

# **Indonesia-Japan Project for Development of REDD+ Implementation Mechanism (REDD+ Planning Study)**

## **Final Report**

**April 2016**

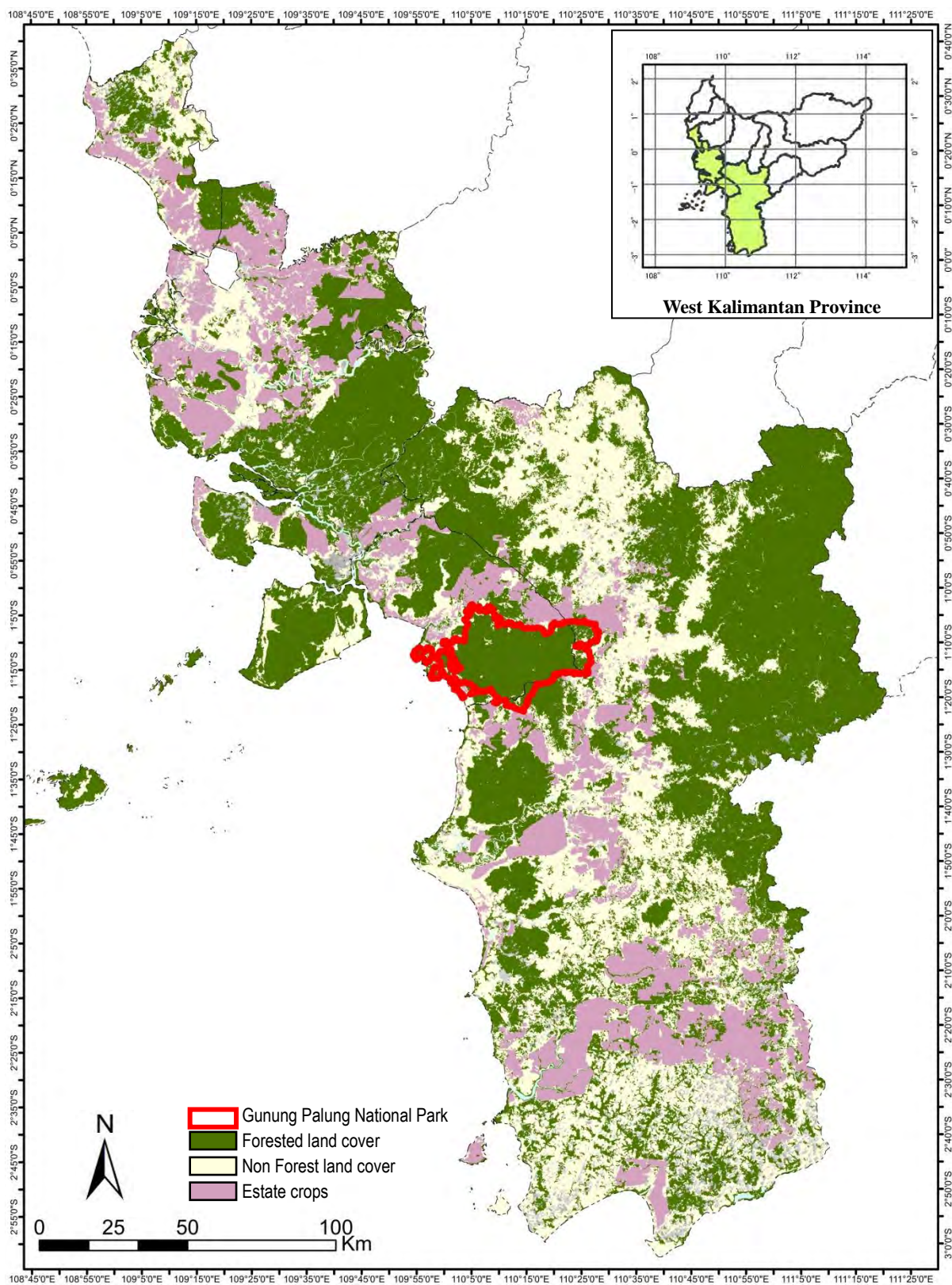
**Japan International Cooperation Agency (JICA)**

**Mitsubishi UFJ Research and Consulting**

**Japan Forest Technology Association**



## 1. Project Area Map





## 2. Abbreviation Table

Abb.	English	Indonesian
ADB	Asian Development Bank	-
ADP	The Ad Hoc Working Group on the Durban Platform for Enhanced Action	-
AEZ	Agro Ecological Zone	-
AGB	Above Ground Biomass	-
APL	Other land use	Areal Penggunaan Lain
ASEAN	Association of South-East Asian Nations	-
ASRI	-	Alam Sehat Lestari (NGO)
BAPENASS	National Development Planning Board	Badan Perencanaan Pembangunan Nasional
BAPPEDA	Local Development and Planning Agency	Badan Perencanaan Pembangunan Daerah
BAU	Business as Usual	
BBSDLP	Agriculture Land Resources Research and Development Center	Balai Besar Penelitian dan Pengembangan Sumberdaya Lahan Pertanian
BIG	Geospatial Information Agency	Badan Informasi Geospasial
BKPRD	Coordination Agency for Local Spatial Plan Regulation	Badan Koordinasi Penataan Ruang Daerah
BKSDA	Natural Resources Conservation Office	Balai Konservasi Sumber Daya Alam
BLH	Environmental Agency	Badan Lingkungan Hidup
BLHD	Local Environmental Agency	Badan Lingkungan Hidup Daerah
BPDAS	Watershed Management Office	Balai pengelolaan Daerah Aliran Sungai
BPKH	State Forest Consolidation Office	Balai Pemantapan Kawasan Hutan
BPN	National Land Affairs Agency	Badan Pertanahan Nasional
BSN	National Standardization Agency	Badan Standarisasi Nasional
CAR	Corrective Action Request	-
CCLA	Community Conservation Livelihood Agreement	-
CIFOR	Center for International Forestry Research	-
COP	Conference of the Parties	-
DAK	Special Allocation Fund	Dana Alokasi Khusus
DisPU	Public Work Service	Dinas Pekerjaan Umum
DNPI	Indonesian National Council on Climate Change	Dewan Nasional Perubahan Iklim
DRC	Democratic Republic of the Congo	-

Abb.	English	Indonesian
FAO	Food and Agriculture Organization of the United Nations	-
FCP	Japanese Technical Cooperation Project for Program of Community Development of Fires Control in Peat Land Area	Program Pengembangan Masyarakat dalam Pengendalian Kebakaran di Areal Gambut
FFI	Fauna Flora International (NGO)	-
FGD	Focus Group Discussion	-
FMU	Forest Management Unit	-
FORDA	Forest Research and Development Agency	-
FPIC	Free, Prior, and Informed Consent	-
FREL	Forest Reference Emission Level	-
GCF	Green Climate Fund	-
GCF	Governors' Climate and Forests Task Force	-
GHG	Greenhouse Gases	-
GIS	Geographical Information System	-
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit	-
GPNP/TNGP	Gunung Palung National Park	-
GPS	Global Positioning System	-
HD	Village Forest	Hutan Desa
HGU	Business Use Right	Hak Guna Usaha
HH	Right Forest	Hutan Hak
HK	Conservation Forest	Hutan Konservasi
HL	Protection Forest	Hutan Lindung
HP	Production Forest	Hutan Produksi
HPT	Limited Production Forest	Hutan Produksi Terbatas
HPK	Convertible Production Forest	Hutan Produksi yang Dapat Konversi
HPH	Forest Concession	Hak Pengusahaan Hutan
HR	Private Forest	Hutan Rakyat
HTI	Industrial Plantation Forest	Hutan Tanaman Industri
IAR	International Animal Rescue (NGO)	-
IFACS	Indonesia Forestry and Climate Support	-
IJ-REDD+	Indonesia-Japan Project for Development of REDD+ Implementation Mechanism	-
INCAS	Indonesian National Carbon Accounting System	-

Abb.	English	Indonesian
INDCs	Intended Nationally Determined Contributions	-
IPCC	Intergovernmental Panel on Climate Change	-
ISHOMA	Break and Pray	Istirahat dan Sholat
ISO	International Organization for Standardization	-
IUPHHK-HT/ HA	Nature/Man-made Forest Timber Forest Product Management Business Permit	Izin Usaha Pengelolaan Hasil Hutan Kayu-Hutan Tanaman/ Hutan Alam
JAFTA	Japan Forest Technology Association	-
JCM	Joint Crediting Mechanism	-
JICA	Japan International Cooperation Agency	-
JNR	Jurisdictional and Nested Approach	-
JST	Japan Science and Technology Agency	-
KLH	Kementerian Lingkungan Hidup	-
KLHS	Strategic Environmental Study	Kajian Lingkungan Hidup Strategis
KPH	Forest Management Unit	Kesatuan Pengelolaan Hutan
KPHK	Conservation Forest Management Unit	Kesatuan Pengelolaan Hutan Konservasi
KPHL	Protection Forest Management Unit	Kesatuan Pengelolaan Hutan Lindung
KPHP	Production Forest Management Unit	Kesatuan Pengelolaan Hutan Produksi
KSDAE	Directorate General of Nature Resources and Ecosystem Conservation	Direktorat Jenderal Konservasi Sumber Daya Alam dan Ekosistem
KTG	Ketapang	Ketapang
KU	Kayong Utara	Kayong Utara
LAPAN	Indonesian National Institute of Aeronautics and Space	Lembaga Penerbangan dan Antariksa Nasional
LC	land cover	Tutupan Lahan
LCCS-UNFA O	land Cover Classification System (LOCS)-Food and Agriculture of United Nations	-
LCM	land cover map	Peta tutupan lahan
LOI	Letter of Intent	-
LREP	Land Resources Evaluation Project	-
LU	land use	Tata guna lahan
METI	Ministry of Economy, Trade and Industry	
MoE	Ministry of Environment	
MoEF	Ministry of Environment and Forestry	
MoF	Ministry of Forestry	
MPA	Fire Care Community Group	Masyarakat Peduli Api

Abb.	English	Indonesian
MRV	Measuring/Reporting/Verification	Pengukuran, Pelaporan dan Verifikasi
MURC	Mitsubishi UFJ Research & Consulting	-
NAMAs	Nationally Appropriate Mitigation Actions	-
NFI	National Forest Inventory	Inventarisasi Hutan Nasional
NGO	Non Government Organization	LSM
NIR	Near Infrared	-
NP	National Park	Taman Nasional
NTFP	Non timber forest products	Hasil Hutan Bukan Kayu
ODA	Official Development Assistance	-
PALSAR	Phased Array type L-band Synthetic Aperture Rader	-
PCA	Principal Component Analysis	-
PD	Project Description	-
PDD	Project Design Document	-
PDM	Project Design Matrix	-
PEP	Monitoring, Evaluation and Reporting	Pemantauan, Evaluasi dan Pelaporan
PHKA	Directorate General of Forest Protection and Nature Conservation	Direktorat Jenderal Perlindungan Hutan dan Konservasi Alam
PIPIB	Indonesian Forest Moratorium map	Peta Indikatif Penundaan Izin Baru
PLANOLOGI	Directorate General of Forest Planning	Direktorat Planlogi Hutan
PLG	Mega Rice Project	Pengembangan Lahan Gambut
PO	Plan of Operation	-
PSF	Peat Swamp Forest	-
PSP	Permanent Sample Plot	Petak Sample Permanen
QA/QC	Quality Assessment/Quality Control	-
QGIS	Quantum GIS	-
R/D	Record of discussion	-
RAD-GRK	Regional Action Plan for Green House Gasses	Rencana Aksi Daerah Penurunan Emisi Gas Rumah Kaca
RAN-GRK	National Action Plan Reducing Greenhouse Gas Emissions	Rencana Aksi Nasional Penurunan Emisi Gas Rumah Kaca
RBI	-	Peta Rupa Bumi Indonesia
REDD+	Reducing emissions from deforestation and forest degradation and plus	-
REL/RL	Reference Emission Level/reference level	-



Abb.	English	Indonesian
RePPProT	Regional Physical Program for Transmigration	–
RTR Desa	Village Spatial Plan	Rencana Tata Ruang Desa
RTRW	Local Ordinance of Spatial Plan	Rencana Tata Ruang Wilayah
SBI	Subsidiary Body for Implementation	–
SBSTA	Subsidiary Body for Scientific and Technological Advice	–
SIGN	National GHG Inventory System	Sistim Inventarisasi Gas Rumah Kaca Nasional
SING-SMART	National GHG Inventory System with Simple, Easy and Accurate, Quick and Transparent	Sistim Inventarisasi Gas Rumah Kaca Nasional secara Sederhana, Mudah, Akurat, Ringkas dan Transparan
SK	Decision Letter	Surat Keputusan
SKPD	Local Government's Work Unit	Satuan Kerja Pemerintah Daerah
SMART	Simple, Easy and Accurate, Quick and Transparent	Sederhana, Mudah, Akurat, Ringkas dan Transparan
SFM	Sustainable Forest Management	Pengelolaan Hutan Lestari
SNI	Indonesian National Standard	Standar Nasional Indonesia
SOP/POS	Standard Operational Procedure	Prosidur Operasional Standar
SPOT	Satellite Pour l'observation la Terre	-
SRAP	Provincial Strategy and Action plan	Strategi dan Rencana Aksi Provinsi
TF	Task Force	-
TSP	Temporary Sample Plot	Plot Sample Sementara
UKP4	Presidential working unit for supervision and control of development	Unit Kerja bidang Pengawasan dan Pengendalian Pembangunan
UNFCC	United Nations Framework Convention on Climate Change	-
UNPAR	Palangkaraya University	-
UNTAN	Tanjungpura University	-
USAID	United States Agency for International Development	-
VCS	Verified Carbon Standards	-
WALHI	Friends of Earth Indonesia	Wahana Lingkungan Hidup Indonesia
WI	Wetland International	-
WWF	World Wide Fund for Nature	-



### Mechanism (REDD+ Planning Study)

# Final Report

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## Chapter 1 Management policy

### 1. Background

#### 1.1. International trend in REDD+

At the 13th Conference of the Parties (COP 13) to the United Nations Framework Convention on Climate Change (UNFCCC) in 2007, hosted by Indonesia, the Bali Action Plan was adopted. Under the plan, REDD+ was recognized as one of the mitigation actions of the next framework started in 2013. Since then technical issues had been discussed and the broad agreement (Warsaw Outcomes) was made on measures for the issues by 2013 (COP 19).

