows the summary of information of the different sites and map in Figure 1 indicates their location. Further site description for each site is highlighted in the following section. The estimated budget is about USD 219,240 as listed in Table 2.

Table 1. Summary of information for the proposed demonstration sites in Viet Nam.

Name	**Location (Lat, Lon) of 4 corners**		**Forest types and**	**administration designation**
	Upper left (UL)	**Lower Right (LR)**		
1. Tam Dao Forest reserve	Lat: 21° 42’ Long: 105° 22’	Lat : 21° 22’ Long : 105° 48’	evergreen tropical forest	Permanent Forest Reserve 36,883ha
2. Xuan Thuy Forest reserve	Lat: 30° 15’00 Long: 106° 20’00	Lat : 20° 10’ Long : 106° 32”	Mangrove forest	Permanent Forest Reserve 8,640ha
3. Yok Don Forest reserve	Lat: 13° 10’00’’ Long: 107° 29’30”	Lat : N12° 45’00” Long : 107° 48’30”	Hill Dipterocarp forest	Permanent Forest Reserve 115,545 ha
4.Chu Mom Ray Forest Reserve	Lat: 14° 38’ Long: 107° 29’	Lat : 14° 18’ Long : 107° 47’	evergreen tropical forest	Permanent Forest Reserve 56,621ha

STUDY SITES FOR PILOT PROJECT

Figure 1. Location of the proposed demonstration sites in Viet Nam

A. Tam Dao Forest Reserve

1. Description of the study area

The Tam Dao Forest Reserve is under the management of Tam Dao Natural Park management Board - Forestry Department, located at the northwest of Ha Noi above 80km. It is a tropical evergreen broadleaf forest characterized by several family dominance and by three tree layers (emergent, main-storey and understorey trees)..

Total area: 36,883 ha

2. Partners working in the area

Two 25 ha permanent research plot in Tam Dao managed by FIPI for study of forest dynamic and diversity

3. GIS and Remote Sensing information

· **GIS**: complete

· **Satellite imagery**:
○Landsat TM 2002
○SPOT 5 – 2004

B. Xuan Thuy Forest Reserve

1. Description of the study area

The Xuan Thuy Forest Reserve is under the management of Xuan Thuy Natural Park management Board - Nam Dinh province Committee, located at the Southeast of Ha Noi above 200km.

The forest in Xuan Thuy Reserve is Magrove. Within this mangrove swamp are found multitudes of tree species, birds and shrimp farming.

Total area: 8,640ha

2. Partners working in the area

FIPI have case study of forest dynamic and bird diversity in 2005-2010

3. GIS and Remote Sensing information

· **GIS**: complete

· **Satellite imagery**:
○Landsat TM 2002

C. Yok Don Forest Reserve

1. Description of the study area

The Yok Don Forest Reserve located at Dac Lac Province in central highland of Viet Nam, about 1800km from Ha Noi . It is under the management of Yok Don Natural Park management Board - Forestry Department It consists of lower and upper hill dipterocarp forest.

Total area: 115,545ha

2. Partners working in the area

Two 25 ha permanent research plot in Yok Don managed by FIPI for study of forest dynamic and diversity.

3. GIS and Remote Sensing information

· **GIS**: Not yet complete

· **Satellite imagery**:
○Landsat TM 2002
○SPOT 5 – 2004;

D. Chu Mom Ray Forest Reserve

1. Description of the study area

Chu Mom Ray Nature Reserve is located between the administrative boundaries of two districts Sa Thay and Ngoc Hoi of Kon Tum province. This is the only nature reserve of Vietnam that located at three-border crossing point of Indochina. The Chu Mom Ray Forest Reserve is under the management of Chu Mom Ray Natural Park management Board – Kon Tum Province Committee, located at the South of Ha Noi above 1700km.

It is a tropical evergreen broadleaf forest.

Total area: 56,621 ha

2. Partners working in the area

Two 25 ha permanent research plot in Yok Don managed by FIPI for study of forest dynamic and diversity.

3. GIS and Remote Sensing information

· **GIS**: complete

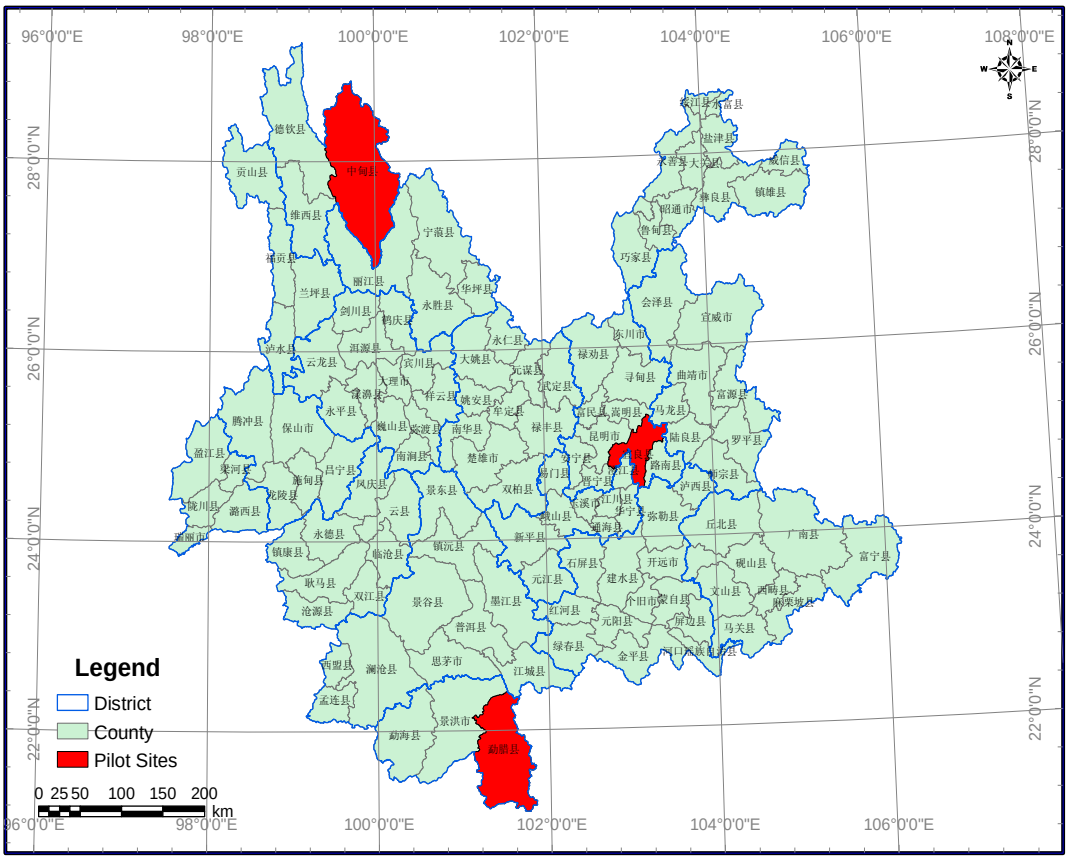
· **Satellite imagery**:
○Landsat TM 2002
○SPOT 5 – 2004; 2009

Yunnan

Pilot Sites in Yunnan, China For GMS Demonstration Project

Name Of The Site	Xmin	Ymin	Xmax	Ymax
Shangrila	99°22'54.921"E	26°51'57.832"N	100°19'17.481"E	28°51'14.730"N
Yiliang	102°44'28.158"E	24°30'59.043"N	103°28'50.509"E	25°16'33.697"N
Mengla	101°04'46.123"E	21°09'05.778"N	101°52'05.753"E	22°24'18.952"N

Ellipsoid and datum: WGS84



A. SITE: Shangrila

1. Description of the study area

Shangrila is located in the northwestern part of Yunnan province, between 26°51'57.832" and 28°51'14.730"N and 99°22'54.921" and 100°19'17.481"E (Fig.1). The total area of Shangrila is 1 141 738.4 ha. Shangrila is a famous tourist site. In Tibetan, Shangrila means a place of good fortune and luck.

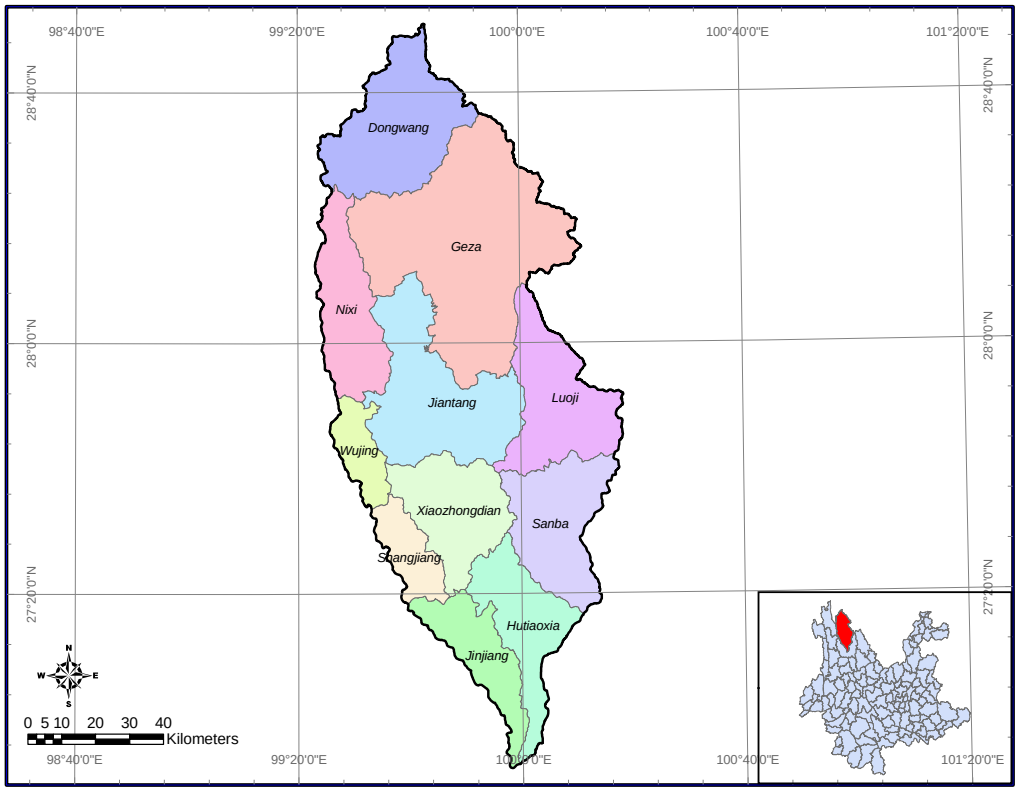
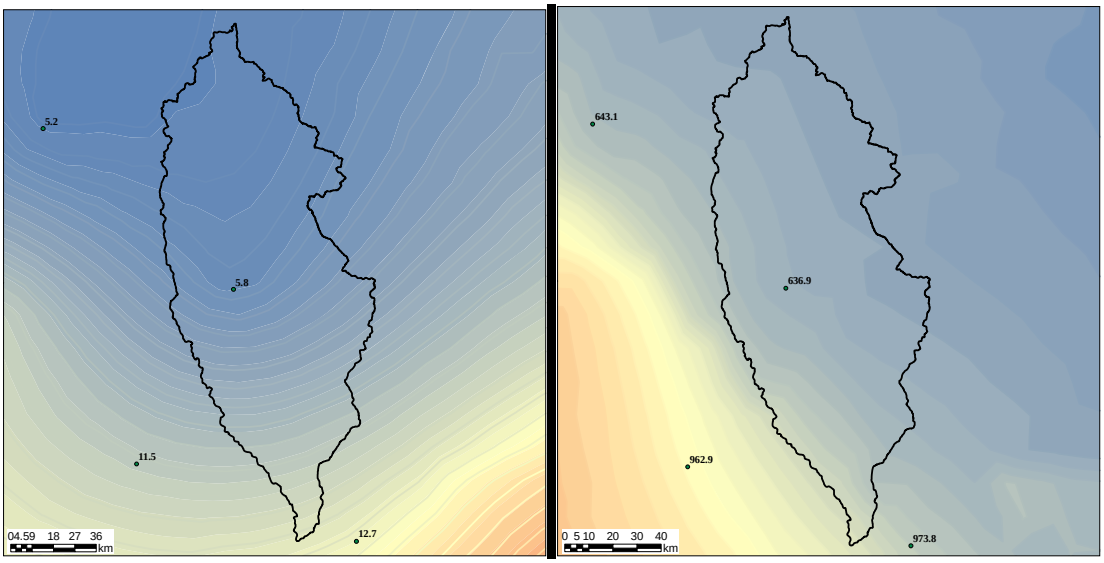


Figure 1. Location of Shangrila

Located in the midst of three rivers - the Jinsha, Lancang and Nujiang River, the mean altitude of Shangrila is over 3 400 m. There are 11 towns, 688 villages. In the year of 2008, the population was over 0.16 million, and the GDP was 3 620 million Yuan.

Figure 2 shows the spatial interpolation of temperature and precipitation based on the data of 1958 ~ 2008. Located in the high altitude region, annual average temperature of Shangrila is 5.8 ℃, and annual average precipitation is 636.9 mm, and relative humidity is 69.0 %, and sunshine duration is 2 166.4 hours.



a. Temperature b. Precipitation

Figure 2. Temperature and precipitation of Shangrila

Figure 3 is the terrain map of Shangrila. Most of Shangrila locates in mountain region. The highest altitude is 5 323 m, and the lowest altitude is only 1487m.

