Papua New Guinea
Forest Authority

CAPACITY DEVELOPMENT ON FOREST RESOURCE MONITORING FOR ADDRESSING CLIMATE CHANGE IN PAPUA NEW GUINEA

FINAL REPORT

March 2013

Japan International Cooperation Agency (JICA)
Kokusai Kogyo Co., Ltd.

Picture at Beginning: Status of Local Activities

June, 2011 – February, 2012

Participation in MRV Design Workshop

Discussion with PNG Forestry Authority

Discussion with UPNG Dr. Phil

Discussion with Mineral Resource Authority

Discussion with UNITECH Dr. Pal

Discussion with Forest Research Institute

March, 2012 – September, 2012

PNGFA-JICA Workshop (Progress Report)

PNGFA-JICA Workshop (GPS Training)

Remote Sensing Training

Database Discussion

Field Survey Training for Carbon Estimation

Field Survey for Carbon Estimation (Camp Site)

October, 2012 – March, 2013

PNGFA-JICA Workshop (Progress Report)

PNGFA-JICA Workshop (GIS Training)

Ground Truth Training (GPS & Sketch)

Ground Truth Training (GPS & Picture)

Exercise on Image Interpretation & Ground Truth

PNGFA HQ Stuffs teaching Local Area Officers

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Picture at Beginning – Status of Local Activities

Annexes

Currency conversion rate table

Month	Rate PGK1=
June, 2011	35.324
July, 2011	36.664
August, 2011	35.756
September, 2011	35.509
October, 2011	35.585
November, 2011	36.219
December, 2011	37.466
January, 2012	37.658
February, 2012	38.246
March, 2012	40.334
April, 2012	41.525
May, 2012	41.074
June, 2012	40.103
July, 2012	40.699
August, 2012	39.913
September, 2012	39.867
October, 2012	39.241
November, 2012	40.067
December, 2012	41.707
January, 2013	43.175
February, 2013	44.828
March, 2013	46.042

Abbreviation

AusAID	The Australian Agency for International Development
COP	Conference of the Parties
C/P	Counterpart
DAL	Department of Agriculture and Livestock
DB	Data-Base
DEC	Department of Environment and Conservation
DSM	Digital Surface Model
DTM	Digital Terrain Model
FAO	Food and Agriculture Organization of the United Nations
FIMS	Forest Inventory Mapping System
FIPS	Forest Inventory Processing System
FRI	Forest Research Institute
GIS	Geographic Information System
GPS	Global Positioning System
GUI	Graphical User Interface
IC/R	Inception Report
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
JICS	Japan International Cooperation System
K	Kina
MRA	Mineral Resource Authority
MRV	Measurable, Reportable and Verifiable
NFI	National Forest Inventory
NFS	National Forest Services
OCCD	Office of Climate Change and Development
OJT	On the Job Training
PALSAR	Phased Array type L-band Synthetic Aperture Radar
PDM	Project Design Matrix
PNG	Papua New Guinea
PNGFA	Papua New Guinea Forest Authority
PNGRIS	Papua New Guinea Resource Information System
PO	Plan of Operation
R/D	Record of Discussions
REDD	Reducing Emissions from Deforestation and forest Degradation (in developing countries)

RS	Remote Sensing
SFM	Sustainable Forest Management
UML	Unified Modeling Language
UN-REDD	United Nation REDD
UNITECH	University of Technology
UPNG	University of Papua New Guinea

Chapter 1 Outline of the Project

1.1 Background of the Project

The Independent State of Papua New Guinea (herein after referred to as "PNG") has one of the world's largest tropical rainforests and leads the Coalition of Rainforest Nations. Wood harvested from forests is one of the major export goods alongside with mineral resources and agricultural products and contributes significantly to the country's economy. As approximately 87 % of the people of PNG live in rural areas, forests play important roles in the lives of people in rural areas as sources for food supply, fibers and construction materials. The tropical rainforests of PNG are important also for conservation of biodiversity as new species of organisms have been registered almost every year.

The conversion of forest areas through gardening and subsistence agriculture, etc has reduced the forest cover from 38 million ha (approximately 82 % of the total land area of PNG) in 1972 to 33 million ha (approximately 71 %) in 2002. As a result of conversion to gardens for subsistence agriculture, etc. Thus, the rate of decline and degradation of forest resources is a serious problem in PNG.

PNG, jointly with Costa Rica, first proposed "Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD)" at the 11th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP11) in 2005. Since then, the Government of PNG has been working actively toward developing and implementation of measures in reduction and degradation of forests through participation of relevant government offices and donors. Its achievement so far includes the formulation of "the Forest and Climate Change Policy Framework" in 2009 and the establishment of a technical working group on REDD+[1] under the Office of Climate Change and Development in 2010.

Estimation of CO2 emissions and absorption by forests is a basic requirement for the implementation of REDD+. However, the fact that data on forests at the accepted level of accuracy required for the estimation have not been fully available in PNG is the major obstacle to the implementation of practical measures.

Against this background, the Government of PNG submitted a request to the Government of Japan for technical cooperation for the capacity development on forest resource monitoring with the aim of constructing a system to monitor vast forest areas in PNG using satellite imagery and GIS and human resource development for the system construction. In response, JICA conducted a detailed design survey in November 2010. During this survey, JICA and the Government of PNG reached an agreement on the framework for the cooperation and signed and exchanged the Record of Discussions (R/D) describing the details of the framework on November 26th, 2010.

In accordance with the R/D, JICA is to implement "the Project for the Capacity Development on Forest Resource Monitoring for Addressing Climate Change in Papua New Guinea," for the three-year

[1] At present, REDD is being discussed as a framework of an international system, "REDD+," which includes not only measures against the reduction and degradation of forests, but also promotion of sustainable forest management.

project between March 2011 and March 2014, with the PNG Forest Authority (PNGFA) as the counterpart. At present, two long-term experts, the chief advisor who is in charge of forest administration and the person in charge of forest surveys and project coordination have been dispatched to PNG for the periods between March 2011 and March 2013 and between May 2011 and May 2013.

1.2 Purpose of the Project

The table below shows the overall goal, project purpose and outputs of the Project. The Project aims to achieve the project purpose through implementation of the project activities and collaboration with long-term experts.

Overall goal:	Forests in PNG are conserved and managed sustainably as important measures to mitigate and adapt to the effects of climate change.
Project purpose:	In order to promote measures against climate change, capacity to monitor forest resources including carbon stock of the relevant organizations in PNG is strengthened.
Outputs:	1. Use of remote sensing technologies improves the national forest cover map. 2. The forest resource database is improved. 3. In order to promote measures against climate change, the system to monitor forest resources including carbon stock is improved.

1.3 Scope of the Project

The Project is part of the technical cooperation project which is implemented in accordance with the R/D concluded between the Government of PNG and JICA in November 2010.

1.3.1 Counterpart organization and beneficiaries of the recipient country

[Counterpart organization]	Papua New Guinea Forest Authority (PNGFA)
[Beneficiaries]	PNG Forest Authority (PNGFA), Forest Research Institute (FRI) UPNG Remote Sensing Centre UPNGRS, PNG University of Technology (PNG Unitech), Department of Environment & Conservation (DEC) etc.

1.3.2 Project Area

The Project covered the entire area of PNG. However, major Project activities are to be implemented from Port Moresby. The Project Office was established in the Head Office of the counterpart (C/P) organization in Port Moresby.

1.3.3 Scope of the Project

The Project is to provide assistance to the C/P organization in capacity development in such technologies as remote sensing.

1.4 Organizational Structure for the Project Implementation

Figure 1-1 エラー! 参照元が見つかりません。 shows the organizational structure for the implementation of the Project.

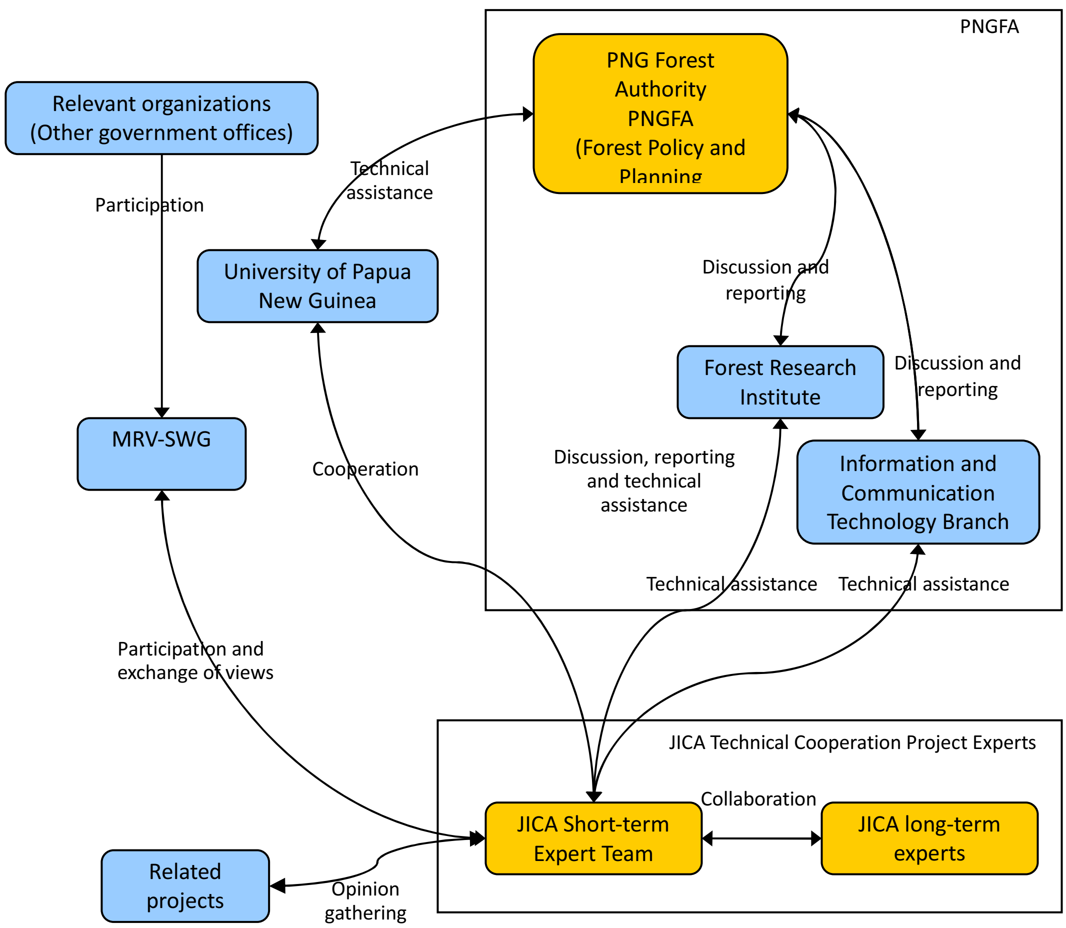


Figure 1-1 Organizational Structure of the Project Implementation

1.4.1 Papua New Guinea Side Implementation Agency

The counterparts (main members that participated in discussions and activities) are listed in Table 1-1.

Table 1-1 List of Counterparts

Name	Division (Position)	Project Field Handled
Ruth C H Turia	Director - Forest Policy and Planning	Project Director
Goodwill Amos	Manager - REDD & Climate Change	REDD Advisor
Constin Bigol	Manager - Inventory & Mapping	Project Manager
Dambis Kaip	Manager - Aid Coordinator	Coordinator
John Worimbangu	Senior Forest Plans Officer	Forest Planning
Tongo Margaret	Forest Plans Officer	Forest Planning
Perry Malan	Senior Cartographer	RS/GIS and Database
Patrick La'a	Cartographer	RS/GIS and Database
Ledino Saega	Senior Forest Inventory Officer	Inventory Survey
Samuel N. Gibson	Forest Inventory Officer	Inventory and RS/GIS
Gewa Gamoga	Climate Change Officer	Climate Change
Elizabeth Kaidong	REDD	REDD
Rabbie I. Lalo	Data Analyst	Vegetation and RS/GIS
Simon Saulei	Director, Forest Research Institute	Project Director at FRI
Martin Golman	Deputy Director, Forest Research Institute	Inventory Advisor at FRI
Patrick Nimiago	Manager Natural Forest Management	Project Manager at FRI
Bruno Kuroh	Researcher at Forest Research Institute	Field Survey Leader
Cossey Yosi	Researcher at Forest Research Institute	Field Survey Leader
Agnes Sumareke	Researcher at Forest Research Institute	GIS Trainee at FRI
Miller Kawanamo	Researcher at Forest Research Institute	GIS Trainee at FRI
Kunsey Lawong	Researcher at Forest Research Institute	GIS Trainee at FRI

1.4.2 Japan Side Expert Team

The Japanese experts are listed in Table 1-2.

Table 1-2 Japanese Experts

Name	Field
Masamichi Haraguchi	General/remote sensing 1
Masaki Kawai	Remote sensing 2 (SAR)
Kunihiro Ishii	Forest GIS database 1 (Overall design)
Yasuyuki Okada	Database 2 (Detailed design/Operation and development)

1.4.3 Joint Coordinating Committee (JCC)

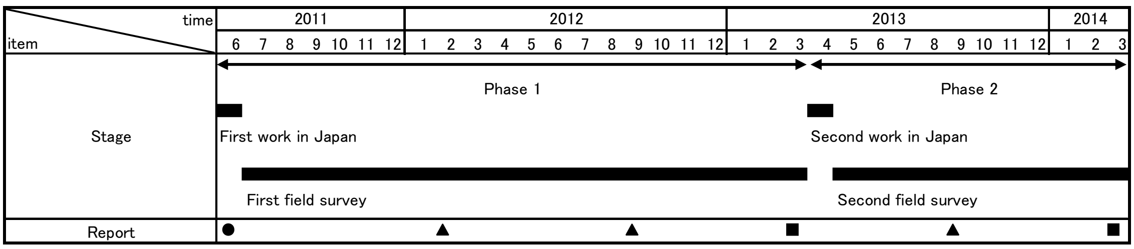
A meeting of the JCC was held in the capital city of Port Moresby, with an explanation and discussion concerning the yearly results of activities and plans for subsequent activities and other operations, after which the agreement of the participants was obtained. The JCC has the following functions, and holds at least one meeting a year during the term that yearly activities are conducted.

- Preparation of Annual Project Plan in accordance with Plan of Operation
- Evaluation of overall project progress and level of achievement
- Review of problems related to project implementation
- Review of changes in activity content made according to situation

1.4.4 Overall Schedule

The overall schedule for this project is described in Table 1-3.

Table 1-3 Overall Schedule



Chapter 2 Basic Policy for Project Implementation

2.1 Basic Concept of Project

An outline of the project is shown in Figure 2-1. This project is being implemented to develop a national forestry resource monitoring system in Papua New Guinea in order to obtain an accurate grasp of the current status of the forest base, changes in the forest and other details with the objective of promoting the implementation of measures against climate change (REDD+) through Sustainable Forest Management (SFM).

The main activities consist of: "1. Obtaining grasp of current state of national forest resources utilizing satellite data (preparation of forest base maps)", "2. Development of national forest resource database that links satellite data and ground data" and "3. Development of trial reference emissions level for REDD+", and implementing the training necessary for item "1." to "3.".

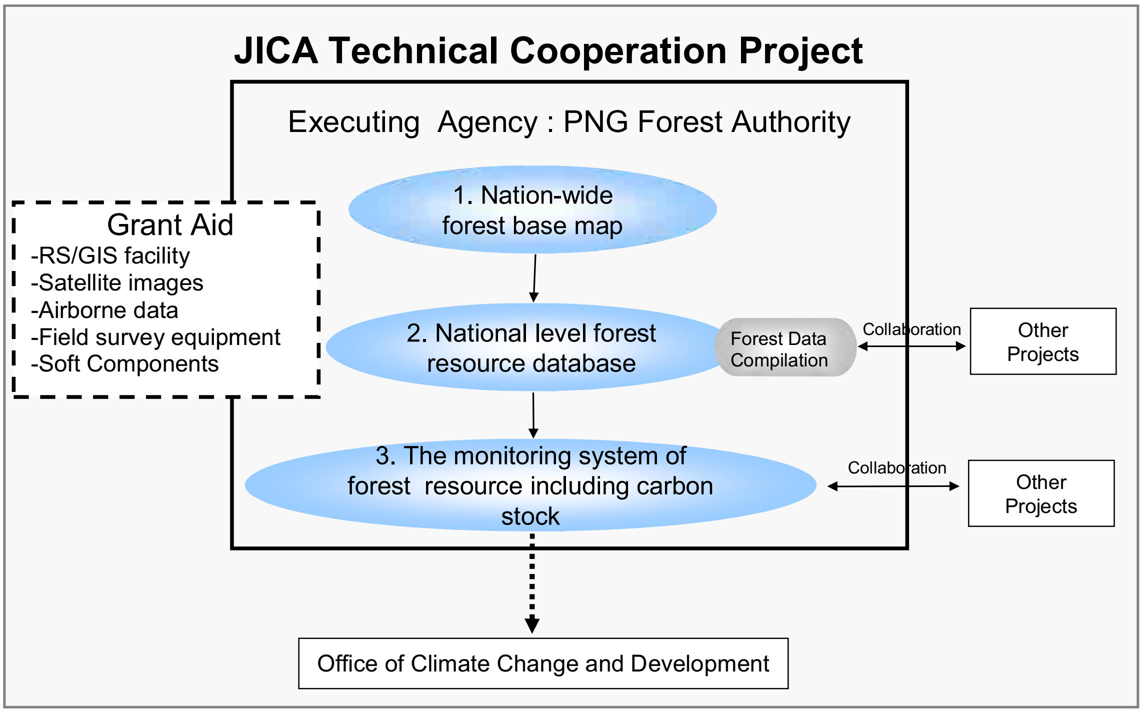


Figure 2-1 Overview of JICA Technical Cooperation Project

In addition, in order to provide a concrete image of an overview of the project described in Figure 2-1, the various issues were organized into the current status of forest resource monitoring in PNG (As-Is), future objectives (To-Be) and challenges that exist between these (Problems) so that the proper approach could be determined for them respectively during this project. These relationships have been compiled in Figure 2-2.

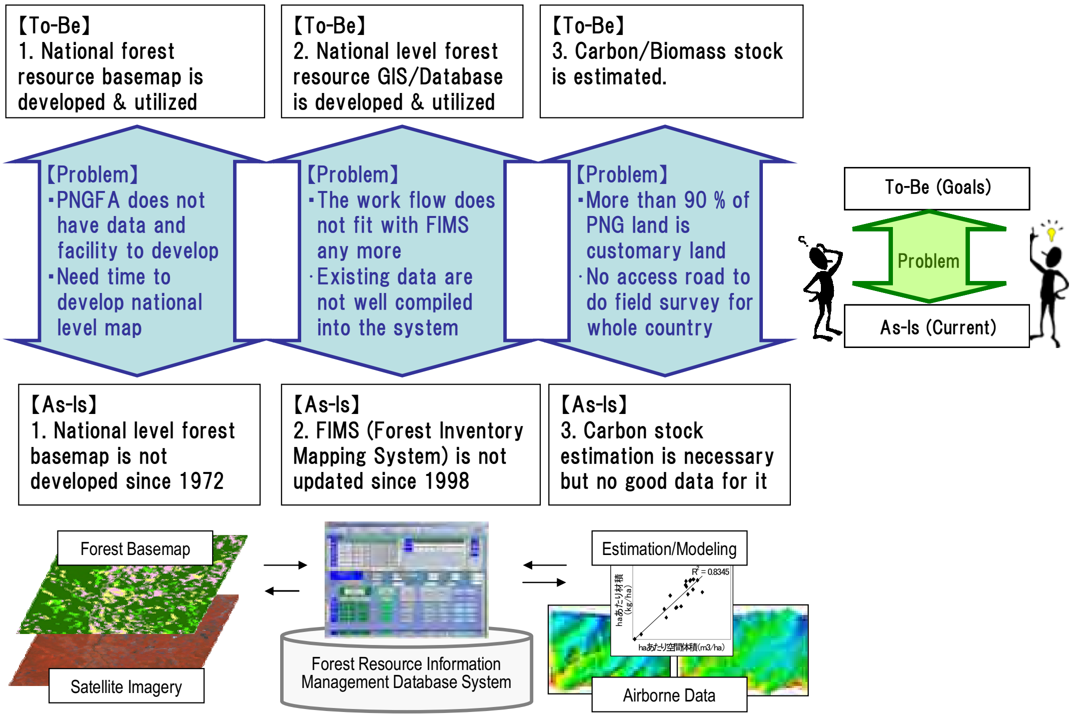


Figure 2-2 Organization of Current Status of Forest Monitoring in PNG, Future Objectives and Problems

Furthermore, this project is planned to be closely coordinated with the "Forest Conservation Program" under the Grant Aid for Environment and Climate Change (hereinafter GAECC) implemented in fiscal 2009. Coordination between JICA technical cooperation and technical assistance provided under GAECC, as well as the division of roles are described in Figure 2-3. This project mainly consists of the analysis and design of forest monitoring, utilization and operation of maps and databases, and capacity building related to these fields.

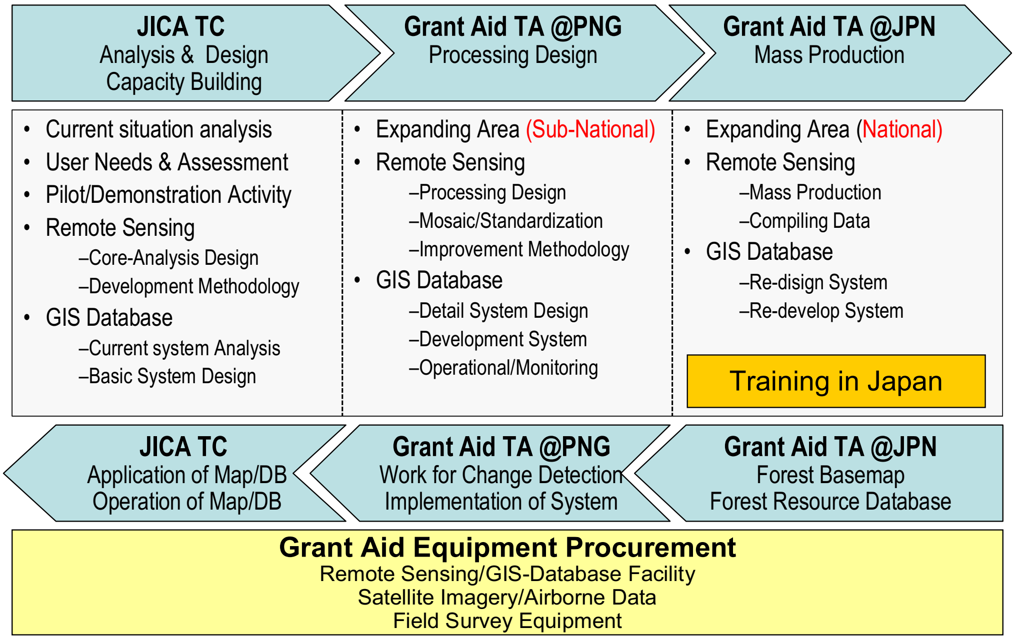


Figure 2-3 Coordination of JICA Technical Cooperation & GAECC and Division of Roles

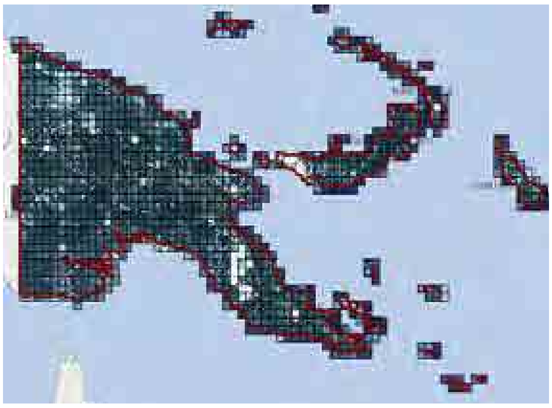
Bidding for equipment required for GAECC was conducted in August 2011, and then equipment was delivered by March 2012. The equipment delivery ceremony was held on 13th March, 2012. It is expected that the optical satellite images which had been an issue of concern in the acquisition of data in the past was addressed by using five RapidEye satellites which acquired data for the entire nation of PNG in a short period of about one year, yet still provided color images with 5m resolution.

Ref. RapidEye Web

Orbit	620 km, sun synchronous
Number of Satellites	5
Spacecraft Mass	150 kg each
Image Data Downlink	>80 Mbps
Onboard Data Storage	>1500 km of image data
Max. Spacecraft Roll Angle	± 25 degrees
Payload Type	Push broom Optical Imager 5 Optical bands
Swath	78 km
Nadir Pixel Ground Sampling Distance	6.5 m
Global Revisit Time	1 day
Average Repeat Period (Europe and North America)	<5 days
DEM Generation Capability	Yes
Mission Life	7 Years

Figure 2-4 Specifications for Satellite Images (RapidEye) Procured with GAECC

SPOT4 Coverage in 2002 (20% or less clouds)



RapidEye Coverage in 2010 (20% or less clouds)

Figure 2-5 Satellite Images Obtained in Past and Photographing of Satellite Images to be Procured with GAECC

2.2 Project Design Matrix (PDM)

As described above, this project is providing assistance to develop remote sensing technical skills and other types of capacity by the PNG side C/P (counterpart) agencies. Cooperation will be implemented with the framework indicated in Table 2-1 in order to achieve these objectives, a PDM was prepared based on this, and it was approved at the first JCC meeting.

Table 2-1 Project Design Matrix (PDM)

Narrative Summary	Objectively Verifiable Indicators	Means of Verifications	Important Assumptions
Overall Goal: Forests in PNG is conserved and managed in sustainable manner as an important mitigation and adaptation measure against climate change.	1 Forestry sector policies and plans for climate change mitigation and adaptation are developed/revised by using upgraded forest resource database. 2 Forest areas which are sustainably conserved and managed are increased and aligned to meet the targets of PNG Vision 2050.	Reports of related government agencies and local governments	- Appropriate satellite images are continuously provided.
Project Purpose: To address climate change, the capacity of relevant institutions in PNG is enhanced for the monitoring of nation-wide forest resource including carbon stock.	Nation-wide monitoring of forest resource including carbon stock is carried out and the improved GIS database is properly managed in collaboration with related institutions.	1 Project reports 2 Interview with PNGFA, OCCD and related institutions	- There is no particular change in government's policies on nature conservation and climate change. - There is no particular change in natural conditions of PNG.
Outputs: 1 Nation-wide forest base map is improved by using remote sensing technology.	1.1 Nation-wide forest base map is developed by using remote sensing data. 1.2 Manuals and workflow design documents for preparing, utilizing and managing the forest base map are prepared. 1.3 More than 10 officers become capable of preparing and managing nation-wide forest base map. 1.4 Workshops for the developed nation-wide forest map are held and 70% of the participants consider the workshops useful.	1.1 Developed Nation-wide forest base map 1.2 Prepared manuals and workflow design documents 1.3 Examination of trained staff 1.4 Questionnaires to the workshop participants	- There is no significant organizational change in PNGFA affecting implementation of the Project.
2 National level forest resource database is improved.	2.1 GIS-based national level l forest resource database is developed. 2.2 Manuals and database design document s for preparing, utilizing and managing the forest resource database are prepared. 2.3 More than10 officers become capable of preparing and managing nation-wide forest resource database. 2.4 Workshops for the developed national level forest resource database are held and 70% of participants consider the workshops useful.	2.1 Developed GIS-based database 2.2 Prepared manuals and database design documents 2.3 Examination of trained staff 2.4 Questionnaires to the workshop participants	
3 To address climate change, the monitoring system of forest resource including carbon stock is improved.	3.1 The basic design of appropriate forest resource monitoring system is prepared in written format. 3.2 The past change of national forest carbon stock is estimated. 3.3 Preliminary reference emission levels for REDD+ are developed.	3.1 Project reports 3.2 Project reports 3.3 Project reports	

Activities:	Input: Japanese Side	Input: Papua New Guinean Side	Important Assumptions
1.1 Capture and analyze current condition of remote sensing utilization in forest sector. 1.2 Prepare a basic design of remote sensing analysis based on the result of 1.1. 1.3 Conduct preliminary analysis of remote sensing data. 1.4 Conduct on-site checking of the result of the preliminary analysis. 1.5 Conduct secondary analysis of remote sensing data using the result of on-site checking. 1.6 Develop nation-wide forest base map. 1.7 Train related institutions/personnel for above 1.2 to 1.6 activities. 2.1 Capture and analyze currently available data on nation-wide forest resources. 2.2 Prepare a basic design of national level forest resource database based on the result of 1.2 and 2.1. 2.3 Develop the national level forest resource database linked with the forest base map and ground survey data. 2.4 Train related institutions/personnel for above 2.2 to 2.3 activities. 3.1 Participate in national multispectral working groups for addressing climate change including REDD+ working group to promote communication and collaboration with relevant public and private organizations. 3.2 Liaise with the Office of Climate Change and Development (OCCD) to ensure the project activities are implemented in line with national policies and strategies. 3.3 Prepare a basic design of the forest resource monitoring system. 3.4 Estimate the past change of forest carbon stock by analyzing the developed national forest resource database. 3.5 Develop preliminary reference emission levels for REDD+, based on the estimated past change in forest carbon stock.	**Experts** - Chief Advisor/ Forest Management - Project Coordinator - Remote sensing Expert - Forest GIS / Database Expert - Biomass Survey Expert - Other experts necessary for the implementation of the Project **Machinery and Equipment** - Vehicle: 1 unit - Equipment for training and survey; - Office equipment and stationeries; - Other materials necessary for the implementation of the Project **Training of Papua New Guinean personnel in Japan/PNG**	**Counterparts & Administrative personnel** - Project Director - Deputy Project Director - Project Managers - Deputy Project Manager - Technical staff - Administrative personnel(Secretary, Drivers, Other supporting staff) **Land, Buildings and Facilities** - Office spaces and facilities within Forest Policy and Planning Directorate, PNGFA HQ, Port Moresby for the implementation of the project; - Electricity, air conditioning, water supply and necessary telecommunication facilities including telephone, facsimile and internet services; and - Other facilities necessary for the implementation of the Project **Administration and operational costs**	- Commitment by Papua New Guinean government and cooperation by authorities concerned are maintained. - Counterparts are not transferred to other departments and/or agencies. - Papua New Guinean government budget for PNGFA is maintained at least at the same level as present. **Pre-conditions** - There is no particular change in government's policies on nature conservation and climate change.

Chapter 3 Status of Activity (Operation) Progress

3.1 Plan of Operation

A Plan of Operation (PO) has been prepared that is linked with the PDM "Activities", "Indicators" and "Target Values". The PO is shown in Table 3-1.

Table 3-1 Plan of Operation

As of November 26, 2010

Outputs			Activities	Year 1				Year 2				Year 3			
				1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
1	Nation-wide forest base map is improved by using remote sensing technology.	1.1	Capture and analyze current condition of remote sensing utilization in forest sector.	■	■										
		1.2	Prepare a basic design of remote sensing analysis based on the result of 1.1.		■										
		1.3	Conduct preliminary analysis of remote sensing data.			■	■								
		1.4	Conduct on-site checking of the result of the preliminary analysis.					■							
		1.5	Conduct secondary analysis of remote sensing data using the result of on-site checking.						■	■					
		1.6	Develop nation-wide forest base map.							■	■				
		1.7	Train related institutions/personnel for above 1.2 to 1.6 activities.			□	□	□	□	□	□	□	□	□	□
2	National level forest resource database is improved.	2.1	Capture and analyze currently available data on nation-wide forest resources.	■	■										
		2.2	Prepare a basic design of national level forest resource database based on the result of 1.2 and 2.1.		■	■									
		2.3	Develop the national level forest resource database linked with the forest base map and ground survey data.					■	■	■	■				
		2.4	Train related institutions/personnel for above 2.2 to 2.3 activities.		□	□	□	□	□	□	□	□	□	□	□
3	To address climate change, the monitoring system of forest resource including carbon stock is improved.	3.1	Participate in national multisectoral working groups for addressing climate change including REDD+ working group to promote communication and collaboration with relevant public and private organizations.	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
		3.2	Liaise with the Office of Climate Change and Development (OCCD) to ensure the project activities are implemented in line with national policies and strategies.									▨	▨	▨	▨
		3.3	Prepare a basic design of the forest resource monitoring system.			■	□	□	□	□	■				
		3.4	Estimate the past change of forest carbon stock by analyzing the developed national forest resource database.									■	■		
		3.5	Develop preliminary Reference Emission Levels for REDD+, based on the estimated past change in forest carbon stock.											■	■

Legends

- ■ Activities that must take place at a given time
- ▨ Occasional activities
- □ Activities that will be continued over the given time, but in low intensity

3.2 Implementation Schedule

The implementation schedule that takes the above PO into consideration is shown in Table 3-2. The work performance / plans (as of March 2013) for the staff engaged in the project are shown in Table 3-3.