Meanwhile the agreements were also made on the mechanism and strategy for REDD+ implementation that developing countries establish national entities or focal points as REDD+ windows for UNFCCC and prepare to implement REDD+ and receive results-based payments (e.g. providing summary of information on safeguards). Also in COP 20 in 2014 held in Peru, it was decided that UNFCCC secretariat established special REDD+ information hub named in “Lima REDD+ Information Hub”, which was according to Warsaw International Mechanism.

The Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP 2-9) and the 42nd sessions of the Subsidiary Body for Implementation (SBI 42) and the Subsidiary Body for Scientific and Technological Advice (SBSTA 42) were held in June 2015 in Bonn, Germany. The SBSTA 42 meeting gave consideration of three methodological issues on REDD+ (non-carbon benefit, non-market based approaches, safeguard) that were left, with an agreement reached on a draft conclusion (FCCC/SBSTA/2015/L.5) and all technical considerations relating to REDD+ completed (Figure 1).

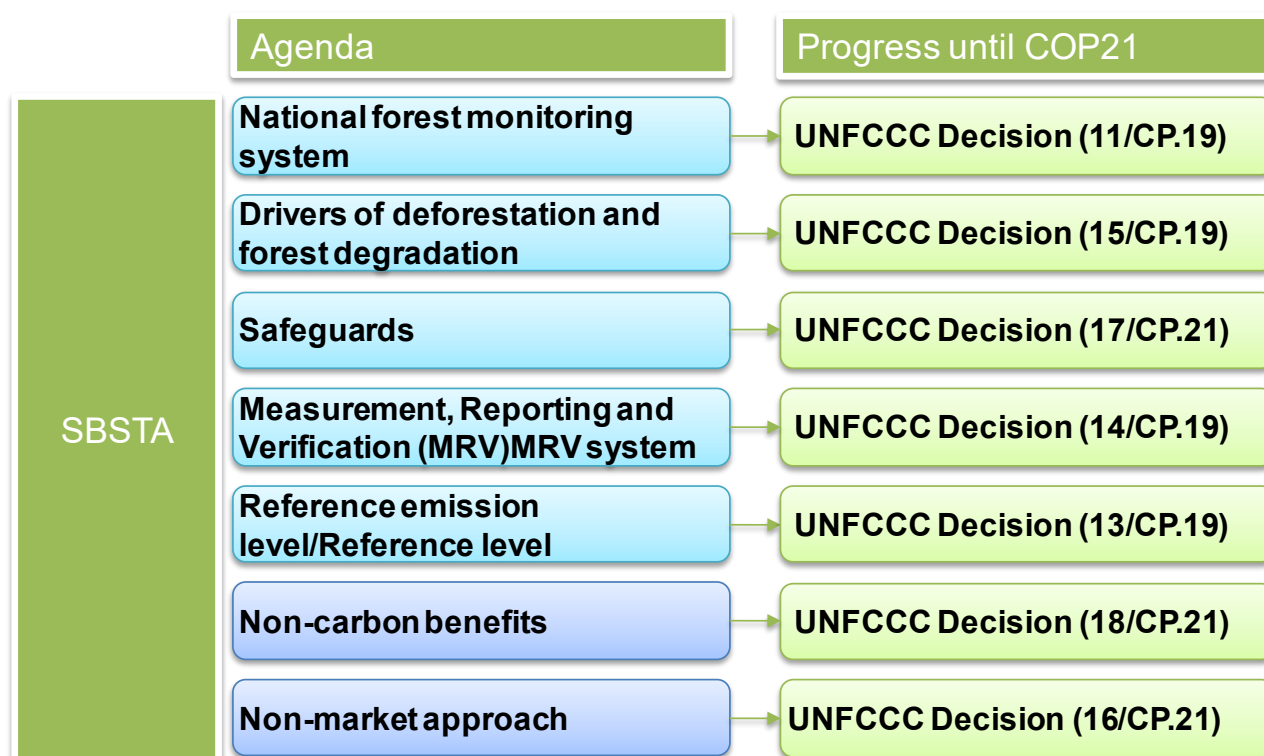


Figure 1 UNFCCC Decisions after Cancun Agreement in COP16.

Over the past negotiations no country was against the concept of REDD+, and governmental development organizations, private enterprises, and NGOs have already been initiating activities autonomously prior to international agreements under the UNFCCC. It is highly possible that these advanced activities will be accepted as an early action of official REDD+ project in future framework.

In 2015, according to Warsaw International Mechanism and results of COP 20 in 2014, it was decided that each countries (both of developed and developing countries) should submit their GHG emission reduction target (i.e. INDCs). Considering such situation, REDD+ project(s) which will create many GHG emission reductions (credits) are expected as special mitigation activities after 2015.

Intended Nationally Determined Contributions (INDCs) are nationally determined, and each nation is left to decide on whether or not to include countermeasures relating to REDD+. Also, at the COP 21 held in Paris, France from November to December 2015, COP decisions including the Paris Agreement, which form a new legal framework for 2020 and beyond, were adopted. Paragraph 55 of the COP agreement recommends capital aid for REDD+ implementation, stating that it “Recognizes the importance of adequate and predictable financial resources, including for results-based payments, as appropriate, for the implementation of policy approaches and positive incentives for reducing emissions from deforestation and forest degradation, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks. Also, Article 5 Paragraph 1 of the Paris Agreement states that “Parties should take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases as referred to in Article 4, paragraph 1(d), of the Convention, including forests” suggesting that initiatives for land use



fields including REDD+ are important both in developed and developing countries. The Paris Agreement also sets forth an obligation for nations to renew their reduction targets every 5 years, with each nation requested to make greater efforts in order to achieve a reducing emissions to hold the increase temperature to below 2 degree above pre-industrial levels. REDD+ will contribute greatly to reducing emissions, and it is expected that each nation will further investigate targets including REDD+ going forwards.

## 1.2. Actions by the Government of Japan

Japan proposed not participating in the second commitment period of the Kyoto Protocol so that Japan does not have responsibility to reduce GHG emissions. On the other hand, a scheme for promoting strategy for reducing GHG emissions in developing countries by fully utilizing Japan's ability of contribution through such as low carbon technology and products should be discussed. Based on this view, Japan has been proposing the Joint Crediting Mechanism (JCM) (In August 2013, Japan and Indonesia agreed and signed to the JCM documents). Various guidelines and methodologies have been prepared in order to achieve emission reductions under the JCM at an early stage. The first JCM project was registered in October 2014 in Indonesia, and as of November 2015 a total of 10 methodologies and 3 projects have been registered.

One feasibility study was undertaken for REDD+ in fiscal year 2015 by the Ministry of Economy, Trade and Industry (METI), and two JCM-REDD+ subsidized projects were implemented by the Ministry of the Environment (the Secretariat was the Global Environment Center Foundation). In Indonesia, discussions were held between Japan and Indonesia regarding REDD+ methodology development guidelines (there are also plans to consider various other guidelines relating to REDD+) with the aim of implementing REDD+ under the JCM, and the Ministry of the Environment is proceeding with subsidized projects in Boalemo province. These REDD+ initiatives under the JCM are considered important because of the enormous potential.

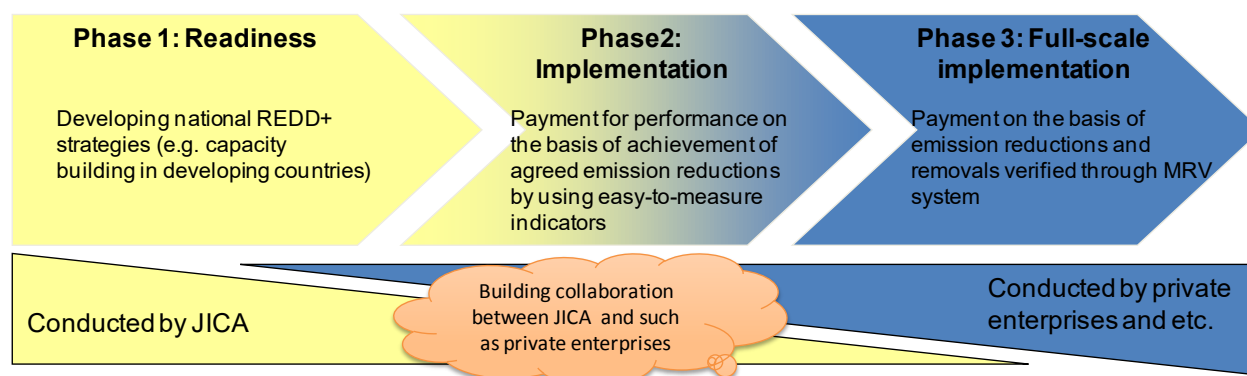
To promote REDD+ activities under the JCM, public-private collaboration has put efforts, and some private enterprises have made steady progress, such as obtaining permission (concessions), to implement REDD+ fully. Also most of stakeholders of REDD+ expected that registration of REDD+ project(s) and creation of GHG emission reductions (credits) are to be done in 2015 and after 2015,

## 1.3. Role of Japan International Cooperation Agency (JICA) in promoting REDD+

Since REDD+ is to be implemented in developing countries, it is inseparable from technical issues on methods to project future GHG emissions and to calculate actual GHG emissions and removals, and political issues such as harmonizing views amongst stakeholders including rural people. That is why immense knowledge and experience are required to implement REDD+. In that context, JICA has been continuously running forest conservation projects in developing countries: actions against technical issues on measuring/reporting/verification (MRV) system, focusing on capacity building toward REDD+

implementation including promoting participatory forest conservation, cultivating knowledge and experience of concerned issues on REDD+, and building human network.

The cooperation between JICA and other organizations such as private enterprises is significant to proceed with REDD+ projects implemented and supported by Japan, including such as enterprises. It is also important to build a JICA-centered REDD+ implementation structure (Figure 2).



\*This study will consider collaborations with such as private enterprises in the phase 2 as depicted in the figure above.

Figure 2 Collaboration between JICA and private enterprises, etc. for REDD+ implementation

In November 2014, specific forum of “Japan Public-Private Platform for REDD+” had established, and as one of the taskforces under the forum, “Taskforce on REDD+ Business Model” also established. The Taskforce is aiming to develop the REDD+ implementing structure which will be designed as “Japan REDD+ Model” and such activities will be related in REDD+ activities in Indonesia and direction of this study.

## 2. Objectives

### 2.1. Planning study for developing REDD+ project model

This study is in charge of a part of REDD+ activities undertaken for West Kalimantan Province, which is a technical cooperation project, Indonesia-Japan Project for Development of REDD+ Implementation Mechanism (IJ-REDD+), and aims to promote activities inclusively to implement REDD+. In particular, this study supported REDD+ implementation in the four western districts of West Kalimantan Province -Mempawah, Kubu Raya, Kayong Utara and Ketapang- and carried out activities for studying to develop a REDD+ project model for Gunung Palung National Park (GPNP) and its landscape. In addition, this study was technically support REDD+ and mitigation actions by the forest sector such as establishing a sub-national based reference level (RL), which West Kalimantan Province is working on in accordance with the Local Action Plan for Reducing Greenhouse Gas Emissions (RAD-GRK) formalized through the Presidential Regulation No.71/2011. Thus, this study was implemented in order to intend to develop the

project to a sub-national based REDD+ project across West Kalimantan Province in the future.

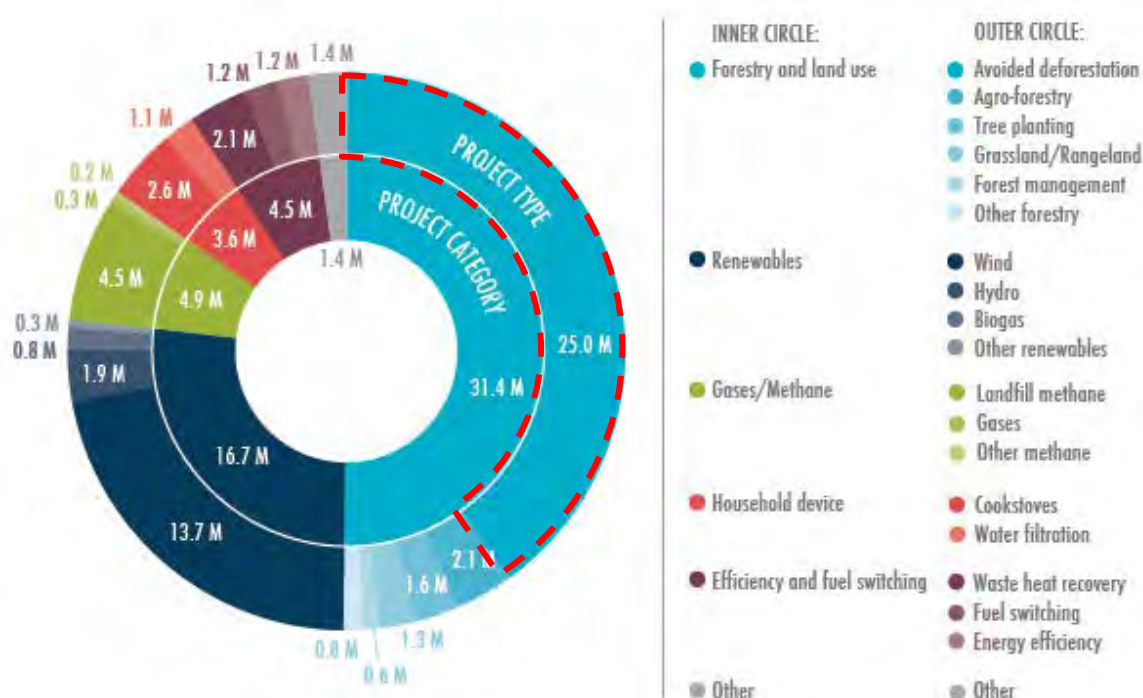
## 2.2. Others

This study carried out activities in the four western districts of West Kalimantan Province (Mempawah, Kubu Raya, Kayong Utara and Ketapang) and GPNP, especially focusing on activities to be validated and registered as a REDD+ project for GPNP. Such activities would be good case studies not only for REDD+ projects undertaken in the areas concerned but also for other areas in Indonesia and other countries all over the world. Thus, knowledge and experience, which was accumulated through this study, would be shared effectively and efficiently to promote REDD+ projects undertaken and supported by the Government of Japan.