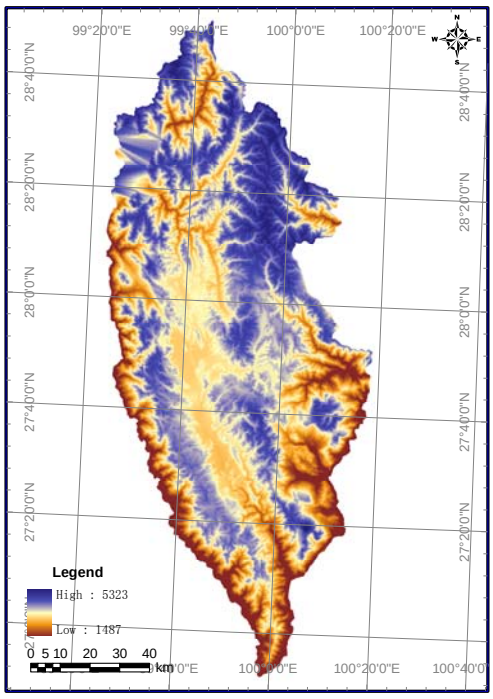


Figure 3. Digital Elevation Model of Shangrila

The forest resources in Shangrila are rich. According to the forest resource inventory carried out by Forestry Bureau of Diqing District in 2006, the forest coverage of Shangrila was 75.0 %. The main dominant species were Fir, Alpine Pine, Oak, Yunnan Pine, Spruce, Larch, etc. (Fig.4).

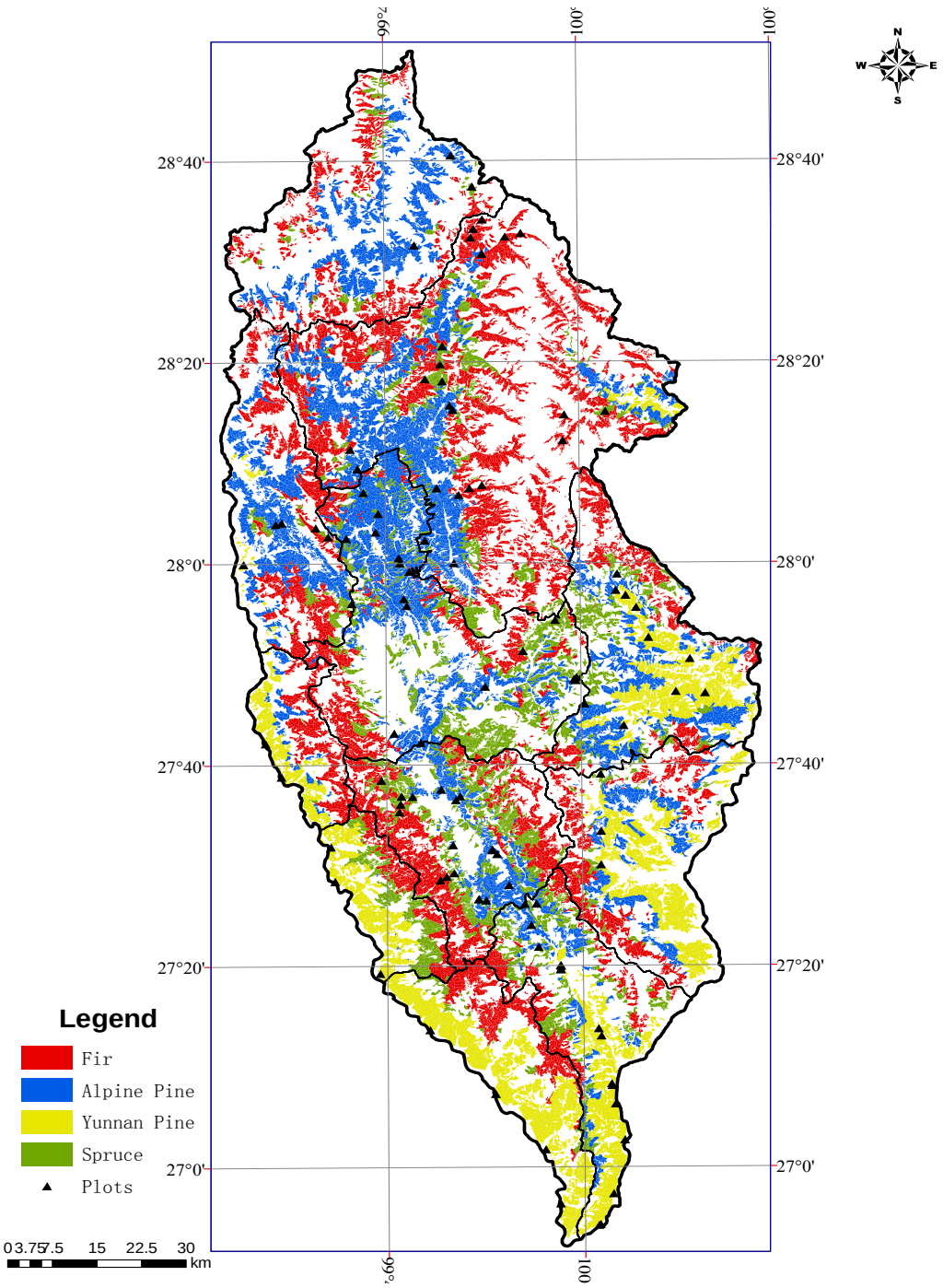


Figure 4. Forest Map of Shangrila

2. Partners working in the area

Local partners

- Yunnan Institute of Forest Inventory and Planning
  - ❍ Activities: Forest management inventory.
  - ❍ Presence: Since 2006

- Han Wenping:
  - Activities: Paper topic: "Research on Acquiring Information of Landuse / landcover by Remote Sense Image Based on GIS".
  - Presence: Since 2007
- Li Zhixi:
  - Activities: Paper topic: "Remote Sensing Analysis on Shangrila".
  - Presence: Since 1998
- Xu Tianshu:
  - Activities: Research Project called: " Carbon Storage Estimation of Forest Ecosystems in Three Rivers based on Remote Sensing".
  - Presence: Since 2009

International partners

- TNC(The Nature Conservancy, USA):
  - Activities: Projects called “The Great River National Park” and “Shangri-La Gorge nature reserve planning” and “Yunnan golden monkeys protection”
  - Presence: Since 1998

3. Field works

- Forest management inventory
  - Time:2006
  - Plots: 723
  - Forest types: Oak, Yunnan Pine, Spruce, Larch.
  - Measurements: Species, coverage, DBH, height, volume, et al.
- National natural science funded Project Field survey
  - Time: August, 2010
  - Plots: 129
  - Forest types: Fir, Alpine Pine, Oak, Yunnan Pine, Spruce, Larch.
  - Measurements: Species, coverage, DBH, height, volume, et al.

4. GIS and Remote Sensing information

- **GIS**: complete

- **Satellite imagery**:
  - Landsat MSS: 1974-01-05
  - Landsat TM: 2009-11-24

- Landsat ETM+: 4 periods, 1999-11-21, 2000-11-07, 2001-11-10, 2002-11-29
- EO1 ALI: 2003-12-02 (Partly cover)
- EO1 Hyperon: 2003-12-02 (Partly cover)
- MODIS: 131 periods, from 2000-02 to 2010-12
- SPOT5: 2008-01-10
- ALOS PALSAR：FBD、PLR 2010（Partly cover）

5. References

Han Wenping, Wang Jinliang, Ke Huaming, et al. 2007. Research on Acquiring Information of Landuse / landcover by Remote Sense Image Based on GIS. Yunnan Geographic Environment Research, 2: 98-102.

Li Zhixi. 1998. Remote Sensing Analysis on Shangrila. Remote Sensing Information, 2: 29-31.

B. SITE: Yiliang

1. Description of the study area

Yiliang is located in the midland of Yunnan province, between 24°30'59.043" and 25°16'33.697"N and 102°44'28.158" and 103°28'50.509"E (Fig.5), 55 kilometer far from Kunming, capital of Yunnan. The total area of Yiliang is 191 814.6 ha. The forest coverage is about 49.3%. Yiliang is a very important forestry and agriculture county in Kunming district.

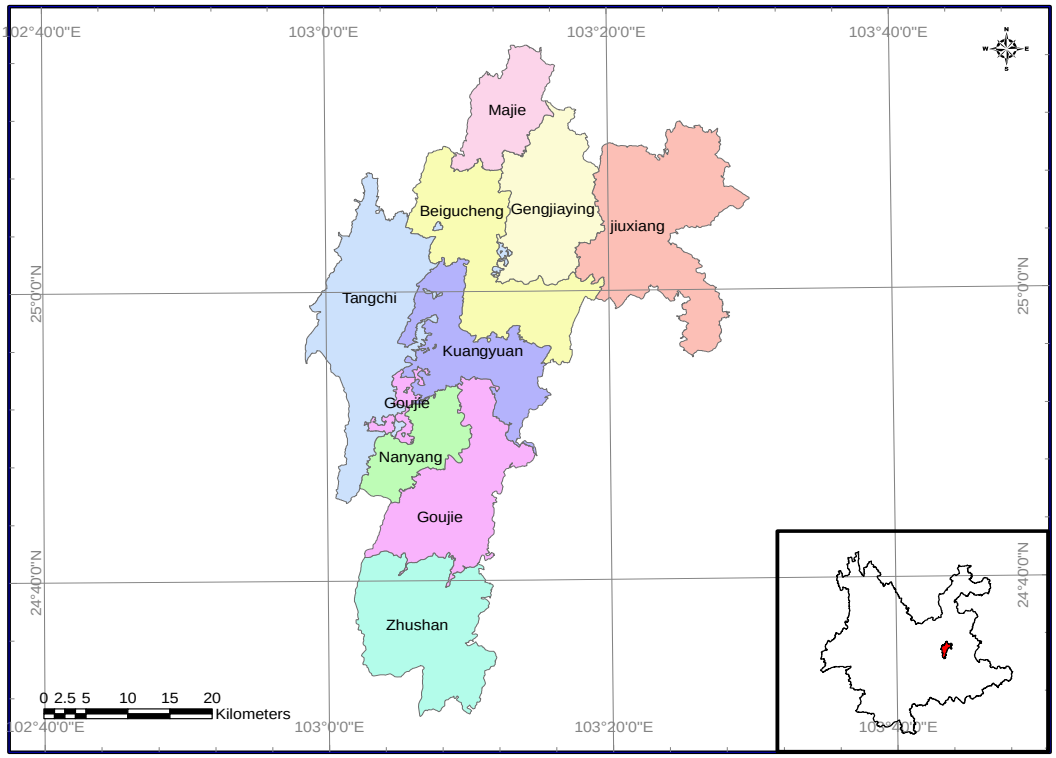
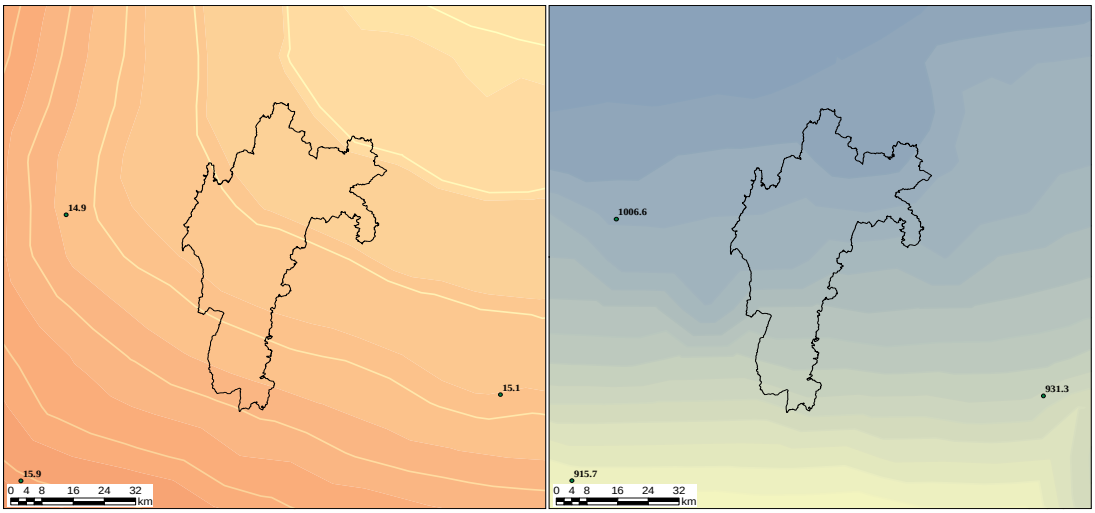


Figure 5. Location of Yiliang

With a north subtropical monsoon climate, the climate of Yiliang is very mild. There are 12 towns, 142 villages. In the year of 2009, the population was about 0.43 million, and the GDP was 59 00 million Yuan.

Figure 6 shows the spatial interpolation of temperature and precipitation based on the data of 1958 ~ 2008. Annual average temperature of Yiliang is 16.3 ℃, and annual average precipitation is 912.2 mm, and relative humidity is 75.0 %, and sunshine duration is 2 177.3 hours.



a. Temperature b. Precipitation

Figure 6. Temperature and precipitation of Yiliang

Figure 7 is the terrain map of Yiliang. Most of Yiliang locates in low mountains and hills region. The altitude distributes from 1 277 m to 2 704 m.