Table 3-2 Implementation Schedule

Work / Year	2011							2012												2013												2014		
FY	2011										2012												2013											
Month	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
A: First preparatory work in Japan																																		
A.1 Collection and analysis of relevant materials	□																																	
A.2 Proposal and procurement of necessary equipment	□																																	
A.3 Preparation of an inception report (draft)	□																																	
B. First work in PNG																																		
B.1 Discussion on an inception report and participation in the Joint Coordination Committee	■																																	
B.2 Discussion on the technology transfer and guidance plan and decision on plans by goals and sectors		■																																
B.3 B.3 Improvement of the national forest cover map – Part 1																																		
(a) Identification and analysis of the remote sensing utilization status		■																																
(b) Basic design of remote sensing analysis		■																																
(c) Primary analysis of remote sensing data					■																													
(d) Field verification of primary analysis results					■																													
(e) Secondary analysis of remote sensing data									■																									
(f) Preparation of a national forest cover map based on the secondary analysis results										■																								
(g) OJT required for Steps (b) through (e)					■				■	■																								
(h) Development of manuals and work flow designs on making, usage, and management																■																		
B.4 Improvement of the forest resource database – Part 1																																		
(i) Identification and analysis of the existing data on forest resources		■																																
(j) Basic design of the forest resource database					■																													
(k) Database development that links the forest cover map and the ground survey data														■				■																
(l) OJT required for Steps (i) through (k)		■			■									■				■																
B.5 Improvement of the forest resource monitoring system – Part 1																																		
(m) Preparation of a basic design/design document of forest resource monitoring – Part 1																■		■			■													
B.6 Monitoring and evaluation of the project output																						■												
B.7 Report to JCC/ Activity plan (draft) /Report Preparation																						■												
C. Second Work in Japan																																		
C.1 Preparation of a draft activity plan of the current year																							□											
D. Second Field Survey																																		
D.1 Preparation, discussion, and approval of a draft activity plan of the current year																								■										
D.2 Improvement of the national forest cover map – Part 2																																		
(a) OJT required to make a forest cover map																								■				■						
D.3 Improvement of the forest resource database – Part 2																																		
(b) OJT required to build a forest resource database																								■				■						
D.4 Improvement of the forest resource monitoring system – Part 2																																		
(c) Preparation of a basic design/design document of forest resource monitoring – Part 2																								■										
(d) Calculation of changes in the forest carbon stock in the past																									■	■								
(e) Making of a reference emission level on an experimental basis																												■						
D.5 Evaluation of activity outputs and summary in a report (draft)																														■		■		
D.6 Report to the Joint Coordination Committee, reflection of comments in the report, and submission of the report																																		■
D.7 Cooperation for final evaluation																													- -	- -	- -	- -	- -	- -
E. Operations regarding Training in Japan																																		
E.1 E.1			□	□																														
F. Operations regarding Material and Equipment Procurement, etc.																																		
F.1 Support for materials and equipment to be procured by JICA																																		
F.2 Proposal on procurement of survey materials and equipment																																		
(Reference) Grant Aid for Environment Program						■	■	■			■	■	■		■	■	■		■	■	■													

Table 3-3 Work Performance / Plans for Staff Engaged in Project (as of March 2013)

	Designation	Name	Affiliation	Grade	Phase 1																						M/M Total	
					2011							2012												2013				
					6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	PNG	Japan
Field Survey	Team Leader/ Remote Sensing 1	Masamichi HARAGUCHI	Kokusai Kogyo Co., Ltd.	4	6/25 7/16				10/8 11/5			1/14 2/4		3/3 3/24						9/2 9/15	10/3 10/13			1/19 1/26	2/9 2/16; 2/26 3/11		5.0	
Field Survey	Remote Sensing 2 (SAR)	Masaki KAWAI	Kokusai Kogyo Co., Ltd.	3	6/25 7/9				10/8 10/22					3/3 3/17						9/15 9/29							2.0	
Field Survey	Forest GIS/Database 1 (Overall Design)	Kunihiro ISHII	Kokusai Kogyo Co., Ltd.	3	6/25 7/9				10/22 11/5											9/1 9/30					2/23 3/9		2.5	
Field Survey	Database 2／ Detail Design/Operation, Development	Yasuyuki OKADA	Kokusai Kogyo Co., Ltd.	3	6/25 7/9				10/8 11/5											9/8 9/22		11/17 11/24	12/8 12/22			3/2 3/9	3.0	
																											12.5	
Analysis in Japan	Team Leader/ Remote Sensing 1	Masamichi HARAGUCHI	Kokusai Kogyo Co., Ltd.	4	□								□															0.6
Analysis in Japan	Remote Sensing 2 (SAR)	Masaki KAWAI	Kokusai Kogyo Co., Ltd.	3	□																							0.1
Analysis in Japan	Forest GIS/Database 1 (Overall Design)	Kunihiro ISHII	Kokusai Kogyo Co., Ltd.	3	□								□															0.6
Analysis in Japan	Database 2／ Detail Design/Operation, Development	Yasuyuki OKADA	Kokusai Kogyo Co., Ltd.	3	□																							0.1
																												1.4
	Report				Δ IC/R								Δ PG/R							Δ PG/R						Δ IT/R		
																											PNG 12.5	Japan 1.4
																											Total 13.9	

Legend: ▬ Field Survey ▭ Analysis in Japan

3.3 Implementation Flow

A flow chart for project implementation is shown in Figure 3-1 Implementation FlowFigure 3-1.

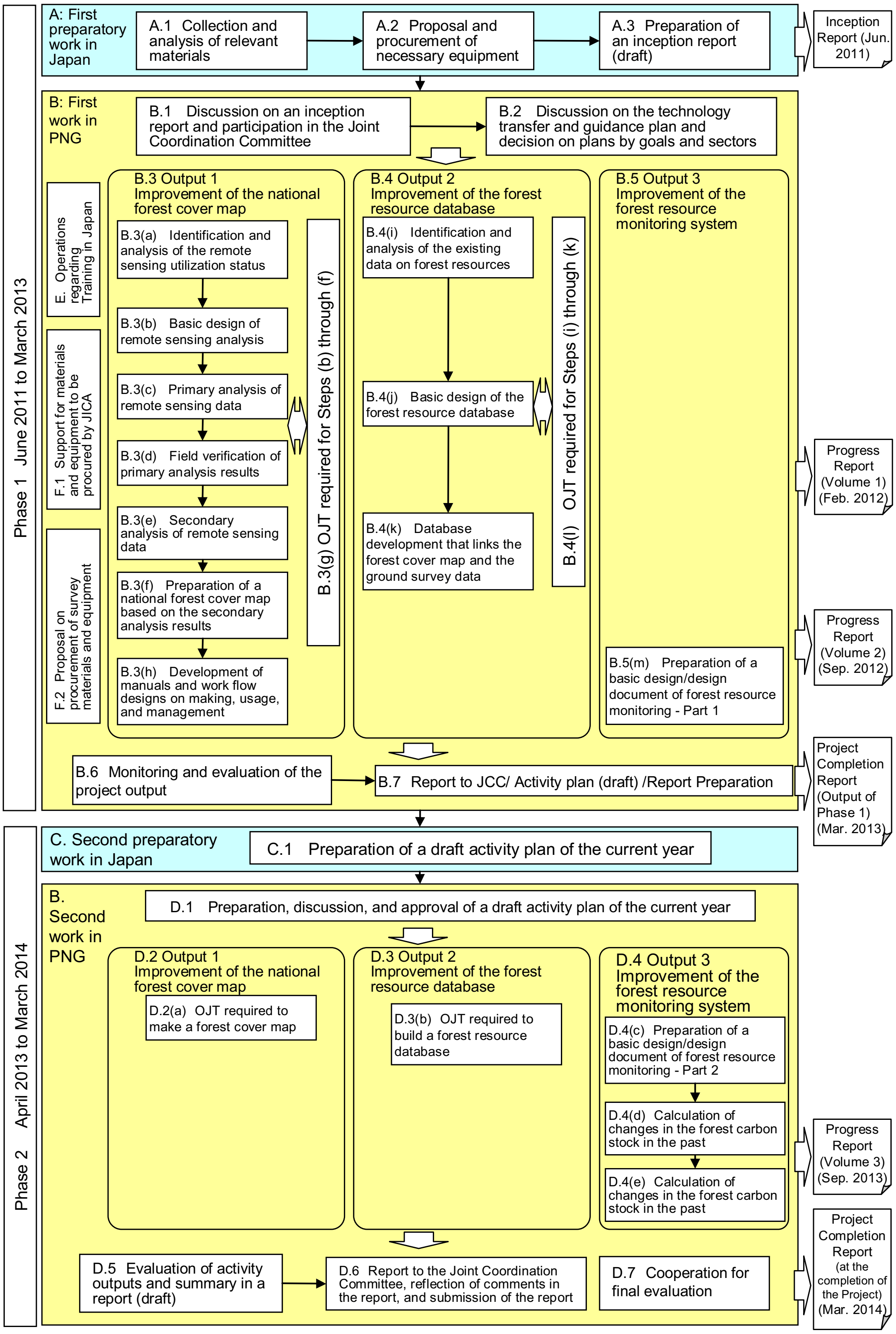


Figure 3-1 Implementation Flow

The persons in charge of the respective project implementation items are shown in Table 3-4.

Table 3-4 Task Assignment Table

Field / Work / Name	Team Leader/ Remote Sensing 1	Remote Sensing 2 (SAR)	Forest GIS/Database 1 (Overall Design)	Database 2 (Detail Design/Operation, Development)
	Masamichi HARAGUCHI	Masaki KAWAI	Kunihiro ISHII	Yasuyuki OKADA
A: First preparatory work in Japan				
A.1 Collection and analysis of relevant materials	◎	○	○	○
A.2 Proposal and procurement of necessary equipment	◎			
A.3 Preparation of an inception report (draft)	◎	○	○	○
B. First work in PNG				
B.1 Discussion on an inception report and participation in the Joint Coordination Committee	◎	○	○	○
B.2 Discussion on the technology transfer and guidance plan and decision on plans by goals and sectors	◎	○	○	○
B.3 Improvement of the national forest cover map - Part 1	◎	○		
(a) Identification and analysis of the remote sensing utilization status	◎	○		
(b) Basic design of remote sensing analysis	◎			
(c) Primary analysis of remote sensing data		◎		
(d) Field verification of primary analysis results		◎		
(e) Secondary analysis of remote sensing data		◎		
(f) Preparation of a national forest cover map based on the secondary analysis results		◎		
(g) OJT required for Steps (b) through (e)	◎	○		
(h) Development of manuals and work flow designs on making, usage, and management	◎			
B.4 Improvement of the forest resource database - Part 1			◎	○
(i) Identification and analysis of the existing data on forest resources			◎	○
(j) Basic design of the forest resource database			◎	○
(k) Database development that links the forest cover map and the ground survey data				◎
(l) OJT required for Steps (i) through (k)			◎	○
B.5 Improvement of the forest resource monitoring system - Part 1	◎		○	
(m) Preparation of a basic design/design document of forest resource monitoring - Part 1	◎		○	
B.6 Monitoring and evaluation of the project output	◎		○	
B.7 Report to JCC/ Activity plan (draft) /Report Preparation	◎		○	
C. Second Work in Japan				
C.1 Preparation of a draft activity plan of the current year	◎	○	○	○
D. Second Field Survey				
D.1 Preparation, discussion, and approval of a draft activity plan of the current year	◎		○	
D.2 Improvement of the national forest cover map - Part 2	◎	○		
(a) OJT required to make a forest cover map	◎	○		
D.3 Improvement of the forest resource database - Part 2			○	◎
(b) OJT required to build a forest resource database			○	◎
D.4 Improvement of the forest resource monitoring system - Part 2	◎	○		
(c) Preparation of a basic design/design document of forest resource monitoring - Part 2	◎	○	○	
(d) Calculation of changes in the forest carbon stock in the past	◎	○		
(e) Making of a reference emission level on an experimental basis	◎	○		
D.5 Evaluation of activity outputs and summary in a report (draft)	◎	○	○	
D.6 Report to the Joint Coordination Committee, reflection of comments in the report, and submission of the report	◎	○	○	
D.7 Cooperation for final evaluation	◎	○	○	○
E. Operations regarding Training in Japan				
E.1 Support for training in Japan	◎	○		
F. Operations regarding Material and Equipment Procurement, etc.				
F.1 Support for materials and equipment to be procured by JICA	◎			
F.2 Proposal on procurement of survey materials and equipment	◎			

3.4 Activities Related to Output 1

Output 1: Improve National Forest Cover Classification Maps by Utilizing Remote Sensing Technology

3.4.1 Obtain Grasp / Analyze Remote Sensing Utilization Status

During the first field survey (from June 25 to July 9 2011), hearings and discussions were held to obtain a grasp of the current status of remote sensing.

(a) Obtaining Grasp of Current Status of Remote Sensing Data in FIMS/FIPS

The satellite images being used in the FIMS are very old and have a low spatial resolution. Therefore, there are discrepancies in the current forest distribution and forest classification, and deviations in the locations. Hearings were conducted concerning the current status of the FIMS and FIPS in order to solve these problems.

Figure 3-2 Image s of Hearings Concerning FIMS (Left) and FIPS (Right)

In addition, the following materials were obtained to help obtain a grasp of current conditions.

- Forest Resource Vegetation Mapping of Papua New Guinea
- Papua New Guinea Resource Information System (PNGRIS) Handbook 3rd
- FIM Forest Inventory and Mapping System User Guide

(b) Obtaining Grasp of Requests to REDD+

In order to obtain a grasp of how the forest base maps that will be prepared by March 2014 under this project are related to REDD+, the respective relationship with the FIMS, FIPS and satellite images was organized. Discussions on the requests made to REDD+ were held with C/P and have been compiled in Figure 3-3.

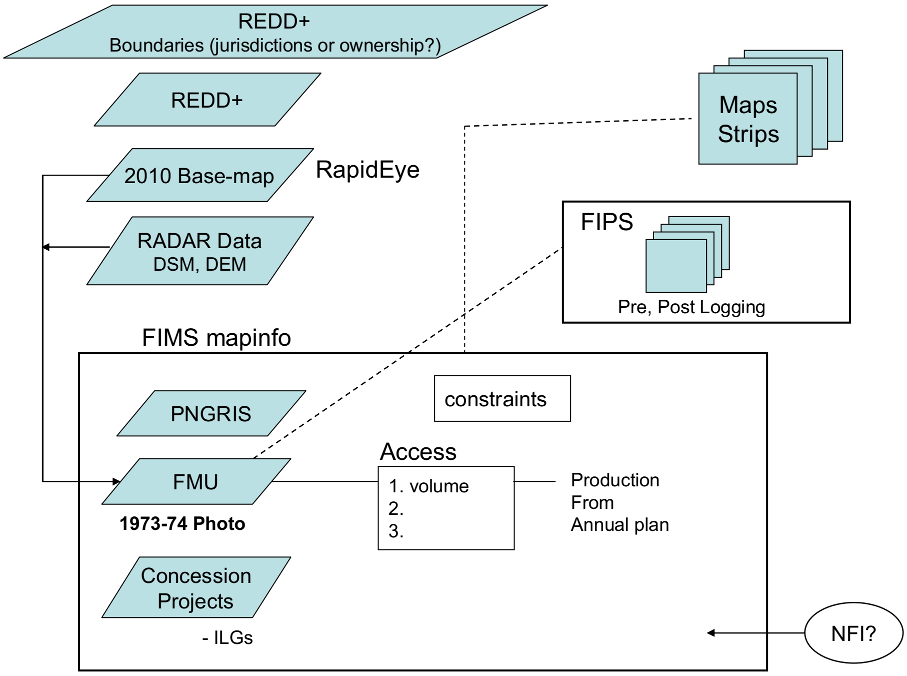


Figure 3-3 Obtaining Grasp of Requests to REDD+

(c) Cooperation with Other Agencies

Discussions were held to review the sharing range of satellite images that will be procured under this project and with grant aid cooperation. The target data consists of RapidEye (optical sensors), PALSAR (radar) and GeoSAR (airborne SAR). Due to differences in the number of licenses for which the respective data can be shared, discussions were held with the C/P on the agencies with which the data will be shared. The respective satellite image product levels and number of licenses (number of agencies) that can be used are shown in Table 3-5.

Table 3-5 Respective Satellite Image Project Levels and Number of Licenses

		Preliminary (5,000km^2)	G.A. (whole country)
RapidEye	1:Raw data	1 *1	5
	2: Processed/Analysis (Raster)	1	5
	3: Processed/Analysis (Vector)	no limit	no limit

*1 Can be increase later by additional payment

PALSAR	1:Raw data	1	1
	2: Processed/Analysis (Raster)	no limit	no limit
	3: Processed/Analysis (Vector)	no limit	no limit

GeoSAR (2011)	1:Raw data	depend on PNGFA	x *2
	2: Processed/Analysis (Raster)	depend on PNGFA	x
	3: Processed/Analysis (Vector)	depend on PNGFA	x

*2 But, 2006 data can be accessible (only mainland)

3.4.2 Basic Design of Remote Sensing Analysis

During the second field survey (from October 8 to October 22, 2011), hearings and discussions concerning the basic design for the preparation of forest cover classification maps were held.

(a) Organization of Classification Items

First, the land cover classification codes registered in the FIMS were extracted and organized. The person in charge was asked to select the classification codes required for the Forestry Authority to perform the work, and the classification codes that can be obtained from the actual satellite images were reviewed. During this project, 17 items were organized that are indicated in blue in Table 3-6 out of the items that can be classified from satellite images.

Table 3-6 Classification Codes in FIMS and Target Classifications Codes for This Project

IPCC GL-AFOLU	UPNG	Structural formation	Vegetation type	Condition	Code	
Forest lands		Forest	Low Altitude Forest on Planins and Fans	below 1000m	Pl	Large to medium crowned forest
					Po	Open forest
					Ps	Small crowned forest
			Low Altitude Forest on Uplands	below 1000m	Hl	Large crowned forest
					Hm	Medium crowned forest
					HmAr	Medium crowned forest with Araucaria common
					Hmd	Medium crowned depauperate/damaged forest
					Hme	Medium crowned forest with an even canopy
					Hs	Small crowned forest
					Hse	Small crowned forest with an even canopy
					HsAr	Small crowned forest with Araucaria common
					HsCa	Small crowned forest with Castanopsis
					HsCp	Small crowned forest with Casuarina papuana
					HsN	Small crowned forest with Nothofagus
					HsRt	Small crowned forest with Rhus taitensi
			Lower Montane Forest	above 1000m	L	Small crowned forest
					LAr	Small crowned forest with Araucaria common
					LN	Small crowned forest with Nothofagus
					Lc	Small crowned forest with conifers
					Ls	Very small crowned fores
					LsCp	Very small crowned forest with Casuarina papuana
					LsN	Very small crowned forest with Nothofagus
			Montane Forest	above 300m	Mo	Very small crowned forest
			Dry Seasonal Forest		D	Dry evergreen forest
			Litoral Forest		B	Mixed forest
					BCe	Forest with Casuarina equisetifolia
					BMl	Forest with Melaleuca leucadendron
			Seral Forest		Fri	Riverine mixed successions
					FriCg	Reverine successions with Casuarina grandis
					FriK	Riverine successions with Eucalyptus deglupta
					FriTb	Riverine successions with Terminalia brassii
					Fv	Volcanic
			Swamp Forest		Fsw	Mixed swamp forest
					FswC	Swamp forest with Campnosperma
					FswMl	Swamp forest with Melaleuca leucadendron
					FswTb	Swamp foresl with Terminalia brassii
Grassland		Woodland			W	Woodland
					Wri	Riverine successions dominated by woodland
					WriCg	Riverine successions with Casuarina grandis woodland
					Wv	Volcanic successions dominated by woodland
					Wsw	Swamp woodland
					WswMl	Swamp woodland with Melaleuca leucadendron
		Savanna			Sa	Savanna
					Saf	Savanna with galley forest
					SaMl	Savanna with Melaleuca leucadendron
		Scrub			Sc	Scrub
					ScBc	Scrub with Melaleuca leucadendron
					Scv	Volcanic successions dominated by scrub
		Grassland and Herbland			G	Grassland
					Ga	Alpine grassland
					Gi	Subalpine grassland
					Gf	Grassland with some forest
					Gr	Grassland reverting to forest
					Grf	Grassland reverting to forest with some forest
					Gsw	Swamp grassland
					Gri	Riverine successions dominated by grass
					Gv	Volcanic successions dominated by grass
					Hsw	Herbaceous swamp
Forest		Estuarine Communities			M	Mangrove
Cropland		Other Non-vegetation and areas dominated by land use			O	PNGRIS agricultural land use intensity classes 0-4
Wetlands					E	Lakes and large rivers
Other Land					Z	Bare areas
Settlements					U	Larger urban centres

(b) Obtaining Grasp of Classification Item Features

Comparisons were made of how existing vegetation types appear in optical sensor images (RapidEye) and radar sensor images (PALSAR). Existing GIS data was overlaid onto satellite images when comparison was performed to confirm how which items (shapes, colors, sizes, patterns, shadows, etc.) can be deciphered, and these results were organized in Table 3-7.

Figure 3-4 Review of Classification Items

Table 3-7 Features of Classification Items That Can be Deciphered from Optical Sensor Images (RapidEye)

Structural formation	Vegetation type	Shape (Crown)	Color	Shape	Size	Pattern	Texture	Shade	Circumstance	Tree picture
Forest	Low Altitude Forest on Plains and Fans “P” (<1,000m)		Mixed			Relatively regular Scattered crown	Relatively regular, fine in Natural (RGB 4:5:2) Image of RapidEye		Along coast, flat topography, lower elevation (<50-100) than H	
	Low Altitude Forest on Uplands “H” (<1,000m)					vary	vary in RapidEye in Natural Image (RGB 4:5:2) of RapidEye		Upland, hilly/ aspects/ slope, higher elevation (>50-100) than P, Mountain range	
	Lower Montane Forest (>1,000m) “L”		(Dark when Intact, lighter after disturbance)			Relatively regular,	(Dense, thick, undulating canopy) (RGB452)		(1,000 m demarcation is not very visible) (Inaccessible areas)	
	Montane Forest “Mo” (>3,000m)									
	Dry Seasonal Forest “D”									
	Littoral Forest “B”			sparsely, patchily scattered Crown Open canopy	Medium	Regular crowns	Relatively regular, fine in Natural		Sign of settlement and gardening Often within 150-200m from coast line	
	Seral Forest (River line) “Fri”		Lighter green		Vary in small area	Mixed	Mixed		Along river (can be mixed with gardening)	
	Swamp Forest “Fsw”									
Woodland “W”										
Savanna “Sa”										
Scrub “Sc”										
Grassland and Herbland “G”	Grassland		Reddish brown (RGB452)	NA	NA	NA	Matt		Sign of settlement and gardening and areas Often contains burnt patches	
Estuarine Communities	Mangrove		Medium green in RapidEye optical image (RGB452) Visible from PALSAR				Rough, uneven		Often within 150-200m from coast line Along the river (can be associated with littoral forest)	
Other Non-vegetation and areas dominated by land use	PNGRIS agricultural land use intensity classes 0-4				Oil palm: Small, fine	Oil palm: Very regular,	Oil palm: smooth	Oil palm: None	Oil palm: Along road, flat	
	Lakes and large rivers		Purple, blue						(Sea surface looks similar)	
	Bare areas		Light brown							
	Road system		Clearly visible in RGB5:4:2							
	Larger urban centres									

The features in Table 3-7 were used as reference to determine whether or not forest classification can actually be deciphered from optical sensor images (RapidEye).

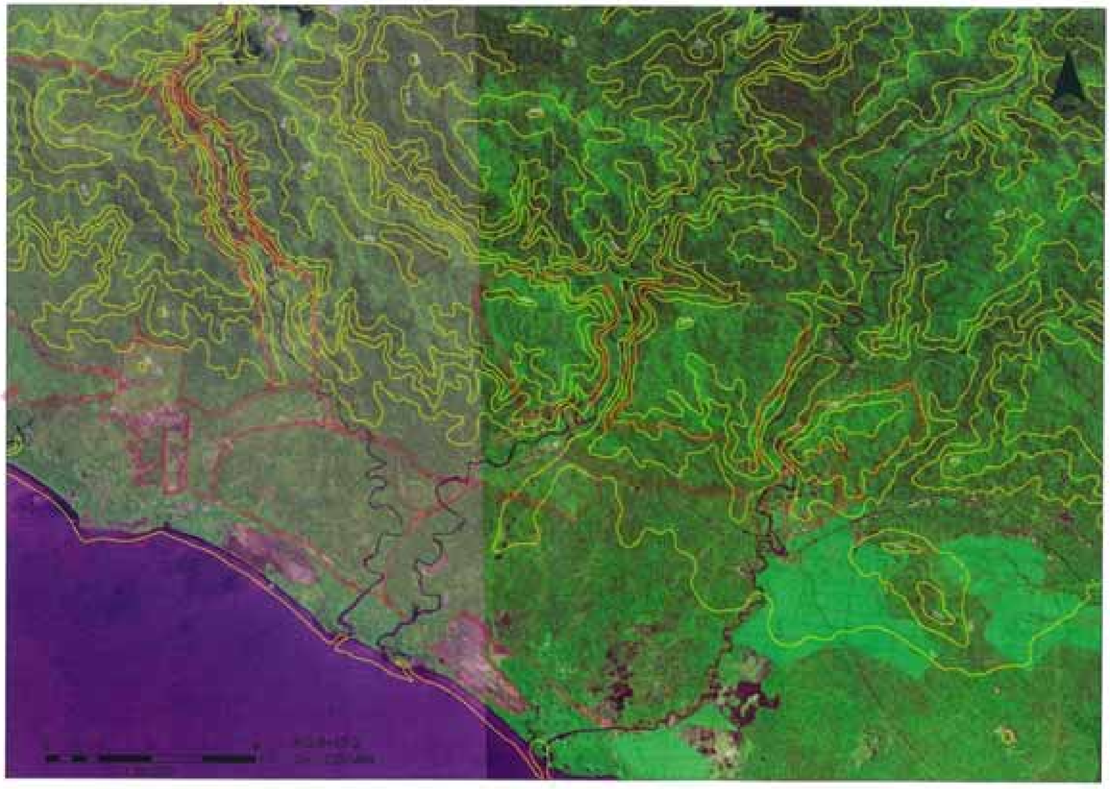


Figure 3-5 Results That Were Actually Deciphered (Orange Marker Line is Deciphered Border Line)

3.4.3 Primary Analysis of Remote Sensing Data

(a) Strengthening of Basic Knowledge in Preparation for Remote Sensing Analysis

In preparation for the analysis of remote sensing data, training using JICA-NET and training in Japan were implemented. The JICA-NET is a self-instructional text for RS/GIS analysis. Please refer to Annex 3 for the concentrated lecture schedule of JICA-NET training and a list of the participants. Mr. Constin (Department Chief) and Mr. Perry (Senior Map Production Engineer) from the Forestry Authority came to Japan to participate in training.

The objective of training in Japan was to enable the participants to acquire a basic understanding of REDD+ and remote sensing / GIS techniques. During the first half of training, case studies related to REDD+ activities in Japan were introduced with the objective of enabling the trainees to grasp an overall image of future activities. During the latter half of training, practical training on forest classification with remote sensing was conducted while actually using PNG satellite images with the objective of organizing the basic information that will be required to allow the project to move forward in the future. The schedule of training in Japan is shown in Table 3-8.

Table 3-8 Schedule of Training in Japan

Week 1 (12th – 16th September)				
12th September	13th September	14th September	15th September	16th September
Orientation	Lecture and Discussion	Lecture and Discussion	Facility Tour	Orientation
• Orientation at JICA Tokyo. • Courtesy call for JICA headquarter and Forestry Agency. • Introduction of JICA's REDD+ projects in other countries.	• JAFTA: Design for forest resource monitoring investigation. • ERSDAC: Japan's satellite data.	• FFPRI: Projection of warming impacts and evaluation of carbon sink. • FFPRI: Global warming impacts and evaluation of carbon sink.	• Visit to the Geospatial Information Authority of Japan. • Visit to University of Tsukuba.	• Company introduction • KKC Facility tour • Overview of Remote sensing and GIS training.

Week 2 (19th – 23rd September)				
19th September	20th September	21st September	22nd September	23rd September
Holiday (Aged People's Day)	Facility Tour and Lecture	Lecture and Discussion	Lecture and Assessment	Holiday (Autumnal Equinox Day)
• Visit to Asakusa and Akihabara.	• JAXA: Visit to JAXA space center. • JAXA EORC: Introduction of case examples of SAR in forestry.	• Basic training about Remote Sensing and GIS using PNG satellite data. • Discussions about local forest cover classifications. • Creation of interpretation cards (Google Earth vs. RapidEye).	• Lecture about GIS and database of PNG forest. • Basic training and discussions about specifications. • JICA Tokyo: Assessment meeting. (Constin)	• Excursion of downtown Tokyo.

Table 3-8 Schedule of Training in Japan (Continued)

Week 3 (26th – 30th September)				
26th September	27th September	28th September	29th September	30th September
OJT: RapidEye Processing	OJT: RapidEye Processing	OJT: PALSAR Processing	OJT: PALSAR Processing	Summary and Discussion
•Introduction of Remote Sensing softwares. •Geometric correction. •Mosaic RapidEye images.	•Atmospheric correction. •Introduction of Object-base classification. •Explain of function of ERDAS IMAGINE for optical images.	● Applications of PALSAR data. ● How to search PALSAR data using ERSDAC GDS website. ● Introduction of GeoSAR data (difference between P-band and X-band).	・Processing of PALSAR data. ・Comparison between HH and HV polarization. ・Comparison between PALSAR images in 2007,2010.	•Comparison between RapidEye and PALSAR image. •Follow-up to this week training.

Week 4 (3rd – 7th October)				
3rd October	4th October	5th October	6th October	7th October
Manual Development	Manual Development	OJT : Arc GIS training	Report Development Summary and Discussion	Seminar and Assessment
•Development of simple operation manual (optical). •Follow-up discussions.	•Development of simple operation manual (radar). •Follow-up discussions.	•Introduction of ArcGIS.	•Development of evaluation report about the training. •Review of the training. •Discussion about the future plan.	•Participation to Viet Nam REDD+ seminar. •JICA Tokyo: Assessment meeting. (Perry)

The agencies that were visited during the first half of training in Japan and the content of lectures are described below.

- JICA Headquarters (JICA REDD+ project in other countries)
- Forestry Agency (Introduction of forestry management in Japan, visit to forestry resource DB room)
- Japan Forest Technology Association (Design of forest resource monitoring survey)
- Earth Remote Sensing Data Analysis Center (Overview of satellite data in Japan)
- Forestry and Forest Products Research Institute (Forecast of impact of global warming, evaluation of carbon dioxide absorption resources, etc.)
- Geospatial Information Authority of Japan (Visit to Science Museum of Map and Survey)
- Japan Aerospace Exploration Agency (Case study of forest analysis using Synthetic Aperture Radar [SAR])

Figure 3-6 shows a picture of a lecture.

Figure 3-6 Picture of Lecture at Forestry and Forest Products Research Institute

The latter half of training in Japan focused on practical training in satellite image analysis conducted by means of On-the-Job-Training (OJT). The ERDAS Imagine satellite image analysis software that is to be procured under the Grant Aid for Environment and Climate Change Program was used. After learning the basic image analysis functions, Milne Bay Rapid Eye images and PALSAR images which represent a preceding analysis area were used to teach the differences in the respective images and the differences in the analysis methods.

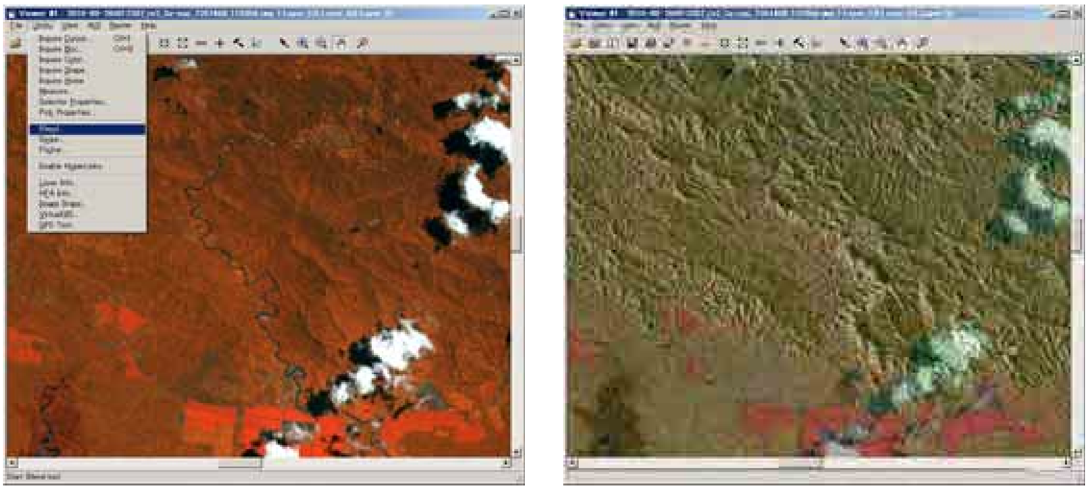


Figure 3-7 Optical Sensor Image (Left) and Comparison of Optical / Radar Image Features by Means of Permeabilization (Right)

At the end of training, the respective applications for optical sensors, radar sensors and airborne SAR data were compiled in Table 3-9 along with the demerits when using the respective data.

Table 3-9 Applications for Remote Sensing Images and Demerits When Actually Using

RapidEye	PALSAR	GeoSAR
Applications Forest/Vegetation Types Plantation Land-use Roads Rivers Settlements Natural/Man-made disaster	**Applications** Forest/Vegetation Change detection Geological structure Natural/man-made disaster Plantations	**Applications** Forest cover detection Tree height
Demerits Cloud cover Expensive	**Demerits** Difficult to interpret/understand	**Demerits** More expensive One time observation Limited area of observation (Cannot cover whole of PNG)

The results of training in Japan were compiled in an Image Analysis Manual (Annex 4). The trainees held a training report meeting at the Forestry Authority after they returned to Papua New Guinea. The trainees prepared the materials for the training report meeting themselves. There were some mistakes in the materials, but this meeting verified that the trainees had an overall understanding of the content of training in Japan.

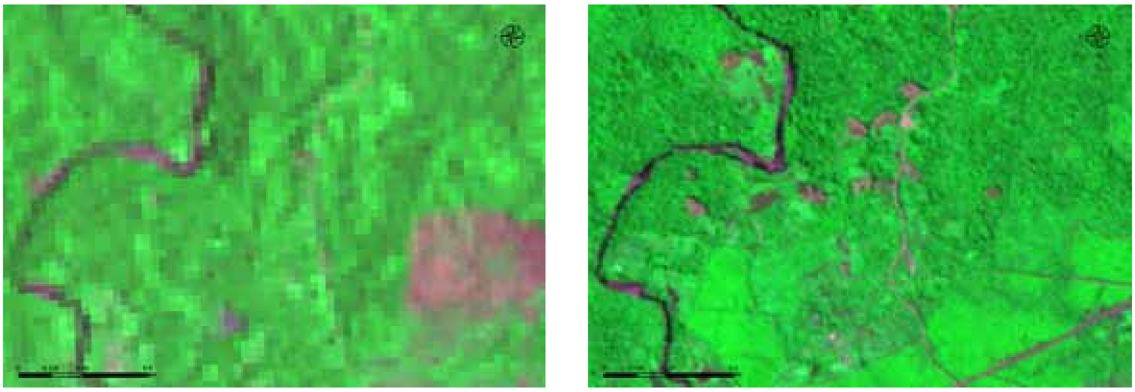
A picture of the training report meeting is shown in Figure 3-8.