## 3. Understanding of this study

### 3.1. Key points to be considered

Regarding the emission trading system, including free market, as a place to trade REDD+-derived credits, its methodology has been discussed and its structure has also been continuously coordinated. As a result, its circumstance is changing every minute. For example, according to an Ecosystem Marketplace report, projects originating from deforestation control in 2014 ranked highest by sector in independent markets, and there are high hopes for credits derived from REDD+. Therefore, to understand and evaluate such trend appropriately, it is necessary to provide personnel thoroughly familiar with international negotiations, activities undertaken by other countries and trends in Japan from the past up to the present. Consequently, regarding ever-changing emission trading system and REDD+, it is highly possible that the most updated information has not documented yet or even if information is documented, the circumstances have already changed.



Source) Ecosystem Market Place entitled as "State of the Carbon Markets 2015"

Figure 3 Transaction of REDD+ credits in Voluntary Market in 2014

For this reason, it is particularly important to exchange information with researchers, consultants and government officials engaged in REDD+ in Japan and abroad.

### 3.2. Understanding of Indonesia

Indonesia submitted goals for GHG emission reductions at the Copenhagen Accord, COP15 held in the end of 2010, so that it is imperative to implement mitigation actions with a central focus on REDD+. In February 2011, the National Action Plan for Reducing Greenhouse Gas Emissions (RAN-GRK) was prepared under the Presidential Regulation No.61/2011 and "GHG emission reduction targets for each sector" were announced. Meanwhile, each Indonesian province was required to prepare "provincial GHG emission reduction scenario" by September 2012 in accordance with the RAD-GRK. This raised expectations for REDD+ to have profound mitigation effect by synergy between the RAN-GRK and the RAD-GRK. Under the RAN-GRK, GHG emission reduction target is to be achieved by implementing expected Nationally Appropriate Mitigation Actions (NAMAs), including REDD+. The NAMAs basically consists of existing emission reduction programs and activities of all sectors (forestry, agriculture, industry, mining, energy, public works and so forth). It remains to be seen what methods will be taken to achieve the targets; however, the National Council on Climate Change (DNPI) set the RL as Business as Usual (BaU) and announced following: utilizing the national budget for measures to reduce emission by 26% or autonomously implementing NAMAs (Unilateral NAMAs) within Indonesia, and for

the extra 15% emission reduction, utilizing the budget of Official Development Assistance (ODA) or implementing financially supported foreign NAMAs (Financed/Supported NAMAs). Additionally, further emission reduction seems to be considered as NAMAs, which enables to generate credit (Creditable NAMAs).

### 3.3. Context of forest sector in Indonesia

In Indonesia, 1.36 million hectares out of 1.92 million hectares of land mass (approximately 71%) is classified as forest, which is the third biggest tropical forest (approximately 10% of world tropical forest mass) behind Brazil and Democratic Republic of the Congo (DRC). Therefore, forest management in Indonesia is not a domestic agenda but the particularly important to mitigate global warming on global basis. However, as a result of exploitation of forest development and timber products since the early 1970s, over 20 million m<sup>3</sup> of logs had been produced per year till 1990s and this significant deforestation became a concern world widely. In addition, illegal logging, forest fire, and conversion of lands to agriculture enhance forest degradation. Researchers and NGOs have alerted that if no immediate action is taken, Sumatra Island as well as 98% of Kalimantan Island forest will be disappeared by 2022.

Demand of wood resources and developing oil palm farm are not exception. Intensive buying of resources by multinational companies is getting noticeable in response to a world trend to secure resources. In particular, conversion to oil palm farms in Indonesia has increased drastically since bio fuel, as a raw material, has caught attention as substitute energy.

Considering land use change driven by deforestation etc., Indonesia's GHG emission is the third biggest, following USA and China. According to the Second National Communication of Indonesia submitted to UNFCCC in 2005, more than 60% of the GHG emission was resulted from forest related causes including forest fire and peatland fire. Since the COP13 of UNFCCC held in Bali in December 2007, Indonesia, with the supports by Norway and other countries, has developed the National REDD+ Strategy<sup>1</sup> and discussed a management body for REDD and MRV (REDD+ Agency and MRV Agency), and fund mechanism. In addition, REDD+ Agency had been established in September 2013.

In 2014, Indonesia had President Selection and its result had big effects on Governmental re-structure in central level. From results of Governmental re-structuring, the Ministry of Forestry which is counter-part organization of IJ-REDD+ integrated into the Ministry of Environment and Forestry. Also re-structuring is considered that other organization including REDD+ Agency was integrated into the Ministry of Environment and Forestry.

### 3.4. Actions for REDD+ in Indonesia

Indonesia and Norway signed a Letter of Intent (LOI) in 2010, and it consequently had accelerated REDD+ efforts in Indonesia. Notably, issuing logging rights has been suspended (moratorium) since 2011, and responding to it, concession (right of land-use) for developing new oil palm farms has been

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<sup>1</sup> The REDD+ National Strategy was already formulated in June 2012.

frozen. Such significant political challenges in land use are deeply related to implementation of REDD+ in Indonesia so that it is important to take place tangible REDD+ activities during the moratorium period to ensure the effect of REDD+ will be fully recognized by the time moratorium ends.

Hereafter, major challenges are to review effects of the moratorium, and to maintain the status of deforestation and forest degradation, which have been temporally prevented due to the moratorium. It is assumed that especially areas, in which local economy largely relies on logging industry, like West Kalimantan Province -the target area of this study- will reach a turning point.

Although an REDD+ agency was officially established in Indonesia in September 2013 and actions for various issues to implement REDD+ got underway in earnest, Presidential Regulation No. 16, which was issued on January 23, 2015 led to the REDD Agency being disassembled and its functions were integrated into the Ministry of Environment and Forestry. There are five departments established within the Ministry of Environment and Forestry (Climate Change Mitigation Department, Climate Change Adaptation Department, GHG Inventory/MRV Department, Resource Mobilization Department, and Forest Land Fire Management Department), and it is mainly the Climate Change Mitigation Department that is focusing on REDD+ initiatives. At the same time, when implementing REDD+, it is necessary to proceed not only with initiatives in the forestry field centered on the Ministry of Environment and Forestry, but also through coordination with mine development (under the jurisdiction of the Ministry of Industry and Trade) and plantation development (under the jurisdiction of the Ministry of Agriculture) etc., which are also connected to deforestation/forest degradation.

In 2015, the El Nino phenomenon caused a prolonged dry season and abnormally high temperatures and dryness continued and had been leading to frequent large-scale forest fires in Indonesia. According to a report by the World Resource Institute, 127,000 forest fires were observed, which was the highest numbers since 1997, and peatland fires became severe on Kalimantan Island, where peatland is widely dispersed. In view of this chain of events, President Joko Widodo at UNFCCC COP21 declared the establishment of the Peatland Restoration Agency to perform restoration of peatland destroyed by forest/peatland fires on Sumatra Island and Kalimantan Island, management of peatland, and direct control of rights to use, etc. Going forwards, it is assumed that full-blown initiatives for control of peatland degradation and restoration will be implemented.

Also, Indonesia progressed with development of a National based level submitted to UNFCCC, and “the National Forest Reference Emissions Level (FREL) for REDD+” was submitted to UNFCCC on December 9, 2015. Applied methodologies in the FREL can be related in direction of the technical approach of this study, so attention must be paid to ensure that there is consistency. In addition, because the FREL in Indonesia is very closely related to GHG emission reduction potential (an amount of more than 10 million t-CO<sub>2</sub>) by implementing REDD+ as described above, the results will be connected to GHG emission reductions (i.e., GHG emission reductions, or INDC) in developed countries. At UNFCCC COP21, held from November to December 2015, each nation submitted an INDC and Indonesia also submitted an INDC on September 24, 2015, indicating GHG (target gases: carbon dioxide, methane, nitrogen oxide) of a 26% BAU ratio from 2010 to 2020 and, with support such as international

cooperation, a 41% BAU ratio by the year 2030.

## Chapter 2 Methods and Contents of the Project

### Output 1 Sub-national Framework on REDD+ is Developed in West Kalimantan

#### Activity 1 Components of the Output 1

According to Project Design Matrix (PDM) of the project, activities under the Output 1 are separated into 7 activities (from Activity 1-1 to Activity 1-7).

#### Activity 1-1 Organize a team that consists of provincial/district governments and university

*(Not addressed by REDD+ planning study team)*

#### Activity 1-2 Provide training on remote sensing analysis and sample plot monitoring

##### 1. Implementing methods

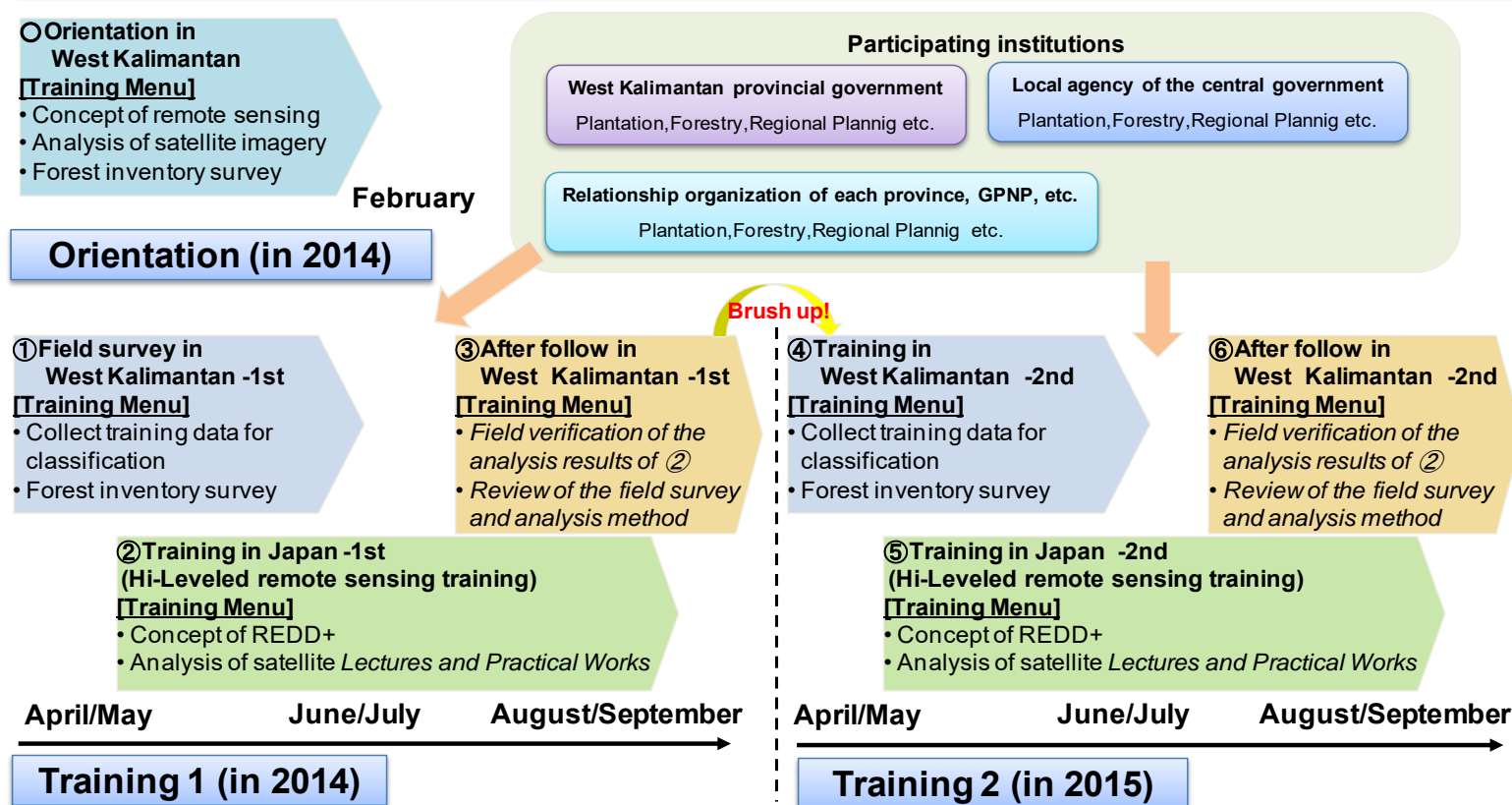
##### 1.1. Components of the training

REDD+ of this study is expected to be developed into sub-national based REDD+ in medium-long term. It is, thus, preferable that staffs of province or district level get involved in REDD+ proactively. In that context, trainings aimed to nurture people who will be dedicated to REDD+. In addition, the trainings encouraging cooperation with stakeholders such as counterparts of activities in West Kalimantan Province initiated by IJ-REDD+.

We decided to carry out a course of training as per the schedule and delivery guidelines shown in Figure 4; this included lectures to explain the overview, concept and trends of REDD+. Furthermore, we divided the training into two lots (Year 1: 2014, and Year 2: 2015) as we expected the institutions involved to send a large number of people to participate in the training; institutions that included the state government of West Kalimantan, 4 provincial governments and the central government.