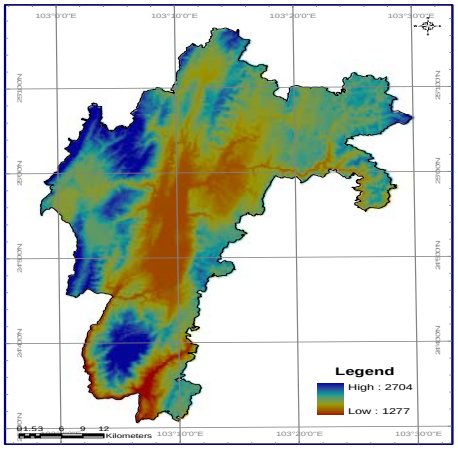


Figure 7. Digital Elevation Model of Yiliang

The forest resources in Yiliang are rich. According to the forest resource inventory carried out by the Yunnan Institute of Forest Inventory and Planning in 2007, the forest coverage of Yiliang was 49.3 %. The main dominant species were Yunnan Pine, Oak, Chestnut, Armand Pine, Alder, Eucalyptus, etc. (Fig.8).

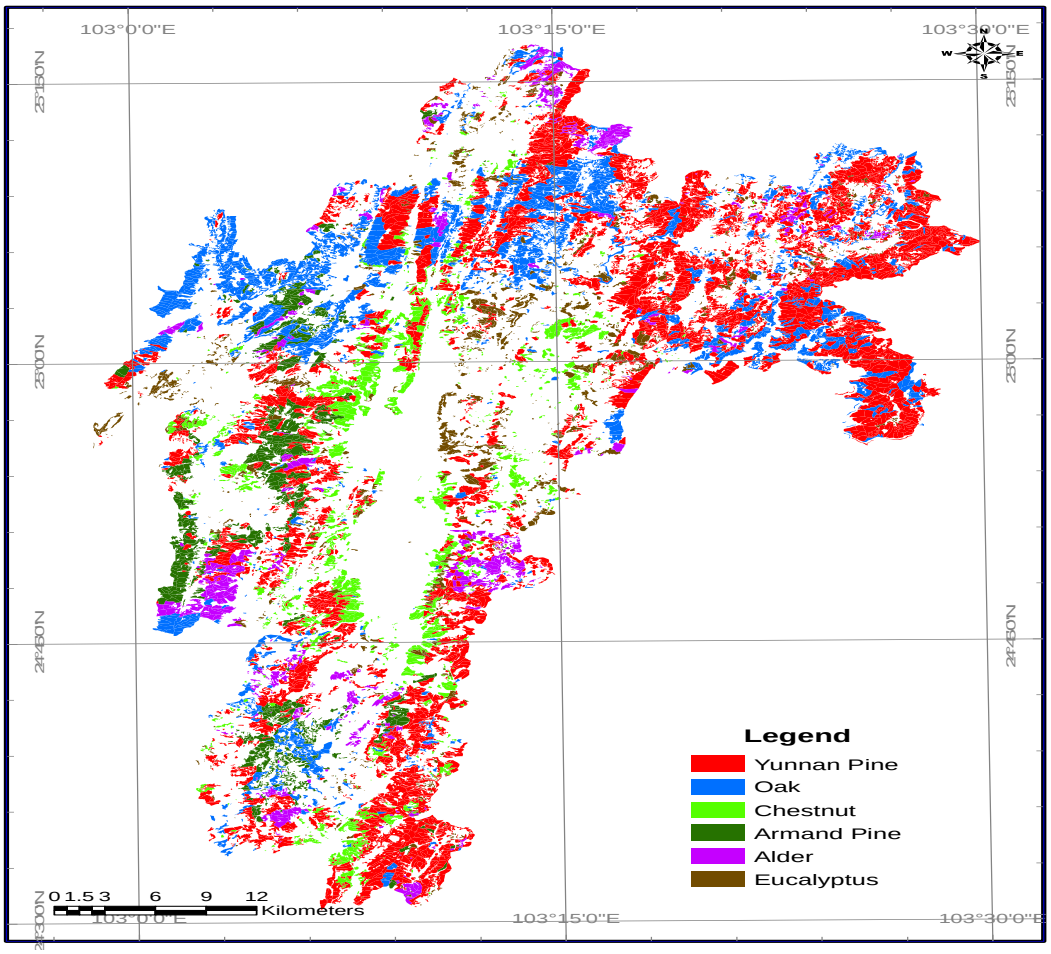


Figure 8. Forest Map of Yiliang

2. Partners working in the area

- Yunnan Institute of Forest Inventory and Planning
  - Activities: Forest management inventory.
  - Presence: Since 2007
- Xu Tianshu:
  - Activities: Research Project called: "Biomass Estimation of Yunnan Pine Based on ALOS PALSAR Data" supported by The National Natural Science Fund
  - Presence: Since 2009

3. Field works

- Forest management inventory
  - Time:2007
  - Plots: 189
  - Forest types: Oak, Yunnan Pine, Chestnut, Armand Pine, Eucalyptus.
  - Measurements: Species, coverage, DBH, height, volume, et al.
- National natural science funded Project Field survey
  - Time:July, 2010
  - Plots: 45
  - Forest types: Yunnan Pine, Oak, Chestnut, Armand Pine, Alder, Eucalyptus.
  - Measurements: Species, coverage, DBH, height, volume, et al.

4. GIS and Remote Sensing information

- **GIS**: complete

- **Satellite imagery**:
  - Landsat MSS: 1975-12-11
  - Landsat TM: 2002 、 2004
  - Landsat ETM+: 2000-01-15
  - MODIS: 131 periods, from 2000-02 to 2010-12
  - QuickBird: 2008-07-16
  - ALOS PALSAR：FBD、PLR 2010
  - ALOS optical：PRISM、AVNIR(partly cover)

5. References

Xu Tianshu, Zhang Wangfei, Yue Cairong. 2007. Remote sensing information model of forest biomass based on principal components analysis. Ecology and Environment, 16 (6): 1759-1762.

Xu Tianshu. 2008. Study on Forest Biomass & Carbon Storage Estimation based on Remote Sensing Information. Forest Inventory and Planning, 33 (3): 11-13.

Zhou Nan, Xu Tianshu. 2010. Study on Estimate Model for Remote Sensing of Spruce-fir Forest Biomass. Forest Inventory and Planning, 35 (4): 29-31.

Wu Xiaoli, Xu Tianshu. 2008. Quantitative Evaluation of Forest Ecosystem Biomas. Inner Mongolia Forestry Investigation and Design, 31 (4): 4-5.

Pan Haibo, Yue Cairong, Cui Tongqi. 2009. Precision Comparison of Delineating Clan Forestland based on Quickbird Satellite Image and Topographic Map. Forest Inventory and Planning, 34 (1): 41-44.

C. SITE: Mengla

1. Description of the study area

Mengla is located in the southern part of Yunnan province, between 21°09'05.778" and 22°24'18.952"N and 101°04'46.123" and 101°52'05.753"E (Fig.9). The total area of Mengla is 705 600 ha. Mengla is a famous tourist site.

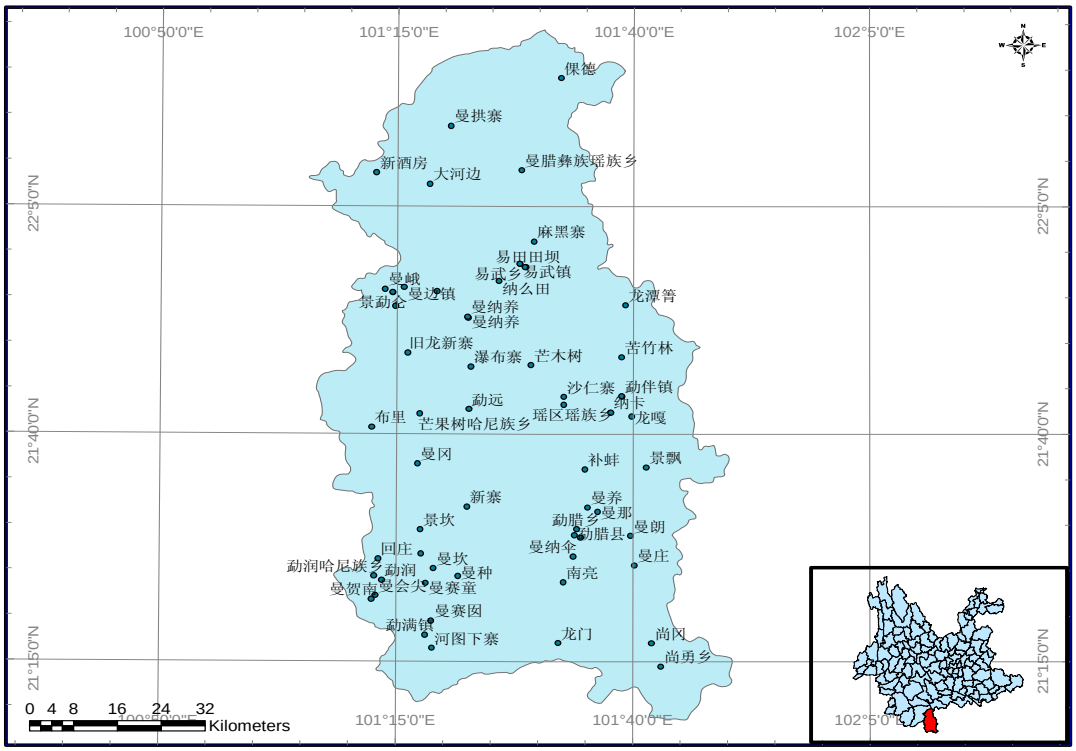
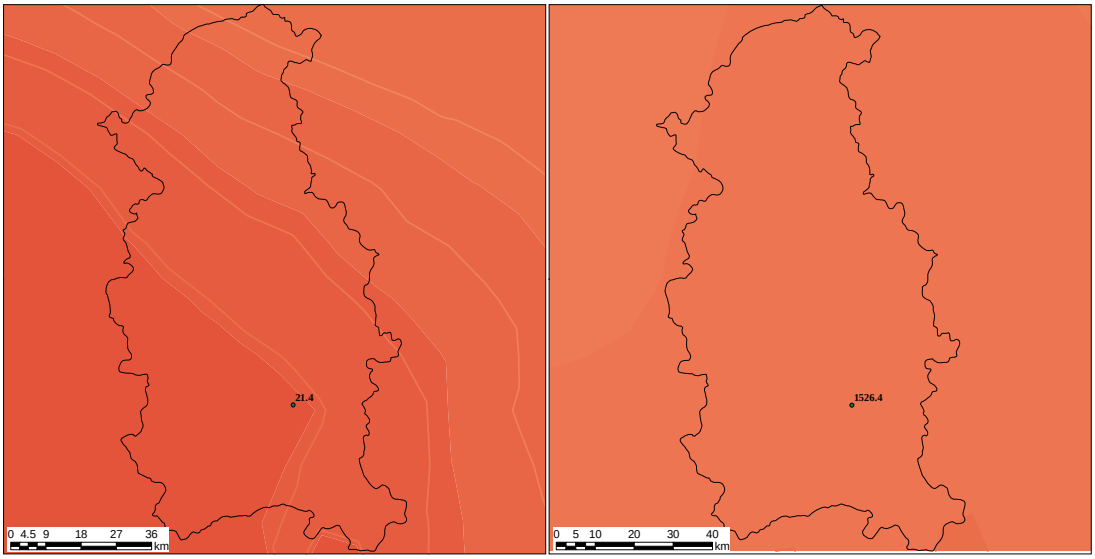


Figure 9. Location of Mengla

With a north tropical humid monsoon climate, the climate of Mengla is very mild. There are 13 towns, 544 villages. In the year of 2009, the population was over 0.18 million, and the GDP was 3 350 million Yuan.

Figure 10 shows the spatial interpolation of temperature and precipitation based on the data of 1958 ~ 2008. Annual average temperature of Mengla is 21.0 ℃, and annual average precipitation is 1 540 mm, and relative humidity is 84.3 %, and sunshine duration is 1 871.7 hours.



a. Temperature b. Precipitation

Figure 10. Temperature and precipitation of Mengla

Figure 11 is the terrain map of Mengla. Most of Mengla locates in low mountains and hills region. The altitude distributes from 469 m to 2 007 m.

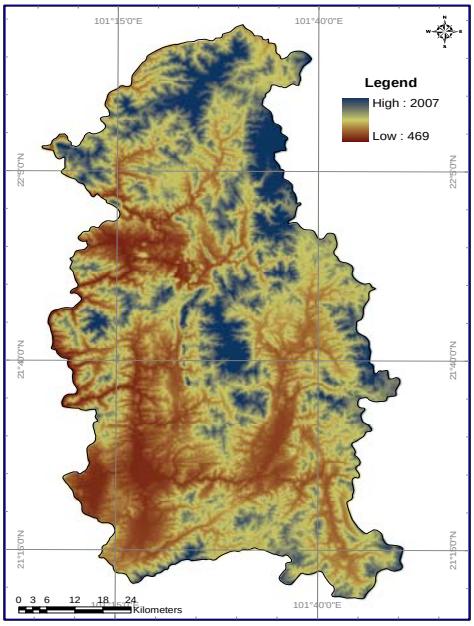


Figure 11. Digital Elevation Model of Mengla

The forest resources in Mengla are rich. According to the forest resource inventory carried out by the Yunnan institute of forest inventory and planning in 2006, the forest coverage of Mengla county was 86.2 %.High biodiversity, complicated forest species are the characteristics of Mengla forest. Meanwhile, it makes more difficult to forest classification based on remote sensing technology.