Figure 3-8 Picture of Training Report Meeting

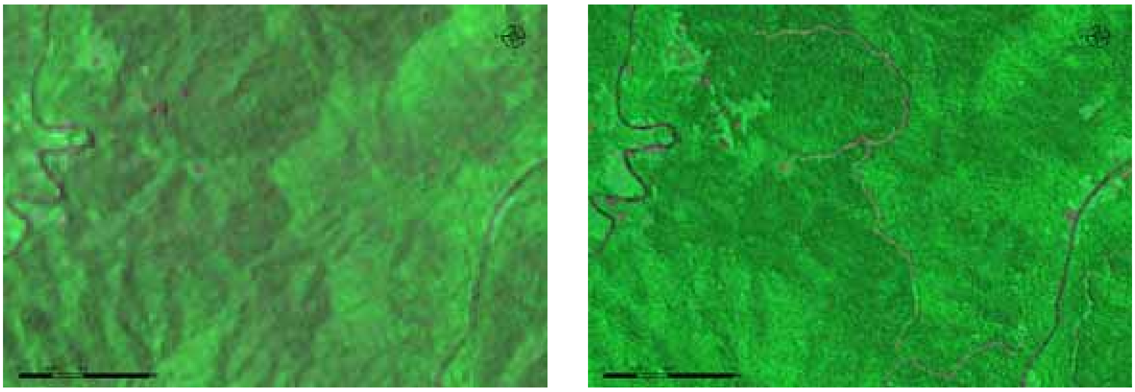
(b) Demonstration of Image Resulting from Remote Sensing Analysis

A demonstration was conducted using remote sensing images and GIS obtained in advance for a portion of the area to give the involved parties an image of how work (results) can be performed with the satellite images (RapidEye, PALSAR) and elevation data that are to be obtained under the GAECC program. The chairman of the Forestry Authority participated in the demonstration, which also served as an Interim Report on the results.

A review of the decipherability of the monitoring target due to differences in satellite image resolution has been compiled in Figure 3-9. When (1) and (2) are compared, it can be confirmed that while it is difficult for the Forestry Authority to conduct adequate monitoring of logging roads and collection yards for which it is responsible with LANDSAT 30m class resolution, these areas can be clearly deciphered with RapidEye 5m class resolution. Next, when (3) and (4) are compared, it was confirmed that the logging road built in the center of the image in 2010 can be clearly deciphered with RapidEye.



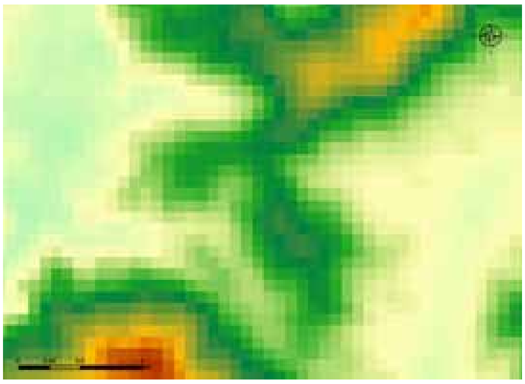
(1) LANDSAT in 2000 (30m resolution)   (2) RapidEye in 2010 (5m resolution)



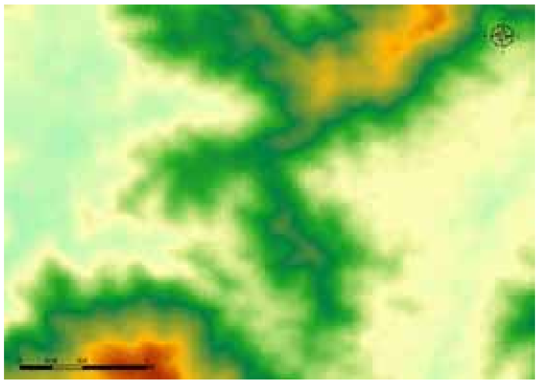
(3) LANDSAT in 2000 (30m resolution)   (4) RapidEye in 2010 (5m resolution)

Figure 3-9 Review of Decipherability of Monitoring Target Due to Differences in Satellite Image Resolution

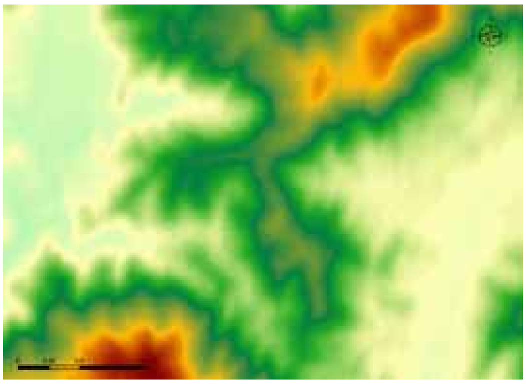
The differences in elevation data resolution and a demonstration of topographic analysis have been compiled in Figure 3-10. The 90m resolution elevation data that is used as the world standard is shown in (1), but this is not adequate for logging roads in PNB where there are many mountainous regions or for design applications for inventory surveys. The 30m resolution elevation data does improve the decipherability (Refer to (2)), but it was verified that this does not guarantee stable quality in PNG where there is a high rate of cloud cover. The provision of 5m resolution elevation data (Refer to (3)) that covers the entirety of the main island of PNG has adequate resolution for the calculation of contour lines (4), shadow analysis (5) and slope analysis (6), and is a good match for the actual logging roads.



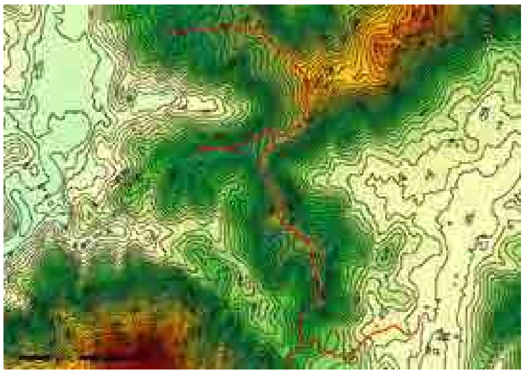
(1) Elevation data (90m resolution: SRTM)



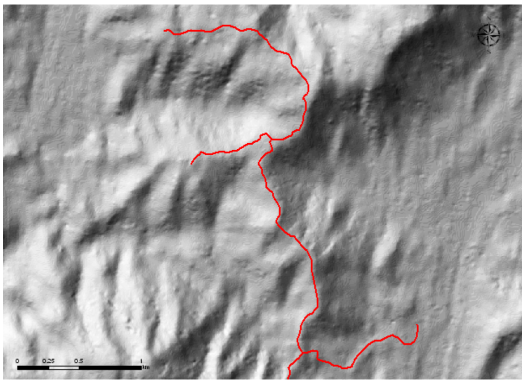
(2) Elevation data (30m resolution: ASTER GDEM)



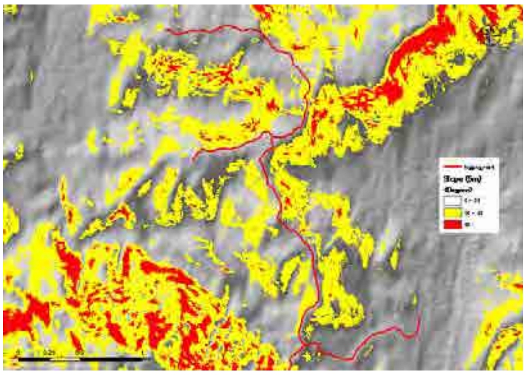
(3) Elevation data (5m resolution: GeoSAR sample)



(4) Elevation data original contour lines and logging roads



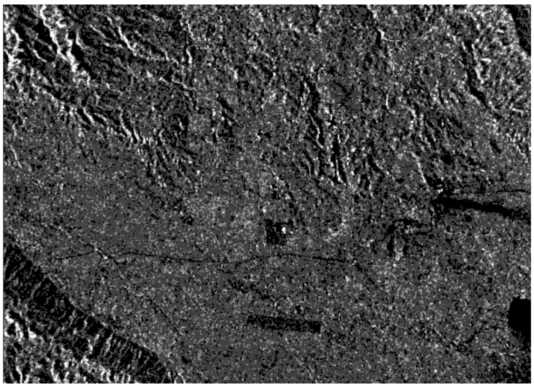
(5) Elevation data original shadow map and logging roads



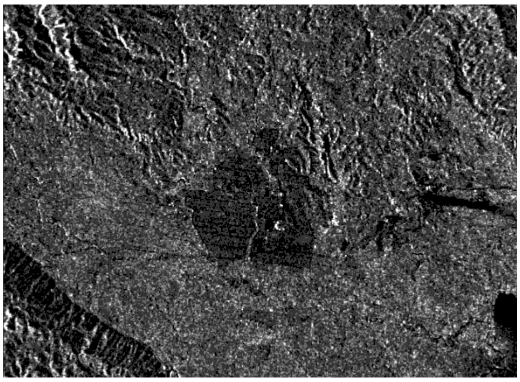
(6) Elevation data original slope map and logging roads

Figure 3-10 Differences in Elevation Data Resolution and Demonstration of Topographic Analysis

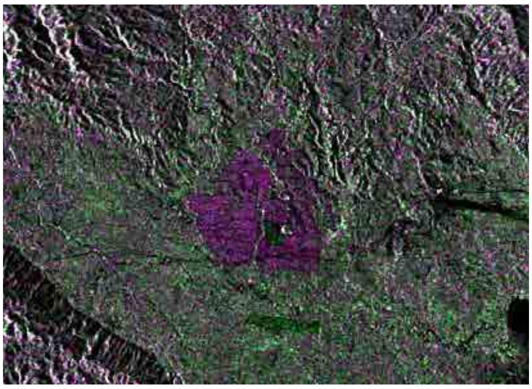
A comparison of a change extraction demonstration with PALSAR data using an optical image (RapidEye) has been compiled in Figure 3-11. The locations where there is a reduction in forest cover are dark in the PALSAR data. The locations in which there may have been a reduction in forest cover can be verified by simply combining the data from different years [(1) and (2)] to create a composite image (3) (locations displayed in purple in (3)). However, since it is difficult to judge the land being used where there is a reduction in forest cover, this data should be combined with optical images to facilitate effective management (Combination of (3) and (4)). In addition, a demonstration of automatic calculation of land use border lines using analysis software was conducted (which can be easily set) ((5) and (6)).



(1) PALSAR data in 2007



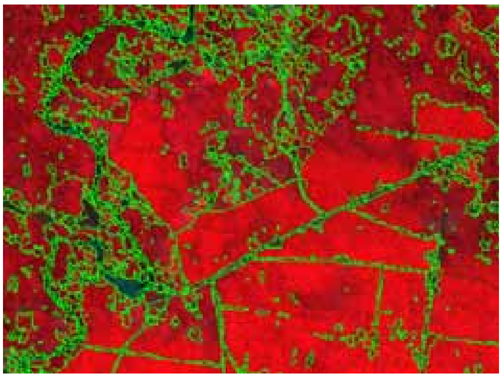
(2) PALSAR data in 2010



(3) PALSAR color composite image in 2007 & 2010

(4) RapidEye image in 2010

(5) RapidEye (False color display)



(6) Automatic calculation of border line (demonstration)

Figure 3-11 Comparison of Change Extraction Demonstration with PALSAR Data using Optical Image (RapidEye)

3.4.4 Field Confirmation of Primary Analysis Results

(a) Forest Observation from Ground

A one day field survey was conducted with the C/P to obtain a grasp of the forest conditions in PNG. Gardening plots, plantations and natural broad leafed forest areas that were observed along the Brown River are indicated by the red marks in Figure 3-12.

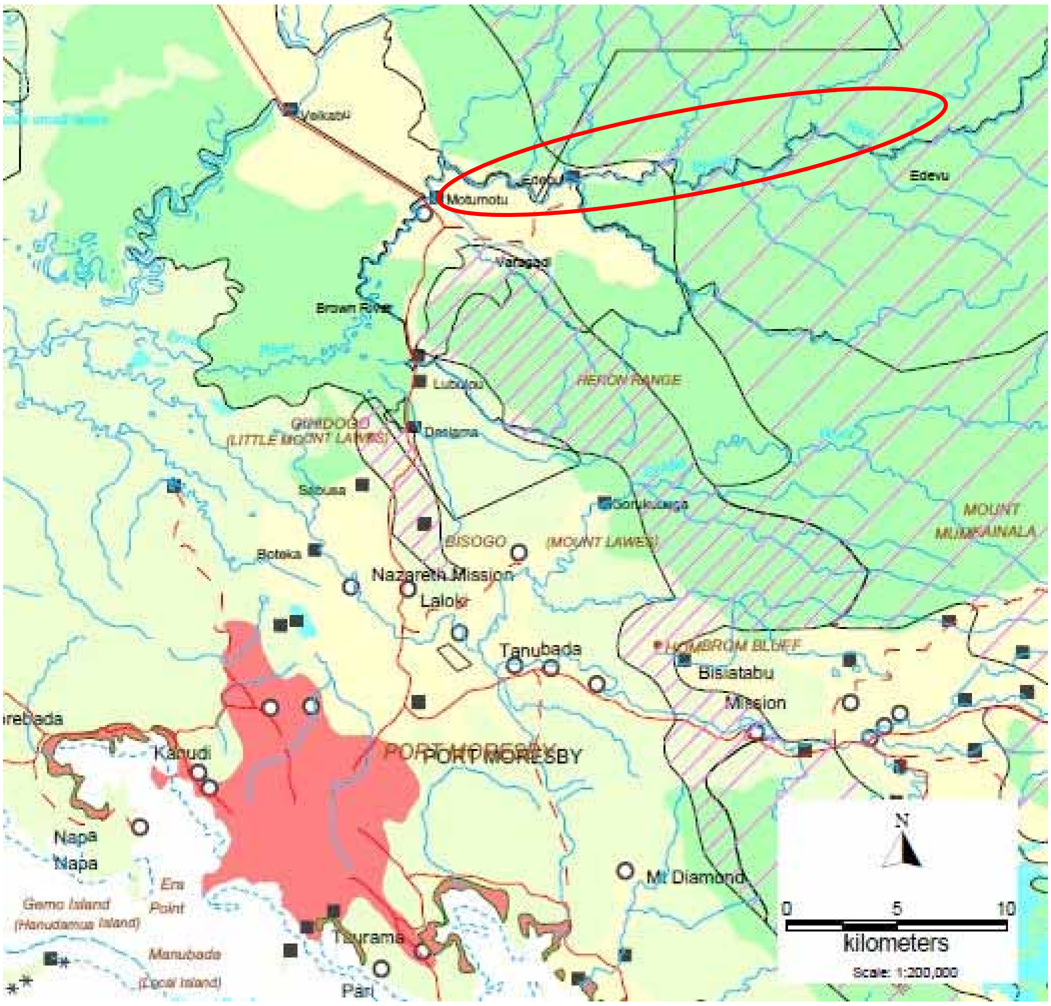


Figure 3-12 Field Survey Location Diagram

A picture of the local forest is shown in Figure 3-13.

Figure 3-13 Picture of Forest along Brown River

(b) Forest Observation from Helicopter

In preparation for analysis of forest conditions in PNG using remote sensing, staff participated in a forest observation survey by helicopter (Chopper) that was planned by the C/P and long-term experts in order to obtain a grasp of the correspondence between and decipherability of forest conditions and satellite images by observing the forest conditions from above. After consultation with the C/P and long-term experts, the area around Mt. Hagen in the highlands where it is difficult to conduct a survey from the ground that has many changes in elevation and an abundant variation of vegetation was designated as the survey area. The helicopter survey flight plan, route and priority survey locations are shown by red lines and red dots in Figure 3-14.

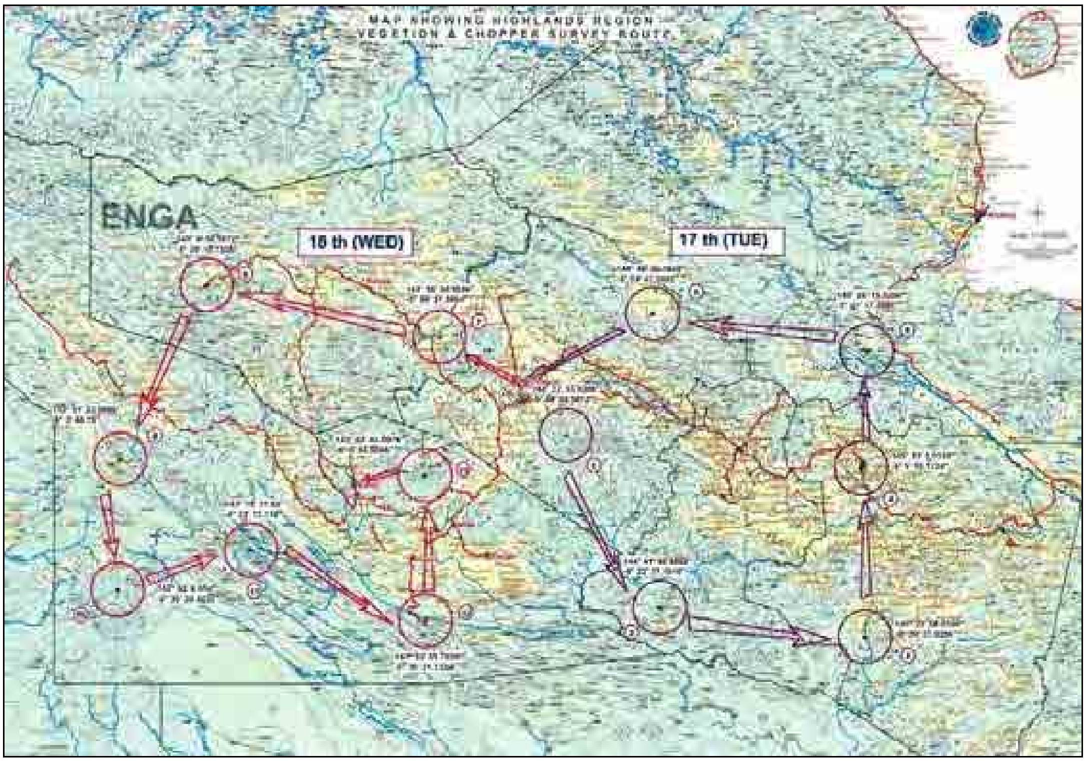


Figure 3-14 Helicopter Survey Flight Plan / Route and Priority Survey Locations

The actual flight path that was flown (red line), location and direction from which pictures were taken with the GPS camera (yellow arrow), and movement path on the ground (blue line) are shown in Figure 3-15. Pictures with GPS data (GeoTag pictures) were used to demonstrate to the C/P the mechanism to efficiently display the photographed location and direction using ArcGIS that is to be procured with GAECC. Since satellite images have not been procured yet for this area, the background image is one taken with LANDSAT in 2000.

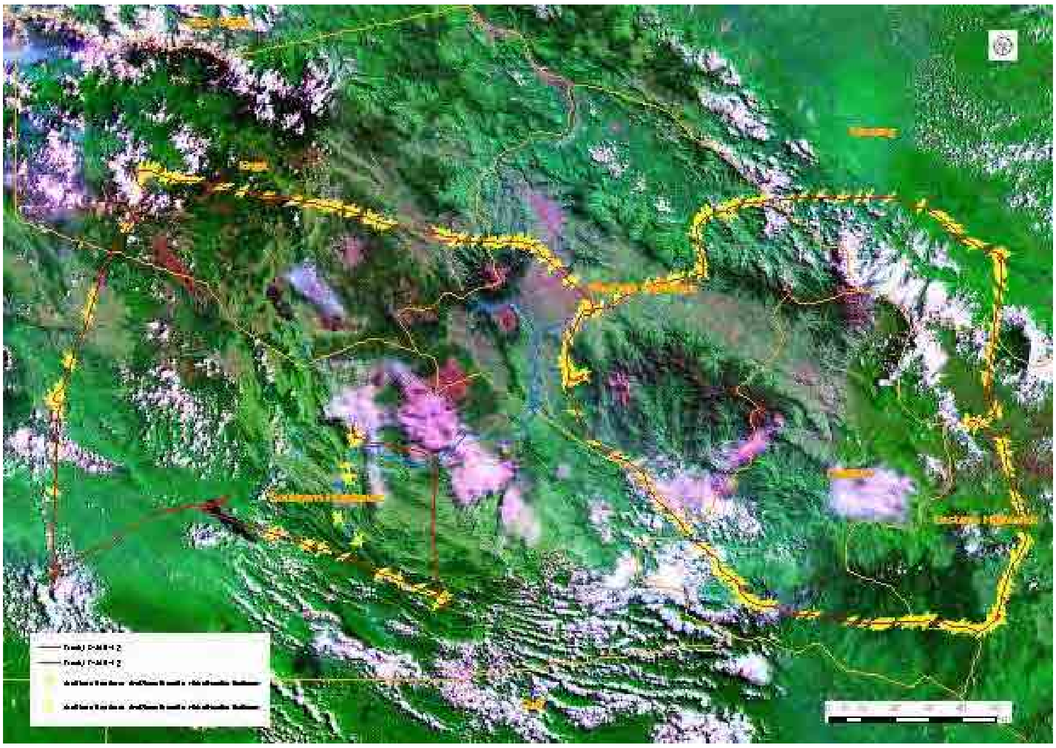
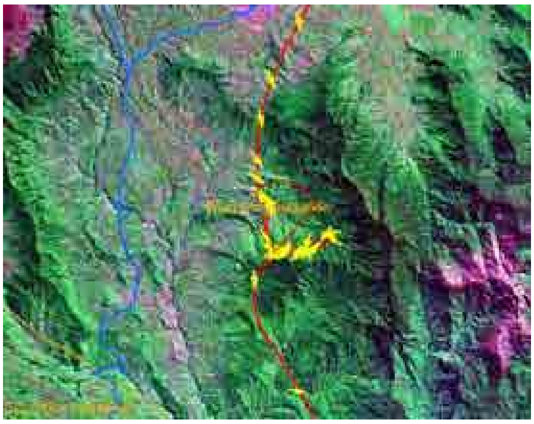


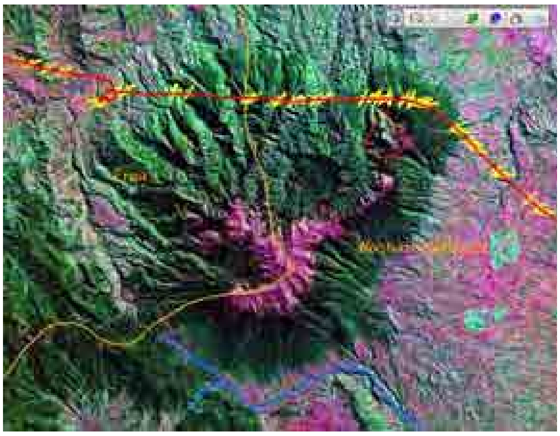
Figure 3-15 Actual Flight Path and Locations Where GPS Tag Pictures Were Taken

A number of enlarged pictures that were photographed with GPS tags are shown in Figure 3-16. By linking satellite images and actual pictures in this manner, the results can be utilized to verify the ground truth of remote sensing analysis (field verification data). In particular, the area where the helicopter survey was conducted this time is difficult to access from the ground, and valuable data was acquired that can be used to review the samples of classification work and classification results that will proceed in the future.



Photograph location & direction display (Red fan)

Vegetation/canopy in natural forest



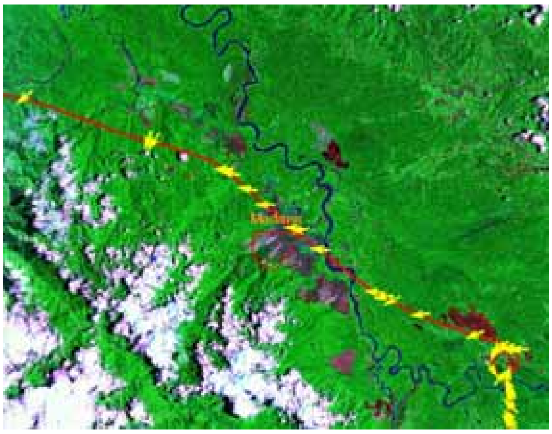
Photograph location & direction display (Red fan)

Mountainous areas with steep slopes

Photograph location & direction display (Red fan)

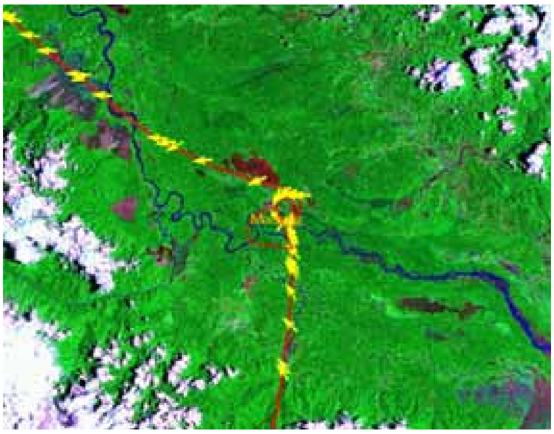
Artificially forested areas

Fig. 3-16 Enlarged View of Locations Where Pictures with GPS Tags Were Taken and Actual Pictures



Photograph location & direction display (Red fan)

Grass lands

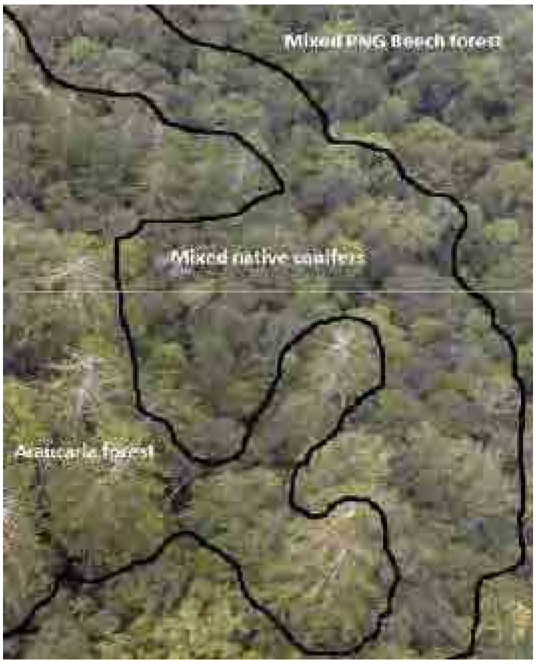


Photograph location & direction display (Red fan)

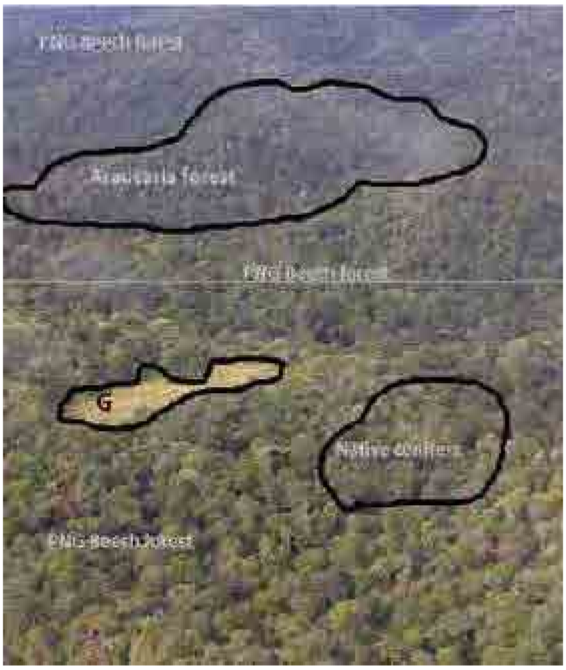
Marsh forests

Figure 3-16 Enlarged View of Locations Where Pictures with GPS Tags Were Taken and Actual Pictures (Continued)

Counterparts (C/P) that are familiar with the vegetation were asked to decipher the vegetation using pictures taken with a GPS camera, and then to compile the respective features. A sample of the pictures with GPS tags and interpretation of vegetation is shown in Figure 3-17. It was the first time for many of the C/P to actually observe the forest from above, and represented invaluable experience to improve the capability of the C/P to decipher vegetation on satellite images that is vital for conducting actual remote sensing analysis in the future.



Lc: Lower Montane Forest, small crowned forest with conifers,>2,400 m a.s.l



L: Lower Montane Forest, small crowned forest >1,400 m a.s.l

Hm: Low Altitude Forest on Uplands, <1,000m

Mo: Montane Forest, >3,000m a.s.l

Fig. 3-17 Sample Pictures with GPS Tags and Interpretation of Vegetation

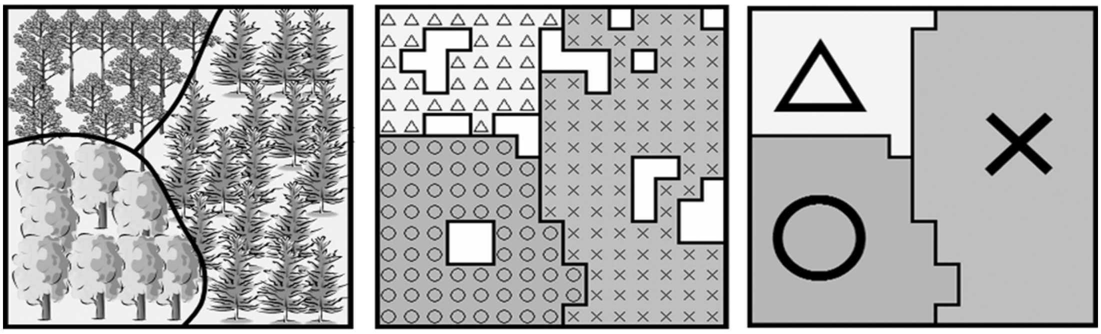
G: Grassland O: PNGRIS Agricultural land use intensity 0-4

Figure 3-17 Sample Pictures with GPS Tags and Interpretation of Vegetation (Continued)

3.4.5 Secondary Analysis of Remote Sensing Data

(a) Review of Forest Classification Flow Chart

During the training in Japan that was previous described, trainees learned the features of optical sensor and radar sensor images and the usage procedure of satellite image analysis software. Here, satellite images that were actually procured under the Grant Aid for Environment and Climate Change are used to review techniques used for forest classification. The eCognition software that is capable of performing object based classification was used for forest classification. By using object based classification, forest classification can be performed by recognizing the forest as a collection of compartment and layer units, rather than in satellite image pixel units (Refer to Figure 3-18).



(a) Condition of Forest (b) Pixel Unit Classification (c) Object Based Classification

Figure 3-18 Differences between Pixel Unit and Object Unit Classification (Image)

For this project, a total of 17 forest classification items have been compiled in "Table 3-6 Classification Codes in FIMS and Target Classifications Codes for This Project". We had our counterparts verify these items on the satellite images, and deliberated as to which satellite images (band combination and vegetation index / elevation data) are effective. The results are shown in Table 3-10.

Based on the results of Table 3-10 and classification features of eCognition, satellite images (5 bands); NDVI (vegetation index), DEM (elevation data), Slope (slope angle) and Watershed (watershed boundary) were used as the input images for forest classification. Due to the fact that it has not been possible to obtain tree height data on the PNG mainland at the current point, it was decided that continued review would be performed concerning the usage of tree height data.

A review was conducted as to which input data was effective for the respective forest types using eCognition for this input data. After this, the threshold that is to be applied for classification was determined through a process of trial and error. A look at classification using eCognition is shown in Figure 3-19, and the results of classification during trial operation are shown in Figure 3-20.

Table 3-10 Review Results of Input Data That is Effective for Forest Classification

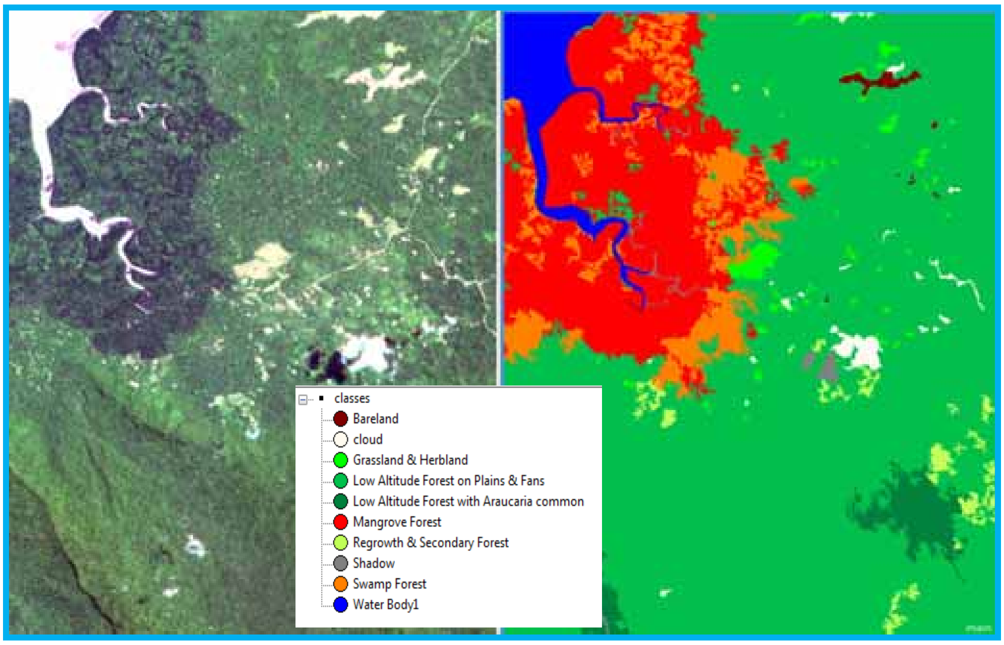
Classification Work Flow

No.	Vegetation or Forest Types	RS & GIS techniques Used to detect forest types									
		NDVI	Unsupervised Classification	PCA	rue Imag	Red Edge Band	Watershed polygons	Contour lines	Slope	DEM	Tree Canopy height
	Evergreen Broadleaf Forests	Cannot detect	Cannot detect	Cannot detect	Good detection	Good detection	Good detection	Good detection			Good detection
1	Mangrove Forest	Good detection	Cannot detect	Cannot detect	Good detection	Good detection	Good detection	Good detection			Good detection
2	Litoral Forest	Cannot detect	Cannot detect	Cannot detect	Broad detection	Cannot detect		Good detection			Good detection
3	Swamp Forest	Cannot detect	Cannot detect	Cannot detect	Broad detection	Cannot detect		Good detection			Good detection
4	Seral Forest	Cannot detect	Cannot detect	Cannot detect	Good detection	Good detection	Good detection	Good detection			Good detection
5	Dry Seasonal Forest	Cannot detect	Cannot detect	Cannot detect	Cannot detect	Good detection		Good detection			Good detection
6	Low Altitude Forests on Plains & Fans	Cannot detect	Cannot detect	Cannot detect	Cannot detect	Cannot detect		Good detection	Good detection	Good detection	Good detection
7	Low Altitude Forests on Uplands	Cannot detect	Cannot detect	Cannot detect	Cannot detect	Cannot detect		Good detection	Good detection	Good detection	Good detection
8	Lower Montane Forests	Cannot detect	Cannot detect	Cannot detect	Cannot detect	Cannot detect		Good detection	Good detection	Good detection	Good detection
9	Mid Montane Forests	Cannot detect	Cannot detect	Cannot detect	Cannot detect	Cannot detect		Good detection	Good detection	Good detection	Good detection
10	Montane Forests	Cannot detect	Cannot detect	Cannot detect	Cannot detect	Cannot detect		Good detection	Good detection	Good detection	Good detection
	Evergreen Mixed Conifer Forests	Cannot detect	Cannot detect	Cannot detect	Cannot detect	Cannot detect	Broad detection	Good detection	Broad detection	Broad detection	Good detection
11	Low Altitude Forest with Araucaria common	Cannot detect	Cannot detect	Cannot detect	Cannot detect	Cannot detect		Good detection	Broad detection	Broad detection	Good detection
12	Lower Montane Forests with Araucaria common	Cannot detect	Cannot detect	Cannot detect	Cannot detect	Cannot detect		Good detection	Broad detection	Broad detection	Good detection
13	Mid Montane Forests with Conifers	Cannot detect	Cannot detect	Cannot detect	Cannot detect	Cannot detect		Good detection	Broad detection	Broad detection	Good detection
14	Montane Forests with Conifers	Cannot detect	Cannot detect	Cannot detect	Cannot detect	Cannot detect		Good detection	Broad detection	Broad detection	Good detection
	Other Wood Lands	Cannot detect	Cannot detect	Cannot detect	Cannot detect	Good detection	Broad detection	Good detection	Broad detection	Broad detection	Good detection
15	Woodland	Cannot detect	Cannot detect	Cannot detect	Cannot detect	Good detection		Good detection	Broad detection	Broad detection	Good detection
16	Savanna	Cannot detect	Cannot detect	Cannot detect	Cannot detect	Good detection		Good detection	Broad detection	Broad detection	Good detection
17	Scrub	Cannot detect	Cannot detect	Cannot detect	Cannot detect	Good detection		Good detection	Broad detection	Broad detection	Good detection
18	Grassland & Herbland	Cannot detect	Cannot detect	Good detection	Good detection	Good detection		Good detection	Broad detection	Broad detection	Good detection
*	Bareland,waterbodies,clouds, shadows etc…	Good detection	Good detection	Good detection	Good detection	Good detection		Not sure			Not sure
*	Watershed (catchment)	Good detection	Cannot detect	Good detection	Broad detection	Good detection	Good detection	Good detection	Good detection	Good detection	Good detection
*	Degraded areas	Cannot detect	Cannot detect	Good detection	Good detection	Good detection		Not sure			Not sure
*	Ridges & terrains	Cannot detect	Cannot detect	Good detection	Broad detection	Good detection	Good detection	Good detection	Good detection	Good detection	Good detection
*	Young & matured forests	Cannot detect	Cannot detect	Good detection	Broad detection	Good detection		Not sure			Good detection
*	Canopy height							Not sure			Good detection

Key:

Broad detection	(orange)
Good detection	(yellow)
Cannot detect	(black)
Not sure	(blue)

Figure 3-19 Appearance of Classification Flow Chart Review



Left diagram: Satellite image Right diagram: Review of classification parameters and classification results

Figure 3-20 Forest Classification Results (Classification Results during Parameter Review)

Regarding all 17 forest types, discussion was conducted with the four counterparts that participated in the review process to determine the data that will be used for object classification and threshold values compiled in one table. The reason for this is that threshold values are determined by human judgment and a process of trial and error, and consensual validation is required in order to judge whether or not the values are appropriate. The forest classification table (draft) that was created is shown in Table 3-11. A forest classification flow chart, which is a graphic representation of Table 3-11, is shown in Figure 3-21. Plans call for the general versatility of this forest classification table to be verified in the months ahead, with the table values optimized in order to create a final version of the forest classification table and the flowchart.