■ The project suggest Orientation and 2 times trainings which are for 2 districts (e.g. Pontianak) in first time and for other 2 districts in second time as follows;



- Orientation (pre-training): consultations on details of how to deliver training and selection of participants for this round of training (February 2014, Pontianak).
- Field Survey: implementation of pre-analysis - survey design - and field survey (May 2014 /2015, Pontianak)
- Training in Japan: Lectures to provide an overview of REDD+ and explain its key concepts and trends etc. Estimates of the changes in forest acreage made by remote sensing using data obtained in the field survey mentioned above (June 2014/2015, Tokyo).

Figure 4 Overview of training course

## 1.2. Training details – Year 1

The training for Year 1, which began in February 2014, firstly promoted an understanding of REDD+ as a whole and secondly encouraged capacity building among RAD-GRK officers etc., to ensure that in the ordinary course of business they would be able to use GIS analysis technology to carry out studies, investigations and adjustments. In other words the training developed at this stage emphasized the expansion of fundamental personnel involved in the implementation of REDD+, rather than being advanced training to make the REDD+ project in West Kalimantan ready for immediate implementation. As a result the training did not include, for example, the use of advanced technology for the analysis of satellite imagery (such as the introduction/use of software to develop automatic categorization); instead, it taught participants how to efficiently carry out basic tasks for the REDD+ project (such as the use of land cover maps etc.) with the aim of improving fundamental capacity at provincial/state level.

It was noted that with regard to the acquisition of technology for GIS analysis, we used the free GIS/Remote Sensing software "QGIS"; a software that has performed well in recent years and has become popular in developing countries Figure 5.

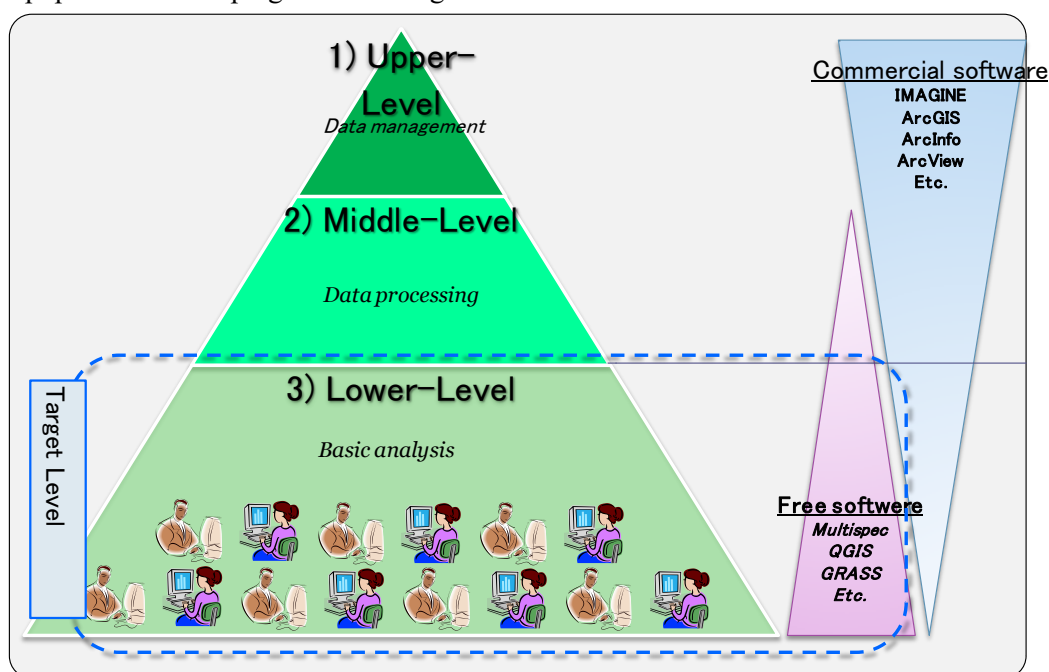


Figure 5 Target persons and used software

## 2. Detailed operations in Year-1

### 2.1. Local pre-training in Indonesia

In February 2014, the first phase was the basic training held in Pontianak, then in April 2014 advance preparations (pre-training) were held to link in with the later training scheduled for June 2014 in Japan. The 9 trainees scheduled to participate in the training in Japan took part in the pre-training (Table 1).

Table 1 List of the trainees who participated in Pre-training

	Organization	Name	Sex	Age
State Govt.	Forestry Agency	Mr. Hendra Saputra	Male	35
	Planning & Development Bureau	Mr. Jeffrey Mere	Male	29
	Environment Agency	Ms. Etty Septia Sari	Female	32
Provincial Govt.	Ketapang Province Forestry Agency	Mr. Muhammad Hasan	Male	32
	Kayong Utara Province Forestry & Farmlands Agency	Mr. Murti Anom Suntoro	Male	34
From Central Govt.	Natural Resource Conservation Centre	Mr. Subyantoro Tri Pradopo	Male	32
	Centre for the Stabilization of Forest Regions	Mr. Kelik Tri Cahyono	Male	30
	Watershed Management Centre	Ms. Asih Idha Listiyowati	Female	34
	Gunung Palung National Park Office	Mr. Wahyu Iskandar Edi	Male	29

During pre-training each of the trainees reviewed basic GIS technology and developed their ability to use GIS software to collate data obtained in the field (in forest surveys). In particular, the pre-training tried to improve understanding of the sequence of GIS-related techniques; it focused on carrying out field surveys with portable GPS units and then used the independently-obtained data to carry out GIS analysis (Table 2).

Table 2 Pre-training schedule of events

Date	Details	Location
May 20	<u>Classroom Training</u> - Initial analysis of local data - Local training - preparation & planning.	Pontianak
May 21 & 22	<u>Field Training</u> - Summary understanding of forest types - The use of forest surveys to collect data	Cagar Alam Mandor



Data collecting by using GPS machine



Ground truth in the forest

Figure 6 Pre-Training (May 2014)

## 2.2. Training in Japan

The training in Japan took place in June 2014, after the pre-training conducted in Indonesia in May 2014. As well as sequential, technical improvements in GIS analysis, the training in Japan developed planning (work to develop an Action Plan) to enable trainees to use the knowledge they had gained, in their routine works (Figure 7).

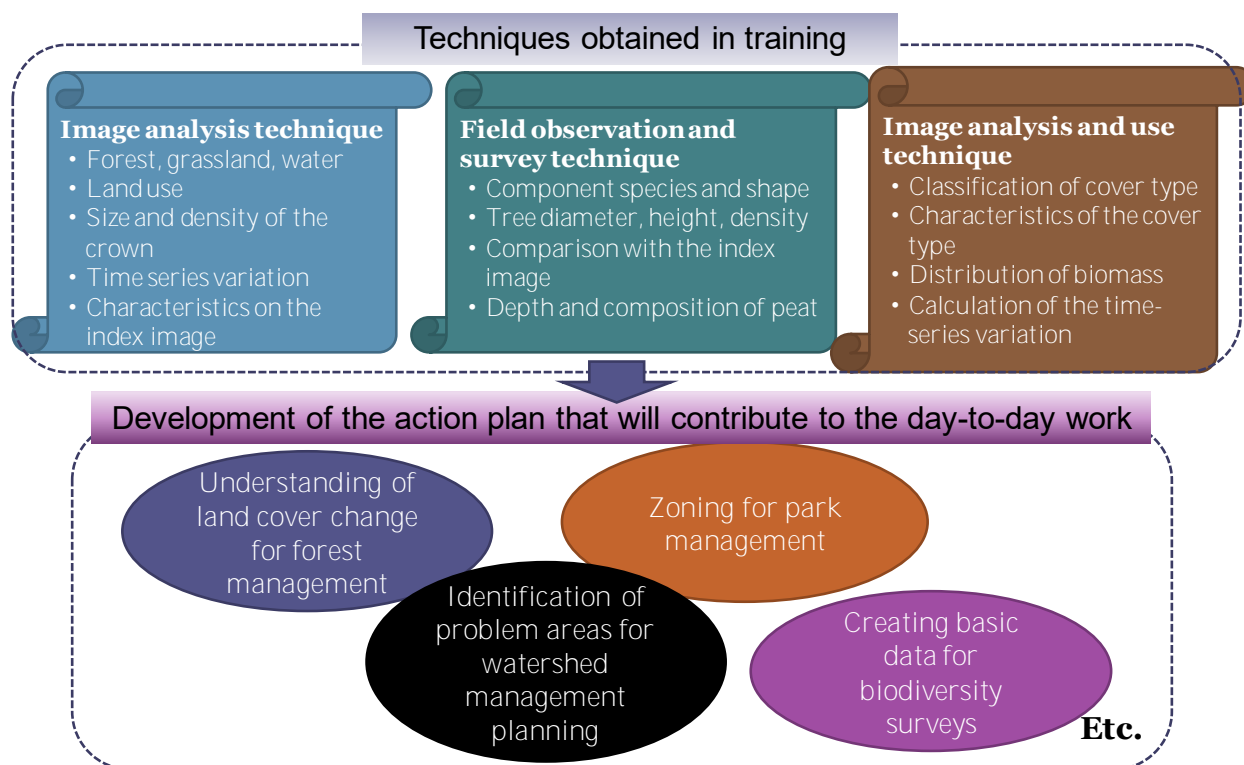


Figure 7 Diagram of the concepts behind the training in Japan

9 trainees were participated in the training in Japan for 10 days in total; some of them were participated in the pre-training as well (Table 3).

Table 3 Timetable for Training Held in Japan

Date	Time	Type	Details of Training
June 11	9:00 ~ 12:00		Briefing on rules and regulations
	13:00 ~ 14:00	Lecture	Summary of training
	14:10 ~ 15:30	Lecture	Trends in peat carbon monitoring
	15:40 ~ 17:00	Lecture	An introduction to REDD+
June 12	9:00 ~ 10:30	Lecture	REDD+ & remote sensing
	10:40 ~ 12:00	Lecture	Creating (individual) action plans - Presentation No.1
	13:00 ~ 14:30	Lecture	A design for monitoring forest carbon
	14:40 ~ 17:00	Practical	Preparations for the Nikko field survey
June 13	8:30 ~ 10:30		Transport to Ashio Copper Mine, Nikko
	10:30 ~ 15:00	Field Trip	Forest management field trip: Nikko Forest Management Station
	15:00 ~ 17:00	Field Trip	Transport to Nikko Toshogu for overnight stay
June 14	8:00 ~ 8:40		Transport to Senjogahara
	8:40 ~ 11:40	Practical	Practical training on creating vegetation maps (at Senjogahara)
	12:30 ~ 16:30	Practical	Practical training on forest inventory surveys (Sannotoge to Kirikomiko/Karikomiko)
	16:30 ~ 19:30		Transport to JICA, Tokyo
June 15	~		Rest Day
June 16	9:00 ~ 12:00	Practical	Remote Sensing - Cover Type 1
	13:00 ~ 17:00	Practical	Remote Sensing - Cover Type 2
June 17	9:00 ~ 12:00	Practical	Creating (individual) action plans - Presentation No.2
	13:00 ~ 17:00	Lecture	Carbon monitoring of forests and national forest resource surveys
June 18	9:00 ~ 12:00	Practical	Time series analysis of forest acreage using remote sensing
	13:00 ~ 17:00	Practical	Using data from ground surveys to understand forest carbon quantities
June 19	9:00 ~ 12:00	Field Trip	Field trip to see satellite image delivery systems etc.
	13:00 ~ 17:00	Practical	Action plan - group adjustments
June 20	9:00 ~ 12:00	Practical	Action Plan task analysis
	13:00 ~ 15:00	Presentation	Group presents its adjusted action plan
	15:15 ~ 16:00	Presentation	Evaluation meeting

## 2.3. Training summary – Year 1

The training in Year 1 made no pre-judgments about the system that would be used to implement REDD+ in West Kalimantan and recruited a wide range of participants from stake-holder organizations involved in forestry and land use. The outcome of the training was an accumulation of guidelines that showed each of these participants how to use of GIS technology in their own work.

On the last day of training in Japan, the trainees gave presentations on: (i) how they would use GIS technology in the future; and (ii) their action plan to utilize GIS technology, and the results of both showed very positive directions (Table 4). This seems to show that, in a broad sense, the training course has developed the human resources that will be needed to implement REDD+.

Table 4 Ways in which the knowledge learned during training will be used – as shown in the Action Plan  
(organized version)

Where it will be used	How it will be used
Used in everyday work	<ul style="list-style-type: none"> <li>• To participate in work pertaining to the creation of forest inventories (currently outside the remit of work) and also to review the way in which forest monitoring is carried out</li> <li>• To improve land &amp; forest cover maps provided from central government (to provide data as a "ground truth" outcome.)</li> <li>• To crack down on forest fires and illegal logging using land &amp; forest maps and portable GPS units; and to review monitoring methods</li> </ul>
Used in REDD+ project	<ul style="list-style-type: none"> <li>• To arrange forest monitoring system for REDD+ implementation; collected data by monitoring; and carry out forest management using the data obtained etc.</li> </ul>
Other	<ul style="list-style-type: none"> <li>• To offer consultations as an organization that has used the knowledge obtained to improve its works (organization preparations when adding new business operations).</li> <li>• To consult with regard to new works based on REDD+ trends in national and abroad (i.e. to consult within the organization).</li> </ul>

Meanwhile, the selection of trainees was mentioned as revision point of the training. Although high levels of expertise are required for REDD+ implementation, selection of trainees could not be focused on only the person who in charge of the REDD+ project; and as a result the training emphasized to develop basic GIS work capacity.

### 3. Detailed operations in Year-2

#### 3.1. Local pre-training in Indonesia — Year 2

The Pre-training of the second year took place from June 1<sup>st</sup> to June 5<sup>th</sup> in 2015 in Pontianak of West Kalimantan. Same like the last year, the purpose of this training is set capacity development of the technical expert of RAD-GRK and activity related REDD+. With the cooperation of certificated trainee of the first year, we intended the development of the cooperative relationship between whole trainees.