2. Partners working in the area

- Yunnan Institute of Forest Inventory and Planning
  - Activities : Forest management inventory.
  - Presence: since 2006
- Cui Wenju:
  - Activities: Paper topic: "Study on Stability of Tropical Forest Landscape in Xishuangbanna".
  - Presence: Since 2010
- Zhang Peifang:
  - Activities: Paper topic: "Spatial and temporal dynamics of rubber plantation and its impacts on tropical forest in Xishuangbanna".
  - Presence: Since 2006
- Yang Cunjian:
  - Activities: Paper topic: "Correlation analysis of the biomass of the tropical forest vegetation，meteorological data and topographical data".
  - Presence: Since 2005

3. Field works

- Forest management inventory
  - Time:2006
  - Plots: 513
  - Forest types: tropical rain forest, tropical seasonal moist forest, tropical monsoon forest and tropical montane evergreen broad leaved forest .
  - Measurements: Species group, coverage, DBH, height, volume, et al.

4. GIS and Remote Sensing information

- **GIS**: complete

- **Satellite imagery**:
  - Landsat MSS: 1974-01-20

- Landsat TM: 1991-02-17
- Landsat ETM+: 2003-02-19
- MODIS: 131 periods, from 2000-02 to 2010-12

5. References

Cui Wenju, Shu Qingtai, Liu Manbin, et al. 2010. Study on Stability of Tropical Forest Landscape in Xishuangbanna. Yunnan Geographic Environment Research, 22 (2): 29-33.

Zhang Peifang, Xu Jianchu, Wang Maoxin, et al. 2006. Spatial and temporal dynamics of rubber plantation and its impacts on tropical forest in Xishuangbanna. Remote Sensing for Land & Resources, 3: 51-55.

Zhang Peifang, Wang Maoxin. 2006. Land-use and land-cover changes based on 3S technique in Xishuangbanna of Yunnan Province. Transactions of the CSAE, 22 (3): 57-62.

Yang Cunjian, Liu Jiyuan, Huang He, et al. 2005. Correlation analysis of the biomass of the tropical forest vegetation，meteorological data and topographical data. Geographical Research, 24 (3): 473-479.

UNIVERSITY OF
MARYLAND
DEPARTMENT OF GEOGRAPHY

2181 LeFrak Hall
College Park, Maryland 20742
301.405.4050 TEL 301.314.9299 FAX

April 20, 2011

Dr. Li Zengyuan
Institute of Forest Resources Information Techniques
Chinese Academy of Forestry
Beijing 100091, China

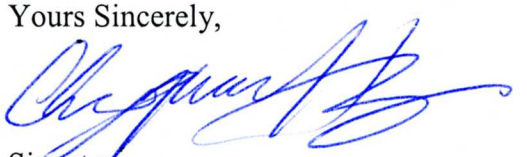
Dear Prof. Li,

I write to confirm my commitment to participate your proposal titled "Forest Cover and Carbon Mapping in the Greater Mekong Subregion and Malaysia", which is submitted to the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet) in collaboration with related agencies from countries over the study area.

I intend to carry out all responsibilities identified for me in this proposal. I understand that the extent and justification of my participation as stated in this proposal will be considered during peer review in determining in part the merits of this proposal. We would enthusiastically collaborate on adapting our data processing and forest mapping algorithms to the Greater Mekong Subregion and Malaysia.

I believe that our collaboration will greatly enhance forest cover and carbon mapping in the Greater Mekong Subregion and Malaysia. Please feel free to contact me if you have any question regarding my commitment.

Yours Sincerely,



Signature
Chengquan Huang, Ph.D
Research Associate Professor
Department of Geography
University of Maryland
College Park, MD 20742, USA
Phone: 1-301-314-2585
Fax: 1-301-314-9299
Email: cqhuang@umd.edu

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Reston, Virginia 20192

May 12, 2011

Professor Li Zengyuan
Institute of Forest Resource Information Techniques,
Chinese Academy of Forestry
Beijing 100091, China

Dear Professor Li,

The U.S. Geological Survey (USGS) has a strong tradition in international collaborations in areas of remote sensing, land cover mapping, and biomass mapping and carbon cycle research. Your proposal "Forest Cover and Carbon Mapping in the Greater Mekong Subregion and Malaysia" builds on an integrated study, focusing on a region that is of great interest to USGS, and is designed to develop biomass mapping methods and land change monitoring capabilities using Landsat data. The proposal is well written and you have put together a highly competent project team. Hence the project shows great promise to produce the expected outcomes including regional forest carbon estimates and forest change monitoring capabilities.

I'm a scientist with the USGS and a project chief for a national assessment of carbon sequestration. I am pleased to offer endorsement of your proposal and would be delighted to serve as a collaborator for your project. As a collaborator, I will coordinate the use of Landsat data processed by the USGS for your project free of charge. Further, I will be interested in participating in research work related to biomass mapping and developing Landsat-based monitoring techniques.

My best wishes for the success of your proposal. If any other information is needed from me, I can be contacted at zzhu@usgs.gov.

Sincerely,

Zhiliang Zhu, PhD
Project Chief, Carbon Assessment
U.S. Geological Survey
Reston, VA USA

AIT
Asian Institute of Technology

Geoinformatics Center
School of Engineering and Technology
Tel:+66-2-524-5580/6195 Fax:+66-2-524-6147
E-mail: geoinfo@ait.ac.th
http://www.geoinfo.ait.ac.th

km 42, Paholyothin Highway, P.O. Klong Luang, Pathumthani 12120, THAILAND

May 26, 2011

Dr. Li Zengyuan
Institute of Forest Resources Information Techniques
Chinese Academy of Forestry
Beijing 100091, China

Dear Prof. Li,

I am writing to confirm my support to your proposal " Forest Cover and Carbon Mapping in the Greater Mekong Sub-region and Malaysia" to be submitted to the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet) in collaboration with the other countries and agencies.

I acknowledge that I am identified by Dr. Pang Yong as a Co-Investigator to the investigation entitled "Forest Cover and Carbon Mapping in the Greater Mekong Sub-region and Malaysia", and that I intend to carry out the responsibilities identified for me in this proposal. I understand that the extent and justification of my participation as stated in this proposal will be considered during peer review in determining in part the merits of this proposal. I have read the entire proposal, and I agree that the proposal correctly describes my commitment to the proposed investigation.

I believe that our collaboration could be very helpful to support the activities of the project on forest cover and carbon mapping in the Greater Mekong Sub-region and Malaysia.

Yours Sincerely

Dr. Vivarad Phonekeo
Senior Researcher
Geoinformatics Center, Asian Institute of Technology
58 Moo 9, Phaholyothin Highway Km42, Khlong Nueng, Khlong Luang, Pathumthani 12120
Tel: (+66-2) 5246197, Fax: (+66-2) 5246147
Email: vivarad@ait.ac.th, vivarad@gmail.com
Website: www.geoinfo.ait.ac.th

Letter of Collaboration

May 23, 2011

Dr. Li Zengyuan
Institute of Forest Resources Information Techniques
Chinese Academy of Forestry
Beijing 100091, China

Dear Prof. Li,

I write to confirm my commitment to participate as Cambodia collaborator for the project "Forest Cover and Carbon Mapping in the Greater Mekong Subregion and Malaysia" to be submitted to the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet) in collaboration with the other countries and agencies.

Specifically, we will attend the activities:

WP4: Ground truth database development (compiling existing data)
WP5: Mid-resolution forest mapping product
WP7: Forest carbon storage mapping product

We would enthusiastically collaborate on integrate available ground truth database with remote sensing data for forest cover and carbon storage mapping in my country.

I believe that our collaboration could be very important for forest cover and carbon mapping in the Greater Mekong Subregion and Malaysia.

Yours Sincerely

Signature

Name: Dr. Kao Dana
Title: Acting Chief in Forest Management Office,
Department: Forest and Community Forestry, Forestry Administration of Cambodia
Address: 40 Preah Norodom, Phnom Penh, Cambodia
Tel: 855-12-540009
Email: kaodana@yahoo.com
Website: www.forestry.gov.kh

广西壮族自治区林业勘测设计院

May 15, 2011

Prof. Li Zengyuan
Institute of Forest Resources Information Techniques
Chinese Academy of Forestry
Beijing 100091, China

Dear Prof. Li,

I write to confirm my commitment to participate as Guangxi Forest Inventory and Planning Institute, China collaborator for the project " Forest Cover and Carbon Mapping in the Greater Mekong Subregion and Malaysia" to be submitted to the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet) in collaboration with the other countries and agencies.

Specifically, we will attend the activities of WP1, WP4, WP5, WP6 and WP7.

We would enthusiastically collaborate on integrate available ground truth database with remote sensing data for forest cover and carbon storage mapping in our region.

I believe that our collaboration could be very important for forest cover and carbon mapping in the Greater Mekong Subregion and Malaysia.

Yours Sincerely

Signature

Name: Li Chungan
Title: Prof.
Agency: Guangxi Forest Inventory and Planning Institute
Address: NO.14 Zhonghua Road, Nanning, Guangxi Zhuang Autonomous Region, China
Tel: 86-771-2239009 Fax: 86-771-2430523
Email: gxali@126.com
Website: www.gxforestry.com

Letter Template of Collaboration

May 3, 2011

Dr. Li Zengyuan
Institute of Forest Resources Information Techniques
Chinese Academy of Forestry
Beijing 100091, China

Dear Prof. Li,

I, on behalf of the Faculty of Forestry, write to confirm our commitment to participate for the project " Forest Cover and Carbon Mapping in the Greater Mekong Sub-region and Malaysia" to be submitted to the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet) in collaboration with the other countries and agencies.

Specifically, we will attend the activities of WP1, WP4, WP5, WP6 and WP7

We would enthusiastically collaborate on integrate available ground truth database with remote sensing data for forest cover and carbon storage mapping in my country.

I believe that our collaboration could be very important for forest cover and carbon mapping in the Greater Mekong Sub-region and Malaysia.

Yours Sincerely,

Name: Associate Prof. Houngphet Changthavong
Title: Dean
Department: Faculty of Forestry, National University of Laos
Address: Dong Dok Campus, Vientiane, Lao PDR
Tel: (856-21) 770 097
Fax: (856-21) 770 294)
Email: fof-nuol@live.com
Website:

Official Letter Template of Commitment

May 3, 2011

Mr. Qu Guilin
Director General of APFNet
APFNet Secretariat

Dear Mr. Qu Guilin and APFNet Secretariat,

Here we confirm that the Faculty of Forestry, National University of Laos will submit a proposal for demonstration project about Forest Cover and Carbon Mapping to APFNet. Basic information of the proposal information are as following:

Project title: "Forest Cover and Carbon Mapping in the Greater Mekong Sub-region and Malaysia"

Duration: 24 months

Executing agency: Faculty of Forestry National University of Laos

We hope you could review it favorably and let us know your feedback at your earliest convenience.

Yours sincerely,

Name: Associate Prof. Houngpheth Chanthavong
Title: Dean
Department: Faculty of Forestry
Address: Dong Dok Campus, Vientiane, Lao PDR
Tel: (856-21) 770 097
Fax: (856-21) 770 294
Website:

Institut Penyelidikan Perhutanan Malaysia
Forest Research Institute Malaysia (FRIM)
Kepong, 52109 Selangor Darul Ehsan, Malaysia
Pejabat Ketua Pengarah
Director General's Office
Tel : 03-6279 7007 / 6279 7822 / 6274 0634 Fax : 03-6280 4624
http : //www.frim.gov.my Email : latif@frim.gov.my

MS ISO 9001 : 2000 CERTIFIED

Ruj Kami/ Our Ref: FRIM394/443/4/3/Klt.2(4) Tarikh/ Date: 9 March 2011
Ruj Tuan/ Your Ref:

Mr. Qu Guilin
Director General of APFNet
Asia-Pacific Network for Sustainable Forest
Management and Rehabilitation
16 North Street He Ping Li,
Dong Cheng District,
Beijing 10013
P.R. China

Dear Sir,

PARTICIPATION IN THE DEMONSTRATION PROJECT ON FOREST COVER AND CARBON MAPPING UNDER APFNET

I am pleased to inform that we, Forest Research Institute Malaysia (FRIM) are interested to participate in the above-mentioned project. Briefly our project is to be based on the following:-

Project title	:	"Forest Cover and Carbon Mapping in the Greater Mekong Sub-region and Malaysia"
Duration	:	24 months
Executing agency	:	Forest Research Institute Malaysia (FRIM)

We hope you could favorably consider our interest and kindly let us have your confirmation at your earliest convenience.

Thank you.