Table 3-11 Forest Classification Table (Draft: Value will be varied, just reference)

No	-1.0 <= NDVI < 0.0	Cloud	Brightness > 6,000			
Vegetation		Water	NIR < 6,000			
		Shadow	Brightness < 3,000			
			NIR < 6,500			
			RedEdge < 2,820			
		Bareland (NDVI < 0)	Human Interpretation	* Rocks, Limestones		
		Larger urban centres	Human Interpretation			
Low	0 <= NDVI < 0.5		0 < NDVI <0.35	Woodland	Human Interpretation	
Vegetation				Savanna	5 < TreeHeight <=10	
				Scrub	TreeHeight <=5	
		Glassland and Herblan	0.35 <= NDVI <0.5			
		Agricultual Landuse	Human Interpretation			
		Bareland (NDVI > 0)	Human Interpretation			
High	0.5 <= NDVI < 1.0	(Plain)	0 <= DTM <500	Litoral	9,000 < NIR	
Vegetation					DTM < 85	
				Mangrove	Green < 4,000	
				Swamp	Green < 6,000	
				Seral (Riverline)	DEM < 25	
					NIR > 8,000	SP=150
					NIR > 11,000	SP=200
				Low Altitude Forest on Plains and	0 <= Slope < 15	
					4 < DTM <210	
				Low Altitude Forest on Uplands	15 <= Slope <30	
				Plantation	12,000 <= NIR	
					RedEdge <= 4,500	
		(Lowland)	500 <= DTM <1,000	Swamp	Green <= 6,300	Gulf
				Seral	NIR > 11,000	
				Dry Seasonal Forest	Green <= 1,920	Western
				Low Altitude Forest on Plains and	0 <= Slope < 15	
				Low Altitude Forest on Uplands	15 <= Slope <30	
				Plantation	12,000 <= NIR	
					RedEdge <= 4,500	
		(Midland)	1,000 <= DTM < 3,000	Swamp	2,000 <= NIR <5,680	
					0.5 <= Slope <= 1.65	
				Seral	NIR > 11,000	
				Dry Seasonal Forest	2,000 <= DTM	
				Plantation	12,000 <= NIR	
					RedEdge <= 4,500	
				Lower Montane Forest	Green <= 5,700	
					DTM < 2,000	
					DTM < 1,500	
		(Highland)	3,000 <= DTM	Swamp	2,000 <= NIR <5,680	
					0.5 <= Slope <= 1.65	
				Seral	NIR > 11,000	
				Montane Forest	Other	

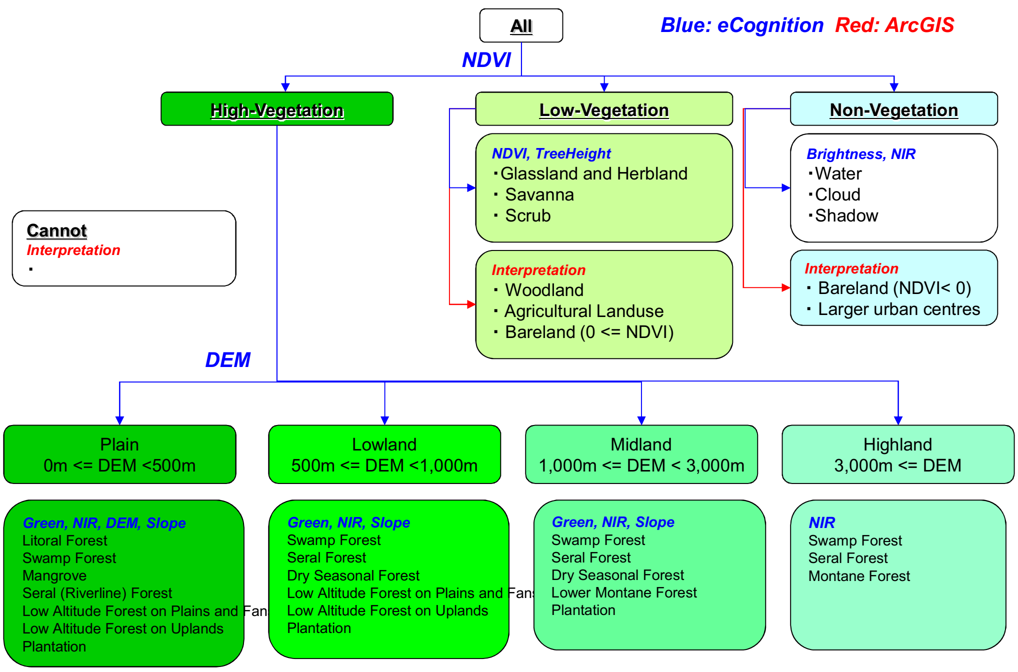


Figure 3-21 Forest Classification Flow Chart (Draft)

Automatic forest classification of a large volume of satellite images can be performed with eCognition by applying the classification flow chart shown in Figure 3-21. However, due to the fact that automatic classification by computer is not perfect, a fair amount of judgment and correction by people are required. Therefore, forest decipher cards were created by the counterparts that are to be used as reference material to facilitate interpretation and correction. The forest decipher cards describe the forest definitions in the Forest Inventory Mapping System (hereinafter FIMS), the “features of the respective classification items that can be deciphered by the optical sensors (RapidEye)”, and the definitions of the classes defined by eCognition. A sample of the forest decipher cards is shown in Table 3-12 (The template only, as the cards are currently in preparation). The results of the application of the classification flow chart to Central Suau in Milne Bay Province are shown in Annex 8.

Table 3-12 Template for Forest Decipher Card

Structural formation		Forest	
Vegetation type		Low Altitude Forest on Plains and Fans"P" (<1,000m)	
Definition of FIMS (Forest)		Tree canopy is greater than 5m in height. Crowns are touching or overlapping. Ground layer is not visible on airphotos.	
Characteristics of RapidEye image	Shape (Crown)	-	
	Color	Mixed	
	Shape	-	
	Size	-	
	Pattern	Relatively regular Scattered crown	
	Texture	Relatively regular, fine in Natural (RGB 4:5:2) Image of RapidEye	
	Shade	-	
	Circum-stance	Along coast, flat topography, lower elevation (<50-100) than H	
eCognition	1st condition		
	2nd condition		
	3rd condition		
	4th condition		
RapidEye sample images	Rapid Eye true color image		Google Earth image
Comments			

(b) Analysis of Watershed (Preparing for Usage in Forest Classification)

The watershed boundary in mountainous areas is located on ridge lines and saddleback areas, serving the function of inhibiting the flow of materials and people, with the capability of separating living zones or cultural zones. In addition, there are cases that these living zones or cultural zones become administrative boundaries. The flow of materials and energy within the watershed acts continuously in the downstream direction, and the watershed becomes an ecosystem. Therefore, a grasp of watershed boundaries needs to be obtained in order to conduct forest management, secure water resources, predict disasters and perform other such work.

Consequently, during this project, remote sensing DEM data will be used to perform watershed analysis in order to create the watershed boundaries. The size of the watershed boundaries will be created at three levels, from large watersheds to small watersheds, in consideration of usage at a variety of levels. In particular, the most detailed small watershed boundaries will be utilized in order to obtain a grasp of vegetation boundaries on forest cover classification diagrams that are created during this project.

The creation procedure for watershed boundaries is shown in Figure 3-22. GeoSAR data that was borrowed from UPNG RSC which is cooperating with the C/P was used as the DEM data. GeoSAR DEM data has an extremely high resolution of 5 meters, but this GeoSAR DEM data has locations where the data is missing. SRTM data with a resolution of 90 meters was used to supplement the locations where the data was missing (① in Figure 3-22). Small watershed boundaries were created in a number of different sizes, and the respective watershed boundaries were overlaid with the satellite images in order to determine the watershed size that best reflects the vegetation boundaries after discussion with the C/P (⑧ in Figure 3-22). The results of the survey which were overlaid onto the watershed boundaries and vegetation diagrams are shown in Figure 3-23. As a result of a review, the following conditions were established for the respective watershed boundary sizes: Cumulative flow volume of 50,000 or more for small watershed boundaries, 500,000 or more for medium watershed boundaries and 5,000,000 or more for large watershed boundaries.

Creation of the small watershed boundaries has been completed, and medium and large watershed boundaries are currently being created. A sample of a created small watershed boundary is shown in Figure 3-24.

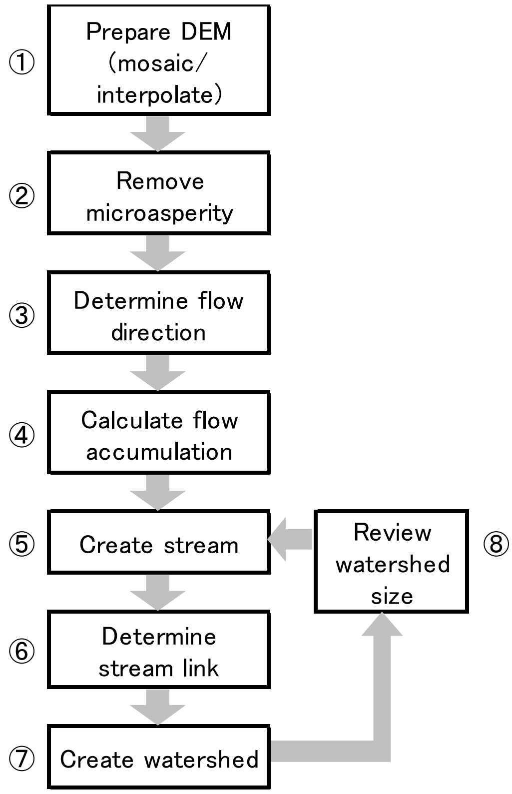


Figure 3-22 Watershed Boundary Creation Procedure

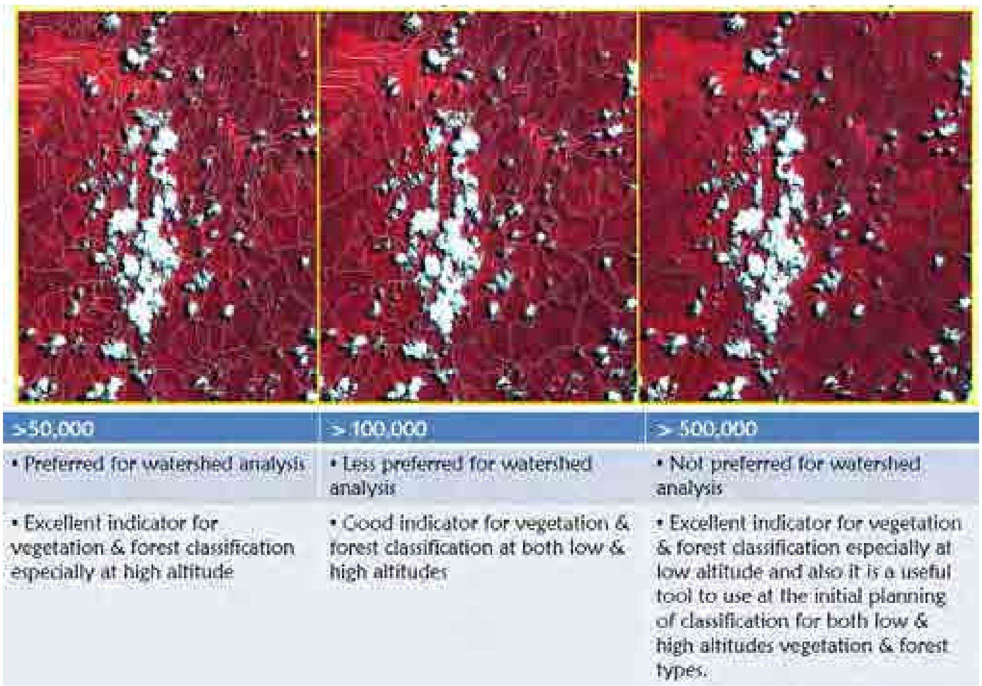


Figure 3-23 Watershed Boundaries for Different Cumulative Flow Volumes and Survey Results Overlaid onto Satellite Images

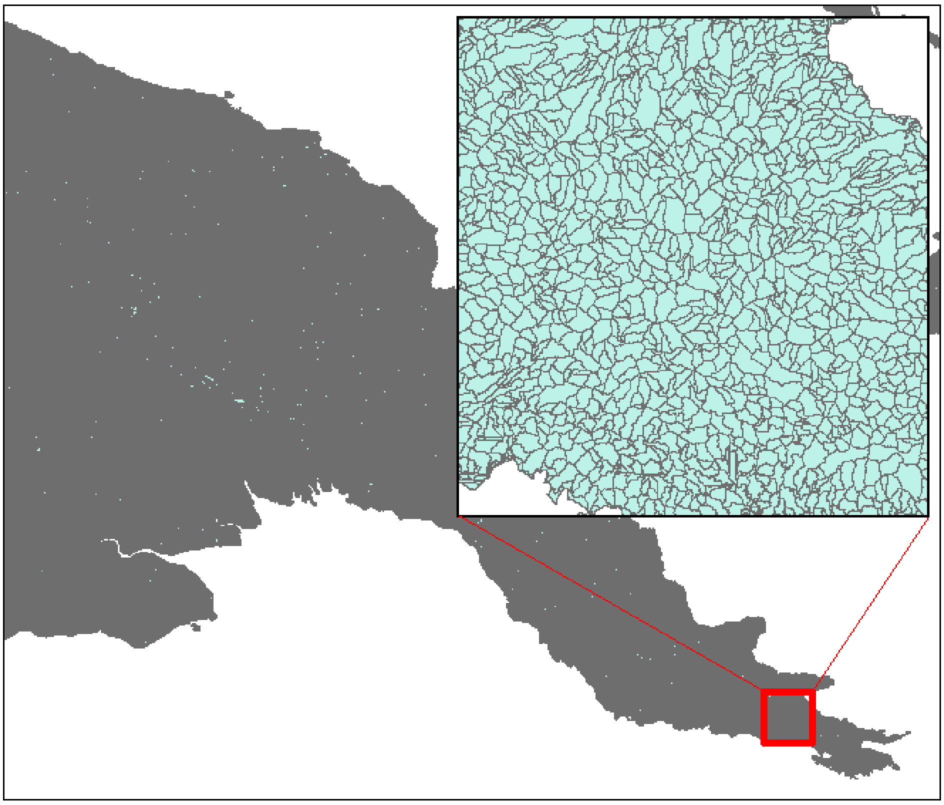


Figure 3-24 PNG Small Watershed Boundaries Created with DEM Data Analysis

3.4.6 Preparation of Nationwide Forest Cover Classification Maps Based on Secondary Analysis Results

(a) Addition of Classification Categories

Deliberation was conducted again with the C/P and long-term experts regarding the forest cover diagram classification items. This resulted in classification of Grassland and Herbland using altitude, and classification of Forest plantations into Forest plantations and other plantations (Plantations other than forest plantations) due to the fact that the C/P has Plantation boundary data (Refer to Figure 3-25).

A list of the latest vegetation classification items which reflect these additions is shown in Table 3-13.

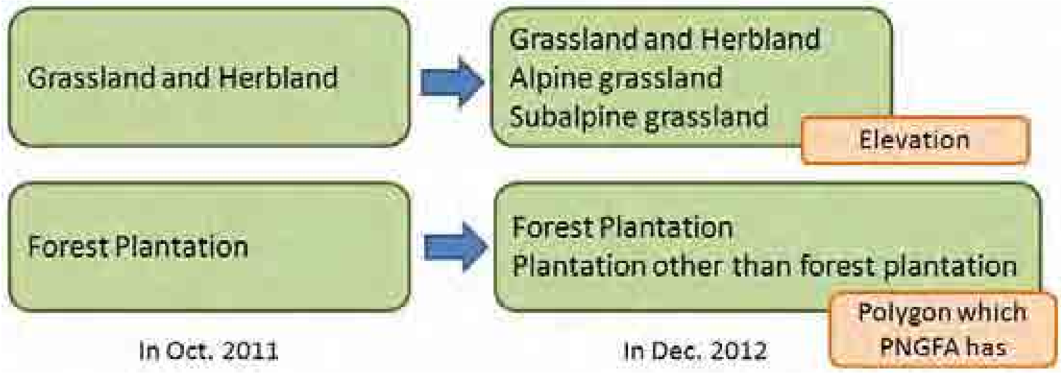


Figure 3-25 Change in Grassland and Plantation Classification Items

Table 3-13 List of Forest/Vegetation Classification Items

As of 10th December, 2012

IPCC GL-AFOLU	No.	Vegetation type	Condition	Code	No.	Remarks
Forest land	1	Low Altitude Forest on Plains and Fans	below 1,000m	Pl		Large to medium crowned forest
				Po		Open forest
				Ps		Small crowned forest
	2	Low Altitude Forest on Uplands	below 1,000m	Hl		Large crowned forest
				Hm		Medium crowned forest
				HmAr		Medium crowned forest with Araucaria common
				Hmd		Medium crowned depauperate/damaged forest
				Hme		Medium crowned forest with an even canopy
				Hs		Small crowned forest
				Hse		Small crowned forest with an even canopy
				HsAr		Small crowned forest with Araucaria common
				HsCa		Small crowned forest with Castanopsis
				HsCp		Small crowned forest with Casuarina papuana
				HsN		Small crowned forest with Nothofagus
				HsRt		Small crowned forest with Rhus taitensis
	3	Lower Montane Forest	above 1,000m	L		Small crowned forest
				LAr		Small crowned forest with Araucaria common
				LN		Small crowned forest with Nothofagus
				Lc		Small crowned forest with conifers
				Ls		Very small crowned forest
				LsCp		Very small crowned forest with Casuarina papuana
				LsN		Very small crowned forest with Nothofagus
	4	Montane Forest	above 3,000m	Mo		Very small crowned forest
	5	Dry Seasonal Forest	in Western Prov.	D		Dry evergreen forest
	6	Littoral Forest		B		Mixed forest
				BCe		Forest with Casuarina equisetifolia
				BMl		Forest with Melaleuca leucadendron
	7	Seral Forest		Fri		Riverine mixed successions
				FriCg		Riverine successions with Casuarina grandis
				FriK		Riverine successions with Eucalyptus deglupta
				FriTb		Riverine successions with Terminalia brassii
				Fv		Volcanic successions
	8	Swamp Forest		Fsw		Mixed swamp forest
				FswC		Swamp forest with Campnosperma
				FswMl		Swamp forest with Melaleuca leucadendron
				FswTb		Swamp forest with Terminalia brassii
	9	Woodland		W		Woodland
				Wri		Riverine successions dominated by woodland
				WriCg		Riverine successions with Casuarina grandis woodland
				Wv		Volcanic successions dominated by woodland
				Wsw		Swamp woodland
				WswMl		Swamp woodland with Melaleuca leucadendron
	10	Savanna		Sa		Savanna
				Saf		Savanna with galley forest
				SaMl		Savanna with Melaleuca leucadendron
	11	Scrub		Sc		Scrub
				ScBc		Scrub with Bambusa and Cyathea
				Scv		Volcanic successions dominated by scrub
Grassland	12	Grassland and Herbland		G		Grassland
				Gf		Grassland with some forest
				Gr		Grassland reverting to forest
				Grf		Grassland reverting to forest with some forest
				Gsw		Swamp grassland
				Gri		Riverine successions dominated by grass
				Gv		Volcanic successions dominated by grass
				Hsw		Herbaceous swamp
	13	Alpine grassland	above 3,200m	Ga		Alpine grassland (above 3,200m)
	14	Subalpine grassland	2,500m - 3,200m	Gi		Subalpine grassland (2,500m - 3,200m)
Forest land		Estuarine Communities		M	15	Mangrove
Cropland		Other Non-vegetation		O	16	PNGRIS agricultural land use intensity classes 0-4
Wetlands				E	17	Lakes and larger rivers
Other Land				Z	18	Bare areas
Settlements				U	19	Larger urban centres
				-	20	Forest Plantation
				-	21	Plantation other than forest plantation

(b) Addition of Distribution Characteristics

In order to reduce misclassification during automatic classification, verification of which regions the respective classification items exist was performed, as well as the approximate respective area. The Summary of FIMS (FOREST RESOURCES OF PAPUA NEW GUINEA SUMMARY STATISTICS FROM THE FOREST INVENTORY MAPPING (FIM) SYSTEM, 1998) was used as reference to add up the area for each vegetation type and each forest type in each province. The vegetation types are shown in Table 3-14, and the forest types are shown in Table 3-15.

Table 3-14 Area of Each Vegetation Type in Each Province (sq km, 1975)

Province		Vegetation Type							
Name	Area	Forest	Woodland	Savanna	Scrub	Grassland/ Herbland	Mangrove	Land use [a]	Other [b]
Western	98,452	61,352	11,528	9,282	4,466	7,716	1,235	1,035	1,837
Gulf	34,801	28,767	1,709	188	78	430	2,636	667	337
Central	29,872	20,276	1,430	1,710	298	1,670	664	3,842	43
Milne Bay	14,964	8,900	76	14	48	2,161	420	1,635	7
Northern	22,772	16,792	1,667	713	149	1,547	171	1,688	45
Southern Highlands	25,748	20,229	113	0	25	673	0	4,748	62
Enga	11,624	7,615	0	0	65	646	0	3,093	< 5
Western Highlands	9,141	5,253	0	0	32	588	0	3,268	0
Simbu	6,134	4,032	0	0	19	83	0	2,000	0
Eastern Highlands	11,205	5,650	< 5	0	6	1,737	0	3,811	< 5
Morobe	33,983	22,566	469	0	73	3,278	32	7,490	26
Madang	29,095	21,696	923	0	143	2,223	21	3,952	238
East Sepik	43,813	25,669	7,259	0	< 5	7,934	320	2,593	17
West Sepik	36,064	32,896	586	0	49	1,034	14	1,474	0
Manus	2,160	1,523	244	0	33	17	78	263	< 5
New Ireland	9,610	7,798	282	0	0	179	198	1,153	0
East New Britain	15,344	13,062	29	0	126	11	22	2,088	5
West New Britain	20,456	18,420	337	0	141	160	158	1,161	79
North Solomons	9,433	7,043	283	0	321	224	45	1,468	48
Totals	464,101	330,656	26,938	11,906	6,014	32,411	6,016	47,408	2,750

(a) areas of significant land use, urban, mining etc.
(b) bare areas, lakes etc.

Source : FOREST RESOURCES OF PAPUA NEW GUINEA SUMMARY STATISTICS FROM THE FOREST INVENTORY MAPPING (FIM) SYSTEM, 1998

Table 3-15 Area of Each Forest Type in Each Province (sq kim, 1975)

Province		Forest Type							
Name	Area	Lowland Plains (<1,000m)	Lowland Hills (<1,000m)	Lower Montane (>1,000m)	Montane (>3,000m)	Dry Seasonal	Littoral	Seral	Swamp
Western	98,452	2,568	33,810	3,105	< 5	10,629	377	218	10,652
Gulf	34,801	3,517	19,300	1,670	0	0	27	< 5	4,249
Central	29,872	2,439	10,942	8,283	327	0	147	51	87
Milne Bay	14,264	1,259	7,117	1,417	< 5	0	80	20	6
Northern	22,772	2,958	9,410	4,884	221	0	6	209	105
Southern Highlands	25,746	147	7,166	12,695	71	0	0	0	152
Enga	11,824	0	602	8,885	324	0	0	0	< 5
Western Highlands	9,141	0	1,128	3,942	183	0	0	0	0
Simbu	6,134	0	1,627	2,304	102	0	0	0	0
Eastern Highlands	11,206	0	481	5,088	81	0	0	0	0
Morobe	33,933	453	7,598	13,591	207	0	35	56	246
Madang	29,095	2,719	12,695	6,012	156	0	20	63	941
East Sepik	43,813	4,499	14,034	2,474	< 5	0	22	400	4,254
West Sepik	36,064	8,228	17,314	8,146	92	0	29	20	966
Manus	2,160	14	1,492	0	0	0	17	0	0
New Ireland	9,610	134	6,676	1,032	0	0	0	66	0
East New Britain	15,344	417	9,639	2,766	0	0	22	197	22
West New Britain	20,456	1,798	15,318	687	0	0	17	242	359
North Solomons	9,433	1,470	3,732	1,120	0	0	77	106	459
Totals	464,101	32,908	179,468	91,099	1,774	10,629	886	1,710	22,503

Source : FOREST RESOURCES OF PAPUA NEW GUINEA SUMMARY STATISTICS FROM THE FOREST INVENTORY MAPPING (FIM) SYSTEM, 1998

In regard to vegetation types, the following things can be verified from Table 3-14.

- There are not any woodlands in Enga, Western Highlands or Simbu Prov. (Less than 5km^2 in Eastern Highlands).
- There is Savanna in Western, Gulf, Central, Milne Bay and Northern Prov.
- There is no Scrub in Eastern Highlands, East Sepik or New Ireland Prov. (Here, this indicates less than 10km^2).
- There are not any mangroves in Eastern/Western/Southern Highlands, Enga or Simbu Prov.

In addition, with respect to forest types, the following things can be verified from Table 3-15.

- There are not any Lowland Plains (altitude 1,000m or lower) in Eastern/Western Highlands, Enga or Simbu Prov.
- There are not any Lower Montane Forests (altitude 1,000m or higher) in Manus Prov.
- Dry Seasonal Forests are only in Western Prov.
- Most of the Littoral Forests are in Western, Central, Milne Bay and North Solomons Prov., amounting to approximately 80% of the total area.
- There are not any Seral Forests in Eastern/Western/Southern Highlands, Enga, Simbu, or Manus Prov.
- There are not any Swamp Forests in Eastern/Western Highlands, Simbu, Manus or New Ireland Prov. Most of the Swamp Forests are in Western, Gulf and East Sepik Prov., amounting to approximately 85% of the total area.

When automatic classification and correction of interpretation are performed, this information shall be taken into consideration when formulating the classification flow and interpretation procedure so that misclassification can be minimized as much as possible.

(c) Updating and Finalization of Forest Classification Flow Chart

Deliberations were conducted again with the C/P and long-term experts, taking the above content into consideration, and a flow chart to be used during automatic classification of forest was prepared. The forest classification flow chart is shown in Figure 3-26. The flow will be tuned-up based on the challenges/issues faced in the analysis/processing.

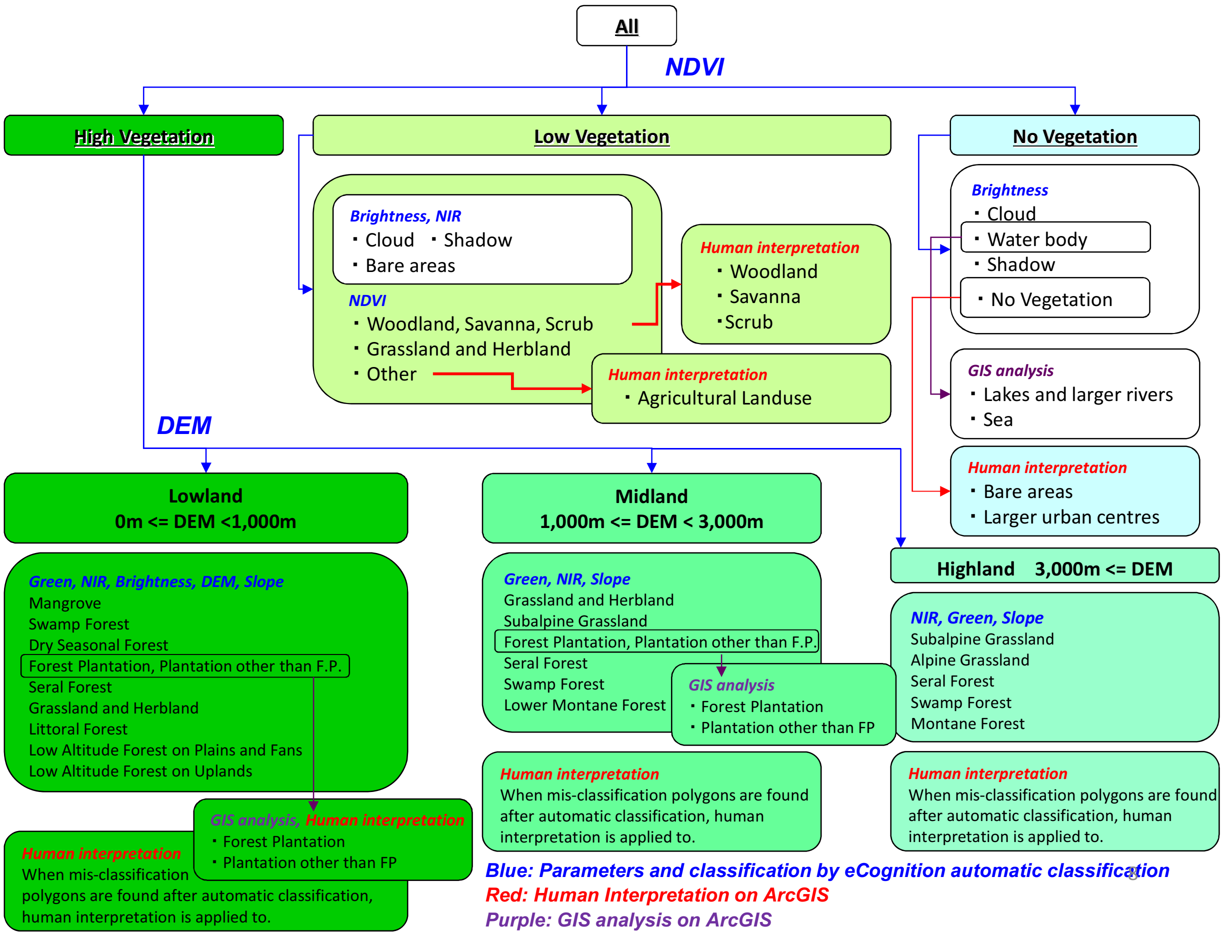


Figure 3-26 Revised Forest Classification Flow Chart

Figure 3-27 Forest Classification Flow Chart Being Reviewed

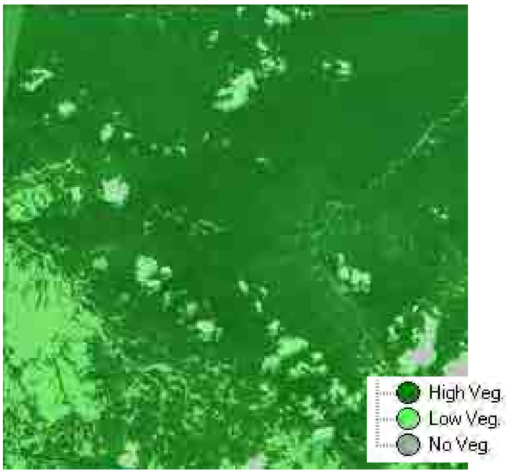
(d) Confirmation and Correction of Automatic Classification results

The decision was made to use RapidEye satellite images (5 bands), NDVI (vegetation index), DEM (altitude data), Slope (slope angle) and Watershed (watershed boundaries) as the input images for forest classification. These images were entered into each RapidEye tile ID (25 km square), and a segmentation was prepared with eCognition.