Table 5 Pre-training schedule

Date / Time	Activity	Resource Persons
Monday / 1st June 2015 Day 1 : Orientation & Preparation for Field Survey Trip		
08.00 – 09.00	Registration	Trainees
09.00 – 09.15	Opening session	Mr. Marcel, Head of Technical Committee IJ-REDD+
09.15 – 09.30	Orientation for training and providing a format of action plan	Team IJ-REDD+
09.30 – 09.45	Coffee Break	
09.45 - 10.15	Review of Pre-training/Basic-level (Remote Sensing and QGIS)	Hendarto, S.Hut. Msc
10.15 – 12.30	Session 1: Orientation for Field Survey trip & its Preparation (1): Basemap	Kazuyo Hirose Kouhei Niitsuma
12.30 – 13.30	ISHOMA	
13.30 – 14.30	UNTAN Biomass Carbon Meter, Introduction for easy tool for biomass measurement.	Dr. Ir. Gusti Hardiansyah M.Sc. QAM
14.30 – 14.45	Coffee Break	
14.45 – 17.00	Session 2: Preparation for Field Survey trip (2): Field Survey sheet	Kouhei Niitsuma
17.00 –	Introduction for importance of Mangrove	Kazuyo Hirose
Tuesday / 2nd June 2015 National Holiday		
Wednesday / 3rd June 2015 Day 2 : Field training for Ground checking of Land Covers		
06.00 – 17.00	6.00 Leave Mercur Hotel	
08.30 – 10.00	Land Cover & Land Use on Peatland	K. Hirose and assistants
10.00 – 10.15	Coffee Break	



Date / Time	Activity	Resource Persons
10.15 – 12.00	Peatland Irrigation	K. Hirose and assistants
12.30 – 13.30	ISHOMA	
13.30 – 14.45	Demonstration of UBCM & Plot survey using Vertex, Diameter tape.	Mr. X, Kouhei, Ega and assistants
14.45 – 15.00	Coffee Break	
15.15 – 16.00	Observation of Mangrove forest	K. Hirose and assistants
16.00 – 16.10	Evaluation 2nd day	
Thursday / 4th June 2015 Day 3 : Field Data & Land Cover Type Analysis		
08.00 – 08.30	Review of 2nd day	
08.30 – 10.00	Session 1: Demonstration Auger drill on Peatland	K. Hirose and UNTAN
10.00 – 10.15	Coffee Break	
10.15 – 10.45	Introduction of Peatland condition in West Kalimantan	K. Hirose
10.45 – 12.00	Session 2 : Calculating Biomass Data entry of field survey & Comparison of the results	N. Kouhei and assistants
12.30 – 13.30	ISHOMA	
13.30 – 14.45	Session 3: Importing GPS data & Coordination into PC and How to import them into QGIS.	K. Hirose and assistants
14.45 – 15.00	Coffee Break	
15.15 – 16.00	Georeference in QGIS	K. Hirose and assistants
16.00-17.30	Making Polygon feature for Mangrove area on QGIS	K. Hirose and assistants
17.30 – 17.40	Evaluation 3rd day	
Friday / 5 June 2015 Day 5: Land cover Analysis & Reporting		
08.00– 08.15	Review 3rd day	
08.15 – 09.45	Land Cover Data Analysis: Supervised Classification	Pak Subyantoro & Pak Hirose
09.45 – 10.00	Coffee Break	
10.00 – 11.00	Follow-up: Question & Answers	K. Hirose and assistants
11.00 – 13.30	SOLAT JUMAT & ISHOMA	
13.30 – 15.00	Preparation for Action plan	K. Hirose and assistants
15.00 – 15.15	Coffee Break	



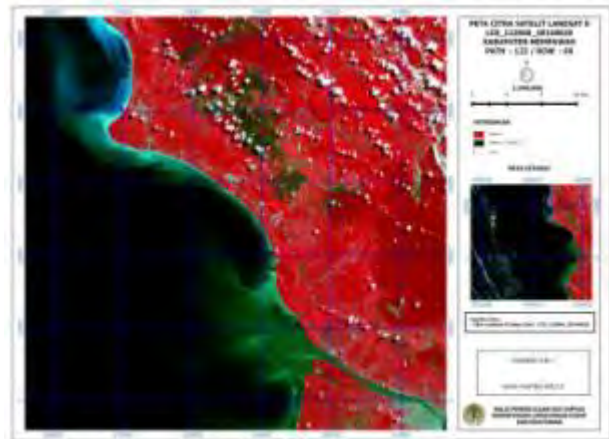
Date / Time	Activity	Resource Persons
15.15 – 16.15	Preparation for Action plan	Participants
16.15 – 17.30	Presentation of Action plan	Participants
17.30 – 17.40	Closing	Head of Technical Committee IJ-REDD+

Table 6 List of the trainee

	Organization	Name
Provincial level.	State Ministry of National Development Planning	Mr. M. Rifani, S. Hut
	Department of Forestry, West Kalimantan	Mr. Henry Octavius K
		Ms. Radiah, S.Hut
		Mr. Novi Adriansyah, S.Hut
	Forest Area Planning Office, Region III Pontianak	Mr. Andi Suhandi
	Department of Environment, West Kalimantan	Mr. Sigit Purwanto, A.Md
		Ms. Etty Septia Sari, ST. M.I.L
	Natural Resource Conservation Office, West Kalimantan	Mr. Tahir Wisata, S.Hut
	Department of Plantation, West Kalimantan	Ms. Meity Moerdiyanti, S.T
		Mr. M. Alfiansyah, SP
District level	Department of Agriculture, Livestock industry, Plantation and Forestry, Mempawah District	Ms. Riza Nopinilianti, S.Hut
		Ms. Reny Ayufrida O, S.Hut
		Mr. Yuliansyah, S.Hut
University	Department of Forestry, UNTAN	Ms. Dra.Siti Latifah, M.Si
		Ms. Dra. Tri Widiastuti, M.Si



A lecture conducted by previous trainee



A sample result of basemap for field trip



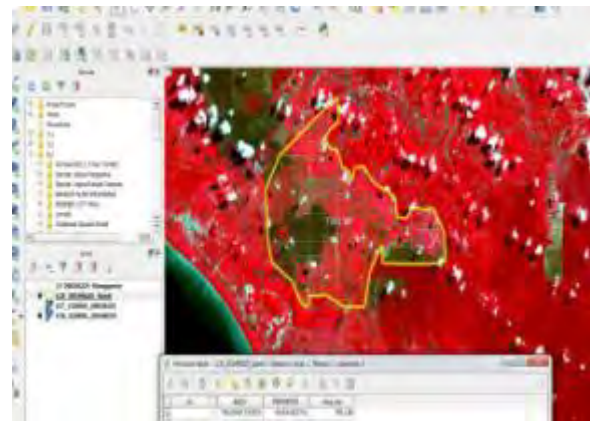
Taking field notes for "Ground Check"



Demonstration of UBCM



Observation of Mangrove



A sample of digitizing result by QGIS

Figure 8 Pre-training (June 2015)

### 3.2. Training in Japan – Year 2

With the knowledge obtained in the pre-training in Indonesia, the trainees participated the classes to learn such as interpretation of satellite image, utilization of GIS software and measurement of forest

biomass. Using these techniques, every trainee produced the action plans for their daily works. Trainees also discussed and designed the provincial action plan together through group discussion. This is intended that trainees will create the technical working group in their province.

Another two participants from Province who had already acquired the basics of forest monitoring attended the advanced course separately (Group B in Table 7).

Table 7 Timetable for training held in Japan

Date	Time	Type	Details of training
Sep.7	10:00 ~ 12:00		Briefing
	13:00 ~ 13:30		Orientation : Explanation about Training
	13:40 ~ 15:00	Lecture	International discussion & trend in REDD+
	15:10 ~ 16:30	Lecture	Corporation between R.I. and Japan in REDD+
Sep.8	9:00 ~ 10:30	Lecture	Designing Forest Carbon Monitoring for REDD+
	10:45 ~ 12:30	Lecture	Basic of Forest Carbon Monitoring
	13:00 ~ 17:00	Lecture	Download LANDSAT images and Import it into QGIS
Sep.9	9:00 ~ 10:30	Lecture	Remote Sensing data utilization in QGIS
	10:45 ~ 17:00		Remote Sensing data utilization in QGIS
Sep.10	9:00 ~ 10:30	Lecture	Manual Interpretation & Digitizing Satellite Images
	10:45 ~ 12:15	Practice	Composing Land cover map in QGIS
	13:00 ~ 17:00	Practice	Composing Land cover map in QGIS
Sep.11	9:00 ~ 12:00	Lecture	Understanding Forest Carbon and Biomass; Practical and basic method
	13:00 ~ 15:00	Practice	Preparation for field trip
	15:15 ~ 16:15	Lecture	Calculating the forest area using GIS
	16:15 ~ 17:30	Practice	Preparation of Action plan (each persons)
Sep.12	10:00 ~ 11:00	Practice	Understanding Forest Carbon and Biomass; Practical and basic method (Field trial)
	11:10 ~ 15:00	Practice	Field course: Measuring Above Ground Biomass
Sep.13			Holiday, Two trainees arrived
Sep.14	10:00 ~ 16:50	Practice	Ground Truth
		Practice	Field trip around Fuji
Sep.15	Group A 6 trainee		
	9:30 ~ 13:00	Practice	Follow-up for Field trip: Data arrangement
	13:00 ~ 14:30	Practice	Follow-up for Field trip: Question & Answer
	14:45 ~ 17:00	Practice	Group discussion for design AP
	Group B 2 trainee		
	9:30 ~ 12:00	Lecture	How to utilize PALSAR images

Date	Time	Type	Details of training
	13:00 ~ 17:00	Practice	How to utilize PALSAR images
Sep.16	Group A		
	9:30 ~ 12:00	Tour	Satellite Image Distributing System
	13:00 ~ 14:30	Lecture	Current trend in Carbon monitoring for Peat land
	14:40 ~ 17:00	Practice	Finalizing Action plan
	Group B		
	9:30 ~ 12:00	Lecture	Managing Database
	13:00 ~ 17:00	Practice	Managing Database
Sep.17	Group A		
	9:00 ~ 12:30	Lecture	Correction of land cover map
	13:00 ~ 15:30	Practice	Correction of land cover map
	15:45 ~ 17:45	Presentation	Finalizing Action plan
	Group B		
	9:30 ~ 17:00	Practice	Managing Database
Sep.18	9:00 ~ 12:00	Presentation	Action plan preparation
	12:00 ~ 12:30	Presentation	Evaluation

Table 8 List of the trainee

	Organization	Name	Sex	Age
West Kalimantan Province	Department of Forestry, West Kalimantan Province	Mr. Henry Octavius K	Male	45
	Department Plantation, West Kalimantan Province	Mr. Hendarto	Male	48
	Natural Resources Conservation Office in West Kalimantan	Mr. Tahir Wisata	Male	36
	Department of Agriculture, Livestock Industry, Plantation and Forestry, Mempawah District	Mr. Yuliansyah	Male	47
Central Kalimantan Province	Regional Environmental Department, Central Kalimantan Province	Mr. Adiyaksa Prasidapati	Male	42
	Regional Environmental Department, Central Kalimantan Province	Ms. Humala Pontas	Male	52
	Natural Resources Conservation Office in Central Kalimantan	Ms. Maulida Indira	Female	31
	Forest Area Planning Office, Region XXI Palangka Raya	Mr. Danang Gian C.N	Male	29



### 3.3. Training summary – Year 2

The training in Year 2 made no pre-judgments about the system that would be used to implement REDD+ in West Kalimantan. Through the progress of the project, we had been recognized the needs of the technical capacity developments for forest monitoring in West Kalimantan. Encouraging formulation of the technical team were especially needed for the future forest monitoring for REDD+ activities.

The trainees' daily needs for their works and their contribution for the project were major consideration during planning process of this training in Japan. The classes were planned to include some review of GIS techniques learned in the pre-training and to develop and acquire the medium level knowledge and techniques.

The theme of the training are overview of the REDD+ activities, composing land cover map using satellite image and measuring the forest biomass. Through the lectures and practices we intended to promote the communication of the lecturers and trainees and also between the trainees.

On the last day of training in Japan, the trainees gave presentations. This presentations and discussion became the opportunity of the communication between trainees deeply and also contributed to make concrete action plan.



Lecture: Visual interpretation & Digitizing Satellite Images



Lecture: Understanding Forest Carbon and Biomass



Lecture: Current trend in carbon monitoring for Peat land



Practice: Composing Land cover map in QGIS



Practice: Forest Carbon and Biomass calculation



Practice: Field trip around Mt. Fuji



Lecture: Measuring the Specter of land covers



Group discussion: Provincial action plan

Figure 9 Training in Japan (September 2015)

## Activity 1-3 Overview drivers of deforestation and forest degradation in West Kalimantan

### 1. Implementing methods

In the socio-economic survey for the four western districts of West Kalimantan Province, namely Mempawah, Kubu Raya, Kayong Utara and Ketapang, after chronologically analyzing the status of land use in each district, drivers of deforestation and forest degradation was identified. Then, the direction of reducing deforestation and forest degradation was provided by implementing countermeasures (Project Activities) against deforestation and forest degradation, and it was taken into consideration that they would be reflected in each district's FREL. Also FREL in national level is be taken into considered to select countermeasures (Project Activities) against deforestation and forest degradation and developing FREL in 4 districts in this study.

Correlation between the chronological changes and forest area gained from statistic information from 1995 to 2011, which is provided by West Kalimantan Province, was analyzed. Considering the result, it was decided to identify specific drivers of deforestation and forest degradation.