Best regards,

(DATO' DR. ABD LATIF MOHMOD)
Director General FRIM

c.c.: APFNet Secretariat
16 North Street He Ping Li,
Dong Cheng District,
Beijing 10013
P.R. China

No Kotak: No Dokumen: 10097548

Institut Penyelidikan Perhutanan Malaysia
Forest Research Institute Malaysia (FRIM)
Kepong, 52109 Selangor Darul Ehsan, Malaysia
Pejabat Ketua Pengarah
Director General's Office
Tel : 03-6279 7007 / 6279 7822 / 6274 0634 Fax : 03-6280 4624
http : //www.frim.gov.my Email : latif@frim.gov.my

MS ISO 9001 : 2000 CERTIFIED

Ruj Kami/ Our Ref: FRIM394/443/4/3/Klt.2(4) Tarikh/ Date: 9 March 2011
Ruj Tuan/ Your Ref:

Mr. Qu Guilin
Director General of APFNet
Asia-Pacific Network for Sustainable Forest
Management and Rehabilitation
16 North Street He Ping Li,
Dong Cheng District,
Beijing 10013
P.R. China

Dear Sir,

PARTICIPATION IN THE DEMONSTRATION PROJECT ON FOREST COVER AND CARBON MAPPING UNDER APFNET

I am pleased to inform that we, Forest Research Institute Malaysia (FRIM) are interested to participate in the above-mentioned project. Briefly our project is to be based on the following:-

Project title	:	"Forest Cover and Carbon Mapping in the Greater Mekong Sub-region and Malaysia"
Duration	:	24 months
Executing agency	:	Forest Research Institute Malaysia (FRIM)

We hope you could favorably consider our interest and kindly let us have your confirmation at your earliest convenience.

Thank you.

Best regards,

(DATO' DR. ABD LATIF MOHMOD)
Director General FRIM

c.c.: APFNet Secretariat
16 North Street He Ping Li,
Dong Cheng District,
Beijing 10013
P.R. China

No Kotak: No Dokumen: 10097548

No. 16184/ 627

Forest Land Management Office
Royal Forest Office
61 Paholyothin RD. Ladyao,
Chatuchak BKK10900

May 25 , 2011

Dr. Li Zengyuan
Institute of Forest Resources Information Techniques
Chinese Academy of Forestry
Beijing 100091, China

Dear Prof. Li,

I write to confirm my commitment to participate as Thailand collaborator for the project " Forest Cover and Carbon Mapping in the Greater Mekong Subregion and Malaysia" to be submitted to the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet) in collaboration with the other countries and agencies.

Specifically, we will attend the activities of WP1, WP4, WP5, WP6, WP7 and WP8.

We would enthusiastically collaborate on integrate available ground truth database with remote sensing data for forest cover and carbon storage mapping in my country.

I believe that our collaboration could be very important for forest cover and carbon mapping in the Greater Mekong Subregion and Malaysia.

Yours Sincerely

Signature

Name: Mr. Samak Donnapee
Title: Director of Forest Land Management Office
Department: Royal Forest Department
Address : 61 Paholyothin Rd., Ladyao, Chatuchak. Bangkok 10900
Tel: +662-5614-292
Fax:+662-5797-583
Website: www.forest.go.th

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT
VIETNAM ADMINISTATION OF FORESTRY
Address: A3, 2 Ngoc Ha, Ba Dinh, Ha Noi, Viet nam
Tel: (+84 4) 38438792, Fax: (+84 4) 38438793

March 29, 2011

To: Mr. Qu Guilin
Director General of APFNet
APFNet Secretariat

Dear Mr. Qu Guilin and APFNet Secretariat ,

Here we confirm that the Viet Nam Administration of Forestry (VNFOREST), Ministry of Agricultural and Rural Development of Viet Nam will submit a proposal for demonstration project about Forest Cover and Carbon Mapping to APFNet. Basic information of the proposal information are as following:

Project title: "Forest Cover and Carbon Mapping in the Greater Mekong Sub region and Malaysia"

Duration: 24 months

Executing agency: Viet Nam Forest Inventory and Planning Institute (FIPI)

We hope you could review it favorably and let us know your feedback at your earliest convenience.

Your sincerely,

Ms.Nguyen Tuong Van
Deputy Director
Department of Science Technology and International Cooperation
Vietnam Administration of Forestry (VNFOREST)
Ministry of Agricultural and Rural Development
Viet Nam

FOREST INVENTORY AND PLANNING INSTITUTE
Address: Vinh Quynh, Thanh Tri- Hanoi
Tel: (+84 4) 36870600, Fax: (+84 4) 38612881

March 30, 2011

Dr. Li Zengyuan
Institute of Forest Resources Information Techniques
Chinese Academy of Forestry
Beijing 100091, China

Dear Prof. Li,

I write to confirm my commitment to participate as Forest Inventory and Planning Institute (FIPI)-Viet Nam collaborator for the project "Forest Cover and Carbon Mapping in the Greater Mekong Subregion and Malaysia" to be submitted to the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet) in collaboration with the other countries and agencies.

Specifically, we will attend the activities of WP1, WP4, WP5, WP6 and WP7.....

We would enthusiastically collaborate on integrate available ground truth database with remote sensing data for forest cover and carbon storage mapping in my country.

I believe that our collaboration could be very important for forest cover and carbon mapping in the Greater Mekong Subregion and Malaysia.

Yours Sincerely,

Name: Dr. Nguyen Phu Hung
Title: Vice Director of FIPI
Forestry Department- Ministry of Agriculture and Rural Development
Address: Thanh Tri Distric – Ha Noi – Viet Nam
Tel: (+84 4) 36870600
Fax: (+84 4) 3 8612881
Website: www.fipivn.org

Official Letter of Collaboration

Dr. Li Zengyuan
Institute of Forest Resources Information Techniques
Chinese Academy of Forestry
Beijing 100091, China

Dear Prof. Li,

I write to confirm my commitment to participate as Yunnan Province collaborator for the project "Forest Cover and Carbon Mapping in the Greater Mekong Subregion and Malaysia" to be submitted to the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet) in collaboration with the other countries and agencies.

Specifically, we will attend the activities of WP1, WP2, WP3, WP4, WP5, WP6, WP7 and WP8.

We would enthusiastically collaborate on integrate available ground truth database with remote sensing data for forest cover and carbon storage mapping in my province.

I believe that our collaboration could be very important for forest cover and carbon mapping in the Greater Mekong Subregion and Malaysia.

Yours Sincerely

Signature Yue cairong 岳彩荣

Name: Yue Cairong
Title: Director of Research Center of GIS, RS & GPS in Forestry
Department: Faculty of Natural Resources, Southwest Forestry University
Address: 300 Bailongsi Str., Kunming, Yunnan 650224, China
Tel: +86-0871-3863022(Office) +86-13577178073(Mobile)
Fax: +86-0871-3863021
Email: cryue@163.com
Website: http://www.swfu.edu.cn

- Project steering committee* (one recommended national representative)

Country	Name	Organization	Title	Email	Telephone	Fax	Working Field	Note
China	Li Zengyuan	IFRIT,CAF	Dr.	zengyuan.li@caf.ac.cn	86-10-62889163		Forest remote sensing	Deputy Director of IFRIT, CAF
USA	John Townshend	University of Maryland	Dr.	jtownshend@bsos.umd.edu	01 301 405 4050	01 301 314 9299	Forest remote sensing	Dean, College of Behavioral and Social Sciences, UMD
Canada	Michael Brady	GOFC-GOLD	Dr.	mbrady@nrcan.gc.ca	1 780 435 5833		Land cover	Executive Director GOFC-GOLD
Cambodia	H.E Chheng Kimsun	Forestry Administration	Delegate of the Royal Government of Forestry Administration	Not available	Not available	Not available	Management	
	Mr. Meas Makara	Department of forest and community forestry management	Director	Not available	Not available	Not available	Management	
Guang Xi, China	Li Chungan	GXFIPI	PhD	gxali@126.com	0771-2239009	0771-2430523	Remote sensing and forest resource monitoring	
Laos	Houngphet Chanthavong	Faculty of Forestry, NUoL	Assoc. Prof.	Houngphet@hotmail.com	856-21-770 097	856-21-770 294	Forest economy	Dean of the faculty of Forestry, NUoL
Malaysia	Abdul Rashid Malik	FRIM	Dr.	rashid@frim.gov.my	60362797012	60362729852	Research Management and Planning	Currently holds a position of Deputy Director General

								(Research) FRIM
	Norini Haron	FRIM	Dr.	norini@frim.gov.my	60362797540	60362729852	Research Planning and Corporate	Currently holds a position of Division Director
Thailand	Rerngchai Prayoonwet	RFD	Deputy Director General	rerng37@gmail.com	662-5614-292 ext. 5171	-	Forestry	
	Songsak Vidtayaudom	RFD	APFNet Focal Point	vitayaudom@hotmail.com	-	-	Forestry	
	Sumet Sirilak	RFD	Director of Foreign Relations Division	sm_sirilak@hotmail.com	662-5614-292 ext. 5037	662-5613-109	Forestry	
Viet Nam	Nguyen Tuong Van	ICD-VNforest	Ms.				Environmental	
	Nguyen Manh Cuong	ICD -Forest	Dr.				GIS and forestry	
	Nguyen Ba Ngai	VN Forest	Dr.				Forestry	
	Ngo Ut	FIPI	Dr.				Forestry	
	Do Xuan Lan	MARD	Dr.				Remote sensing and GIS	
Yunnan, China	Xu Hui	Southwest Forestry University	Vice-President of Southwest Forestry University	zyxy213@126.com	86-0871-3863471 86-15925239191	86-0871-3863021	Forest Management	

*comprised of national representatives and international experts.

- Common activities committee

Country	Name	Organization	Title	Email	Telephone	Expertise
China	Li Zengyuan	IFRIT,CAF	Dr.	zengyuan.li@caf.ac.cn	86-10-62889163	Forest remote sensing
USA	John Townshend	University of Maryland	Dr.	jtownshend@bsos.umd.edu	01 301 405 4050	Forest remote sensing
Canada	Michael Brady	GOFC-GOLD	Dr.	mbrady@nrcan.gc.ca	1 780 435 5833	Land cover
China	Pang Yong	IFRIT, CAF	Dr.	caf.pang@gmail.com	86-10-62889804	Lidar remote sensing
Thailand	Vivarad Phoneke	Geoinformatics Center (GIC), Asian Institute of Technology (AIT)	Dr.	vivarad@ait.ac.th	668-1485-4946	Forest fire monitoring
Malaysia	Khali Aziz Hamzah	FOREST RESEARCH INSTITUTE MALAYSIA (FRIM)	Dr.	khali@frim.gov.my	60362797201	RS and forest management
Viet Nam	Nguyen Phu Hung	FIPI	Dr.	hungfipi@vnn.vn	084-436870600 084-912094190	GIS
Thailand	Sukan Pungkul	Forest Survey and Assessment Division, RFD	Mr.	mr.sukan@gmail.com	668-4774-5888	Forest Ecology RS and GIS
Laos	Thoumthone Vongvisouk	Faculty of Forestry, NUoL	Mr.	thvongvisouk@gmail.com	856-20-56304255	RS&GIS
Cambodia	Kao Dana	Forest Management Office	Dr.	kaodana@yahoo.com kaodana@gmail.com	855-12-540009 855-88-8608-222	Forest Ecosystem Management
USA	Huang Chengquan	University of Maryland, College Park	Dr.	cqhuang@umd.edu		Forest mapping and change detection
USA	Sun Guoqing	University of Maryland, College Park	Dr.	gsun@umd.edu		SAR remote sensing
USA	Zhu Zhiliang	U.S. Geological Survey	Dr.	zzhu@usgs.gov		Carbon estimation
China	Tan Bingxiang	IFRIT,CAF	Dr.	tan@caf.ac.cn	86-10-62889172	Remote sensing classification
China	Chen Erxue	IFRIT, CAF	Dr.	chenerx@caf.ac.cn	86-10-62889164	SAR remote sensing

China	Wu Wenbin	Institute of Agriculture Resources and Regional Planning Chiese Academy of Agriculture Sciences	Dr.	wwb@mail.caas.net.cn		Remote sensing classification
China	Liu Jianbo	China Remote Sensing Satellite Ground Station， Chinese Academy of Sciences(CAS)	Dr.	jbliu@ne.rsgs.ac.cn		Remote sensing data
China	Li Xingchao	China Remote Sensing Satellite Ground Station，CAS	Dr.	xch_li@126.com		China satellite data