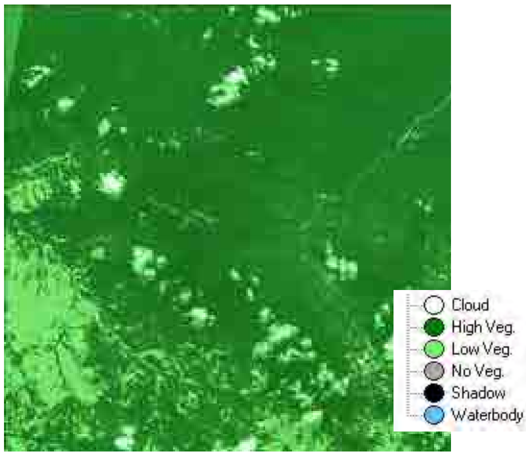
The segmentation was used as the minimum classification unit, and the average value of each parameter and standard deviation were calculated from the total pixel value in the segmentation. These values were used for the feature values to perform forest / vegetation classification. The process of performing classification in accordance with the flow chart shown in Figure 3-26 is shown in Figure 3-28.

(1) RapidEye Image

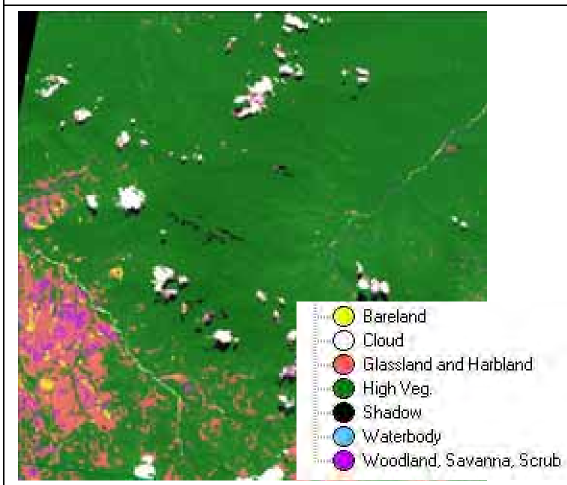
(2) Segmentation Image



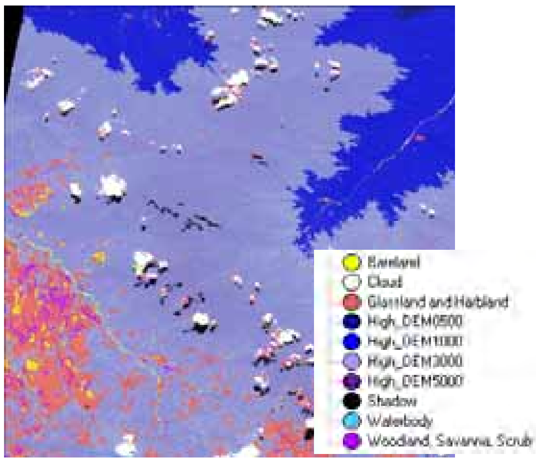
(3) Vegetation area using NDVI



(4) Classification of No Vegetation area

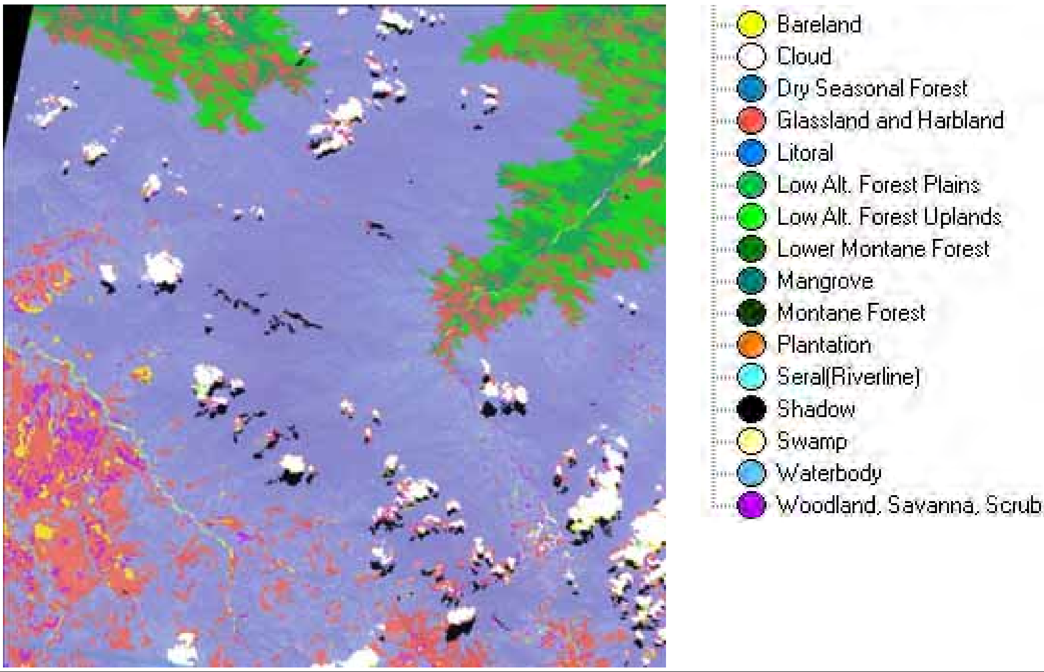


(5) Classification of Low Vegetation area

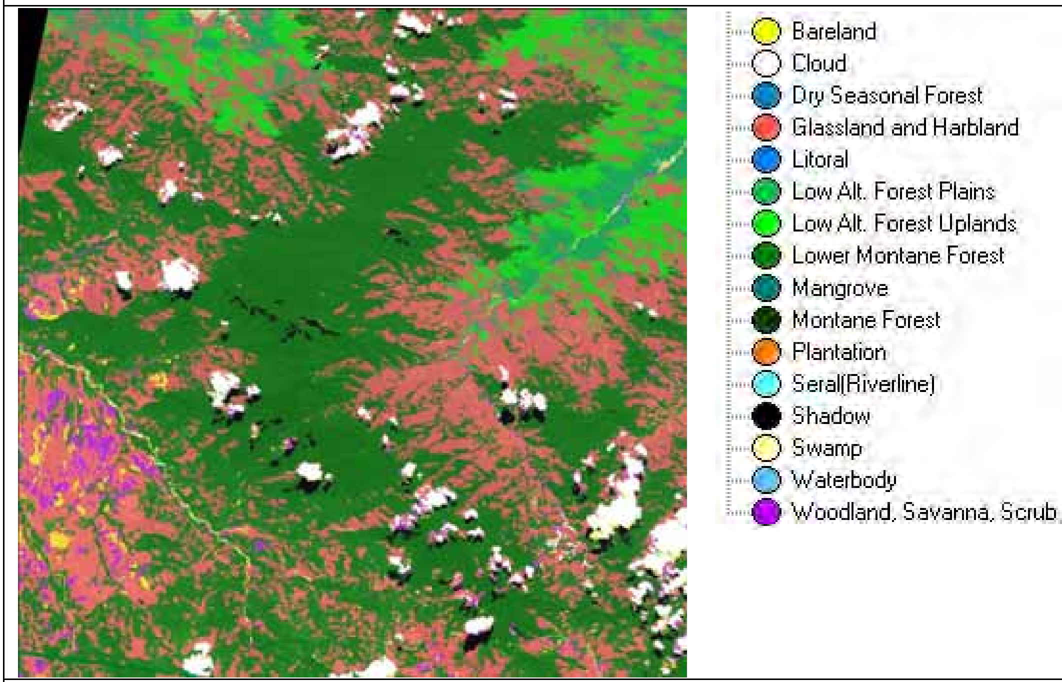


(6) Classification of High Vegetation area

Figure 3-28 Process of Performing Vegetation Classification



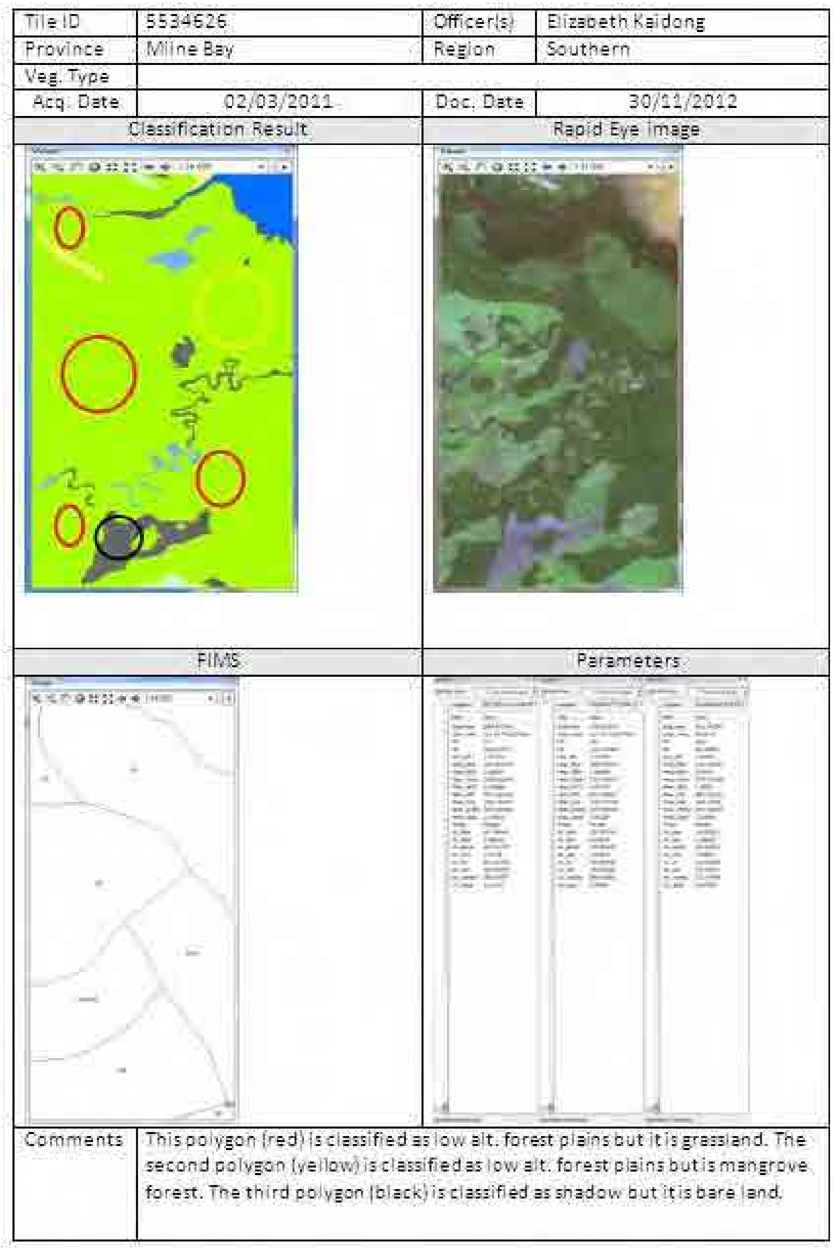
(7) Classification of High Vegetation area



(8) Classification of High Vegetation area

Figure 3-28 Process of Performing Vegetation Classification (Continued)

Since there were a number of misclassifications in the classification results after automatic classification was performed, the misclassified locations (polygons) were visually extracted, and the reasons that misclassification occurred were compiled. The table used to extract the misclassifications and reexamine the parameters is shown in Figure 3-29. The process of extraction of the misclassifications is shown in Figure 3-30. Staff at the FRI (Forestry Research Institute) who are familiar with forests / vegetation were asked to participate in this work, and their knowledge was used extensively. Furthermore, the classification flow parameters were optimized, and automatic classification was attempted again. The automatic classification results before and after the parameters were updated were compared at the project site. These results are shown in Figure 3-31.



Tile ID	5534626	Officer(s)	Elizabeth Kaidong
Province	Milne Bay	Region	Southern
Veg. Type			
Acq. Date	02/03/2011	Doc. Date	30/11/2012
Classification Result		Rapid Eye Image	
FIMS		Parameters	
Comments	This polygon (red) is classified as low alt. forest plains but it is grassland. The second polygon (yellow) is classified as low alt. forest plains but is mangrove forest. The third polygon (black) is classified as shadow but it is bare land.		

Figure 3-29 Misclassification Extraction Results

Figure 3-30 Misclassification Being Extracted

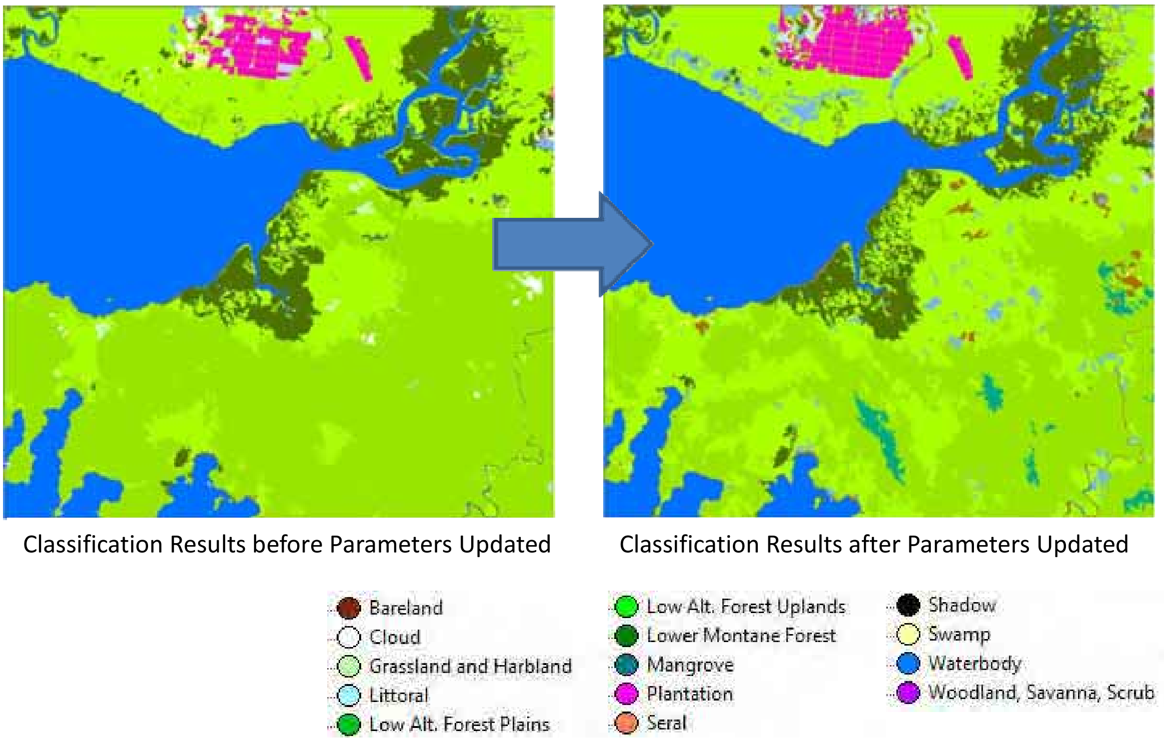


Figure 3-31 Forest Classification Results after Classification Flow / Parameters Updated

It can be seen in Figure 3-31 that while there were a number of misclassifications in the classification results before the parameters were updated such as for Littoral and Dry Seasonal Forest, these misclassifications were reduced after the parameters were updated. This indicates that optimization of the parameters used for classifications and reflecting the characteristics of the region or distribution region in the classification flow leads to enhancement of the classification accuracy.

The results of applying this classification flow to the area around the Central Suau project site in Milne Bay are shown in Figure 3-32. The area of the diagram is approximately 60km x 100km (corresponds to

12 RapidEye tiles). The FIMS vegetation boundaries were overlaid as red lines in order to evaluate the classification results obtained with automatic classification.

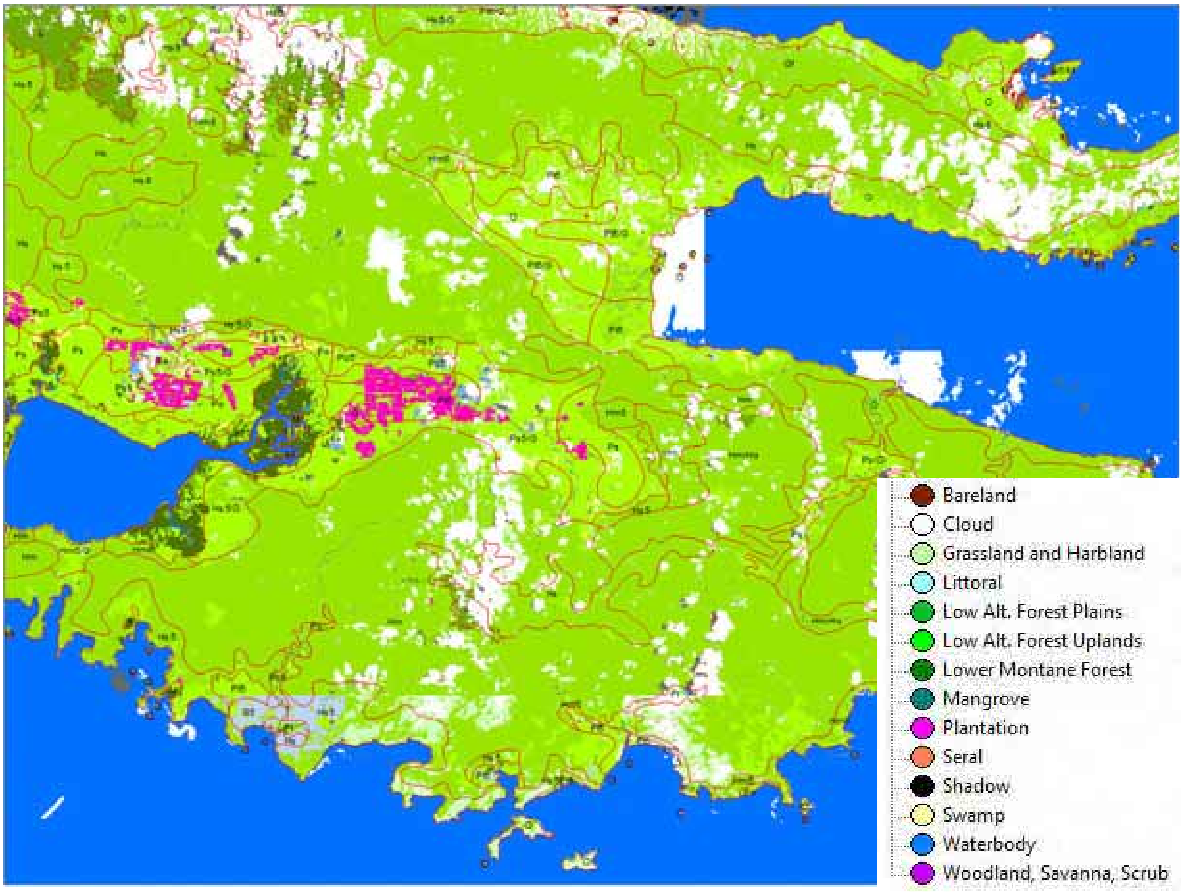


Figure 3-32 Forest Cover Classification Diagram Prepared with Automatic Classification (FIMS Vegetation Boundaries Overlaid with Red Lines)

Due to the fact that preparation of forest cover classification diagrams is being implemented throughout PNG under the Grant Aid for Environment Program (Technical Assistance), in this project, the focus was on a review of forest cover classification diagram preparation and capacity building at the C/P.

(e) Preparation of Interpretation Cards

Due to the fact that accurate forest classification cannot be performed with automatic classification alone, interpretation correction that consists of visual interpretation by trained staff is required. The C/P prepared interpretation cards (collection of classification case studies) which are required for interpretation. The decision was made to have interpretation cards prepared for each of five vegetation regions after consultation with the C/P and long-term experts. These five vegetation regions are: Central/Milne Bay/Oro Province, Highlands Region, Momase Region, Western/Gulf Province and

Islands Region.

In addition, with respect to the classification items that are required for correction of interpretation in particular, priority order was assigned, and a larger number of interpretation samples were prepared. On the other hand, with respect to classification items for which classification can be performed to a certain extent with automatic classification, a smaller number of interpretation samples was designated as a consideration for the volume of work at the C/P (to maintain balance with normal work conducted).

The interpretation card work progress sheet is shown in Table 3-16. In order to prevent subjectivity by different individuals from being included in the interpretation results, preparation of interpretation cards was performed by two people. An example of interpretation card preparation is shown in Figure 3-33. The decision was made to have the C/P enter the boundary line on the satellite image on the interpretation card in order to enable staff performing interpretation and correction work that are not familiar with the types of vegetation in Papua New Guinea to clearly identify the boundary between classes of forests / vegetation.

Table 3-16 Progress Sheet for Interpretation Card Work

As of 20th December, 2012

Priority	No.	Vegetation type	Code	Samuel Patrick	Elizabeth Rabbie (Margaret)	Perry Ledino (John)	**Total**
High	9	Woodland	W	/ 3	/ 3	/ 3	0 / 9
	10	Savanna	Sa	/ 3	/ 3	/ 3	0 / 9
	11	Scrub	Sc	/ 3	/ 3	/ 3	0 / 9
	7	Seral Forest	Fri	/ 2	/ 2	/ 2	0 / 6
	8	Swamp Forest	Fsw	/ 2	/ 2	/ 2	0 / 6
	16	PNGRIS agricultural land use intensity classes 0-4	O	/ 2	/ 2	/ 2	0 / 6
	20	Forest Plantation	-	/ 2	/ 2	/ 2	0 / 6
	21	Plantation other than forest plantation	-	/ 2	/ 2	/ 2	0 / 6
		Subtotal		**0 / 19**	**0 / 19**	**0 / 19**	**0 / 57**
Normal	6	Littoral Forest	B	/ 2	/	/	0 / 2
	5	Dry Seasonal Forest	D	/	/	/	0 / 0
	12	Grassland and Herbland	G	/ 1	/ 1	/ 1	0 / 3
	13	Alpine grassland	Ga	/ 1	/ 1	/ 1	0 / 3
	14	Subalpine grassland	Gi	/ 1	/ 1	/ 1	0 / 3
	15	Mangrove	M	/ 2	/	/	0 / 2
	4	Montane Forest	Mo	/	/ 2	/	0 / 2
	3	Lower Montane Forest	L	/	/ 2	/	0 / 2
	1	Low Altitude Forest on Plains and Fans	P	/	/	/ 2	0 / 2
	2	Low Altitude Forest on Uplands	H	/	/	/ 2	0 / 2
	19	Larger urban centres	U	/	/	/	0 / 0
		Subtotal		**0 / 7**	**0 / 7**	**0 / 7**	**0 / 21**
		Total		**0 / 26**	**0 / 26**	**0 / 26**	**0 / 78**

Structural formation		Forest land
Vegetation type		Savanna "Sa"
Definition of FIMS		Scattered to moderately dense layer of trees.
Characteristics of RapidEye image	Shape (Crown)	-
	Color	-
	Shape	-
	Size	-
	Pattern	-
	Texture	-
	Shade	-
	Circum-stance	-
	Province	Central
	Bookmark	Sa_03

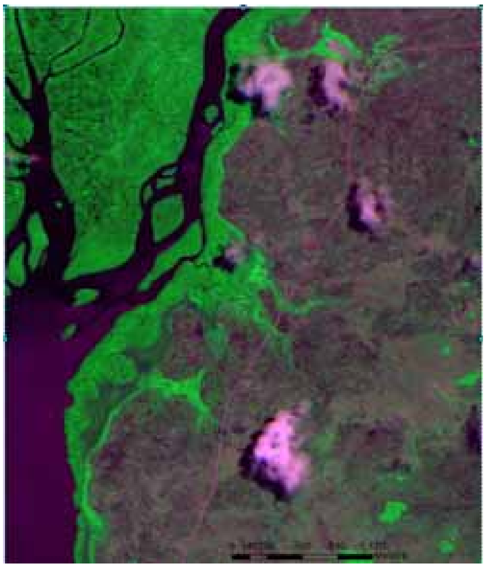
RapidEye sample images

Rapid Eye (Color: B:1 G:2 R:3)	Google Earth image
Image ID: 5535013	Satellite

Location X 146°39'54.78" E Location Y 8°45'57.665" S
Date: Scale: 1:20,000

Location X 146°36'.51.07" E Location Y 8°48'52.48" S
Date: Elevation 14m

Rapid Eye (Color: B:2 G:5 R:3)	Google Earth image
Image ID: 5535013	Satellite



Location X 146°39'54.78" E Location Y 8°45'57.665" S
Date: Scale: 1:20,000

Location X 146°36'38.42" E Location Y 8°49'20.79" S
Date: Elevation 11m

Comments	False colour	Feature
	Dark purplish	water body
	Light green	Mangrove
	Light green (bright)	grassland?woodland
	Pinkish- green tops	Savanna (shrubs, palms, trees)

Figure 3-33 Sample Interpretation Card

3.4.7 Required OJT for 3.4.2 – 3.4.6

The results shown in 3.4.2 – 3.4.6 were achieved by implementing the OJT shown in the table below.

Table 3-17 Implementation of OJT

Date	OJT Content	Participating Member
September 26, 2011 (Monday) September 27, 2011 (Tuesday)	Image processing of RapidEye images	Mr. Perry (Training in Japan)
September 28, 2011 (Wednesday) September 29, 2011 (Thursday)	Image processing of PALSAR images	Mr. Perry (Training in Japan)
October 3, 2011 (Monday) October 4, 2011 (Tuesday)	Preparation of Image Analysis Manual	Mr. Perry (Training in Japan)
October 5, 2011 (Wednesday)	Practice with Arc GIS	Mr. Perry (Training in Japan)
October 13, 2011 (Thursday) 15:20 – 16:20	Discussion of Classification Items	Inventory and Mapping Branch
October 14, 2011 (Friday) 13:30 – 14:50	Report Meeting on Training in Japan	Mr. Perry Inventory and Mapping Branch
October 18, 2011 (Tuesday) 10:30 – 12:20 13:30 – 16:30	Discussion of Satellite Image Classification Discussion Concerning Interpretation of Satellite Images (Trial / Review)	Inventory and Mapping Branch
October 20, 2011 (Thursday) 10:00 – 12:00 14:00 – 17:00	Interpretation of Satellite Images Organization of Deciphered Results	Inventory and Mapping Branch
January 25, 2012 (Wednesday) February 1, 2012 (Wednesday) 13:30 – 16:00	Usage of Handy GPS Demonstration of Data Loading and Usage	Inventory and Mapping Branch
March. 5, 2012 (Mon.) to March. 9, 2012 (Fri.)	ArcGIS preparation & demonstration Demonstration of canopy volume estimation	Inventory and Mapping Branch ＆Climate Change & REDD
September. 18, 2012 (Tue.) to September. 28, 2012 (Fri.)	Optimization of forest classification flow chart Instruction in the preparation of forest decipher cards	Perry, Rabbie, Samuel, Patrick
January 21, 2013 (Mon.) to January 25 2013 (Fri.)	Follow up Training o Object-based forest Classification (eCognition)	Perry, Samuel, Patrick, Elizabeth

3.5 Activities Related to Output 2

Output 2: Forest Resource Database Will be Improved

3.5.1 Obtaining Grasp / Analyzing Existing Data Concerning Forest Resources

(a) Initial Analysis of FIMS

Since the existing FIMS will be used as the base for the forest resource database, work began with obtaining a grasp of FIMS data and performing an analysis. Due to the fact that there were not detailed documents concerning the FIMS database design and other details, the "FIMS User Guide" and actual data were collected, and it was verified that there are the data items shown in Table 3-18.

Table 3-18 Outline of FIMS Existing Data (Prepared Based on FIMS User Guide and Actual Data)

Data Item	Explanation
Forest Mapping Unit(FMU)	An area of forest or other vegetation type mapped as a unique polygon in the 1:100,000 forest inventory mapping series. FMUs are numbered 1 --->n for each Province.
Concession Area	Concession Area
Protected Area	Protected Area under the Flora and Fauna Act (e.g. Wildlife Management Areas, National Parks, Catchment Management Areas).
Slope(Extreme)	land with over 30 degree dominant slope.
Altitude	land over 2400m altitude.
Karst	land with polygonal karst landform.
Inundation(Extreme)	land permanently or near permanently inundated extending over more 80% of the area of that land.
Mangroves	land covered by mangroves.
Inundation(Serious)	land with dominant slope of 20-30 degrees and sub-dominantslope over 30 degrees and with high to very high relief.
Slope/Relief	Slope/Relief
Logged_NotLandUse	areas logged and left to regenerate.
Logged_LandUse	areas logged and subsequently converted to other forms of non-forest forms of land use.
LandUse_NotLogged	areas cleared (but not logged commercially) and subsequently converted to other non-forest land use.
Logged_And_Luse	areas cleared (but not logged commercially) and subsequently converted to other non-forest land use.

Data Item	Explanation
Forest Zone	Forest Zone

Table 3-19 FIMS Data Items and Attributes (Prepared Based on Actual Data)

Feature(layer)	attribute name	Feature(layer)	attribute name
Forest Mapping Unit(FMU)		Concession Area	
	PROVINCE		PLAN_ID
	FMU		NAME
	ZONE		AREA
	MAP_NO		PURCHASE
	MAP_ID		EXP
	VEG_TYPE		CONSTYPE
	VEG_AREA		STATUS
	SLOPE		SCALE
	ALTITUDE	Protected Area	
	KARST		PROTECT_ID
	INUNDATION		NAME
	MANGROVE		TYPE
	SLOPERELIE		GAZ_DATE
	INUNDATI0		PROVINCE
	AREA		LOCATION
	AREA0		TENURE
	EXTREME		AREA
	SERIOUS		ALTITUDE
	AREA1		LOGITUDE
	EXT_SL		LATITUDE
	EXT_ALT	Slope(Extreme)	
	EXT_KST		province
	EXT_IN		provname
	EXT_MAN		area
	SER_SL		slope1
	SER_IN	Altitude	
	TYPE		province
	NO_DIST		provname
	VEG_TYPE_1		area
	VEG_TYPE_2		altitude

Feature(layer)	attribute name	Feature(layer)	attribute name
	VEG_TYPE_3	Karst	
	TYPE_BASE		province
	AREA_75		provname
	INDEX		area
	PERCENT		landform
	AREA_750	Inundation(Extreme)	
	VOLUME		province
	VOL_75		provname
	75TO96		area
	75TO960		inund
	75TO961		iextent
	EXT_SL0	Mangroves	
	EXT_ALT0		province
	EXT_KST0		vegtype
	EXT_IN0		area
	EXT_MAN0	Inundation(Serious)	
	SER_SL0		province
	SER_IN0		provname
	CURRENT		area
	CURRENT0		inund
	CURRENT1		iextent
	CURRENT2	Slope/Relief	
	EXT_SL1		province
	EXT_ALT1		provname
	EXT_KST1		area
	EXT_IN1		slope1
	EXT_MAN1		slope2
	SER_SL1		relief
	SER_IN1	Logged_NotLandUse	
	AREA2		province
	AREA3		area
	FOREST_VOL	Logged_LandUse	
	TEMP_1		province
	TEMP_2		area
	TEMP_3	LandUse_NotLogged	

Feature(layer)	attribute name	Feature(layer)	attribute name
	TEMP_4		province
	TEMP_5		area
	TEMP_6	Logged_And_Luse	
	TEMP_7		province
	ERR_1		area
	ERR_2	Forest Zone	
	ERR_3		
	ERR_4		
	ERR_5		
	ERR_6		
	ERR_7		

(b) Secondary Analysis of FIMS

The FIMS data structure was organized as a UML class diagram, taking primary analysis of the collected materials into consideration. The results are shown by the following items.