S. 46703.74/2

TABEL / Table : 5.1.1  
LUAS PADI, RATA-RATA PRODUKSI DAN PRODUKSI PADI SAWAH  
MENURUT KABUPATEN/KOTA  
Irrigated Area, Yield Rate and Production of Wetland Paddy by Regency/City  
2010

Kabupaten/Kota Regency/City	Luas Padi Irrigated Area (Ha)	Rata-rata Produksi Yield Rate (Kg/ha)	Produksi Production (Toni)
(1)	(2)	(3)	(4)
Kab. Sambas	81.183	33,36	287.649
Kab. Bengkayang	20.512	40,98	84.052
Kab. Landak	55.807	36,53	201.979
Kab. Puntianak	18.687	34,83	65.115
Kab. Sintang	16.031	36,05	58.187
Kab. Kutapang	10.608	34,57	36.740
Kab. Singau	20.355	33,86	68.948
Kab. Kapuas Hulu	5.529	31,34	17.274
Kab. Sekeloa	3.871	31,27	12.108
Kab. Melawi	4.690	31,50	14.764
Kab. Kayong Utara	19.888	34,48	68.594
Kab. Kubu Raya	53.771	34,19	183.851
Kota Pontianak	494	30,19	1.229
Kota Singkawang	8.048	33,49	26.854
Kalimantan Barat	2010	34,85	1.159.012
	2009	34,10	1.131.826
	2008	34,16	1.131.000
	2007	34,26	1.067.998
	2006	33,06	982.892

Left: Cover, Right: Example from the statistics (production from wetland paddy)

Figure 10 Statistics (Kalimantan Barat in Figures) issued by Central Bureau of Statistics, West Kalimantan Province (2011)

## 2. Progress in this period

### 2.1. Data processing

In January 2014, the statistics data (PDF version) from 1995 to 2011 provided by the Central Bureau of Statistics of West Kalimantan Province was put into a statistical software (primary processing). After that, additional statistics data in 2012 and 2013 was provided in August 2014 and putting into a statistical software (primary processing) had been done. From using results of primary processing, the correlation between land use (e.g. agriculture, plantation) and forest area, was identified (secondary processing) (Figure 11).

[illegible]

Figure 11 Factors related to land use and correlation between factors gained from statistical information



Fitting together with the result of the land-use survey in West Kalimantan, as drivers of deforestation, there was negative correlations with the increase of oil palm plantation, maize growing area, and the number of cattle, and that implies that the changes in land usage tends to affect on forest area. On the other hand, no correlation was seen between forest area (i.e. land conversion from forest to other land use) and the increase of large-scale rubber plantation, and buffalo. The large-scale rubber plantations in West Kalimantan Province are the mixed of native and non-native tree species in many cases so that it is assumed not being always a driver of deforestation, and buffalo does not require creating large grazing fields; therefore, it has not been a driver either.

Administrative reformation of West Kalimantan Province, dividing districts, was a concern to keep chronological consistency for processing statistic data. The districts of West Kalimantan had been intermittently divided, and in that context, the four districts, the target areas of this study, became independent (Table 9). Therefore, when process data of overall West Kalimantan as well as that of each district, it is necessary to handle statistical information carefully to keep consistency.

Table 9 History of administrative reformation of West Kalimantan Province

District/ City (as of 2014)	History of separation
Sambas District	Partly divided into Bengkayang District in 1990
Bengkayang District	Separated from Sambas District in 1999
Landak District	Separated from Sambas District in 1999
Pontianak District	Partly divided into Kubu Raya District in 2007
Sanggau District	No reformation has been done
Ketapang District	Partly divided into Kayong Utara in 2007
Sintang District	No reformation has been done
Kapuas Hulu District	No reformation has been done
Sekadau District	Separated from Sanggau District in 2003
Melawi District	Separated from Bengkayang District in 2003
Kayong Utara District	Separated from Ketapang District in 2007
Kubu Raya District	Separated from Pontianak District in 2007
Pontianak City	Statistical information was generated by together with Pontianak District
Singkawang City	Separated from Sambas District in 2001

Following Figure 12 and Figure 13 showed factors related to land use and correlation between factors gained from statistical information in 4 districts. From analysis, area expansion of oil palm (plantation) is quite a negative with forest area in each district.

	Forest	Non-forest	Total	Primary forest (inc. Sec-high)	Secondary forest	Population	Wetland Paddy	Dryland Paddy	Maize	Cassava	Oil Palm (large state)	Rubber (smallholders state)	Oil Palm (smallholders state)	Local Coconut (smallholders state)	Rubber (total)	Oil Palm (total)	Cattle	Buffalo	Pig	Sheep	Goat	Mobile	Forestry tax	Mining tax
Forest	1.00																							
Non-forest	-1.00	1.00																						
Total	-0.99	0.99	1.00																					
Primary forest (inc. Sec-high)	0.99	-0.99	-1.00	1.00																				
Secondary forest	1.00	-1.00	-0.99	0.99	1.00																			
Population	-0.83	0.83	0.86	-0.87	-0.82	1.00																		
Wetland Paddy	0.08	-0.08	-0.13	0.17	0.06	0.08	1.00																	
Dryland Paddy	0.62	-0.62	-0.68	0.69	0.61	-0.52	0.65	1.00																
Maize	-0.50	0.50	0.60	-0.57	-0.49	0.72	0.49	-0.03	1.00															
Cassava	0.70	-0.70	-0.74	0.74	0.69	-0.66	0.40	0.92	-0.15	1.00														
Oil Palm (large state)	-0.99	0.99	1.00	-1.00	-0.99	0.85	0.32	-0.34	0.62	-0.53	1.00													
Rubber (smallholders state)	0.72	-0.72	-0.71	0.67	0.73	-0.20	-0.47	-0.26	-0.22	-0.07	-0.47	1.00												
Oil Palm (smallholders state)	-0.76	0.76	0.78	-0.82	-0.75	0.60	0.44	-0.42	0.40	-0.49	0.83	-0.04	1.00											
Local Coconut (smallholders state)	-0.69	0.69	0.75	-0.75	-0.68	0.79	-0.30	-0.87	0.40	-0.93	0.57	0.03	0.49	1.00										
Rubber (total)	0.72	-0.72	-0.71	0.67	0.73	-0.20	-0.47	-0.26	-0.22	-0.07	-0.47	1.00	-0.04	0.03	1.00									
Oil Palm (total)	-0.92	0.92	0.88	-0.91	-0.92	0.78	0.23	-0.34	0.46	-0.51	1.00	-0.26	0.88	0.51	-0.09	1.00								
Cattle	-0.88	0.88	0.84	-0.82	-0.88	0.77	0.65	0.01	0.73	-0.29	0.80	-0.50	0.49	0.42	-0.50	0.71	1.00							
Buffalo	0.58	-0.58	-0.66	0.65	0.57	-0.56	0.26	0.66	-0.21	0.72	-0.49	0.09	-0.22	-0.63	0.09	-0.36	-0.24	1.00						
Pig	-0.87	0.87	0.86	-0.83	-0.87	0.75	0.52	-0.16	0.62	-0.45	0.86	-0.52	0.51	0.48	-0.52	0.72	0.89	-0.59	1.00					
Sheep	-0.40	0.40	0.44	-0.42	-0.40	0.77	0.29	-0.33	0.61	-0.59	0.67	-0.22	0.30	0.62	-0.22	0.52	0.76	-0.69	0.89	1.00				
Goat	-0.76	0.76	0.72	-0.69	-0.77	0.66	0.74	0.07	0.66	-0.26	0.77	-0.51	0.53	0.34	-0.51	0.67	0.97	-0.25	0.91	0.78	1.00			
Mobile	-0.71	0.71	0.75	-0.75	-0.70	0.67	0.32	-0.27	0.71	-0.34	0.79	-0.17	0.85	0.46	-0.17	0.74	0.59	-0.36	0.60	0.41	0.60	1.00		
Forestry tax	0.03	-0.03	-0.16	0.16	0.01	0.03	0.67	0.64	0.13	0.41	0.13	-0.47	0.06	-0.37	-0.47	0.17	0.53	0.54	0.33	0.09	0.52	-0.20	1.00	
Mining tax	0.18	-0.18	-0.15	0.17	0.19	0.48	0.17	-0.25	0.52	-0.39	0.24	0.16	-0.02	0.52	0.16	0.14	0.45	-0.18	0.34	0.67	0.42	0.09	0.08	1.00

Figure 12 Factors related to land use and correlation between factors gained from statistical information in Pontianak and Kubu raya

	Forest	Non-forest	Total	Primary forest (inc. Sec-high)	Secondary forest	Population	Wetland Paddy	Dryland Paddy	Maize	Cassava	Oil Palm (large state)	Rubber (smallholders state)	Oil Palm (smallholders state)	Local Coconut (smallholders state)	Rubber (total)	Oil Palm (total)	Cattle	Buffalo	Pig	Sheep	Goat	Mobile	Forestry tax	Mining tax
Forest	1.00																							
Non-forest	-1.00	1.00																						
Total	-1.00	1.00	1.00																					
Primary forest (inc. Sec-high)	1.00	-1.00	-1.00	1.00																				
Secondary forest	1.00	-1.00	-1.00	1.00	1.00																			
Population	-0.95	0.95	0.96	-0.95	-0.94	1.00																		
Wetland Paddy	-0.85	0.85	0.87	-0.86	-0.83	0.67	1.00																	
Dryland Paddy	0.44	-0.44	-0.42	0.45	0.44	-0.57	-0.20	1.00																
Maize	0.34	-0.34	-0.35	0.35	0.34	-0.30	-0.40	0.25	1.00															
Cassava	0.64	-0.64	-0.69	0.66	0.63	-0.70	-0.56	0.11	0.20	1.00														
Oil Palm (large state)	-0.97	0.97	0.97	-0.97	-0.97	0.80	0.73	-0.65	-0.27	-0.37	1.00													
Rubber (smallholders state)	-0.88	0.88	0.86	-0.87	-0.90	0.58	0.56	-0.35	-0.17	-0.27	0.74	1.00												
Oil Palm (smallholders state)	-0.91	0.91	0.89	-0.90	-0.92	0.66	0.67	-0.32	-0.27	-0.33	0.80	0.98	1.00											
Local Coconut (smallholders state)	-0.70	0.70	0.73	-0.71	-0.68	0.60	0.66	0.01	-0.39	-0.73	0.53	0.32	0.47	1.00										
Rubber (total)	-0.88	0.88	0.86	-0.87	-0.90	0.58	0.56	-0.35	-0.17	-0.27	0.74	1.00	0.98	0.32	1.00									
Oil Palm (total)	-0.98	0.98	0.97	-0.97	-0.98	0.80	0.74	-0.60	-0.28	-0.37	0.99	0.83	0.88	0.54	0.83	1.00								
Cattle	-0.96	0.96	0.95	-0.95	-0.97	0.79	0.73	-0.56	-0.29	-0.32	0.97	0.85	0.91	0.51	0.85	0.99	1.00							
Buffalo	-0.85	0.85	0.82	-0.83	-0.86	0.68	0.69	-0.47	-0.30	-0.15	0.85	0.76	0.83	0.39	0.76	0.88	0.93	1.00						
Pig	-0.68	0.68	0.72	-0.70	-0.67	0.59	0.72	0.03	-0.42	-0.62	0.58	0.27	0.44	0.92	0.27	0.56	0.53	0.46	1.00					
Sheep	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.00				
Goat	-0.98	0.98	0.97	-0.98	-0.98	0.77	0.73	-0.60	-0.30	-0.36	0.99	0.74	0.81	0.58	0.74	0.99	0.96	0.85	0.62	#####	1.00			
Mobile	-0.43	0.43	0.43	-0.42	-0.45	0.30	0.46	0.20	-0.68	-0.40	0.27	0.37	0.47	0.54	0.37	0.33	0.37	0.39	0.55	#####	0.34	1.00		
Forestry tax	-0.60	0.60	0.62	-0.60	-0.60	0.50	0.15	-0.37	-0.16	-0.23	0.22	0.21	0.21	0.04	0.21	0.22	0.28	0.36	0.01	#####	0.14	-0.32	1.00	
Mining tax	-0.21	0.21	0.27	-0.24	-0.18	0.46	0.64	-0.12	-0.41	-0.47	0.46	-0.09	0.08	0.75	-0.09	0.39	0.33	0.28	0.82	#####	0.50	0.30	-0.08	1.00

Figure 13 Factors related to land use and correlation between factors gained from statistical information in Kayon utara and Ketapang

## 2.2. Compiling statistic information

This study eventually attempts to establish FREL for the province; however, following two ways are suggested to set FREL for districts. That is to allocate from provincial level based on: 1) indicators such as the area of each district (characteristics of districts are not considered) (Figure 14, left) or 2) characteristics of each districts (Figure 14, right). Taking into account the circumstance of international or Indonesian REDD+ implementation, the way 2) is considered appropriate but it will be explored further to determine the direction of outputs with due consideration of international and national REDD+ trends.

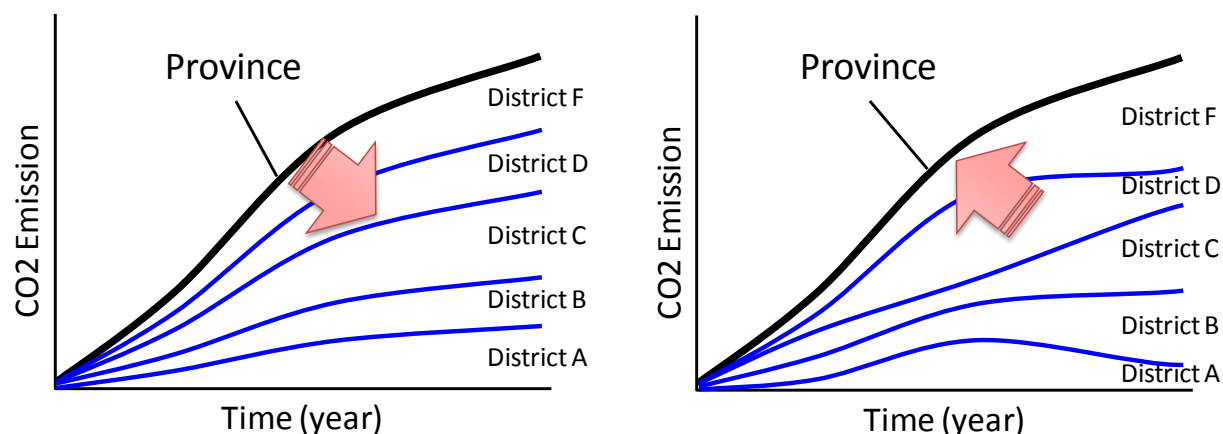


Figure 14 Two ways to establish FREL

It was inferred from establishing a district FREL in accordance with district borders of 2014 that drivers of deforestation and forest degradation of the districts separated from the same district, Pontianak District and Kubu Raya District for example, would be the same or similar. For this reason, the way of establishing FREL are not necessarily to be limited to setting for each district individually based on the way 2), and the other way, to set a FREL for multiple districts and allocate it to each districts depends on their total area.