- National team member for demonstration project

Country	Name	Organization	Title	Email	Telephone	Fax	Expertise	Position in the project	note
Cambodia	Kao Dana	Forest Management Office	Dr.	kaodana@yahoo.com kaodana@gmail.com	855-12-540009 855-88-8608-222		Forest Ecosystem Management	National Leader	Acting Chief
	Ing Paulrattanak	GIS office	Mr.	ingpaulrattanak@gmail.com	855-12-554355		GIS	Remote sensing specialist	Deputy Chief
	Staff of Forest Management Office								
	Staff of GIS office								
Guang Xi, China	Li Chungan	GXFIPI	Dr.	gxali@126.com	86-0771-2239009	86-771-2430523	RS	Regional Leader and Remote sensing specialist	
	Dai Huabing	GXFIPI	Mr.	huabing_dai@126.com	86-0771-2239015	86-771-2430523	Rs	Remote sensing specialist	
	Tan Bizeng	GXFIPI	Mr.	tanbizeng@163.com	86-0771-2239015	86-771-2430523	Forestry	Forest Inventory specialist	
Laos	Khamla Phanvialy	Faculty of Forestry, NUoL	Dr.	klphanvilay@hotmail.com	856-21-770097	856-21-770294	Philosophy	Project leader	vice dean of the faculty of forestry
	Sithong Thongmanivong	Faculty of Forestry, NUoL	Dr.	sithongth@hotmail.com	856-20-56304255	856-21-770294	RS&GIS	RS&GIS expert	Director of research center
	Thoumthone Vongvisouk	Faculty of Forestry, NUoL	Mr.	thvongvisouk@gmail.com	856-20-56304255	856-21-770294	RS&GIS	-RS&GIS expert -Coordinator	Deputy head of Research Division
	Fongkeo Bualapha	Faculty of Forestry, NUoL	Mr.	fongkeo@yahoo.com	856-20-5542 8086	856-21-770294	Forest management	Forest inventory expert	Head of department of forest

									management
	Latsamy Chanthalangsy	Faculty of Forestry, NUoL	Ms.	latsamyfof@hotmail.com	856-20-55675946	856-21-770294	Forest silviculture	Forest inventory expert	Head of Training Model Forest Division
Malaysia	Khali Aziz Hamzah	FOREST RESEARCH INSTITUTE MALAYSIA (FRIM)	Dr.	khali@frim.gov.my	60362797201	60362729852	RS and forest management	National Leader and Remote sensing specialist	
	Mohd Azahari Faidi	FRIM	Mr.	azaharifaidi@frim.gov.my	60362797200	60362729852	Rs	Remote sensing specialist	
	Rodziah Hashim	FRIM	Ms.	rodziah@frim.gov.my	60362797205	60362729852	GIS	GIS specialist	
	Wan Shukri Wan Ahmad	FRIM	Mr.	shukri@frim.gov.my	60362797174	60362729852	Forest Inventory	Inventory specialist	
Thailand	Sukan Pungkul	Forest Survey and Assessment Division, RFD	Mr.	mr.sukan@gmail.com	668-4774-5888	662-5797583	Forest Ecology RS and GIS	WP1,WP4 ,WP5 , WP6, WP7, WP8	Technical Forest Officer
	Warawan Tanakitreungruang	Forest Survey and Assessment Division, RFD	Ms.	warawan47@hotmail.com	668-1406-0373	662-5797583	Forest Land Management RS and Forest Database	WP1, WP4 ,WP8	Director of Forest Survey &Assessment Division
	Vissanu Domrongsatsiri	Forest Geo-informatics Division	Mr.	vdomrong@gmail.com	668-9699-4345	662-5797583	Forest Survey, RS and GIS	WP2, WP6 ,WP7	Technical Forest Officer
	Nuttawut Buddee	Forest Geo-informatics Division	Mr.	jaraput@gmail.com	668-5649-1001	662-5797583	Forest Survey, Database Management, RS and GIS	WP2 ,WP3, WP4, WP6, WP7	Technical Forest Officer
	Theerawat Kenmee	Forest Survey and Assessment Division,	Mr.	varanus63@gmail.com	668-3913-2763	662-5797583	Forest Survey, RS and GIS	WP3, WP4,WP6, WP7	Technical Forest Officer

		RFD							
	Sasithorn Rattadetkumjorn	Forest Survey and Assessment Division, RFD	Ms.	sasithornn@hotmail.com	668-1976-2213	662-5797583	Forest Biology, RS and GIS	WP3, WP4 ,WP7	Technical Forest Officer
	Wanna Nitiwattanachai	Forest Survey and Assessment Division, RFD	Ms.	niti2553@hotmail.com	668-5959-6538	662-5797583	Forest Land Management, Forest Biology and RS	WP3, WP4, WP6	Technical Forest Officer
	Vivarad Phonekeo	Geoinformatics Center (GIC), Asian Institute of Technology (AIT)	Dr.	vivarad@ait.ac.th	668-1485-4946	662-5246147	-Remote Sensing & GIS for Near Real-Time Global Environmental Studies -Active Fire monitoring using MODIS in Southeast Asia	WP1, WP2, WP4, WP7, WP8	Senior Researcher and Terra/Aqua MODIS Ground Receiving Station Manager
	Piyachat Chuayplod	Foreign Forestry Division	Ms.	ch_piyachad@hotmail.com	668-9797-7749	662-5613-109	Foreign Forestry Relations Operation	WP1, WP8	Foreign Relations Officer
Viet Nam	Nguyen Phu Hung	FIPI	Dr.	hungfipi@vnn.vn	084-436870600 084-912094190	084-438612881		Director	
	Vo Van Hong	FREC	Msc.					Coordinator	
	Vu Tien Dien	FREC	Msc.					Remote sensing expert	
	Tran Van Ho	FREC	Forest Ing.					Forest Inventory expert	

	Pham Tuan Anh	FIPI	IT exprt					IT expert, GIS	
	Tran Thu Hang	FREC	Forest Ing.					GIS and Remote sensing expert	
	Pham Manh Ha	FREC	Forest Ing					Forest Inventory expert	
Yunnan, China	Yue Cairong	Southwest Forestry University(SWFU)	Prof.	cryue@163.com	86-0871-3863022 86-13577178073	86-871-3863021	Forest Remote sensing and GIS	In charge of project and WP1 & WP8	Director of Staff Room of Forest Management
	Luo Mingcan	SWFU	Prof.	lmc1961@sohu.com	86-0871-3862418 86-13577177509	86-871-3863021	Forest Management	Inventary specialist and WP2 & WP8	Director of Faculty of Economics and Management
	Xu Tianshu	SWFU	Prof.	tsxue64@163.com	86-0871-3863022 86-13629615389	86-871-3863021	Forest Management	WP2 , WP6	
	Zhang Chao	SWFU	Lec.	zhchgis@hotmail.com	86-0871-3863022 86-13888134614	86-871-3863021	Forest Management	WP4 ,WP7	
	Shu Qingtai	SWFU	A.P.	shuqt@163.com	86-0871-3863022 13008693168	86-871-3863021	Forest Management	WP6 , WP7	
	Wang Leiguang	SWFU	Lec.	lgwang@163.com	86-0871-3863022	86-871-3863021	Remote sensing image processing	WP2,WP3	
	Yuan Hua	SWFU	Lec.	gisyuan@126.com	86-0871-3863022 86-0871-2296297	86-0871-3863021	GIS	WP4, WP5	
	Zhang Wangfei	SWFU	Lec.	mewhff@163.com	86-0871-3863022 86-13619680915	86-0871-3863021	GIS	WP6	
	Li Hao	SWFU	Lec.	lihao.swfc@qq.com	86-0871-3863022 86-13608872578	86-0871-3863021	Forest Management	WP7	

*** Role / position in the project: national leader, remote sensing specialist, inventory specialist, OR related to work packages (WP)**

WP1: Project design and management (including training)

WP2: Methods development (including Algorithms)

WP3: Remote sensing data acquisition and pre-processing

WP4: Ground truth database development (compiling existing data)

WP5: Mid-resolution forest mapping product

WP6: Coarse-resolution forest mapping product

WP7: Forest carbon storage mapping product

WP8: Reporting and dissemination

Institute of Forest Resources Information Techniques (IFRIT), Chinese Academy of Forestry (CAF)

Institute of Forest Resources Information Techniques (IFRIT), Chinese Academy of Forestry (CAF). This non-profit research institute was approved to be built in 1984 by State Forestry Administration, P.R. China. IFRIT is carrying on researches covering extensive fields: renewable resources, environment and disaster investigation, monitoring and assessment; environmental and resources modern management science and its related technology. There are five research laboratories and Forestry Science Data Center under IFRIT. The five research institutes are: Remote Sensing Laboratory, GIS Laboratory, Forest Management and Forestry Statistics Laboratory, Computer Application Laboratory and Network Technology and Application Laboratory. There are two key laboratories under IFRIT which including State Laboratory for Forest Remote Sensing and Information Techniques and Key Laboratory for image processing. China Network Information Center to Combat Desertification (DIN), Asian Network Information Center to Combat Desertification (TPN1), China Forestry Research Network Center and Forestry Computer Applications Branch, Chinese Society of Forestry are also affiliated to IFRIT. IFRIT not only plays an important role in the promotion of the high-tech application in Chinese forestry industry especially in the implementation of “Digital Forestry” project under State Forestry Administration, but also provides a technical support services in the management, analysis and decision of forestry resources modern.

Research Fields

IFRIT currently focus on the application of High-tech in forestry industry which are mainly doing research on optical and microwave remote sensing, geographic information systems technology and applications, forest resource on succession theory

and model simulation technology, forest resource management and decision-making, network technology and application, computer simulation technology, database technology and applications and so on.

Scientific Research Achievements

These years, IFRIT has undertaken many National Science and Technology Planning Projects such as National Key Task Technology Projects/ National Key Technology Support Project, 863 project, 973 project, National Natural Science Foundation of China and achieved 31 awards of national or province prize for progress in science and technology, 2 Liangxi awards. Among them, using TM satellite image as the basic information source, the project-“Remote Sensing Comprehensive Investigation Technology in the Public Test Area of 'Three North' Shelterbelt” has completed remote sensing comprehensive investigation results with higher precision, and multi-disciplinary. Using artificial intelligence and Expert System, “Forest Fire Monitoring for Southwest China” project has built NOAA forest fire monitoring system by which the accuracy of forest fire detection can surpass more than 80%. In order to meet the great demand of Chinese forest inventory and forest management inventory, “Forest Resource Remote Sensing Monitoring and Operational Application” project uses moderate and high resolution remote sensing data as the basic data source to set up the multi-stage remote sensing monitoring sample technique system. It breakthrough the key technology in the integrated processing, analysis and integrated application for forest resource remote sensing data and developed the technology procedures and standards for the application of remote sensing technology. Besides, IFRIT achieved independent research and development in forest resource investigation remote sensing data processing software system and built an application system for forest resource remote sensing monitoring which aims to these two service levels: forest inventory and forest management inventory. “Research on Forest Resource Comprehensive Monitoring” project not only comprehensively enhanced the capability of national forest resource monitoring and warning but also provided the technical support for

Chinese ecological construction and forest sustainable management.

International Cooperation

Frequent academic exchange and cooperation was conducted among nearly 30 countries, region and international organizations aboard. 10 scholars are also taking important positions in international organization and academic institutes. Every year more than 30 science and technical personnel go aboard to give lectures and attend the international conference. IFRIT is undertaking the following bilateral international cooperation programs with foreign university and organizations: “Chinese Tropical Forest Fire Monitoring and Management Exploiting Satellite Remote Sensing Data” under International Tropical Timber Organization (ITTO). “Study on Norwegian Forest Health with Hyperspectral Remote Sensing Data” cooperated with Norwegian and so on. Besides, Chinese Programme Office of Dragon Programme cooperated between European Space Agency (ESA) and Ministry of Science and Technology of the People’s Republic of China (MOST) is set up here charging with the daily management. Among 25 specific projects under Dragon 2 Programme, 3 projects are been undertaking by IFRIT. That is “Early Warning and Damaged Assessment for Forest Fire”, “Techniques for Deriving Land Cover and Earth Surface Deformation Information from Polarimetric SAR Interferometry” and “FOREST DRAGON 2: Forest Ecosystem Observations of The Changing Earth for DRAGON 2 including Identification and Monitoring of Disturbances”.

GOFC-GOLD

Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD) is a coordinated international effort working to provide ongoing space-based and in-situ observations of forests and other vegetation cover, for the sustainable management of terrestrial resources and to obtain an accurate, reliable, quantitative understanding of the terrestrial carbon budget. Originally developed as a pilot project by the Committee on Earth Observation Satellites (CEOS) as part of their Integrated Global Observing Strategy, GOFC-GOLD is now a panel of the Global Terrestrial Observing System (GTOS).

GOFC-GOLD is working to accomplish its objectives by:

- Providing a forum for users of satellite data to discuss their needs and for producers to respond through improvements to their programs;
- Providing regional and global datasets containing information on:
    - ✓ Location of different forest types;
    - ✓ Major changes in forest cover;
    - ✓ Biological functioning of forests (this will help quantify the contribution forests make as absorbers and emitters of greenhouse gases).
- Promoting globally consistent data processing and interpretation methods;
- Promoting international networks for data access, data sharing, and international collaboration;
- Stimulating the production of improved products.

Potential users of GOFC-GOLD products include global change researchers, international agencies, national governments, non-governmental organizations, and international treaties and conventions (such as the Framework Convention on Climate Change). One of the most important challenges facing GOFC-GOLD is to develop

methods and implement systems that provide both research and operational information on a regular sustained basis.

Cambodia- Forestry Administration (FA)

Introduction of Forestry Administration

Forestry Administration (FA) is a government authority under the Ministry of Agriculture Forestry and Fisheries (MAFF) in managing forests and forest resources according to the National Forestry Sector Policy and the Forestry Law.

The Forestry Administration has a unique management and organization structure for the whole country in vertical line, which divided into central, inspectorate, cantonment, division, and triage forestry administration levels.

Vision of FA

Forestry Administration (FA) is to be viewed by the world community as the national agency of excellence for sustainable forest management, making a maximum contribution to the Cambodia's socio-economic development.

Mission of FA

Forestry Administration (FA) is a government organization under the MAFF, which has the authority to manage the forest and forest resources in the Kingdom of Cambodia. According to the National Forestry Sector Policy and the Forestry Law, the main objective of FA is to ensure the sustainable management of forests in the country. To this end, FA is to perform the following duties based on the Forestry Low:.

- Issue regulation and forestry policy governing forest activities to ensure sustainable management of the permanent forest estate.
- Collect data on state forest highlighting the scientific, economic, social and environment factors necessary to determine a sustainable production level.
- Assess boundaries classification and demarcation of forests in order to develop a

land use map of the permanent forest estate in coordination with the Ministry of Land Management, Urban planning and Construction , local authorities and communities

- Prepare and implement the National Forest Management plan at each level of the FA
- Promote reforestation on degraded forest land and idle forest land
- Promote the development of community forest agreements and programs by providing financial and technical assistance to communities where feasible
- Develop and implement research, protection and conservation programs for forest resources and wildlife
- Take appropriate measure investigate, prevent and suppress various forms of forest destruction , forest fires and forest clearing to ensure effective forestry law enforcement
- Promote public education programs demonstrate the importance of managing, maintaining and protecting forest resources, as well as taking action to rehabilitate natural ecosystems and maintain national forest
- Promote international cooperation to strengthen the capacity to protect and develop forest resources
- Ensure the timely and complete assessment of all forest-related activities that may have a significant adverse social and environmental impact prior to approval of such activities

The objective and duties of FA are conceptualized in the following schematic drawing.