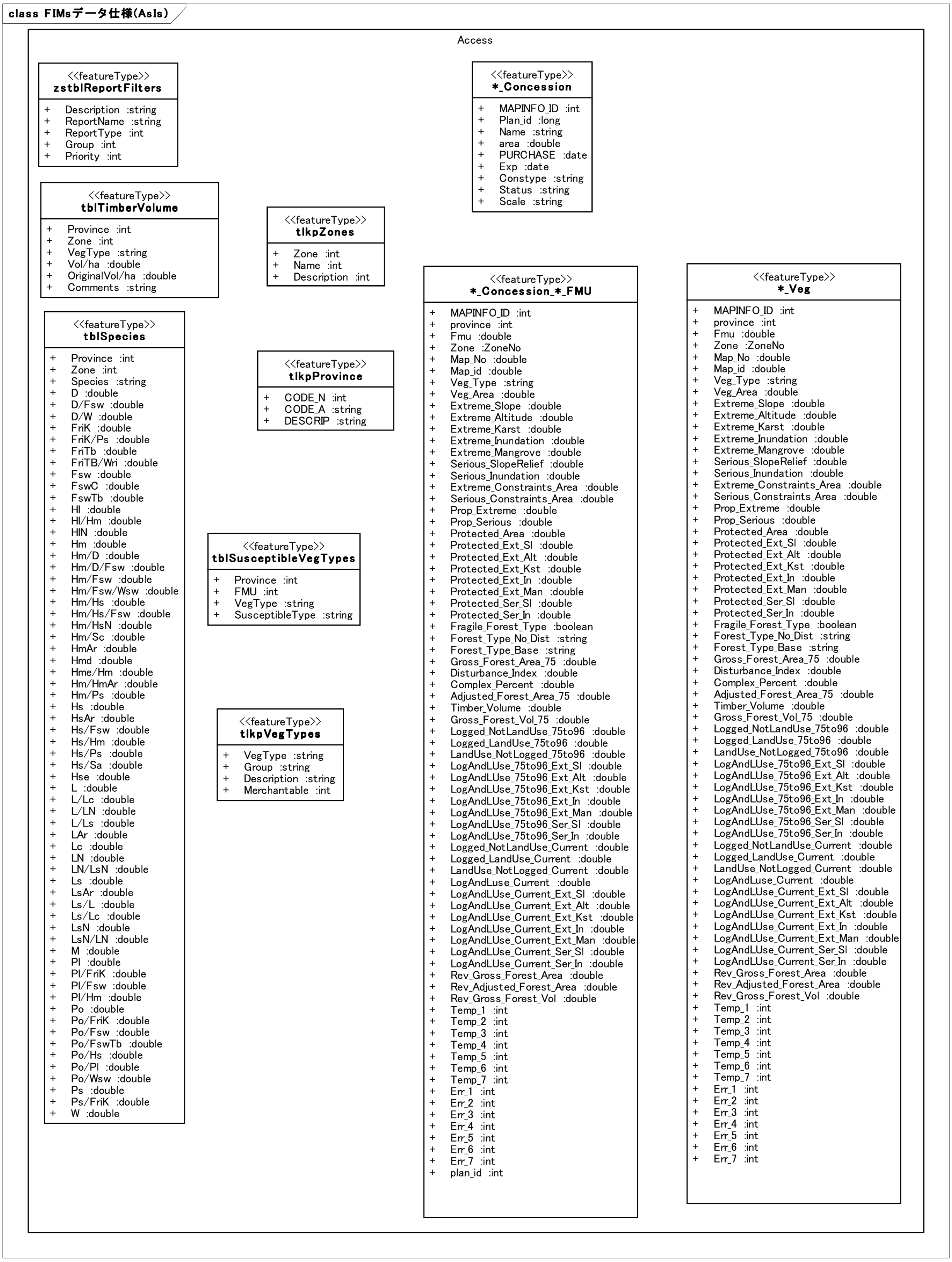


Figure 3-34 UML Class Diagram for Existing FIMS (Access Portion)

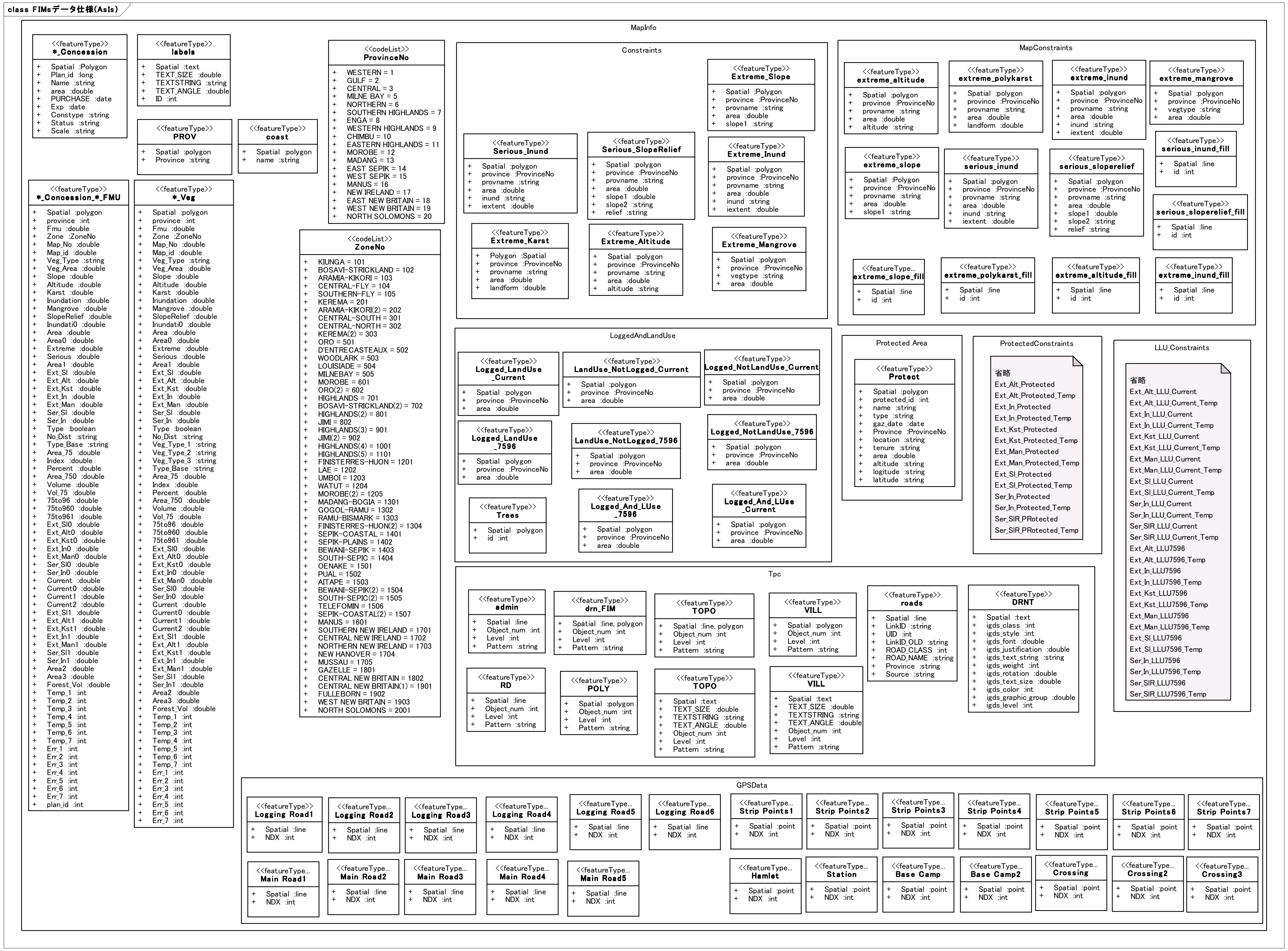


Figure 3-35 UML Class Diagram for Existing FIMS (MapInfo Portion)

(c) Analysis of FIPS

Work was performed in the same manner to obtain a grasp of data for the FIPS and analyze the data. As for the FIPS, there were not detailed documents concerning the FIPS database design and other details, the "FIPS User Manual" and actual data were collected, the content was checked, which resulted in obtaining a grasp of the data structure and content shown in Figure 3-36.

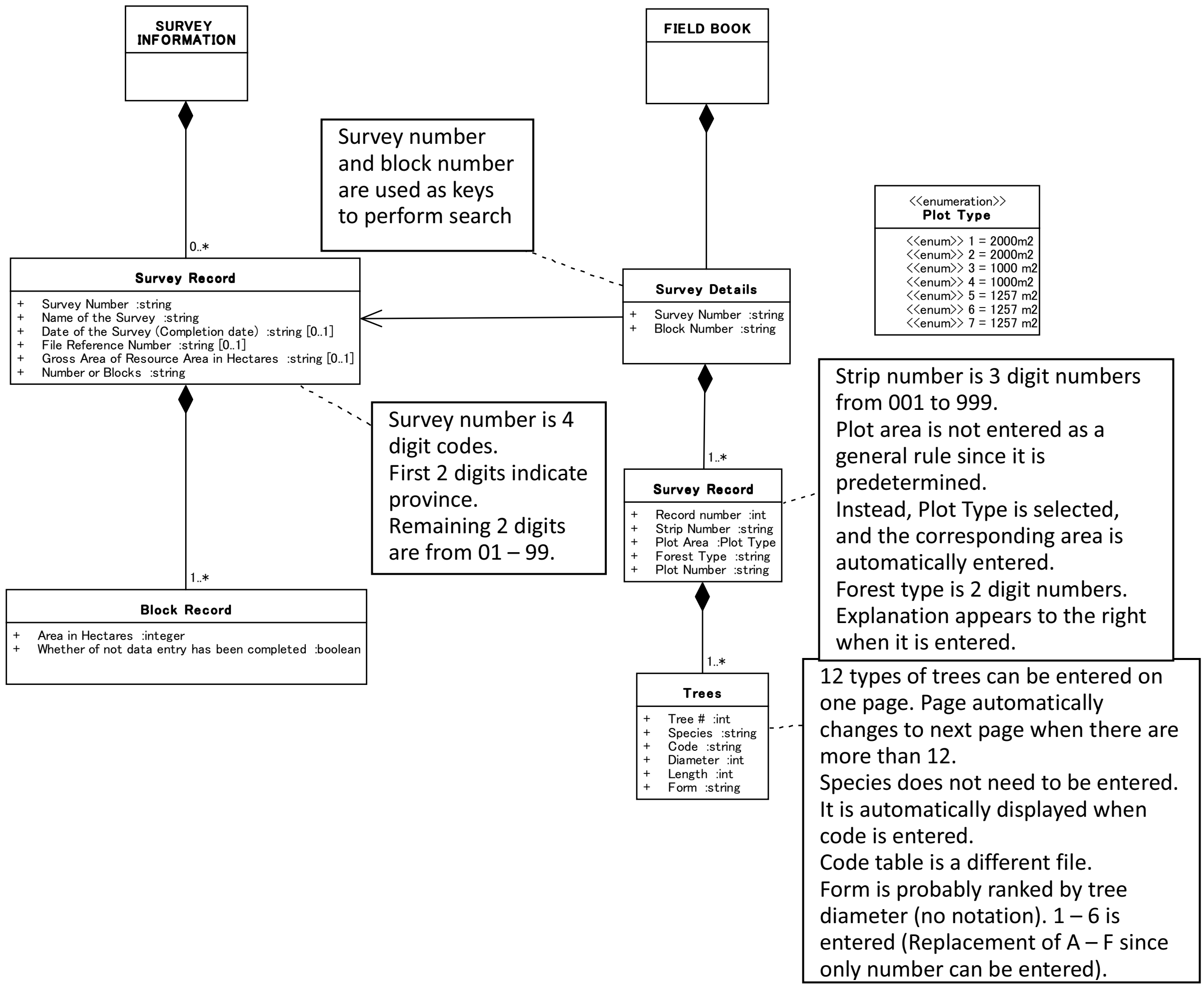


Figure 3-36 Grasping Outline of Existing FIPS Data (Image of UML Class Map)

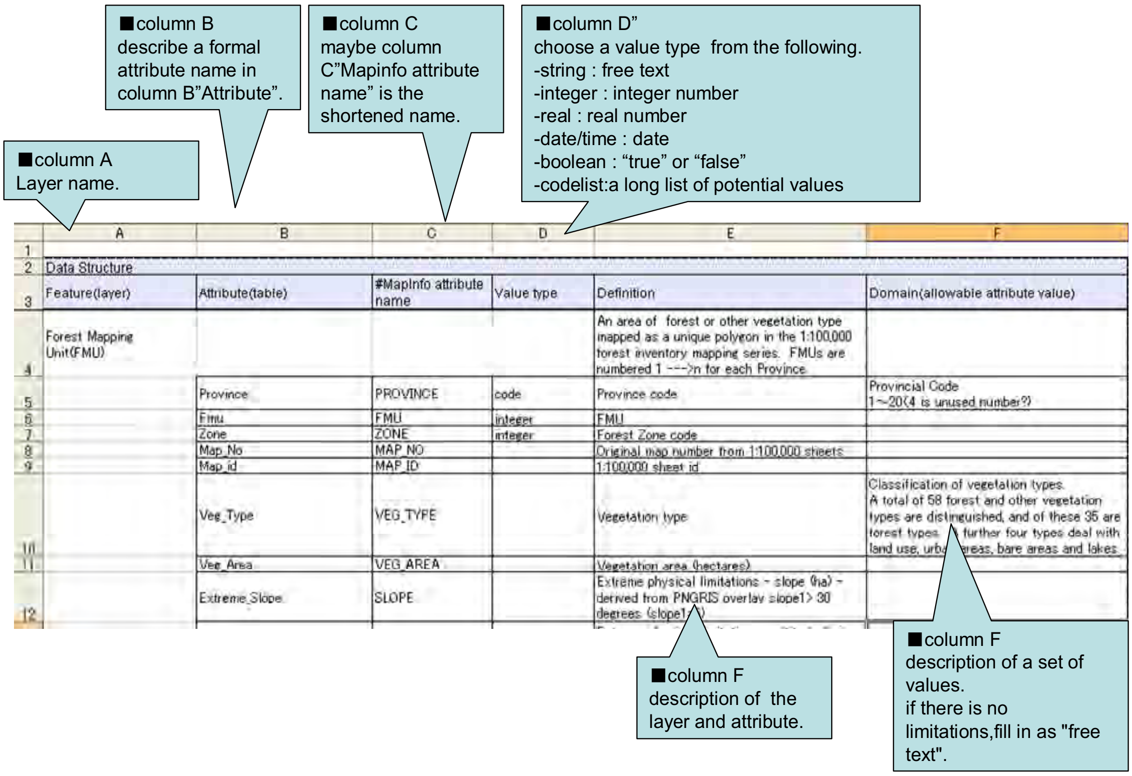


Figure 3-37 Detailed Analysis of Grasp / Analysis of Existing Data

In the future, the data related to forest resources that are respectively managed by the FIMS system and FIPS system will be integrated in order to create a forest resource database that can be used more easily and effectively. In particular, the data managed in the FIPS does not have information that indicates the location on the ground (latitude / longitude), and is not mapped out on the ground which is a problem.

Therefore, the decision was made to have discussions with the C/P on the integration methods to be used for the FIMS and FIPS data in the format indicated in Table 3-20.

Table 3-20 Discussion of Methods Used to Integrate Position Information into FIPS Data

Method			Good point	Bad point	note
Add GPS information	Measured by GPS equipment in field survey.	Once in every plot		have to be measured in field survey.	
		Once in every strip			
		Once in every block			
Digitize on GIS map	Point data	Every plot			
		Every strip			
		Every block			
	Line data	Every strip			
		･･･			
Relate to the information made with GIS	Input the information that relate to the place into FIMS, then relate to that information with the coordinates.	Province			
		Block			
		･･･			

A review was conducted of whether or not data should be newly added in the future to the forest resource data that is managed by the existing systems. Sample Logging Plans that are submitted by forest logging companies were collected for this review, and the content on these plans was verified.

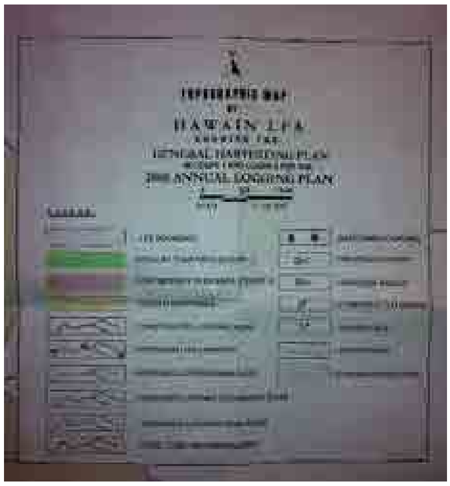



Figure 3-38 Sample Logging Plan

This resulted in discovering the relationship that is organized in Figure 3-39, indicating that such items as “Set-up Area”, “Coupe Area” and “ALP (Annual Logging Plan) Area” should be included in the forest resource data that is managed in the future.

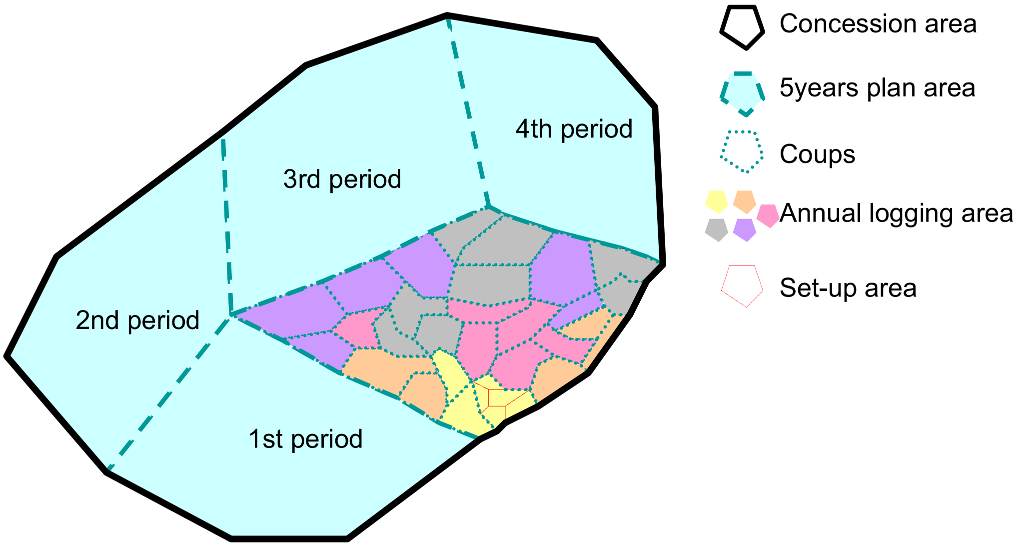


Figure 3-39 Spatial Location Relationship in Concession Areas

3.5.2 Basic Design of Forest Resource Database

The basic design of the forest resource database proceeded in the next step with the main objective of clarifying the work flow (work analysis) of the work that is currently being performed.

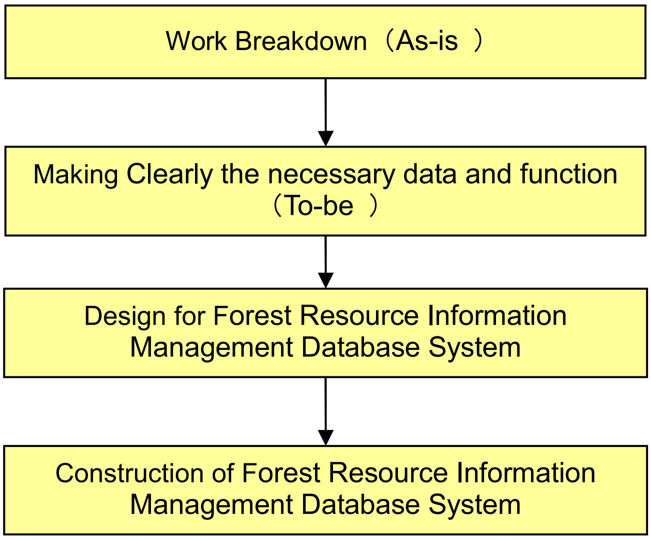


Figure 3-40 Basic Design Procedure for Forest Resource Database (Work Analysis Method)

The scope and basic component of the forest resource database (draft) determined in the first field survey in accordance with the information collected are shown in Figure 3-41 and Figure 3-42.

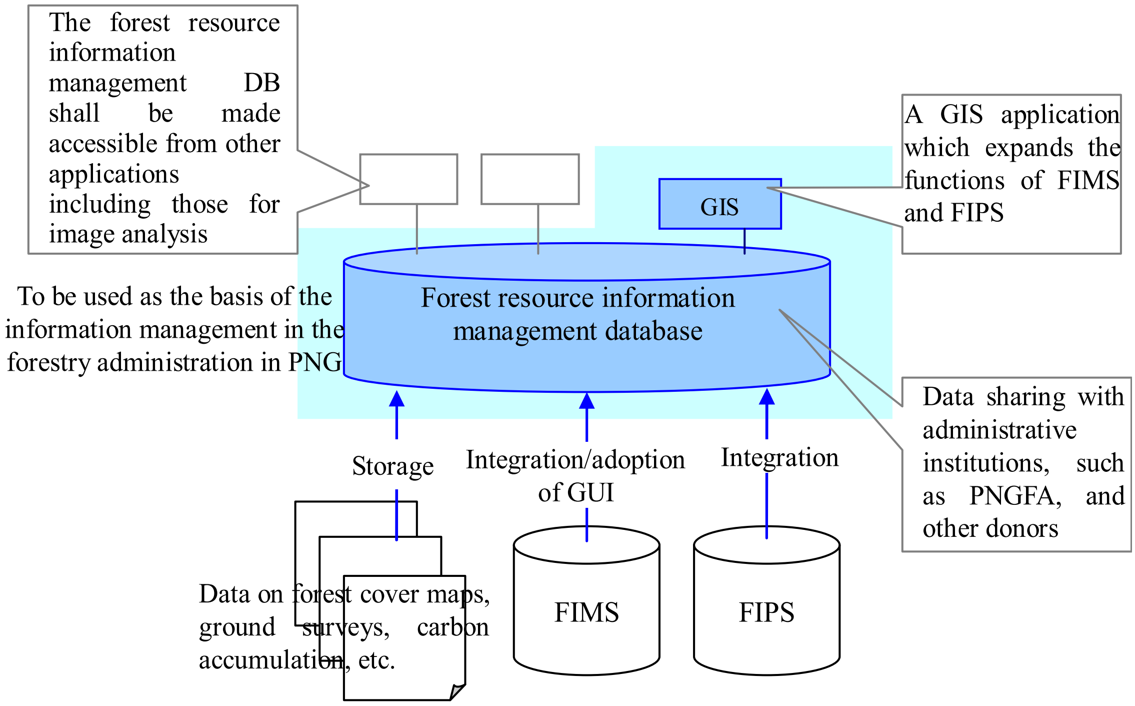


Figure 3-41 Scope of Forest Resource Database (Draft)

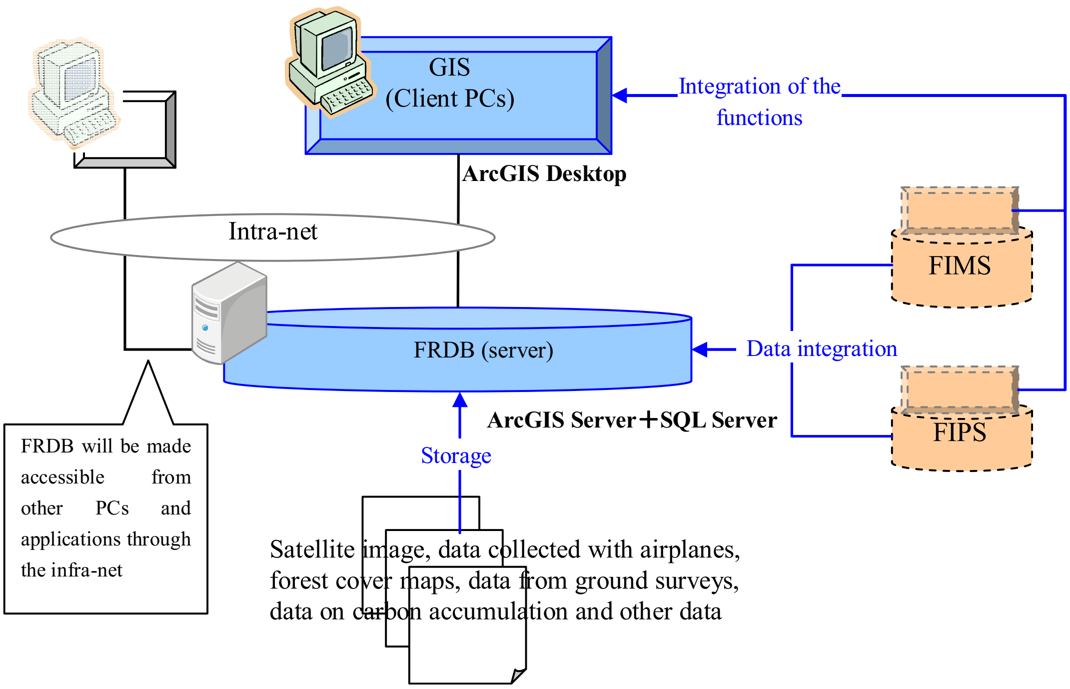


Figure 3-42 Basic Configuration of Forest Resource Database (Draft)

Implemented activities are described as follows.

(a) Breakdown of Work (Detail Analysis of Current Work Contents) (As-Is)

(1) and (2) in the above flow were implemented during activities conducted in this fiscal year.

(1) Discussions with all parties involved in overall concession work flow

(2) Detailed discussions with persons in charge of each type of work

Discussions were held with involved parties on the current breakdown of work with the objective of achieving the following effects.

- Enable involved parties as a whole to understand the overall concession work flow (Enable staff to obtain a grasp of flow of work performed by other staff).
- Facilitate clarification of problem points with current work flow and sharing with involved persons.
- Review ideal Forest Resource Database (ideal system) to enable FIMS (Forest Resource Database) improvement policy to be determined.

These review methods are methods that are generally used for system development, and will serve as reference for standard procedures when the C/Ps proceeds with improvements to the system in the future.

During activities conducted in this fiscal year, the current work flow was verified. Work will proceed on the basic design while having discussions with the C/P on the points in the work flow that should be improved in the future.

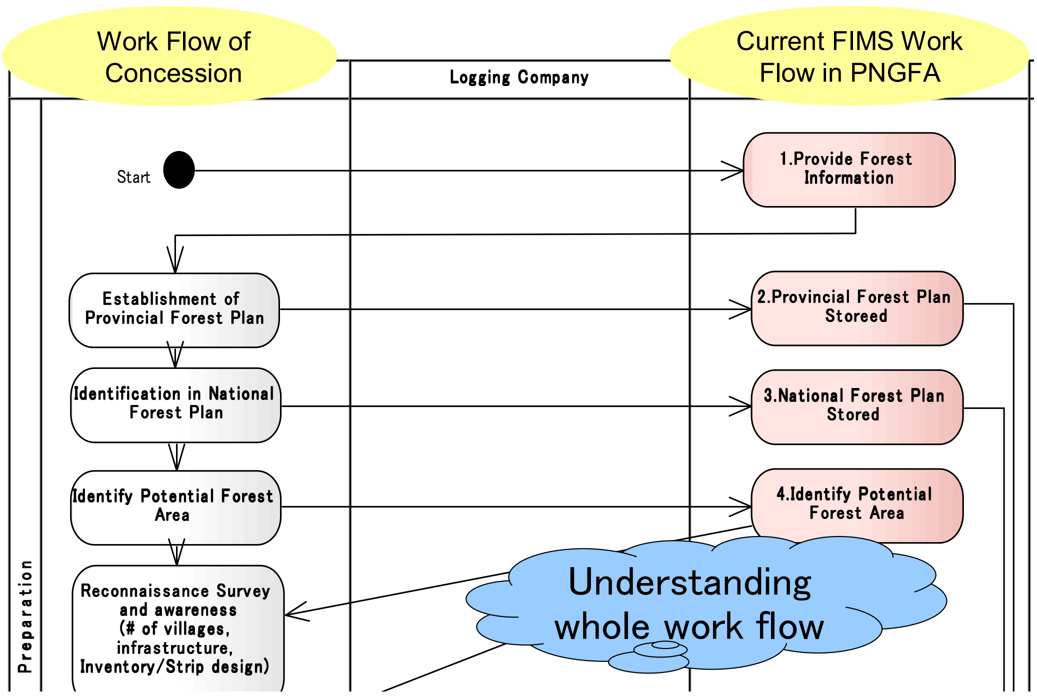


Figure 3-43 Image Organizing Work Flow

Table 3-21 Use Case Organization Table

sequential serial number	Use case (As Is)							What are there between "AS IS" and "TO BE"
	Work	Who	When	for What	Input Data(Information)	Output Data	Function	
FA1	Sequence for Provide Forest Information(FIMS)	FIMS administrator to Senior Plan Supervisor	Every five years (It takes a couple of hours each provinces)	To make Provincial Forest Plan	Protected area data from DEC Logged area from Company	Paper Maps Spreadsheet data (each province)	Mapinfo Access	Viewing & Printing (not editing) for Managers by LAN "Current" in report changes to concrete year
FA2	Sequence for Provincial Forest Plan	Senior Plan Supervisor	Every five years based on Section 49 of Forestry Act 1991 (as amended)	Requirement of the Act. Review of plan.	Relevant stakeholder's consultations. Previous Provincial Forest Plans. Paper Maps and spreadsheet data of each province	Revised Provincial Forest Plan. New concession area(proposed area) Expired concession area(checked) Protected area	Map stored in FIMS. #New concession area(proposed area)(new) #Expired concession area(update) #Protected area(not often)	
FA3	Sequence for National Forest Plan	Senior Plan Supervisor	Every five years based on Section 49 of Forestry Act 1991 (as amended)	Requirement of the Act. Review of plan.	Provincial Forest Plans.	Revised National Forest Plan.	Map stored in FIMS.	
FA4	Sequence for Identify Potential Forest Area	Senior Management and Manager of Inventory and Mapping	Based on National Forest Plan impact project area	For development of new timber project.	Maps of proposed concession area from FIMS	Timber resource information from FIPS.	Resource acquisition	History of Potential Forest area boundary should be stored in FIMS for record purpose.
FA5	Sequence for forest inventory (in potential area identified in NFP) Sequence for Confirm Potential Timber Resource Volume	Senior Inventory Officer	After the area identified in NFP according to the priority and plan identified in Provincial Forest Plan. ASAP as resource available.	To determine merchantable volume, or timber potential.	Field survey data	Timber volume from sampling assessment.	Data stored in FIPS. Information provided to the local consultation.	
FA6	Sequence for Select FMA Area for Development	FIMS administrator	Based on 5 year plan	To determine merchantable volume, or timber potential.	Sketched Map by Inventory Section	FMA polygon	Map digitizing. Mapinfo (Attribute are automatically calculated)	"Current" in report changes to concrete year
FA7	Sequence for identifying Landgroups	Acquisition team and manager	After the inventory report received.	Finalizing FMA boundary.	Inventory report. Paper Map	FMA boundary.	FMA boundary established in FIMS. Generate report including mapping information and timber volume.	
	Sequence for formation of ILG for FMA project (FIMS)							
FA8	Sequence for map to Managements: Reference for Boundary demarcations	MD to FIMS administrators	2 times / month (Forest management agreement stage)	To determine the concession boundary for forest management agreement	Request (sketch maps)	Maps #concession area(updated from proposed concession area)	Changing concession boundaries (Map digitizing.)	Viewing & Printing (not editing) for Managers by LAN
FA9	Sequence for NFS Evaluation	Project branch team and manager	After 5 year plan, annual plan, basecamp plan, and log ponds plan or accomplishment report with ALP received.	Consistency of the plan. Control monitoring purposes.	Map form and report form from FIMS.	To achieve the project annual allowable cut and timber permit conditions.	Control and monitor the logging plan.	
FA10	Sequence for Updating logged over area in Concession Area for calculating remaining resource	FIMS administrator	After the logging plan (5-years, annual, set-up plan) received.	To update logged over area	Logged over area by ALP	-	Map digitizing.	Changes between plan and implementation result to be justified. To store annual coupe plan area by 5years plan and set-up plan area by ALP/ Set-up plan.To receive plans from logging company on time.To receive GIS data from logging company.To customize report format.Viewing & Printing (not editing) for Managers by LAN
FA11	Sequence for FAD							
FA12	Sequence for Waste assessment							
FA13	Sequence for SGS Evaluation	SGS						
FA14	Sequence for Post Logging Inventory Survey (Before the completion of the Project)				Logged over area map from FIMS.			
FA15	Sequence for Submit Report of Current Forest Inventory to the Management		When the management decision or the operating company requested to verify remaining timber resources					
FA16	Managements: Any FIM Maps and Reports: Reports upon request	PNGFA officer to FIMS administrators	5 times / month	To report	-	Maps & reports	Generating Maps & Reports	Viewing & Printing (not editing) for Managers by LAN

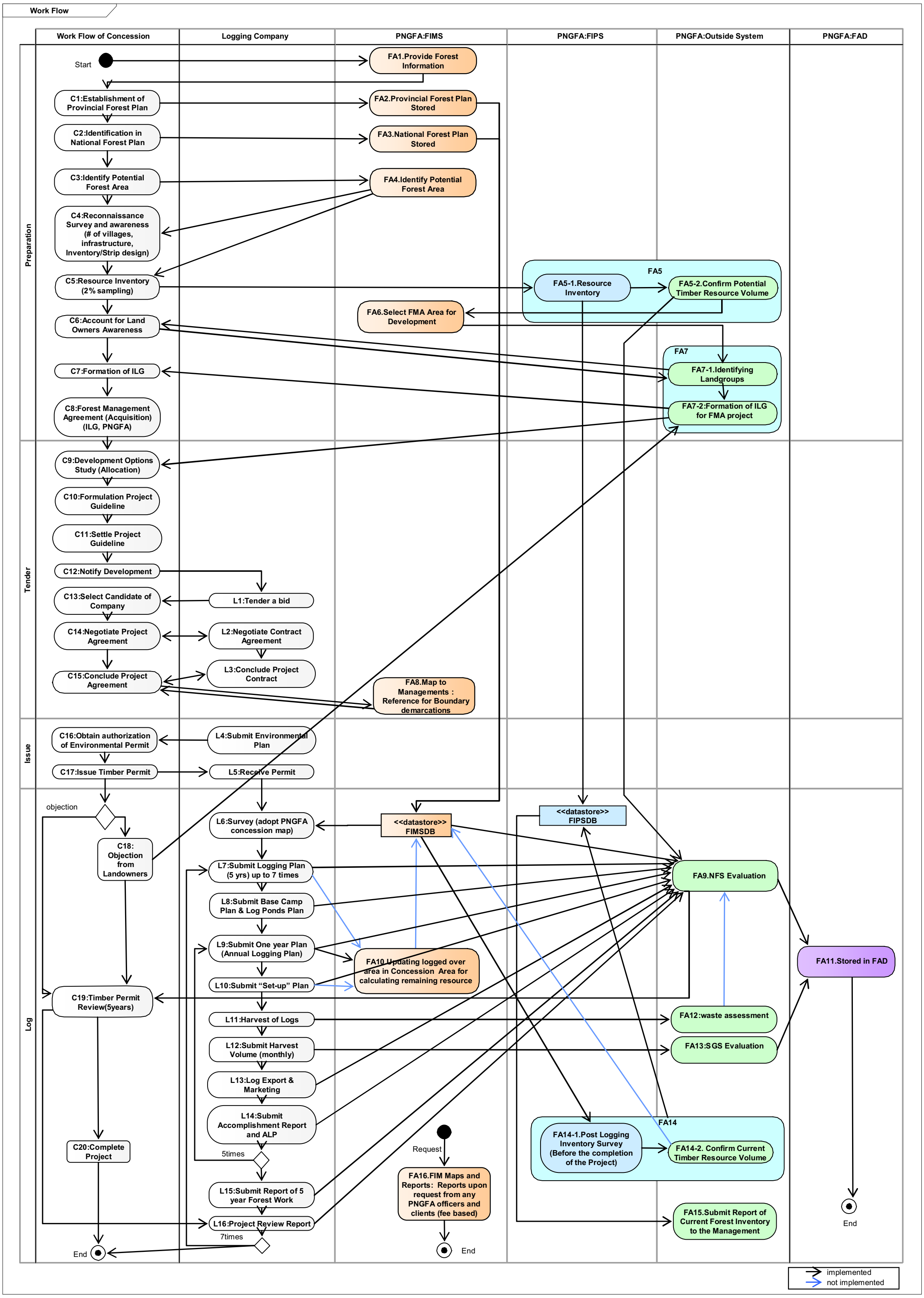


Figure 3-44 Overall Concession Work Flow Prepared with C/P (Revised)

(b) Examination of Required Data and Functions (To-Be)

Taking the results of work flow organization into consideration, the exchange of information was discussed with the respective parties, which led to the necessity of the blue arrows shown in Figure 3-44 as areas that require improvement.

In addition, regarding the linkage of FIMS and FIPS data, it was recognized that improvement needed to be made at two times: After Resource Inventory (FA5 in Figure 3-44), and After Post Logging Inventory Survey (FA14 in Figure 3-44). Organization of the data resulted in the recognition that measures need to be implemented so that the forest resource volume managed in the FIMS and the forest resource volume estimated by the inventory survey can be compared After the Resource Inventory and After the Post Logging Inventory Survey.