## 2.3. Parameters applied into FREL

Based on above Table 9, it was thought that forest area and drivers of deforestation and forest degradation will be not depend on liner regression because 4 districts had unique background of establishment. In this study, 4 districts were integrated into 2 groups, which had similar statistical land use change and human activities in Primary forests and Secondary forests. Also identification of drivers of deforestation and forest degradation was analyzed by comparison among 2 groups (Figure 15).

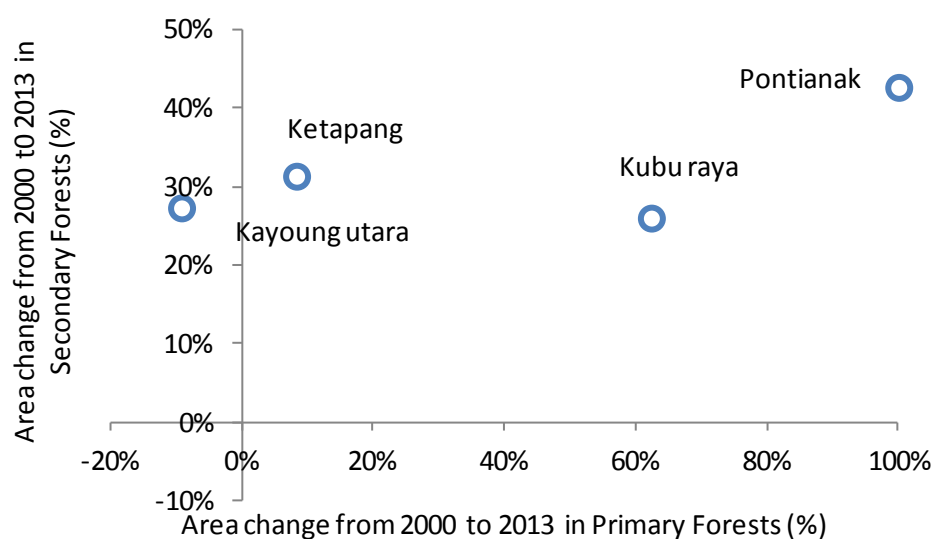


Figure 15 Area change in Primary forests and Secondary forests in each district

From analysis in 2 groups, there was not obvious difference of historical forest area change among 4 districts. On the other hand, Primary forest in Pontianak and Kubu Raya had been high pressures and had experiences of big decrease. Also Kayong Utara and Ketapang had difference experiences, which had small decrease in Primary forests and still keep high ratio of Primary forests even in 2013.

Therefore it indicated that total forest area change in 4 districts had not much difference (flow is not difference), but forest carbon stock in Pontianak and Kubu Raya had specific characteristics by comparison with Kayong Utara and Ketapang (stock is high). Then groups are classified by 1) Pontianak and Kubu Raya and 2) Kayong Utara and Ketapang and such grouping was supported by following reasons;

Pontianak and Kubu Raya, and Kayong Utara and Ketapang were separated into 4 districts in year 2007. It means 4 districts in 2015 were statistically merged into 2 groups from 2000 to current year with keeping consistency of socio-economic statistics.

National FREL which is on progress by Indonesian Central Government applied data from 2000. Therefore, FREL and/or some related activities (i.e. socio-economic survey) should be keep historical consistency with such national activities. If this study uses data from year 2000, analysis and/or results will keep consistency with all of activities of REDD+ activities in Central level.

From now, drivers' analysis of deforestation and forest degradation should be based n 2 groups and future analysis will be according to some statistics approaches.

## Activity 1-4 Collect data on historical/future land use and carbon stock at the district level

### 1. Collected GIS data for map production

The related information for 4 districts - Mempawah, Kubu Raya, Kayong Utara and Ketapang - were collected. The following maps had corrected and summary of major maps were described in Table 10. List of satellite imagery is in Activity 1-4.

Peta Kawasan Hutan and Peta Indikatif Penundaan Pemberian Izin Baru give important information about forest usage and its management. These maps are utilized as basemap for identifying REDD+ suitable sites in targeted area.

Land cover change by developing oilpalm plantation was expected important factor in West Kalimantan. To assure the consistency of produced land cover map, digitized oilpalm plantation map by provincial plantation agency was introduced and integrated. And ground truth data by state forest consolidation office were also introduced to improve accuracy of the produced land cover map.

Table 10 List of collected GIS data

1	Name of data	Peta Rupa Bumi Indonesia <sup>2</sup>
	Provider	BIG (Badan Informasi Geospasial) Note: Badan Koordinasi Survei dan Pemetaan Nasional provided until 2011.
	Format	ESRI shp files
	Published year	2008 (Latest map data is 2008 and is not scheduled to renew until 2013.)
	General description	These maps are usually called as RBI. Each dataset contains ESRI shape files which indicate seven themes (Land covers, Water bodies, Elevation/Contours, Artificial objects, Traffic networks, Administration boundaries and Legends.) that can be available for GIS.
2	Name of data	Peta “Kawasan Hutan” (Map for jurisdictional forested area of MoEF) - SK.733/Menhut-II/2014 - SK.936/Menhut-II/2013 - SK259 /Kpts-11/2000
	Provider	MoEF, the Department of forest planning (Badan Planologi Kehutanan, Menteri Lingkunganhidup dan Kehutanan)
	Format	ESRI shp files
	Published year	2000, 2013 and 2014
	General description	This map legitimates zoning of jurisdictional forested area called “Kawasan Hutan” by the MoEF, Indonesia. The border of national is in this data set.
3	Name of data	Peta Penutupan Lahan (Land Cover Map of Indonesia)
	Provider	The MoEF, the Department of forest planning (Badan Planologi Kehutanan, Mentri Kehutanan)
	Format	KML files for Google Earth (2006, 2009, 2011) and JPG image for year 2012
	Published year	2006, 2009, 2011 and 2012

<sup>2</sup> As mentioned above, for example, the administrative borders or coast-lines are not updated. RBI was not utilized in this project.

	General description	This map is updated every 3 years. LANDSAT7 and SPOT4 satellite images are processed to create this map, and forest cover change in Indonesia is analyzed and calculated by using this map.
4	Name of data	Peta Indikatif Penundaan Pemberian Izin Baru (Indicative Map for Moratorium)
	Provider	UKP4, MoEF
	Format	ESRI shp files,
	Published year	Version 5, 6, 7, 9. Ver. 5 was used. (updated every 6 months)
	General description	This map, so-called “PIPIB”, is regularly updated at 6-month interval. The dataset can be downloaded from the MoEF's web GIS site. This dataset shows the Moratorium area which the government suspends to newly issue land-use concession in “Primary natural forest and Peatlands”.
5	Name of data	Administrative border of West Kalimantan province for Local Ordinance of Spatial Plan
	Provider	BAPPEDA
	Format	ESRI shp files
	Published year	2014
	General description	This GIS data includes administrative border of the province, districts, and sub-districts for RTRWP..
6	Name of data	Digitized Oilpalm land cover map in West Kalimantan
	Provider	Provincial Plantation agency of West Kalimantan
	Format	ESRI shp files
	Published year	2014
	General description	This map is visual interpreted and delineated by a lead technician works in the Dinas Perkebunan who supports Pokja REDD+ in West Kalimantan..
7	Name of data	Ground Check survey result around Maya Island in Kayong Utara district
	Provider	A BPKH staff.
	Format	ESRI shp files
	Published year	2013
	General description	This data provided by a BPKH staff who has experiences around Maya Island in Kayong Utara district. And includes the result of field observation of land cover.
8	Name of data	RBI data especially "Settlement" around Maya Island in Kayong Utara district
	Provider	A Forest agency staff
	Format	ESRI shp files
	Published year	2008
	General description	This data was provided by a staff working in Dinas Kehutanan Prop. Kalimantan Barat who has corporative relationship with Pokja REDD+ in West Kalimantan.

## 2. Collecting related documents

In case of implementing REDD+ activities and MRV system in Indonesia, there are several important documents that is, “RAD-GRK”, ”SRAP” and “National Forest Reference Emission Level For Deforestation And Forest Degradation”. The background and detail of these documents are described in

“Chapter 2 Output 1 Activity 1-6 1.”

Relating with map development, the land cover class is defined in “SNI 7645-2010 Klasifikasi penutup lahan” (Indonesian standard for classification of land covers). The detail standards for cartography is defined in “SNI 6502.3-2010 Spesifikasi penyajian peta rupa bumi 50.000” and so on.

“Monograph Allometric Models for Estimating Tree Biomass at Various Forest Ecosystem Types in Indonesia” composed by Forestry Development and Research Agency in 2012 was great effort to review the bunch of existing knowledge of emission factor and forest biomass in Indonesia. Table 11 is a list of collected documents.

Table 11 List of Collected documents for mapping

1	Name of data	National Forest Reference Emission Level For Deforestation And Forest Degradation
	Provider	MoEF
	Format	PDF
	Published year	2015
2	Name of data	Draft RAD-GRK, Forestry and Peat Soil Sector West Kalimantan Province (Regional Green House Emission Reduction Action Plan, English translation)
	Provider	West Kalimantan Province
	Format	PDF
	Published year	Acquired in 2013.
3	Name of data	REDD+ Strategy and action plan of West Kalimantan province (SRAP)
	Provider	SRAP Authors Team
	Format	PDF (translated)
	Published year	2014
4	Name of data	Monograph Allometric Models for Estimating Tree Biomass at Various Forest Ecosystem Types in Indonesia
	Provider	FORDA, MoEF
	Format	PDF
	Published year	2012
5	Name of data	Executive Summary extracted from The Remote Sensing Monitoring Program of Indonesia's National Carbon Accounting System: Methodology and Products
	Provider	LAPAN
	Format	PDF
	Published year	2014
6	Name of data	SNI 7645-2010 Klasifikasi penutup lahan
	Provider	BSN
	Format	PDF
	Published year	2010
7	Name of data	PERATURAN DIREKTUR JENDERAL PLANOLOGI KEHUTANAN Nomor:P.3/VII-IPSDH/2014 TENTANG PETUNJUK TEKNIS PENGAMBARAN DAN PENYAJIAN PETA KEHUTANAN



	Provider	MoEF
	Format	PDF
	Published year	2014
	Other notes	This document was used to determine the legends of maps.
8	Name of data	SNI 6502.3-2010 Spesifikasi penyajian peta rupa bumi 50.000
	Provider	BPN
	Format	PDF
	Published year	2010
	Other notes	This document was used to determine the legends of maps.

### 3. Interviews regarding maps and geographic information

Interviews regarding existing methodology to determine FREL and data related to forest dynamics and disturbance were conducted. Persons, organizations, date and contents were shown in Table 12.

Table 12 Interview with stakeholders related to emission factors and developing land cover map

Stakeholder /organization	Date	Summary
Mr. Fahmuddin Agus /Indonesian Soil Research Institute	Oct 16 <sup>th</sup> , 2013	Carbon stock in peat swamps
Prof. Rizardi/ Bogor Agricultural University	Oct 16 <sup>th</sup> , 2013	RL is being studied with UKP4 and BAPENASS (RAD-GRK). National RL has not been developed.
Mr. Yuyu Rahayu/ Forest Inventory and Monitoring, Ministry of Forestry (MoF)	Oct 17 <sup>th</sup> , 2013	The land cover map is created every 3 years. Deforestation is easy to be detected. But detecting forest degradation is difficult.
Mr. Yudi, Mr. Ibrahim Sumardi, MS. Rahmi Ananta, Mr. Faisal, Mr. Nendra/GPNP office	Oct 17 <sup>th</sup> , 2013	The land cover map is created according to national definition. RIAP in Bogor makes it.
Mr. Bing bing, Mr. Aan/Dinas Kehutanan , Keb. Kayong Utara	Oct 17 <sup>th</sup> , 2013	Land cover mapping was conducted in cooperation with BAPEDA for Kayong Utara. Detailed map was created by the district office. Land cover maps of 2003-2008 were created every year using LANDSAT.
Mr. Harunoo/ Dinas Kehutanan, Ketapang	Oct 18 <sup>th</sup> , 2013	Land use data are available in PU (Pakarati Umuf).
Aljosja Hooijer /Deltares	Oct 25 <sup>th</sup> , 2013	Regarding the monitoring method of peat swamps, the emission from peat swamps, the distribution map and so on.
Ms. Siti Chandidjah Kaniawati/BKSDA (Nature Resource and Conservation)	Oct 28 <sup>th</sup> , 2013	BKSDA is in charge of HK except national parks.
Prof. Gusti Anshari, Mr. IMAN/ Tanjungpura University	Oct 29 <sup>th</sup> , 2013	Regarding peat swamps distribution maps, the national map and Wetlands International map are useful. Methodology of estimating carbon stock in peat swamps.
Mr. Indra/Dinas Kehutanan	Oct 30 <sup>th</sup> , 2013	Current situation of product forests

Stakeholder /organization	Date	Summary
Mr. Yopie, Ms. Handayani, Mr.Ahmad, BPKH	Oct 30 <sup>th</sup> , 2013	Land cover types in the West Kalimantan Province, the publication year, classification methodology.
Mr. Hendarto /Dinas Perkubunan, Prop. Karbar	Oct 30 <sup>th</sup> , 2013	Explanation regarding creating maps in the RAD-GRK. Results are modified to match the statistic value. Modifying maps provided from BPKH.
Ms. Yuslinda / BAPPEDA	Nov 1 <sup>st</sup> , 2013	Requesting GIS data controlled such as administrative districts and road.
Ms. Anna Tosiani / PLANOLOGI, MoEF	Mar 3 <sup>rd</sup> , 2014	Emission factors are derived from NFI. Land cover maps used in the RAD-GRK were published by the MoF. Maps created in INCAS project.
Mr. Arief Darmawan / President's Delivery Unit for Development Monitoring and Oversight	Mar 3 <sup>rd</sup> , 2014	The peat swamps distribution map created by the Agriculture Institution (2011) is higher accuracy, although Wetlands International is enough.