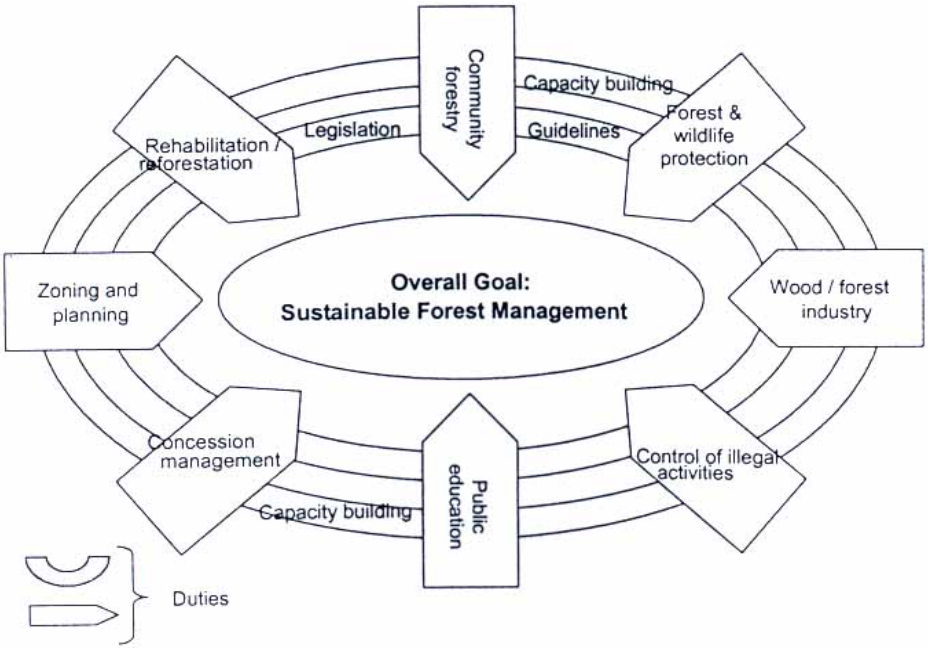


Table show the forest cover of Cambodia.

	Forest Types	Forest Area	%
1	Evergreen forest (E-F)	3,668,902	20.20
2	Semi evergreen forest (S-F)	1,362,638	7.50
3	Deciduous forest (D-F)	4,692,098	25.80
4	Other forest (O-F)	1,007,143	0.20
Total Forest Area		10,730,781	59.09
Non Forest		7,429,893	40.91
TOTAL AREA		18,160,674	100

Guangxi, China- Guangxi Forest Inventory & Planning Institute (GFIPI)

Guangxi Forest Inventory & Planning Institute (GFIPI), which is under the management of the Forest Department of Guangxi Zhuang Autonomous Region's Government, was established in 1953. GFIPI is the exclusive organization with national class A qualification of forest inventory and planning in Guangxi, and the its tasks covers forestry, garden, tourism, road and bridge, etc. Furthermore, GFIPI focus on Forest inventory and planning, Forest management, Plantation, Ecosystem monitoring, Forest protection and Biodiversity conservation.

There are more than 200 staff currently working full-time at GFIPI with nearly 120 of them that specializing in forest and having graduated and post-graduated level. Their educational background is Forestry, Ecology, Botany, Zoology, Environment, Soil, Geographic Information System (GIS), Remote Sensing (RS), Global Positioning System (GPS), Computer, Informatics, Economics, etc. In addition, GFIPI has partnered with lots of top experts from other institutions and colleges in relevant areas, such as Chinese Academy of Forestry, Beijing Forestry University and Purdue University.

GFIPI is equipped with various type of computer, server, and a LAN network, A0-sized printers (HP), A0-sized Scanner, GPS, Total Station, Pocket PC and other supplementary equipments. Its software and IT system is largely comprehensive and wide-ranging, especially those software packages associated with GIS and RS standard which are ArcGIS, ERDAS, ENVI, Definiens Developer, Oracle, etc.

Up to now, GFIPI had in charged of most of the forest inventory activities in Guangxi, including the National Continuous Inventory of Forest resources, and Forest Management Inventory and Forest Cutting Area Survey and Design. From 1977 to 2010, GFIPI had implemented 9 times National Continuous Inventory of Forest

resources in Guangxi, which re-census every 5 years and covers 4998 permanent plots. Similarly, the local Forest Management Inventory which re-census every 10 years by field inventory had been conducted by GFIPI.

Since 1990s, GFIPI had applied RS and GIS to the forest inventory and management. The application including as follow:

1. Using satellite image (Landsat TM) for National Continuous Inventory of Forest resources in 2005 and 2010.
2. Using satellite image (APOT5 and ALOS) for regional forest coverage monitoring in 2008.
3. Using satellite image (APOT5 and ALOS) for Management and Planning Inventory of Forest of Guangxi at 2008-2009.
4. Developing entirely forest sub-compartment GIS-database of Guangxi based on field inventory in 1999 and 2009.

Laos- the Faculty of forestry, National University of Laos

Background

The Faculty of Forestry has been developed from the forestry research center. It was supported by the Australian government. However, after the National University of Laos has been established in 1995, the faculty of forestry joined with faculty of agriculture and forestry to be one faculty under the national university of Laos, which was called “Faculty of Agriculture and Forestry”. Since the faculty of agriculture and forestry has 2 campuses including Dong Dok and Na Bong, this faculty was divided into 2 faculties (faculty of forestry and faculty agriculture).

Education functions

The faculty of forestry is the highest forestry education in Laos. The faculty has fully functioning on development of teaching materials on forestry under the supervise of the National University of Laos. Because of this function, the faculty has been developed from forestry training center to Vientiane Forestry College and up grade current faculty of forestry. The faculty of forestry is currently 3 different level of forestry education. These are

- Diploma on fundamental tropical forestry
- BSc on fundamental tropical forestry, and
- MSc on tropical forest sustainable management and sustainable rural development

Besides teaching above 3 levels of forestry education, the faculty is currently developing Ph.D program on sustainable forest management and rural development.

The faculty of forestry is currently consisting of 4 departments;

1. Department of Watershed Management and Land Use Planning
2. Department of Sustainable Forest Management
3. Department of Wood Industry and Wood Technology
4. Department of Eco-tourism

All most subjects that related to forest cover and land use monitoring and environmental issues are under the Department of Watershed Management and Land Use Planning.

Academic Research and Services

In parallel with teaching, the faculty has function on scientific research on forestry, sustainable natural resource management, environment, socio-economic development, etc. Previously research projects in Northern Laos that related to forest/land cover mapping are:

1. Land cover and land use change in Northern Laos
2. Land use and livelihoods transition in Northern Laos

Current research project related on forest and carbon mapping that the faculty is launching is the project on ***"Impacts of Reducing Emissions from Deforestation and Forest Degradation and Enhancing Carbon Stocks (I-REDD+)"***. The proposed site for this project is Nam Et Phou Luey National Protected Area, which is the same protected area the Forest and carbon mapping project proposed site.

Not only research, but the faculty of forestry also provides technical services to development projects, government agencies, NGOs, and INGOs in Los. There are several staffs at the faculty of forestry can provide technical and academic services based on the requirement of customers (development project).

Regarding the research and technical academic services at the faculty of forestry, the research division is standing on behalf of the faculty of forestry in management of all research and academic services works within the faculty. The faculty establishes a Research Center on Natural Resource Management and Climate Change (NRMCC) under the Research Division.

This research center is currently providing both research/technical services and capacity building. Currently capacity building services is mostly training courses on using tool in Remote Sensing and GIS software. GIS software, we currently train on using software tools within Arch.GIS, Archview. The training is divided into 3 different levels include:

- Fundamental level
- Intermediate level
- Professional GIS user

Malaysia- Forest Research Institute Malaysia (FRIM)

Introduction

Forest Research Institute Malaysia (FRIM) is one of the leading institutions in tropical forestry research in the world. Founded in 1929, the former Forest Research Institute became a fully-fledged statutory body, governed by the Malaysian Forest Research and Development Board (MFRDB) under the Ministry of Primary Industries, in 1985. Presently, both FRIM and MFRDB are under the purview of the Ministry of Natural Resources and Environment. The Institute sits on a 485.2-ha site adjacent to the Bukit Lagong Forest Reserve in the Kepong municipality, 16 km northwest of Kuala Lumpur. The Institute was awarded the MS ISO 9001:2000 certification in December 2007 and gazetted as a natural heritage on 10 February 2009 under the National Heritage Act 2005. It is helmed by Dato' Dr Abdul Latif b. Mohmod as its Director General (DG).

Mission

To achieve excellence in scientific research, development and forestry services.

Vision

To make FRIM a world-class tropical forest research institute.

General Objectives

1. Generating scientific knowledge for the understanding, management, conservation and use of forest resources;
2. Achieving excellence in research and development (R&D) through the use of

the latest scientific equipment;

3. Studying biodiversity to produce useful products through intensive R&D;
4. Developing related technology to fulfill the needs of the forestry industry;
5. Packaging research and development findings for dissemination to clients;
6. Commercialising R&D findings through technology transfer to all interested parties;
7. Providing excellent services, fulfilling clients' needs;
8. Creating strategic cooperation with local and international agencies; and
9. Raising public awareness on the importance of the environment and the conservation of forest biodiversity.

Operational Objectives

1. Providing human resource development programmes to produce a class of authoritative and competent scientists;
2. Providing a work environment that is conducive to encourage creative thinking among scientists and a close relationship with clients;
3. Disseminating the technological and research products as well as giving accurate and professional advice and technical services;
4. Providing practical solutions to problems involving management and usage of forest resources and products; and
5. Providing facilities and professional services in order to raise environmental awareness.

Functions

The main functions of FRIM include:

- Planning and implementing research for the development of the forestry sector and conservation of forest resources;
- Obtaining and disseminating research information to enhance forest

management and the use of forest products;

- Establishing joint research and joint forest development with other bodies within and outside Malaysia.

Research Areas

FRIM's research activities are organised under the following divisions:

- **Forestry & Environment Division**

  Focuses on conservation of forest ecology and biodiversity by providing data, standards and guidelines for the sustainable management of natural forests. Research on the use of new geospatial technologies including remote sensing, geographic information system (GIS) and DGPS for forest mapping, management and monitoring is also undertaken under this Division.

- **Forest Biodiversity Division**

  Responsible for conducting documentation and research for the conservation and sustainable use of components of forest biodiversity in the country.

- **Forest Products Division**

  Focuses on the development of forest based industries and conducting research on the use of ligno-cellulosic materials.

- **Biotechnology Division**

  Undertakes medicinal plant research and studies ways to set up cost-effective forest plantations as an alternative and/or supplementary source of timber.

- **Natural Products Division**

  Involved in research on bio-resources and development of herbal products.

- **Research Planning & Corporate Division**

  Concentrates on strengthening and assessing the impacts of FRIM research.

Research on Geospatial Technologies

Research related to the use of geospatial technologies (remote sensing, GIS and

DGPS) for forestry application in FRIM is being undertaken by the Geoinformation Programme (GI), under the Forest and Environment Division. There are 17 staffs in this Programme and headed by a Senior Researcher Dr. Khali Aziz bin Hamzah. This Programme are divided into two Units, namely the Remote Sensing and GIS Unit (RSGI) and Forest Engineering Unit (KH). The major tasks taken by GI includes undertaking (i) research and development projects in forestry applications by using recent and latest geo-spatial technologies (remote sensing, photogrammetry, Global Positioning System (GPS), Geographic Information System (GIS), forest engineering and related technologies); (ii) technical services, which involve satellite image interpretation and analysis, operating, integrating GPS-GIS data, forest survey, stream survey, topographic survey and tree inventory; (iii) consultancy and collaboration with wide variety of clients particularly in forestry-related aspects; and (iv) training on geo-spatial technologies for forests mapping, monitoring, planning and management.

Some of the completed and on-going researches on remote sensing and GIS include:

1. Research on Development of Forest Carbon Monitoring Methodologies for REDD+ in Malaysia.
2. Assessment of Coastal Erosion Effects on Mangrove Ecosystem and its Potential Impacts to Socio-Economic Values in the Coasts of Peninsular Malaysia Using Remote Sensing and GIS.
3. Generation of Spatial Distribution Maps of *Gonystylus bancanus* (Ramin) using Hypespectral Technology and Determination of sustainable Level of harvest of Ramin in Production Forest of Peninsular Malaysia.
4. Development of tree mapping technique using Differential Global Positioning System (DGPS) and Geographic Information System (GIS) approach.
5. Development of efficient mapping techniques of forest resource and monitoring of environment using high resolution space- and air-borne remote sensing and GIS.

6. Monitoring and mapping of mangrove forest using fine resolution remote sensing data.
7. To develop bamboo inventory technique using remote sensing data.
8. Development of remote sensing technology on monitoring and mapping of tropical forest. Joint research between FRIM and Forestry and Forest Product Research Institute (FFPRI) Tsukuba, Japan.