(c) Design of Forest Resource Database

The forest resource database was designed, taking the above review into consideration.

The database development was implemented in 2 steps as shown in Table 3-22.

The development of the database as such is implemented under the Grant Aid project that is ongoing separately. Therefore, this Project was intended to build up the technology necessary for development and operation/maintenance and review the requirements from the counterparts.

Table 3-22 Database Development Procedure

Step	Development
Step 1	The existing functions of FIMS and FIPS are replaced in the new version as they are. [FIMS] (existing) MapInfo ==> ArcGIS [FIPS] (existing) FoxPro ==> Access
Step 2	The response to the requirements for FIMS and FIPS is made. The integrated operating environment for FIMS and FIPS is developed.

i) Design in Step 1

The design to replace the existing functions of both FIMS and FIPS was made.

The designed results were wrapped up as the Basic Design Documents for FIMS and FIPS individually.

In the replacing work for FIMS, there is no basic change in data architecture and contents because the existing FIMS functions are replaced in the new system as they are. In replacing them in the ArcGIS version, the items were reviewed.

As a result of the review, the ArcGIS version of data specifications (UML-class diagram) is shown in Figure 3-46.

- Integration of Data that is Retained in Both Access and MapInfo

With the existing FIMS, two types of software are being used (Access and MapInfo), and the data is retained in both software systems (Refer to Figure 3-34 and Figure 3-35). However, with the ArcGIS version that is replacing these software systems, the data will only be retained in the ArcGIS system. Consequently, data items that are duplicated by Access and MapInfo were integrated into single data items.

Specifically, the data items shown in Table 3-23 were integrated.

Table 3-23 Content of Changes to Data Structure in Replacement Version

Current FIMS（MapInfo）		Replaced FIMS（ArcGIS）
Software	Name of Data	Name of Data after integrated
MapInfo	*_Concession	ConcessionArea
Access	*_Concession	
MapInfo	*_Concession_*_FMU	Concession_FMU
Access	*_Concession_*_FMU	
MapInfo	*_Veg	FMU
Access	*_Veg	

Note: “*” in the data names indicates the province name or concession number.

- Accommodation of Description Procedure in Accordance with ArcGIS Data Structure Description Rules

With ArcGIS, due to the fact the data structure description rules are determined by the UML class diagram, the description procedure was changed in accordance with those rules. As shown in Figure 3-45, with ArcGIS, data of planimetric features that have spatial attributes is separated into Features (graphics) and ObjectClasses (attributes).

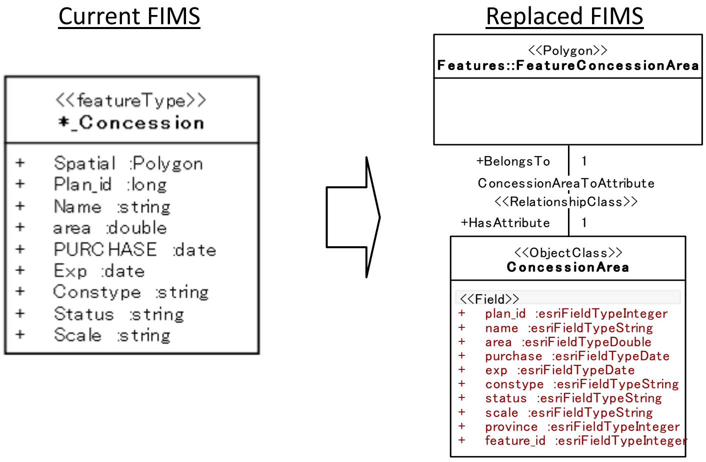


Figure 3-45 Changes In Accordance with ArcGIS Data Structure Description Rules

- Deletion of Temporary Data / Temporary Fields

With the existing FIMS, data to record the intermediate results of space analysis by MapInfo exists (data in ProtectedConstraints folder and below and LLU_Constraints folder and below). In addition, "*_Veg" and "*_Concession_FMU" in MapInfo have fields entitled Temp_1 – 7 and Err_1 – 7 that are used as space analysis fields. Since these are all intermediate results for space analysis and do not need to be retained as data, these results have been deleted.

- Data Managed in Database and Distinction of Display Data

The existing FIMS data includes some data that is only used for display purposes (For example, data in Labels, PROV, coast and Tpc folders and below, data in GPSData folder and below). Due to the fact that these data are not used for the respective FIMS functions, the decision was made to distinguish this data from other data.

Furthermore, regarding the data in the MapConstraints folder and below, even though these data items are for display purposes and are not used by the respective FIMS functions, since these data items have a stronger relationship to the data managed by FIMS compared to the other items, the decision was made to handle these data items separate from the display data as a result of discussions with the C/P.

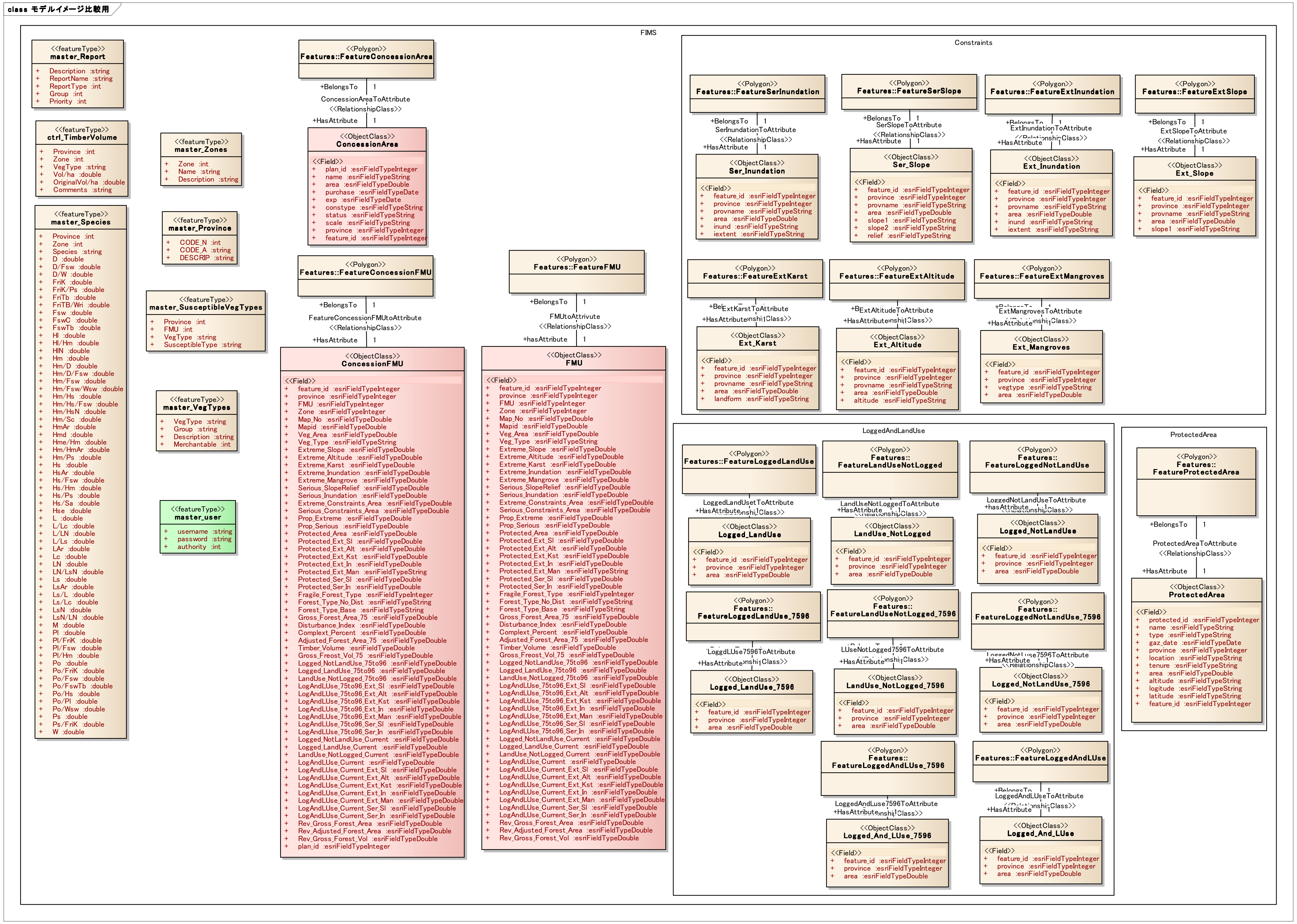


Figure 3-46 FIMS ArcGIS Version UML Class Diagram

ii) Design in Step 2

The necessity for improvement in the system in which the existing functions are replaced was examined.

The matters related to data integration in FIMS and FIPS are discussed in the next section.

- Change in Report Form in FIMS

The report form in FIMS is shown in the red frame in Figure 3-47 and the changes from 1975 up to the present (Current) can be calculated. However, the following problems were pointed out by the counterparts:

- What time point is indicated by "Current" is unclear.
- After 1975, the data was updated in 1996, 2002 and 2009, and they desired to comprehend the data changes for each period.

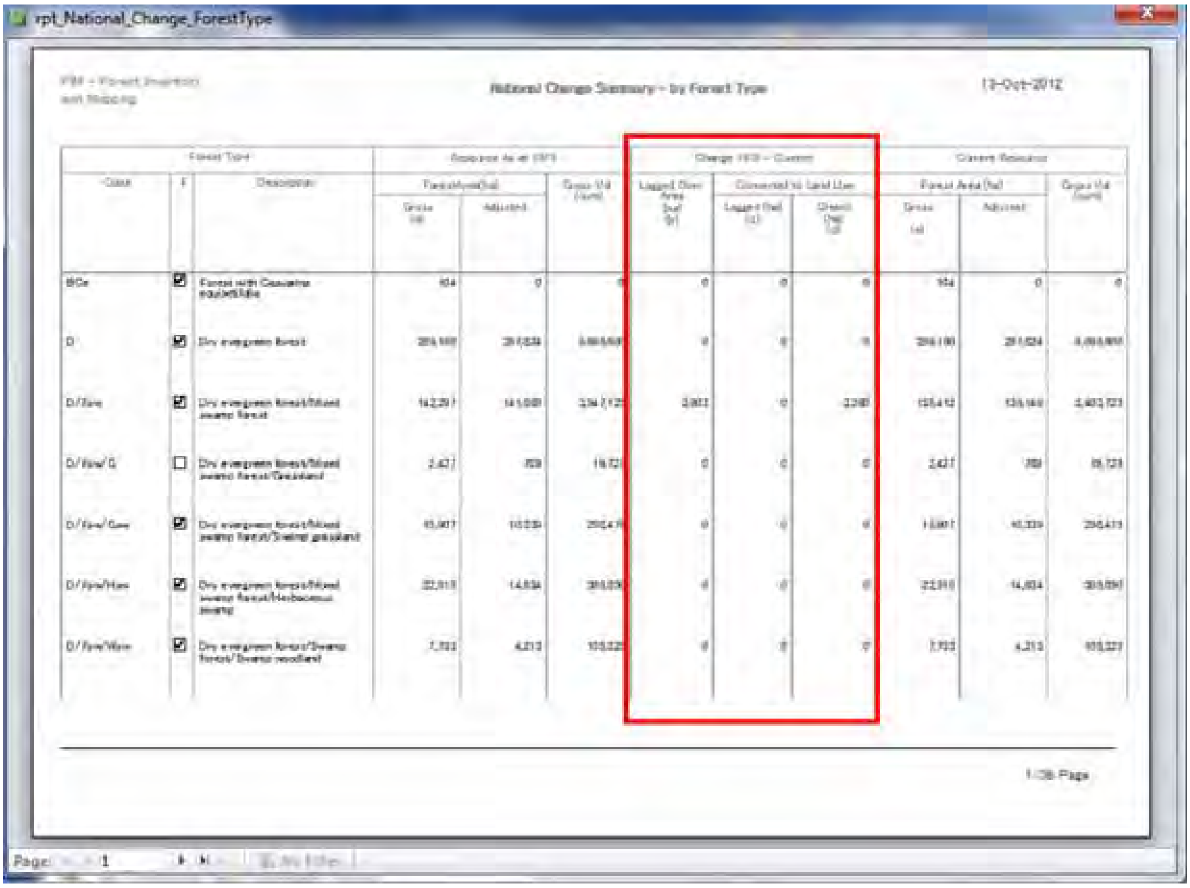


Figure 3-47 Current FIMS Report Window

If the results of comparison with each data updating year are inserted in the report, there is insufficient space in the report form, but it is necessary to insert the results of comparison whenever the data is updated in future. FIMS is designed to overwrite the data in updating and the past data is cleared when it is updated. Therefore, the past data exists only in the report that is outputted on paper. In this situation, the method in which the report information stored as PDF can be browsed in association with each concession was examined, to allow the report in each updating year to be checked.

It was decided that for the "Current" time, not only the output date, but also the final updating date was indicated.

For registering the PDF, the system in which the file uploading function is provided in the Concession Attribute Input Window to register the report whenever it is saved, as shown in Figure 3-48 was discussed.

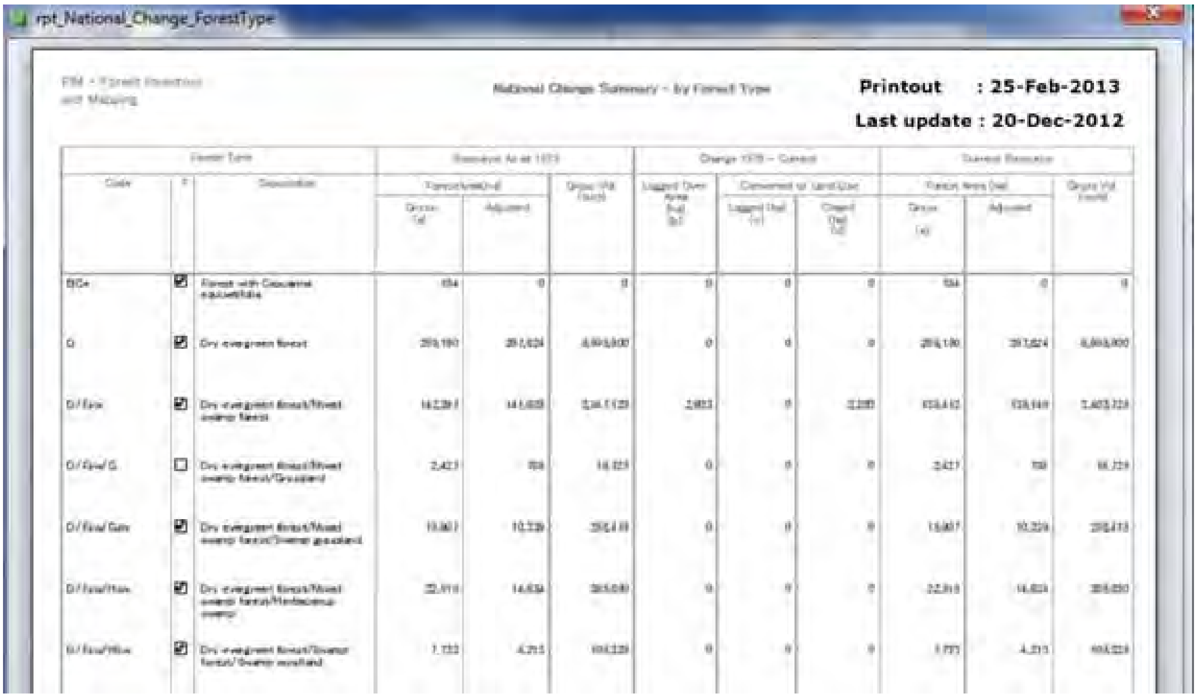


Figure 3-48 Correction Plan for FIMS Report Window

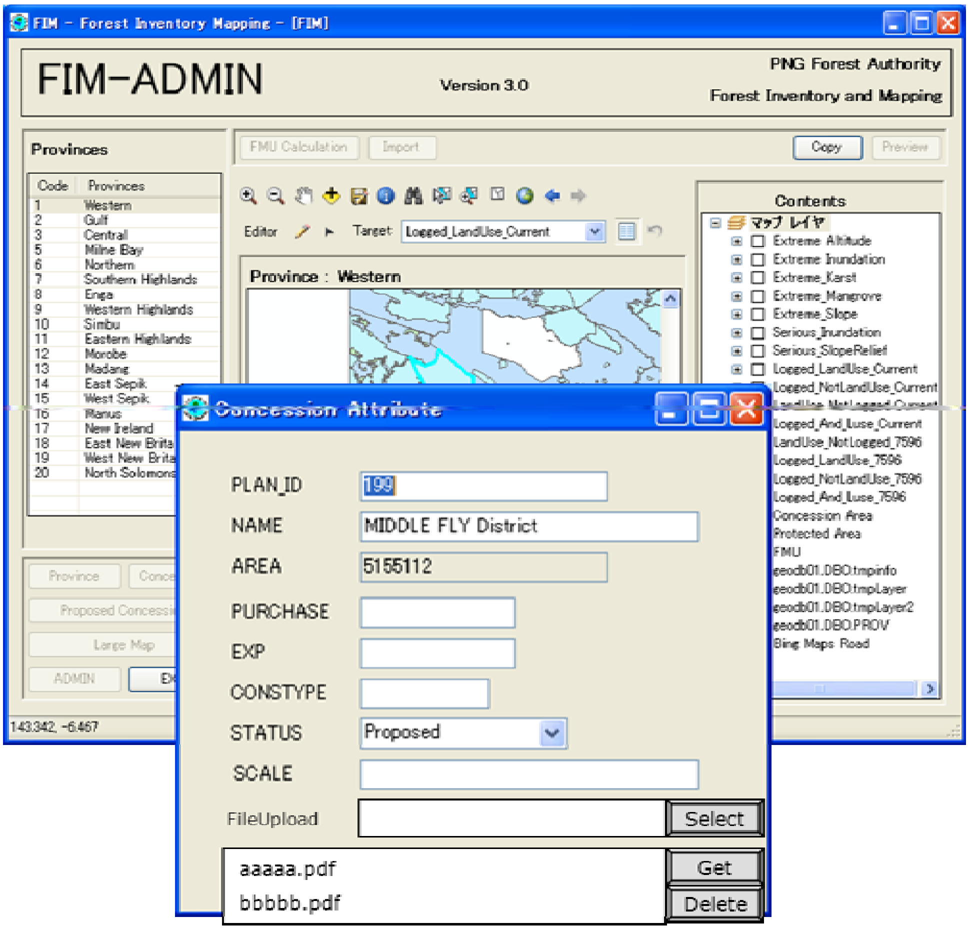


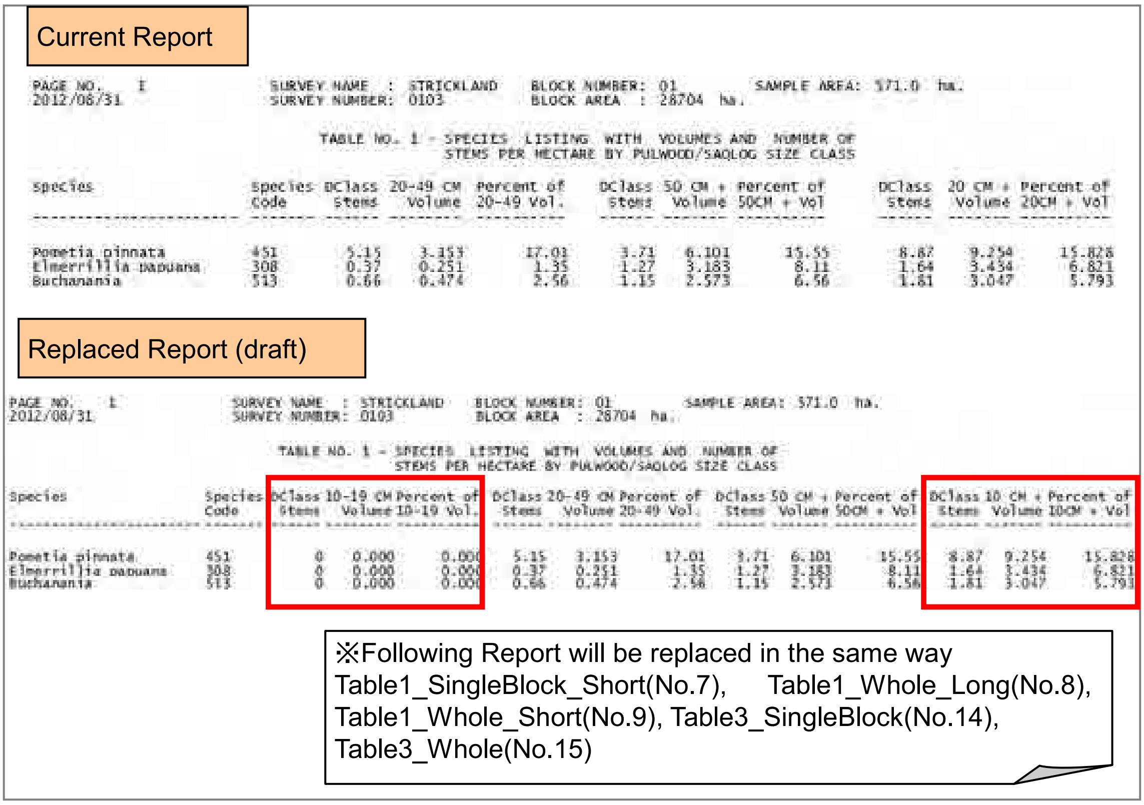
Figure 3-49 Image of Registration of Report in File

- FIPS: Addition of measured/calculated results of diameter class 10 to 19cm

The request for adding the measured/calculated results of the diameter class of 10 to 19cm in the existing report form was made from the counterparts. To respond to this request, the revised report form was planned as shown below.

Table 3-24 Report Form Necessary to Add the Diameter of 10 to 19cm (Draft)

No.	Name of Report	Response	No.	Name of Report	Response
1	MasterControlFile	Not needed	15	Table3_Whole	Needed
2	ForestTypeList	Not needed	16	Table4_SingleBlock	Needed
3	SpeciesListAlphabetical	Not needed	17	Table4_Whole	Needed
4	SpeciesListByCode	Not needed	18	Table5_SingleBlock	Needed
5	FieldBookData	Not needed	19	Table5_Whole	Needed
6	Table1_SingleBlock_Long	Needed	20	10cmTable_SingleBlock_Long	Not needed
7	Table1_SingleBlock_Short	Needed	21	10cmTable_SingleBlock_Short	Not needed
8	Table1_Whole_Long	Needed	22	10cmTable_Whole_Long	Not needed
9	Table1_Whole_Short	Needed	23	10cmTable_Whole_Short	Not needed
10	Table2_SingleBlock_Long	Needed	24	ForestTypes	Needed
11	Table2_SingleBlock_Short	Needed	25	PlotListing	Needed
12	Table2_Whole_Long	Needed	26	Stat_Analysis	Needed
13	Table2_Whole_Short	Needed	27	Summary_Report	Needed
14	Table3_SingleBlock	Needed	28	Summary_Report_Whole	Needed



Current Report

Species	Species Code	DClass 20-49 CM Stems	Volume	Percent of 20-49 Vol.	DClass 50 CM + Stems	Volume	Percent of 50CM + Vol	DClass 20 CM + Stems	Volume	Percent of 20CM + Vol
Pometia pinnata	451	5.15	3.153	17.01	3.71	6.101	15.55	8.87	9.254	15.828
Elmerrillia papuana	308	0.37	0.251	1.35	1.27	3.183	8.11	1.64	3.434	6.821
Buchanania	513	0.66	0.474	2.56	1.15	2.573	6.56	1.81	3.047	5.793

Replaced Report (draft)

Species	Species Code	DClass 10-19 CM Stems	Volume	Percent of 10-19 Vol.	DClass 20-49 CM Stems	Volume	Percent of 20-49 Vol.	DClass 50 CM + Stems	Volume	Percent of 50CM + Vol	DClass 10 CM + Stems	Volume	Percent of 10CM + Vol
Pometia pinnata	451	0	0.000	0.000	5.15	3.153	17.01	3.71	6.101	15.55	8.87	9.254	15.828
Elmerrillia papuana	308	0	0.000	0.000	0.37	0.251	1.35	1.27	3.183	8.11	1.64	3.434	6.821
Buchanania	513	0	0.000	0.000	0.66	0.474	2.56	1.15	2.573	6.56	1.81	3.047	5.793

Figure 3-50 Table1_SingleBlock_Long (No. 6) Form Proposal

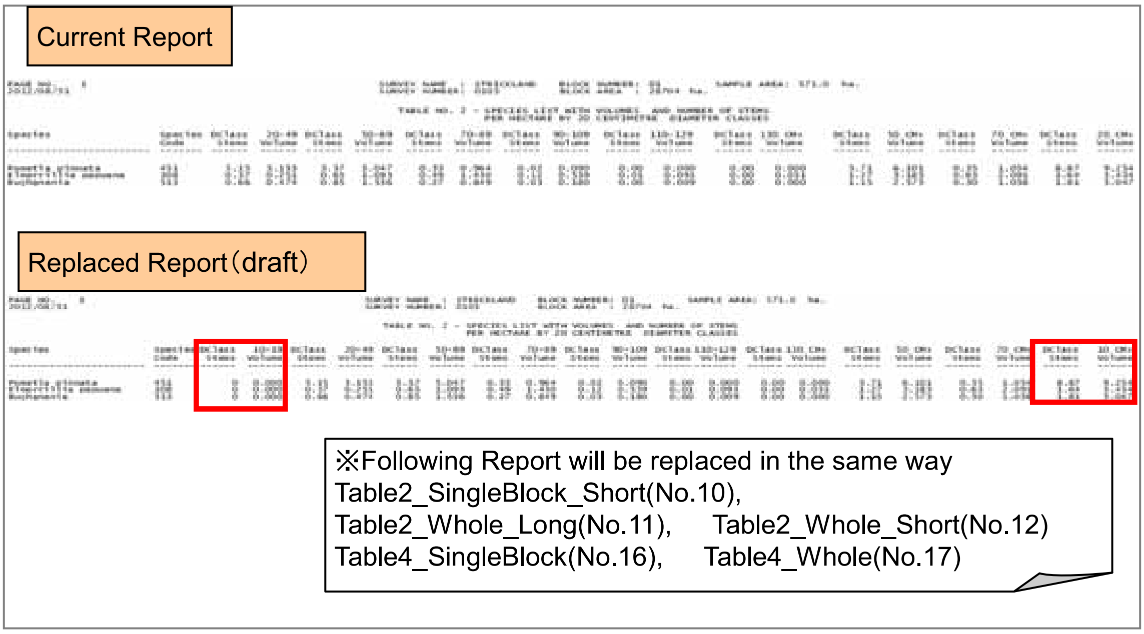


Figure 3-51 Table2_SingleBlock_Long (No. 10) Form Proposal

Current Report

PAGE NO. 1 SURVEY NAME : STRICKLAND BLOCK NUMBER: 01 SAMPLE AREA: 571.0 ha.
2012/08/31 SURVEY NUMBER: 0103 BLOCK AREA : 28704 ha.

TABLE NO. 9 - VOLUMES AND STEMS PER HECTARE BY FOREST TYPE (f_tab139)

	Number of Plots	Sample area (ha)	Forest Type	DClass Number	20-49 cm Volume	DClass Number	50 cm + Volume	DClass Number	20 cm + Volume
** FOREST TYPE 21	2730	546.000	21	29.179	18.630	20.317	39.722	49.496	58.353
** FOREST TYPE 36	125	25.000	36	27.120	16.496	16.240	28.691	43.360	45.187

Replaced Report (draft)

PAGE NO. 1 SURVEY NAME : STRICKLAND BLOCK NUMBER: 01 SAMPLE AREA: 571.0 ha.
2012/08/31 SURVEY NUMBER: 0103 BLOCK AREA : 28704 ha.

TABLE NO. 9 - VOLUMES AND STEMS PER HECTARE BY FOREST TYPE (f_tab139)

	Number of Plots	Sample area (ha)	Forest Type	DClass Number	10-19 cm Volume	DClass Number	20-49 cm Volume	DClass Number	50 cm + Volume	DClass Number	10 cm + Volume
** FOREST TYPE 21	2730	546.000	21	0	0.000	29.179	18.630	20.317	39.722	49.496	58.353
** FOREST TYPE 36	125	25.000	36	0	0.000	27.120	16.496	16.240	28.691	43.360	45.187

Figure 3-52 ForestTypes (No. 24) Form Proposal

Current Report

PAGE NO. 1 SURVEY NAME : STRICKLAND BLOCK NUMBER: 01 SAMPLE AREA: 571.0 ha.
2012/08/31 SURVEY NUMBER: 0103 BLOCK AREA : 28704 ha.

SAMPLE PLOT LISTING WITH NUMBER OF STEMS AND PLOT VOLUMES TOTALLED BY STRIPLINE (f_tabl30)

Strip Number	Plot Number	PlotArea in ha	Forest Type	DiamClass Stem No.	20-49 cm Volume	DiamClass Stem No.	50 cm up Volume	Total Stems	Total Volume
** STRIP NUMBER 001									
001	001	0.2000	21	0	0.000	0	0.000	0	0.000
001	002	0.2000	21	0	0.000	0	0.000	0	0.000
001	003	0.2000	21	7	4.275	2	3.278	9	7.553

Replaced Report (draft)

PAGE NO. 1 SURVEY NAME : STRICKLAND BLOCK NUMBER: 01 SAMPLE AREA: 571.0 ha.
2012/08/31 SURVEY NUMBER: 0103 BLOCK AREA : 28704 ha.

SAMPLE PLOT LISTING WITH NUMBER OF STEMS AND PLOT VOLUMES TOTALLED BY STRIPLINE (f_tabl30)

Strip Number	Plot Number	PlotArea in ha	Forest Type	DiamClass Stem No.	10-19 cm Volume	DiamClass Stem No.	20-49 cm Volume	DiamClass Stem No.	50 cm up Volume	Total Stems	Total Volume
** STRIP NUMBER 001											
001	001	0.2000	21	0	0.000	0	0.000	0	0.000	0	0.000
001	002	0.2000	21	0	0.000	0	0.000	0	0.000	0	0.000
001	003	0.2000	21	0	0.000	7	4.275	2	3.278	9	7.553

Figure 3-53 PlotListing (No. 25) Form Proposal

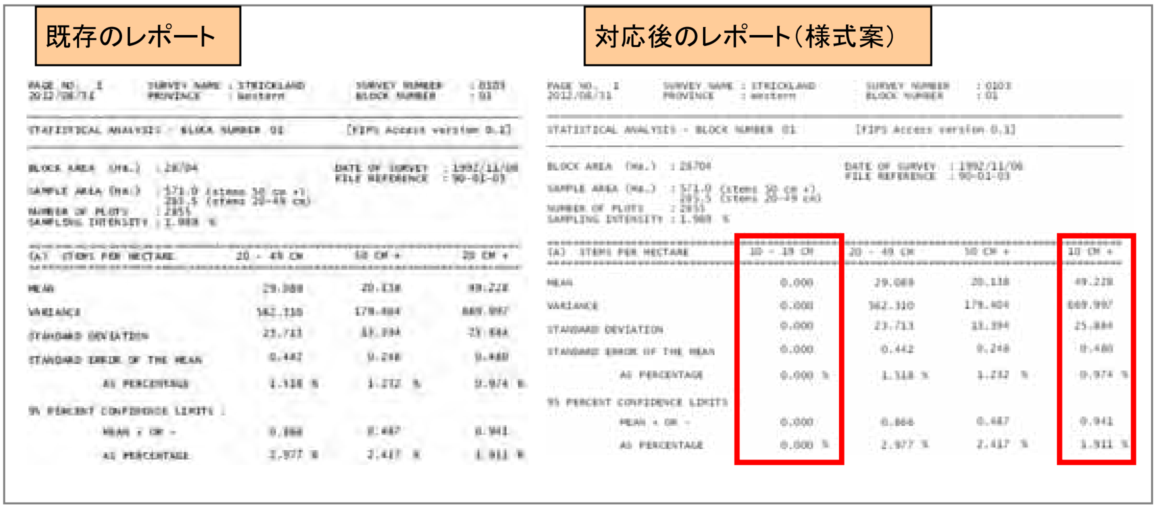


Figure 3-54 Stat_Analysis (No. 26) Form Proposal

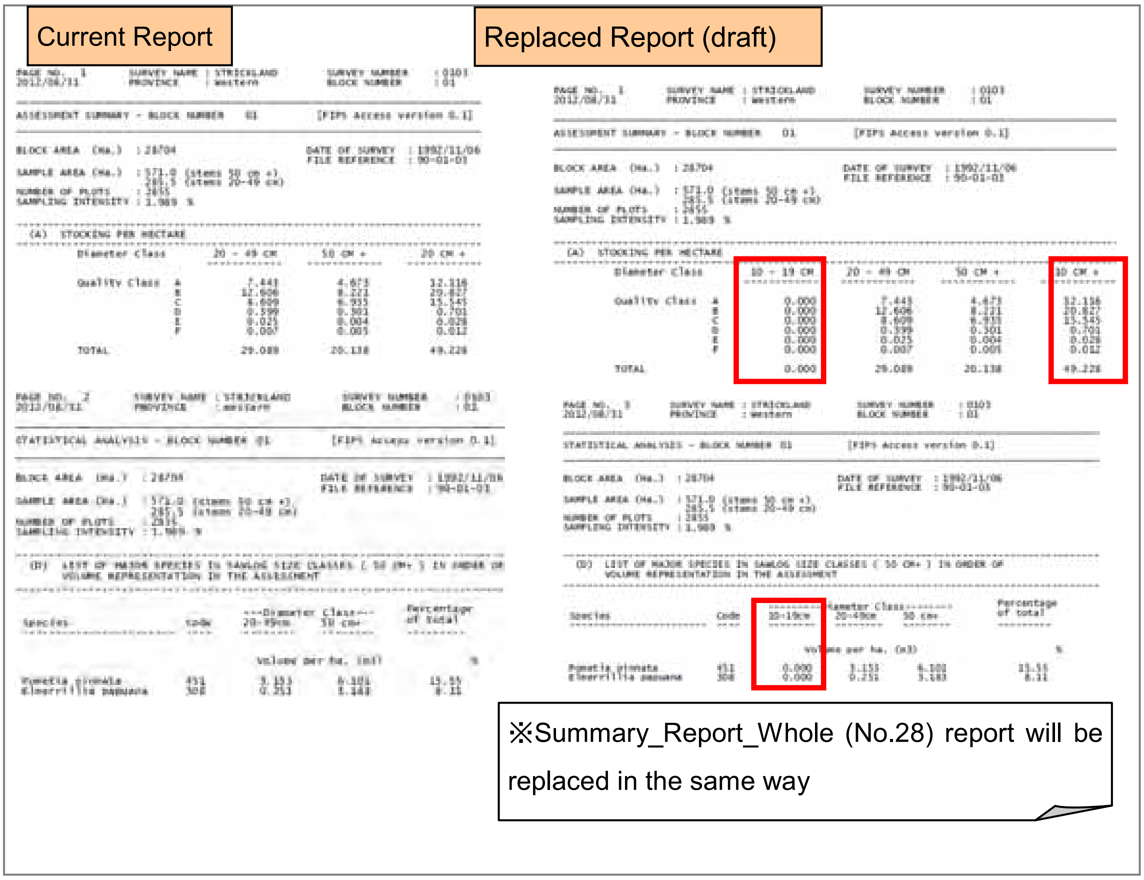


Figure 3-55 Summary_Report (No. 27) Form Proposal

- FIPS: Preparation of Report to meet various evaluation methods

It is necessary to output the report on the inventory survey results created by various evaluation methods to meet the concession conditions. It is difficult to use only the existing FIPS report form and it is desired to develop a system to evaluate the survey results in a flexible manner.