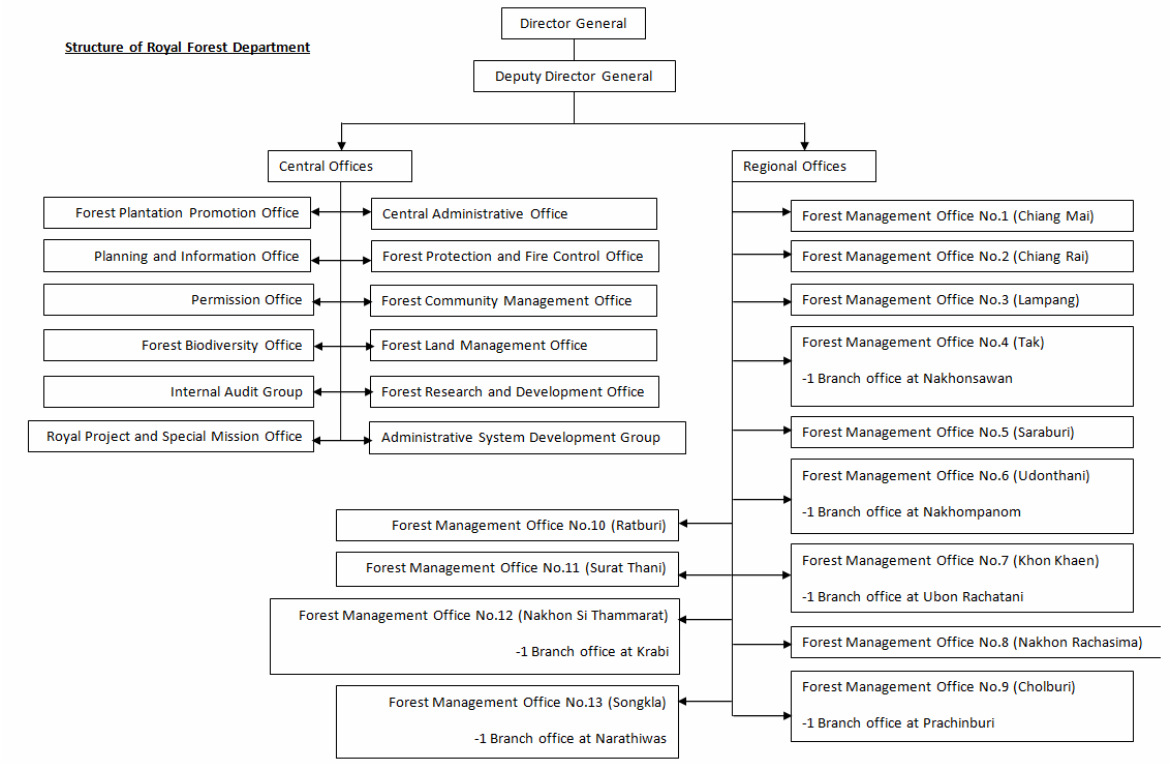
The results of FRIM's research are published in peer-reviewed scientific journals and also transferred to relevant government agencies involved in overseeing and managing forests, as well as forest-related industries.

Field Research Stations

FRIM offers a wide range of facilities for conducting research, including six field research stations in different forest types in various parts of the country. The 600-ha Pasoh research station of lowland dipterocarp forest in Negeri Sembilan was founded in early 1970s. It has received worldwide attention from tropical forest ecologists and scientists and includes a 50-ha permanent ecology plot, an arboretum and a tree tower-canopy walkway system, the forest of its kind in the country. Other stations are the 455-ha Mata Ayer station of teak and pine in Perlis; the Jengka station in Pahang to monitor hydrology, ecology, physiology, soil science, and silviculture; the 53-ha station in Setiu, Terengganu to study the planting of forest species and non-timber species like bamboo on BRIS (beach soils) and the 50-ha Maran station in Pahang to study medicinal plants. While the Segamat station in Johor developed to study forest plantation plot of commercial timber establishment. The 121.4-ha Bidor station in Perak is where afforestation research on ex-mining land is being carried out.

Thailand- Royal Forest Department of Thailand

In the past the forest was regarded as sufficiently abundant and people were free to access it for their own uses and commercial purposes. The exception to this was teak (Tectona grandis Linn.), this was designated by the Act of Legislation of Teak, and any person who wanted to cut the tree down had to get permission from the local Chiefs of Forest (CF). In exchange for this right certain fees, called Stump Fees (local tax) had to be paid to the CF. The forest originally was concerned only with logging and did not take seriously the importance of maintaining the forest land. King Chulalongkorn (Rama V) having made an extensive tour of Europe, brought back to Thailand the idea of natural resource conservation and the importance of preserving the forests. In a lengthy report submitted to the Government on August 10th, 1896, Mr. H. Slade pointed out some weak points in the management of the forest. Most important was that ownership was in the hands of local chiefs instead of being under the control of Central Government and the working of teak forests was so irregular that the principle of conservation for perpetuating the yield had never been employed. Among several recommendations Mr. Slade proposed to the Government, the most urgent and important one was adopted. Sanctioned by His Majesty King Rama V, a Forest Service was created as a department under the Ministry of Interior on September 18th, 1896. Mr. Slade was the first Chief Conservator of the forest. The development of forest management in Thailand has followed the course laid down by him following the pattern of the Forest Services in India and Burma. With the support of H.R.H. Prince Damrong Rajanubhap, the Minister of Interior, and the vast experience of Mr. Slade, the Royal Forest Department (RFD) was brought into a state of efficiency. The RFD remained under the umbrella of the Ministry of Interior for 25 years.



Due to the different trends and policies of the general Government administration, the RFD was transferred under many ministries before it eventually became a unit of the Ministry of Natural Resource and Environment (MNRE) in 2002, where it remains to the present time. Because of this the RFD was split into 2 main departments, the RFD and the National Park, Wildlife and Plant Conservation Department (DNP), and the RFD's previous division of mangrove management was transferred to Department of Marine and Coastal Resources.

Thailand first began to use remote sensing data, by using the Royal Thai Army's aerial photography from the VAP 61 project, to evaluate existing forest area in 1961. The Faculty of Forestry, in Kasetsart University, used the data. The scale was 1:50,000. The project's results showed that the existing forest area of Thailand was 53.33 % of country's total area.

The RFD, under the umbrella of the Ministry of Agriculture and Cooperatives (MGC), began to use the satellite imageries on the 16th January 1973. Thailand had joined with NASA's Earth Resources Technology Satellite Programme (ERTS) on the 14th

September 1973, with the aim of applying satellite imagery to natural resources assessment. Because of this the RFD received data from LANDSAT 1, to survey the existing forest in 1973. The following year the MGC appointed a committee, whose aim was to conduct research on new techniques of applying remote sensing data on natural resource survey. Because of this the RFD used the data from LANDSAT satellites from the programme to survey the existing forest area in 1976, 1978, 1982, 1985, 1988, 1989, 1991, 1993, 1995 and 1998. The bands we used were 3, 4 and 5. The existing forest area interpreted from the satellite imageries mentioned above shows in the table below. (table1)

Apart from the projects mentioned above the RFD itself created many projects using satellite imagery since the last decade until present. The Forest Resources Assessment Division (FRAD) was established in 1993 by the RFD and was responsible for satellite image interpretation for the organization. The RFD used many different satellites data but mainly on LANDSAT data. The data from such satellites are received and processed by Geo-Informatics and Space Technology Development Agency (Public Organization) (GISTDA), Ministry of Science and Technology. The main projects on application of satellite imagery which have been created and run by RFD.

Viet Nam- Forest Inventory & Planning Institute (FIPI)

Introduction

Forest inventory & Planning Institute (FIPI), Department of Forestry (DOF) - Ministry of Agriculture and Rural Development (MARD) is a governmental organization, specializing on state management in the field of forest inventory and planning.

The FIPI has more than 700 staff consisting of 40 post-graduate staff (10 doctors, 30 masters) 264 university degree staff, 415 technicians and technical workers organize a as follows : 11 units directly belonging located throughout the country **(**4 functional sections, 1 Centre, 1 Forestry Museum and Six Sub-FIPI).

At present, FIPI carries out many activities assigned by the Vietnam Government. Amongst the others they are:

- Conduct inventories of forests and forest lands throughout country;
- Monitor land use / land cover change occurred with strong interface between people and forests throughout the country, investigate those factors that affect land cover change and the interactions that may exist between them either spatially or temporally.
- Prepare the effective sustainable forest development plans for national, regional and provincial level and for forests of different functions: Production Forests; Protection Forests (including watershed protection forests) and Special Use Forests (including national parks, Nature Reserves, cultural-historical and environmental sites),
- Carry out researches in the field of environmental protection and biodiversity conservation.

Current status of remote sensing and GIS application in FIPI

The application of Remote Sensing technology in FIPI back to the late 1970s when Landsat MSS and aerial photos were used in Forest resources inventory Project funded by FAO (FAO/UNDP-VIE 79/014) in 1979-1983.

In the period from 1985 to 1990: Satellite imagery of Landsat TM were used for forest mapping in inventory programs, e.g. for Highland Plateau Master Plan;

In the period from 1991 to 1995:

- Satellite imagery of Landsat TM were used for forest mapping in the program "Inventory, assessment and monitoring of forest resources for the whole country inventory for the period 1991-1995";
- Research on dynamic of Mangrove forests in Minh Hai province for 20 years old period based on remote sensing data;
- Initial application of digital remote sensing data for mapping forest resources and land uses in forestry;
- Research on impacts of the chemical defoliants to the forests in American -Vietnam war;
- Mekong River Commission Project titled Forest Cover Monitoring using Landsat TM;

In the period 1996 to 2000:

- Satellite imagery of SPOT4 were used in the Program "Inventory, assessment and monitoring of forest resources for the whole country for the period 1995-2000" for mapping forest resources and land uses for 61 provinces at a scale of 1:100,000;
- Research on impacts of the chemical defoliants to the forests in American – Vietnam war;

- Satellite imagery of SPOT4 were used in the Mangrove forest rehabilitation project in Ca Mau province;
- Watershed Management project funded by MRC;
- Information System Development Project for Tropical Forests in collaboration with JAFTA (Japan Forestry Technical Association)
- Experiment on application of NOAA imagery for forest fires forecasting and RADAR for studying relationship between forest cover and floods.

In the period from 2001 to 2005:

- Satellite imagery of Landsat ETM+ are used in the Program "Inventory, assessment and monitoring of forest resources for the whole country for the period 2001-2005" for mapping forest resources and land uses for 61 provinces at a scale of 1:100,000;
- Take part in the project titled: "Forest Dynamism Study Project for Eastern part of Asia 2001 – 2005" in collaboration with JAFTA (Japan).

FIPI also has close relation in the field of application of remote sensing and GIS with international organizations like RESTEC, JAFTA (Japan), GeoSpatial (Canada), ITC (the Netherlands) etc. FIPI makes use of this by strengthening knowledge, expertise and equipment.

In the period from 2006 to 2010:

The program of Inventory, assessment and monitoring of forest resources for the whole country in period of 2006-2010 is implemented in the whole country with the area of app. 19.000.000 ha and GIS and remote sensing will be used as the key tools. The satellite imagery of SPOT5 are used for forest and land use type mapping for this program. In the next period, aerial photos and satellite imagery with high solution (such as Quickbird, Ikonos...) will be prioritized in research activities. The remote sensing and GIS will be applied in building database for the program.

Yunnan- Southwest Forestry University (SWFU)

Southwest Forestry University (SWFU), located in Kunming, Yunnan, China, is the unique university in forestry in the western part of China. Faculty of Natural Resources (FNR) is the largest teaching unit with about 70 years long history in SWFU, and has powerful teaching staffs, advanced equipments, and distinguished achievement in scientific research. There are 96 teachers in FNR, including 27 professors and 31 associate professors. And, there are 7 undergraduate specialty directions including Forestry, Geographic Information System, Agriculture, Surveying and Mapping Engineering, etc.

Research Center of GIS, RS & GPS in Forestry of Yunnan Province with 21 staffs, being linked by FNR, was established by the Education Department of Yunnan in 2007. The main task of the research center is mainly aiming at technology innovation research of Geomatics. There are 3 focuses research fields: 1) forest resources inventory and dynamic monitoring, 2) forest management and digital forestry information sharing; 3) sustainable forest management. At the same time, hot issues and needs of forest management are concerned and related research and service are carried out.

The main projects which were finished in recent years by the Center include: 1) Technical Services of Tenure Reform based on GIS, RS and GPS; 2) Forest Structure and Biomass Estimation Using Radar Data, 3) Remote Sensing Survey and Mapping of Biodiversity of Northwestern Yunnan, 4) Remote Sensing Survey of Shelter Belt in Yangtze River Valley, 5) Survey and Assessment of Forest Fuels of Yunnan based on Remote Sensing.

The total research funding by the end of 2010 of the Center was about 17.85 million Yuan. And, the funding of projects at the national level was about 7.14 million Yuan,

which covers 40 % of the total funding. It fully reflected our research strength and academic standard.

In the past two years, several achievements were developed by the Center: 1) Management Information System of Collective Forest Rights Reform, 2) Digital Platform of Wetland Reserve, etc. New achievements were finished: 1) Application of MIS of Collective Forest Rights Reform in Yunnan, Sichuan, Guangxi, 2) Demonstration of Community Forestry, 3) Modeling of Biomass and Carbon Storage, etc.