In these circumstances, the function to allow the calculated results by FIPS to be outputted in the Excel or CSV format was discussed.

Table 3-25 Example of Forest Volume Calculation by Species Group

Species	Log Form Volume (m^3)					Basal Area	Total Vol	Gross Vol/ha	Comp %
Group	A	B	C	D	E	(m^2)	(m^3)	(m^3)	
1	334.680	463.760	259.207	4.953	7.684	142.603	1070.284	11.866	39.671
2	61.074	103.377	56.407	0.000	0.000	32.161	220.859	2.449	8.19
3	172.970	302.225	154.679	3.113	1.065	80.383	634.053	7.029	23.50
4	201.327	353.722	203.609	10.526	3.511	98.502	772.694	8.566	28.64
Total	770.052	1223.085	673.902	18.592	12.260	353.648	2697.890	29.910	100.000

3.5.3 Development of Database Linking Forest Cover Classification Maps and Ground Data

Taking the results of efforts to grasp and analyze the existing data related to forest resources and results of the basic design of the forest resource database into consideration, review and organization of the database linked to the forest cover classification map and ground data were performed.

Based on the discussions on the entire concession workflow with the counterparts, the data integration method between FIMS and FIPS was examined. The results are shown in Figure 3-56 and Figure 3-57.

This method allows that the timber volumes managed by the existing FIMS are monitored in the 2 stages when the inventory survey is completed and when the survey after cutting down the trees is completed and that the potential timber resource volumes (cuttable forest resource volume and remaining forest resource volume) are displayed on the same window.

In realizing the data integration between FIMS and FIPS, the following points should be taken into consideration:

- As there are some differences in the range and the quality of survey between the FIMS data and the FIPS data, for instance, the method of replacing part of the FIMS data with the FIPS data is undesirable.
- The operation of FIMS and that of FIPS are made by the respective operators and their scopes of responsibility and workflows are established individually. Therefore, any change involving in an alteration of their workflows is undesirable.
- To display the FIPS data on the FIMS windows, it is necessary to add the coordinate information measured by GPS to FIPS.

Based on the above considerations, the practical data integration method applicable to each of FIMS and FIPS was discussed and examined.

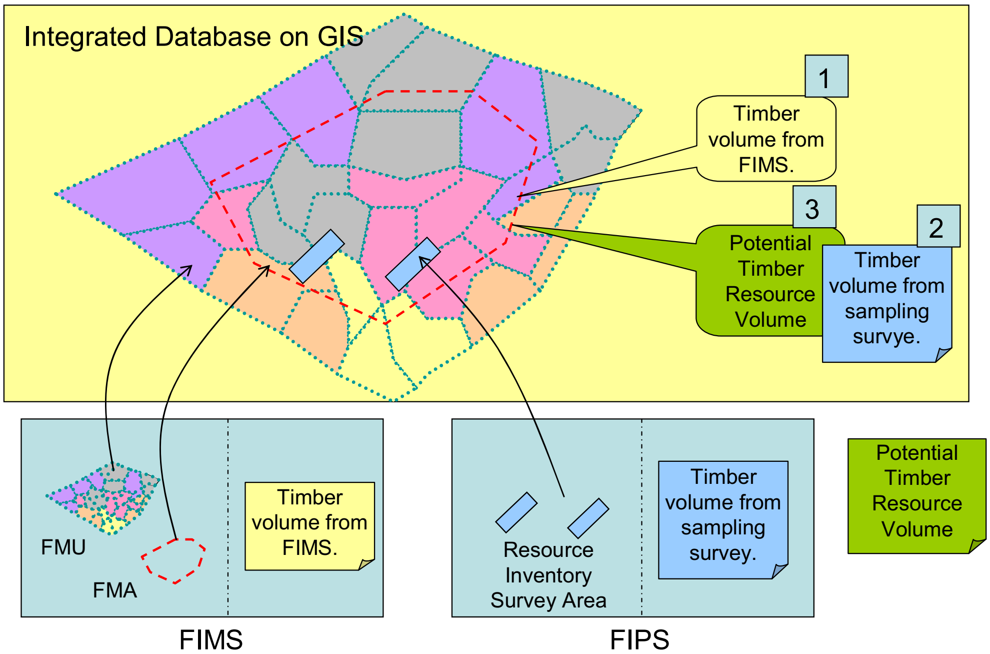


Figure 3-56 Image of FIMS and FIPS Integrated Operation at the end of inventory survey

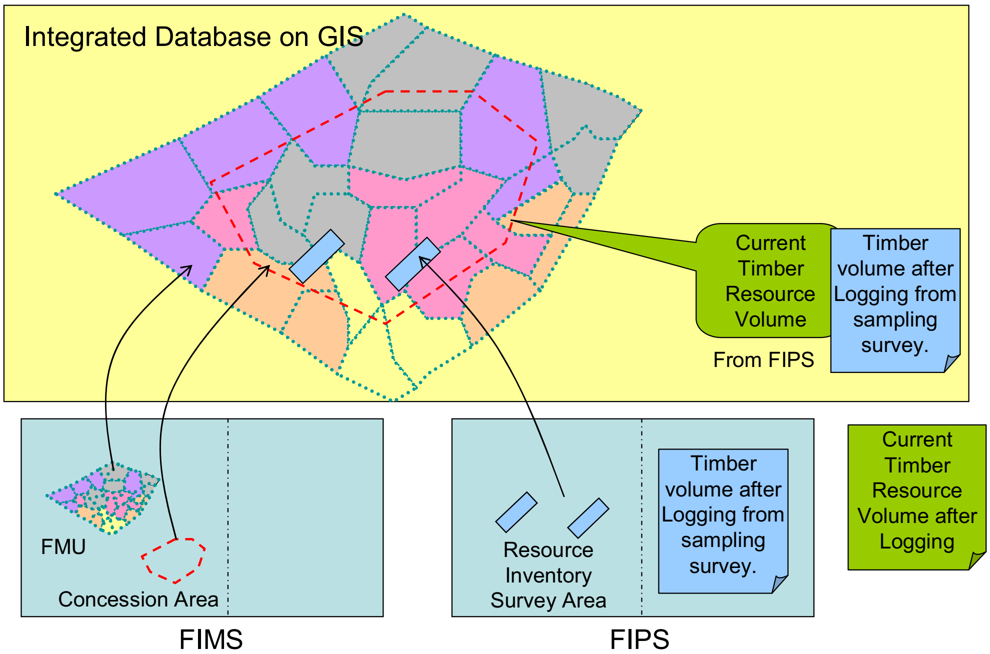


Figure 3-57 Image of FIMS and FIPS integrated operation at the end of survey after tree-cutover

(a) FIMS

i) Display of inventory survey data

The site and the results of the inventory survey which are stored in FIPS are displayed. The display images are shown in Figure 3-58 and Figure 3-59.

FIMS is designed to allow both the forest volume estimated by FIMS and the forest volume presumed by the field survey to be compared and browsed on the Main Window.

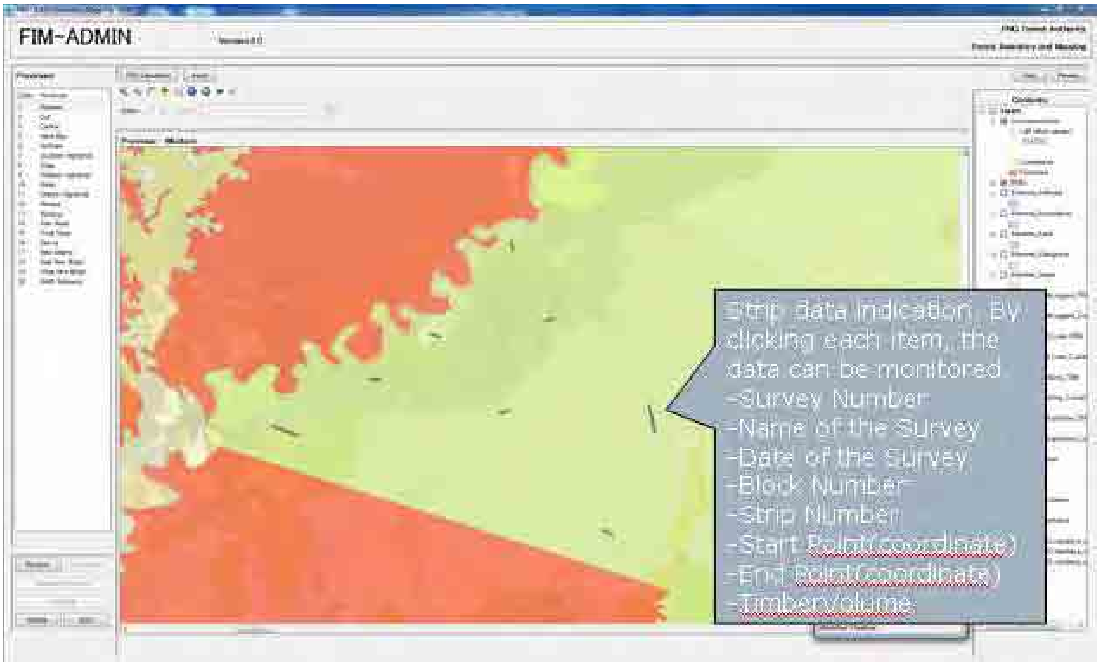


Figure 3-58 Display image of Inventory strip line on Large Map Window

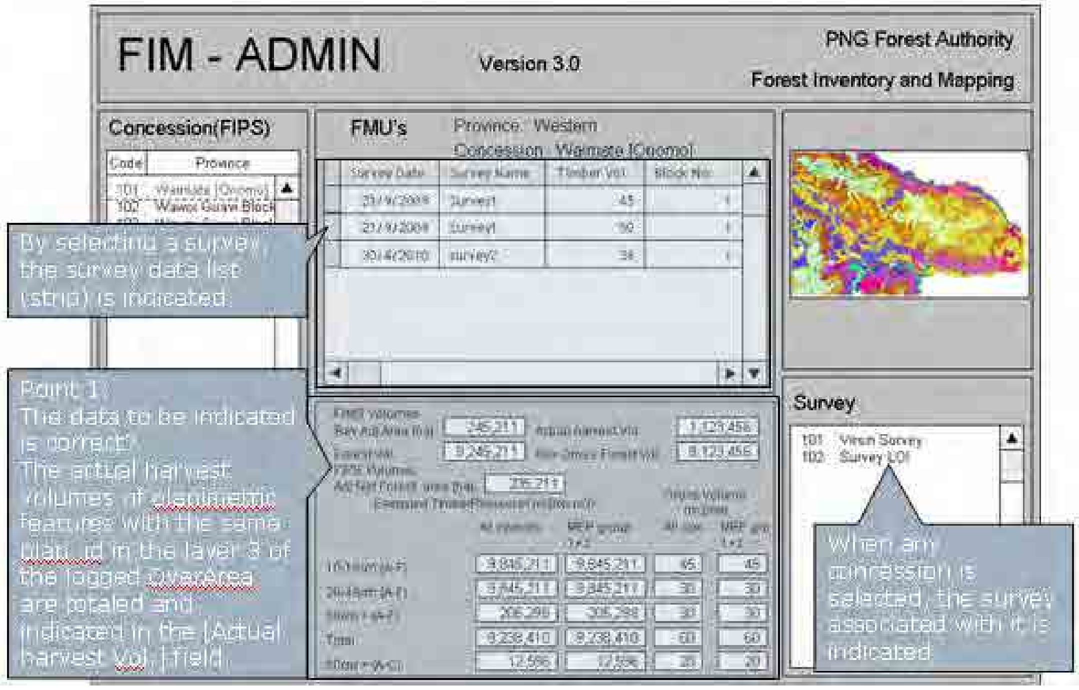


Figure 3-59 Display image of calculated results in inventory survey on Main Window

ii) Storage of actual harvest volume

It is important for the system to allow not only the FIMS-estimated forest volume and the forest volume presumed by the field survey to be compared, but also the actual harvest volume to be monitored. The annual report on actual harvest volumes is issued by the logging company at present. The cutover areas are registered as GIS data only for their ranges in the FIMS in the current workflow. Therefore, the method of registering actual harvest volumes at the time of cutover areas registration was also discussed.

Figure 3-60 Image of registration of actual harvest volume

iii) Import of FIPS data

As the users are different between FIMS and FIPS, both systems are designed as independent systems as mentioned previously. In data integration, it was decided to collect the information in FIMS and import the FIPS data into FIMS under the Manager's authority.

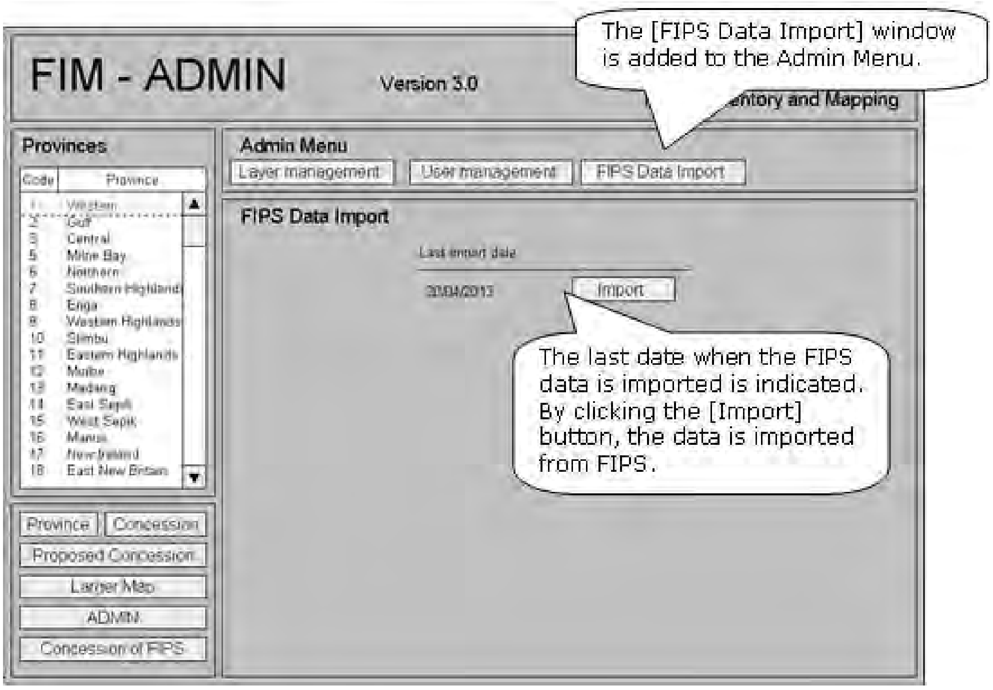


Figure 3-61 FIPS data importing method

The FIPS data to be imported into FIMS is the data which is comparable with the forest resource volume data registered in FIMS.

Strip line	Plan_id
	Survey Number
	Name of the Survey
	Date of the Survey
	Block Number
	Strip Number
	Volume
	Start Point(coordinate)
	End Point(coordinate)
Survey Summary	Plan_id
	Survey_Number
	Name_of_the_Survey
	Adj_Net_Forest_Area
	10-19_m3_per_ha
	20-49_m3_per_ha
	50Over_m3_per_ha

	Total_m3_per_ha
	50Over2_m3_per_ha
	10-19_grp1-2_m3_per_ha
	20-49_grp1-2_m3_per_ha
	50Over_grp1-2_m3_per_ha
	Total_grp1-2_m3_per_ha
	50Over2_grp1-2_m3_per_ha

iv) Data association between FIMS and FIPS

The inventory survey is made per concession. Therefore, the method of associating the FIPS information with the concession of the FIMS was adopted. Two association methods were considered:

- The ID of the FIMS concession is bestowed on the FIPS survey data to associate both sets of data with the common ID.
- The coordinate information on the start point and stop point of the survey is bestowed on the FIPS survey data and spatial analysis is made to determine which concession area (polygon) in FIMS the FIPS data belongs to on the GIS in order to associate it with the relevant concession.

As the concession areas are not duplicated at present, the latter method has an advantage that it is not needed to input new items of information. However, if a new cutover of trees is made in the past concession in which the cutover of trees has been finished, it is impossible to determine which time of survey the cutover of the trees is to be associated with, only based on the positional information. Thus, the former method of association with the Plan ID of the FIMS concession was finally adopted.

(b) FIPS

i) Addition of positional information of the survey

Since FIMS is the system having positional information, FIPS is required to have positional information for association with each other. In the inventory survey, the GPS devices that were provided in the separate Grant Aid project will be carried by the surveyors, allowing easy acquisition of positional information.

Each plot position at which the detailed survey is made is automatically determined on each strip line. Therefore, it was decided to newly register only the coordinate values of the start and the stop points of each strip line.

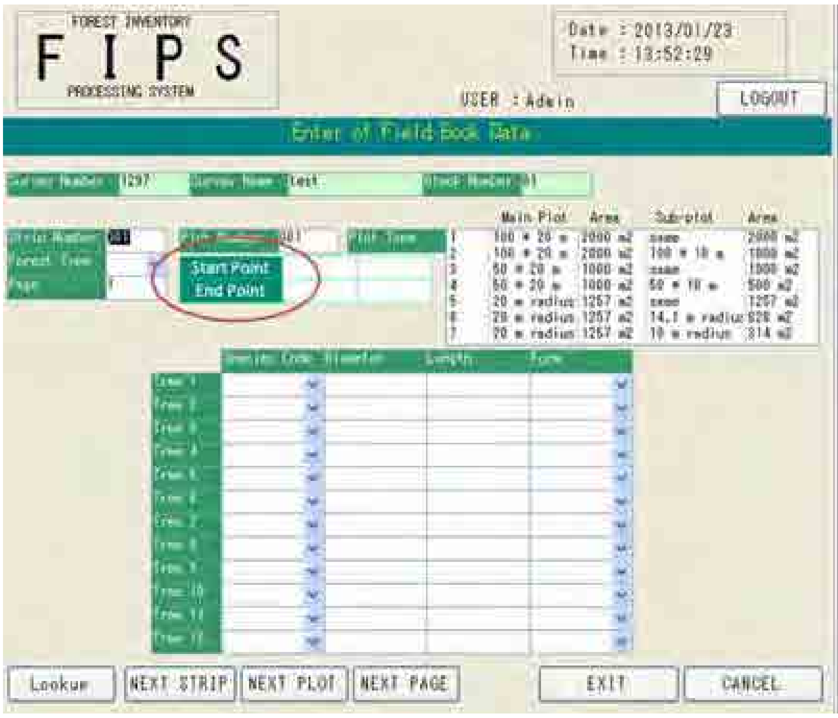


Figure 3-62 FIPS coordinate value registering window (draft)

ii) Installation method for association with FIMS

The database (DB) installation method for association between FIMS and FIPS was examined.

Three layout methods for association were discussed as shown in Table 3-26.

It is unnecessary for workers to do the survey work simultaneously, but Plan ③ was evaluated as the most suitable in considering the data management. As there is the need for the method as a data input and calculation tool in Papua New Guinea, it was decided to examine the common use with the input tool from the external source based on Plan ③.

Table 3-26 FIPS DB layout method for association with FIMS

Plan	Method	Advantage	Disadvantage
①	The FIPS DB is installed on Client PC. The tables associated with FIMS are only transferred to the SQL Server.	A PC which is not operated in a networking environment can be used (carried to field surveys). ※ To reflect the data on the SQL Server, it is necessary to recalculate it on the PC under a networking environment.	The management of the latest data is complicated because the data from Client PC is finally required to be integrated into one Access file.
②	The FIPS DB is installed in the common folder on the server PC. The FIPS in the common folder is directly operated from Client PC. The tables associated with FIMS are only transferred to the SQL Server.	The latest data can be obtained from any Client PC because the Access file is managed from one point. A PC which is not operated in a networking environment can be used. (However, it is necessary to do the data reflecting work in connecting to the network.)	Two or more workers can use the DB simultaneously.
③	The FIPS DB from which all the tables are transferred to the SQL Server is installed on Client PC.	As the exclusive control by the SQL Server is available, the database can be operated safely by two or more workers simultaneously. Data backup and restoration are easily made.	As it is mandatory to log in to the SQL Server, a PC which is not operated in a networking environment cannot be used.

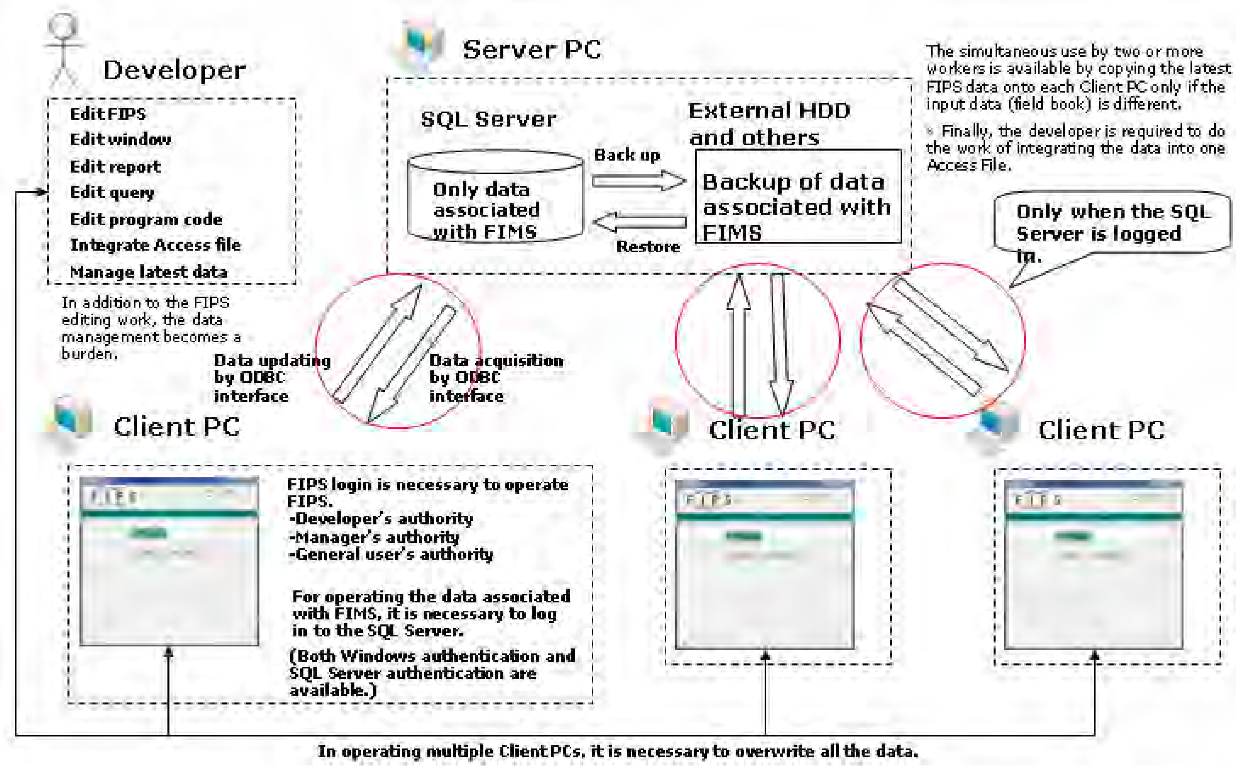


Figure 3-63 FIPS DB Installation Method 1 for Association with FIMS

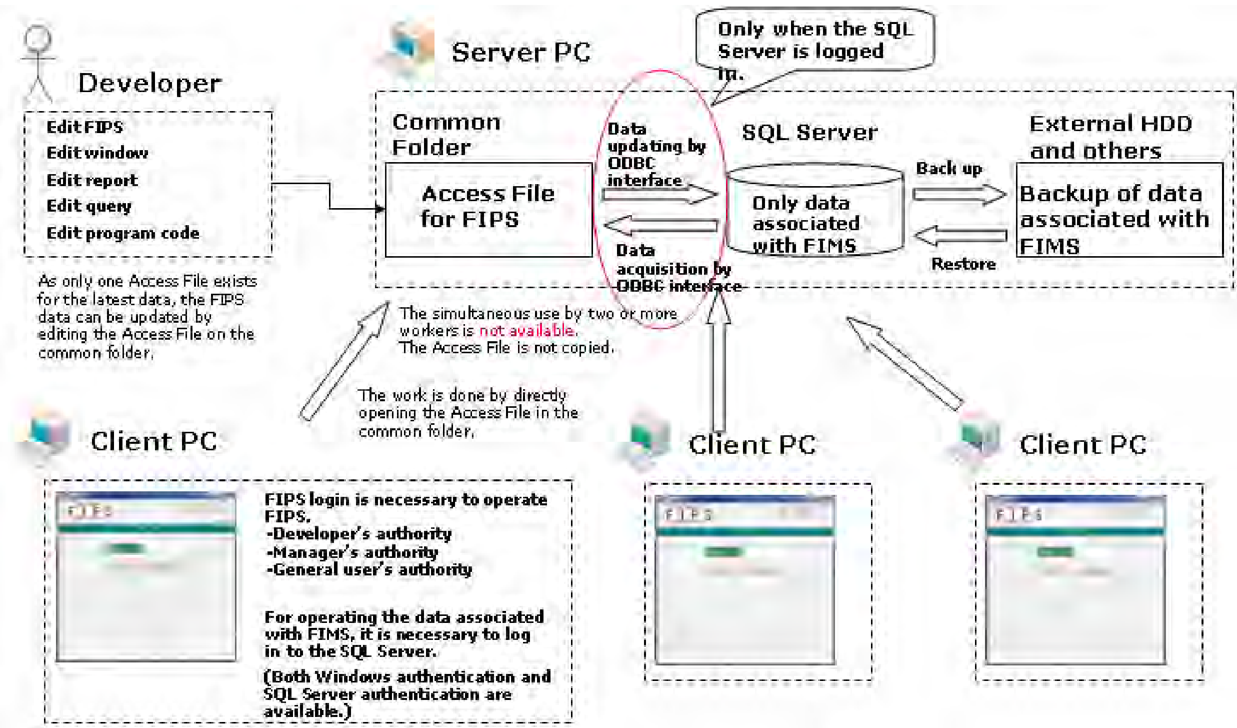


Figure 3-64 FIPS Installation Method 2 for Association with FIMS

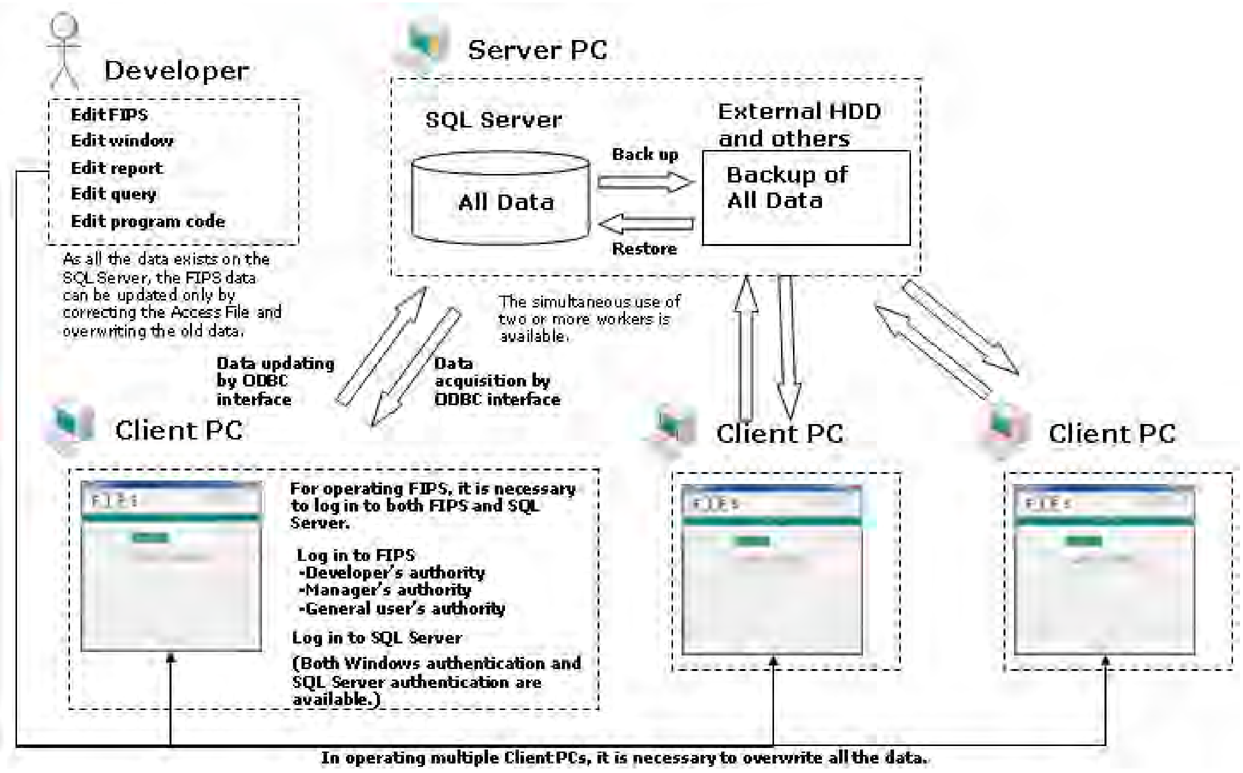


Figure 3-65 FIPS Installation Method 3 for Association with FIMS

3.5.4 OJT Required for 3.5.1 – 3.5.3

The results shown in 3.5.1 – 3.5.3 were achieved by implementing the OJT shown in the table below.

Table 3-27 Implementation of OJT

Date	OJT Content	Participating Members
October 14, 2011 (Friday) 10:00 – 12:00	Analysis of Concession Work	All members
October 17, 2011 (Monday) 15:00 – 17:00	Analysis of Concession Work	All members
October 19, 2011 (Wednesday) 10:00 – 12:00 13:30 – 16:00	Analysis of Concession Work	All members
October 24, 2011 (Monday) 13:30～15:00	Analysis of Concession Work	All members
October 24, 2011 (Monday) 15:15 – 15:45	■Sequence for Provincial Forest Plan ■Sequence for National Forest Plan	Inventory and Mapping Branch
October 25, 2011 (Tuesday) 10:00 – 12:00 13:30 – 15:30	■Sequence for Provide Forest Information(FIMS) ■Sequence for Select FMA Area for Development ■Sequence for Updating logged over area in Concession Area for calculating remaining resource ■Sequence for Submit Report of Current Forest Inventory to the Management ■Map to Managements: Reference for Boundary demarcations ■"Managements: Any FIM Maps and Reports : Reports upon request"	Inventory and Mapping Branch
October 26, 2011 (Wednesday) 13:30 – 16:00		Inventory and Mapping Branch
October 28, 2011 (Friday) 9:30 – 10:30	■Sequence for NFS Evaluation	Acquisition Team
October 28, 2011 (Friday) 11:30 – 12:30	■Sequence for identifying Landgroups and formation of ILG for FMA project (FIMS)	Projects Team
November 1, 2011 (Tuesday) 13:30 – 14:30	Analysis of Concession Work	All members
November 1, 2011 (Tuesday) 14:30 – 15:30	■Sequence for Identify Potential Forest Area ■Sequence for forest inventory (in potential area identified in NFP) ■Sequence for Confirm Potential Timber Resource Volume ■Sequence for Post Logging Inventory Survey (Before the completion of the Project)	Inventory and Mapping Branch
Sept. 4, 2012 (Tues.) 10:00 – 12:00	Comprehension of UML class diagram to facilitate understanding of database structure • Review of "Introduction to Geographic Information Standards" materials used during training in Japan in September 2011.	Inventory and Mapping Branch (Perry Malan, Patrick La'a)
Sept. 5, 2012 (Wed.) 10:00 – 12:00	Verification of data structure and content of changes between existing FIMS and ArcGIS version FIMS data structure based on UML class diagram. Regarding existing FIMS, comparative confirmation with MapInfo format data was performed.	Inventory and Mapping Branch (Perry Malan, Patrick La'a)

Date	OJT Content	Participating Members
Sept. 6, 2012 (Thur.) 10:00 – 12:00	The FIPS data structure that is the target for integration was confirmed based on the UML class diagram. A comparative confirmation with Access format content was performed. The methods for integrated usage of FIMS and FIPS were discussed.	Inventory and Mapping Branch (Perry Malan, Patrick La'a)
Sept. 11, 2012 (Tues.) 9:30 – 12:00	Access database configuration and usage procedure were explained.	Inventory and Mapping Branch (Perry Malan, Patrick La'a)
Sept. 13, 2012 (Thur.) 11:00 – 12:00	Access database configuration and usage procedure were explained.	Inventory and Mapping Branch (Perry Malan, Patrick La'a)
September 19 (Wed), 2012 9:00-10:00, 13:00-14:00	Discussions on possibility of association between PSP and FIMS/FIPS and necessity of improvement	FRI (Cossey Yosi)
September 27 (Thu), 2012 14:00-16:00	Discussions on how to give positional information to the FIPS data to integrate FIPS with FIMS.	Inventory and Mapping Branch (Ledino Saega, Samuel N. Gibson)
November 23 (Mon), 2012 9:45-10:45	Explanation of basic operation of FIMS Replacement version	Inventory and Mapping Branch (Perry Malan)
December 17 (Mon), 2012 14:30-15:30	Explanation of basic operation of FIMS Replacement version	Inventory and Mapping Branch (Patrick La'a)
February 27 (Wed), 2013 14:00-15:00	Discussions on improvements in FIMS/FIPS	Inventory and Mapping Branch (Constin Bigol)