The flow of creating land cover maps and its usage were summarized based on the interviews and showed in Figure 16. Firstly, BPKH (Balai Pemantapan Kawasan Hutan), the Agency for Forestry Area Consolidation, of each province modifies the first version of maps provided by the MoEF. Then once the MoEF consolidates these maps into one, the finalized map is used by BPKH and local government of each province, and utilized for the RAD-GRK.

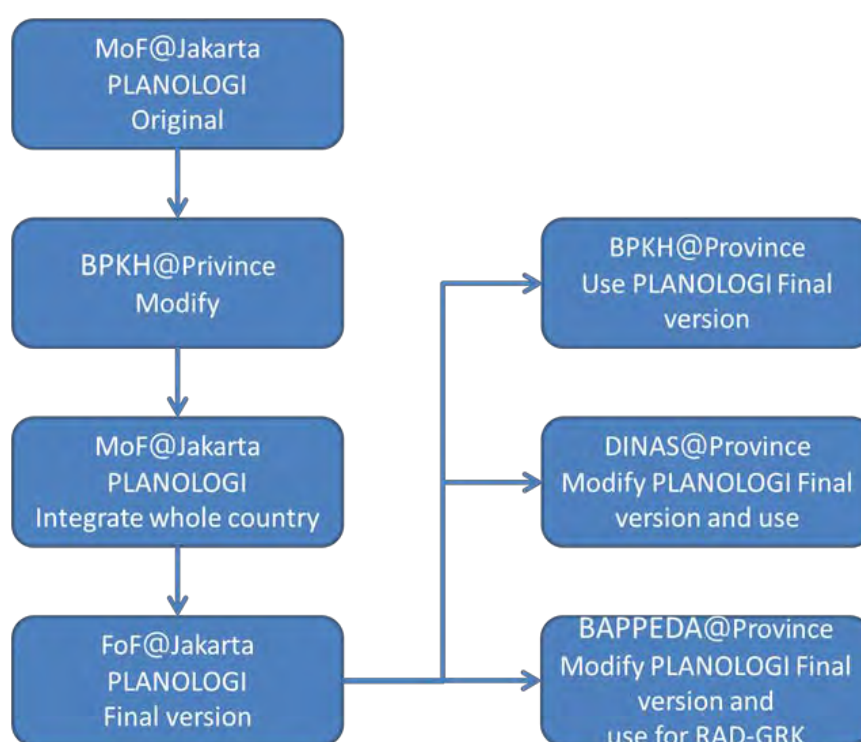


Figure 16 Land cover map usage system between the central and local governments

Interview for methodology and data of land cover map developed by the Ministry of Forestry (at that time) was conducted for the person in charge of the Map developing in BPKH. Results of interview was the following;

[2.2. Land cover map by interpretation, BPKH developing]

Land-cover map prepared by the BPKH is as follows;

Minimum polygon area: 100 ha

It is not published version. Published map follows SK. This means that it is forest if SK shows forest area, nevertheless truth is non-forest.

The ground truth of the BPKH interpretation map was not conducted if budget is not enough.

Interpretation flow:

- (i) PLANOGI, the Ministry of Forestry, prepare base version
- (ii) Modification by BPKH\*\*
- (iii) Checking by PLANOGI
- (iv) Ground truth by BPKH (not conducted if budgets is not enough)
- (v) Reporting by BPKH (not conducted if budgets is not enough)
- (vi) Final map

\*\* Editing of polygon: it is not conducted basically because of cost.

“Mix agriculture” should be described as “Mix agriculture and shrub” based on Indonesian.

Wet and dry land are separated on Agriculture area. Wetland agriculture is classified as “Swamp”

Note: SK733: It was announced on Sept 2014 that latest SK will be published.

Methodology to get digital map and contents of maps is as follows;

The digital base map can be acquired submitting a letter to Kepala BPKH for four districts. These are not included in report book. Hard copy also exists.

Contents are the following,

- (i) The spread of oil palm plantation (include future plan)
- (ii) The spread of mining area
- (iii) Forest boundary
- (iv) Land cover (LANDSAT 2012)

Timber product utilization permission (IUPHHK-HT-HA)

## Activity 1-5 Calculate provincial RL/REL.

### 1. Developing base map for activity data

#### 1.1. Basic concept of methodology

REDD+ base mapping in this REDD+ Planning Study applied a hybrid approach combining automated digital segmentation and/or classification with visual interpretation. Visual scene to scene interpretation of forest area change can be simple and robust, although it is a time-consuming process. A combination of automated segmentation and classification with visual interpretation can reduce the work load. And visual inspection of the result by analysts familiar with the region was carried out to ensure appropriate interpretation. These inspections and consultation were also conducted together with provincial or local experts. Base mapping process is shown in Figure 17. Detail methodology is described in Supplemental Document 2 “Report of Developing REDD+ Base Map” which targeted four Districts and Gunung Palung National Park (GPNP) and its Landscape.

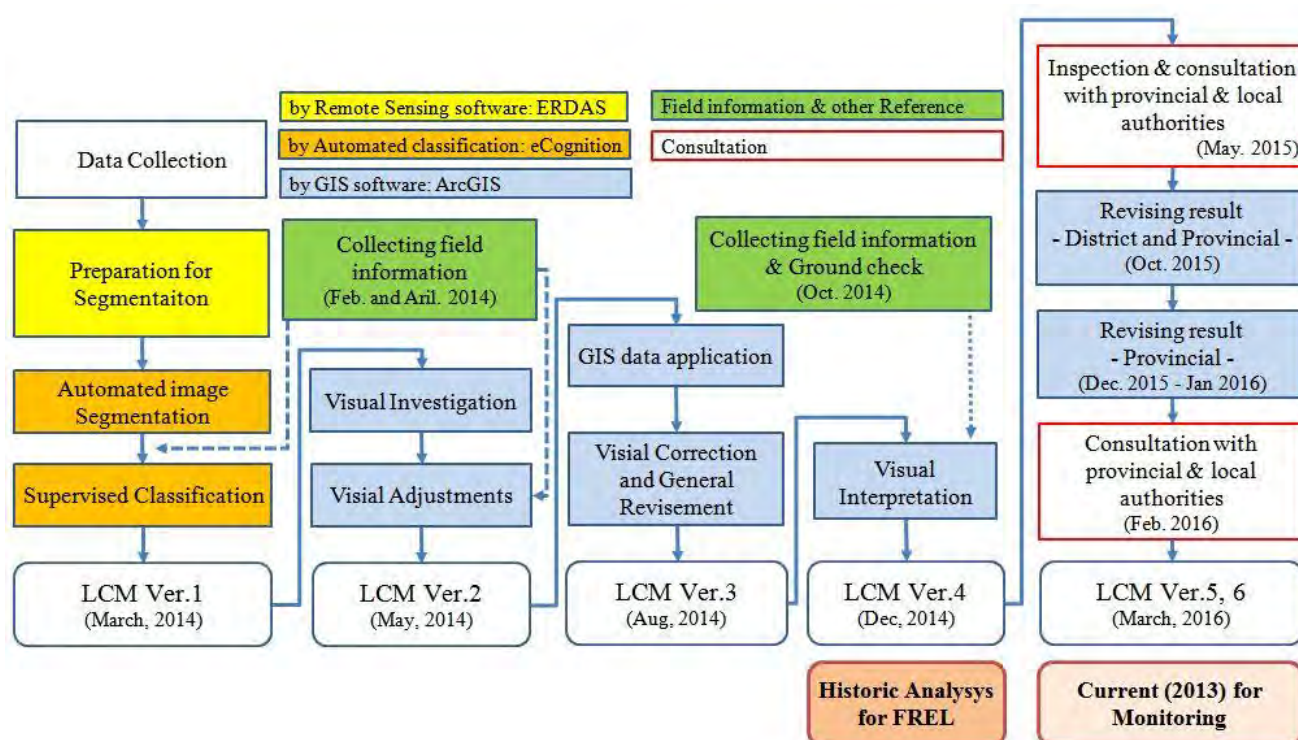


Figure 17 Flowchart of processing land cover map (LCM)

Historic analysis on land cover change and forest dynamics was conducted using LCM Version 4. LCM Version 4 of 2013 was further enhanced for preparing base maps. In order to enable future forest monitoring in West Kalimantan Province, the inputs and information collected at the consultation meeting on October 26-27, 2015 with provincial and district technical stakeholders - including the

information on oil palm plantation distribution of provincial crop estate office - was introduced to produce LCM Ver. 5. LCM Ver. 5 was finalized based on the consultation with provincial stakeholders as LCM Version 6.

## 1.2. Satellite imagery used

The 5-year LANDSAT imageries (2000, 2006, 2009, 2011 and 2013) were used to develop LCM of four districts in West Kalimantan. Table 13 shows LANDSAT imageries used. And SPOT6 higher resolution satellite imageries also utilized to improve the classification around GPNP and its Landscape.

Table 13 List of LANDSAT imageries for producing LCM

2000		2006		2009		2011		2013	
File name	Source	File name	Source	File name	Source	File name	Source	File name	Source
LE71200602001134SGS00	USGS	LT51200602006268BKT00	USGS	MOSAİK_2009_NUT M49 N01	INCAS-L APAN	MOSAİK_2011_NU TM49 N01	INCAS-L APAN	LC81200602013175LGN00	USGS
LE71200612001134SGS00	USGS	LT51200612006268BKT00	USGS	MOSAİK_2009_NUT M49 S01	INCAS-L APAN	MOSAİK_2011_NU TM49 S01	INCAS-L APAN	LC81200612013175LGN00	USGS
LE71200622001134SGS00	USGS	LT51200622006268BKT00	USGS	MOSAİK_2009_NUT M49 S02	INCAS-L APAN	MOSAİK_2011_NU TM49 S02	INCAS-L APAN	LC81200622013175LGN00	USGS
LE71210602001173SGS00	USGS	LT51210602005224BKT00	USGS	MOSAİK_2009_NUT M49 S05	INCAS-L APAN	MOSAİK_2011_NU TM49 S05	INCAS-L APAN	LC81210602013166LGN00	USGS
LE71210612001173SGS00	USGS	LT51210612005224BKT00	USGS					LC81210612013166LGN00	USGS
LE71210622001173SGS00	USGS	LT51210622005224BKT00	USGS					LC81210622013150LGN00	USGS

## 1.3. Land cover classes

Indonesian National Standard (Standar Nasional Indonesia) named “SNI 7645:2010 Klasifikasi penutup lahan” defines land cover classes for Indonesia. This standard refers to the land cover classification system by FAO (LCCS-UNFAO) and “ISO 19144-1 Geographic information – Classification Systems – Part 1: Classification system structure”. Based on these documents, it was modified and developed for especially Indonesia. Land cover map (LCM) produced by project is based on this standard. 23 land cover class of MoEF was referred to and modified as like Table 14.

Table 14 Land cover class applied

No.	Ministry of Environment and Forestry		No.	IJ-REDD+
1	Hutan lahan kering primer	Primary dry forest	1	Primary dry forest
2	Hutan lahan kering sekunder	Secondary dry forest	2	Secondary dry forest
3	Hutan rawa primer	Primary swamp forest	3	Primary swamp forest
4	Hutan rawa sekunder	Secondary swamp forest	4	Secondary swamp forest
5	Hutan mangrove primer	Primary mangrove forest	5	Primary mangrove forest
6	Hutan mangrove sekunder	Secondary mangrove forest	6	Secondary mangrove forest
7	Semak belukar	Shrub	7	Shrub
8	Semak belukar rawa	Swamp shrub	8	Swamp shrub
9	Hutan tamanan	Forest plantation	9	Forest plantation
10	Perkebunan	Plantation/Estate crops	10	Plantation oilpalm
			11	Plantation rubber
			12	Plantation others
11	Permukiman	Settlements	13	Settlements

No.	Ministry of Environment and Forestry		No.	IJ-REDD+
12	Tanah terbuka	Open ground	14	Open ground
13	Savana	Grassland	15	Grassland
14	Air	Water	16	Water
15	Pertanian lahan kering	Dry land agriculture	17	Agriculture
16	Pertanian lahan kering campur semak	Dry agriculture mixed with shrub	18	Mixed agriculture
17	Sawah	Rice field	19	Rice field
18	Tambak	Fishponds	20	Fishponds
19	Bandara/Pelabuhan	Airport/Port		(merged with Settlements)
20	Transmigrasi	Transmigration area		(merged with Settlements)
21	Pertambangan	Mining area	21	Mining
22	Rawa	Swamps	22	Swamps
23	Awan	Clouds	23	Clouds
			24	Cloud shadows

## 2. Activities for developing peat distribution map

### 2.1. Collecting spatial data and maps for improving peatland maps

Peatland covers about 20 percent of the study area (Wetlands International, 2004; Ritung et al., 2011). Recent developments of industrial forest plantations and conversion to agricultural land have caused rapid disappearance of peat. Moreover, huge amount of carbon dioxide emissions has been accelerated from dried peat which was formed by intensive canal constructions and decreasing ground water table. Although total amount of carbon dioxide emission from peat is needed to calculate, there is an uncertainty of accuracy of existing peatland map because of the difficulty of the access to the peatland. In this situation, collecting spatial data, maps and interviews to experts were carried out for improving existing peatland maps.

Ministry of Agriculture and Ministry of Public Works developed peatland maps at 1/250,000 scale based on the field surveys that had been conducted since 1970s (e.g. RePPProT<sup>3</sup>, 1990). Wetlands International developed revised peatland distribution maps for Sumatera, Kalimantan and Papua with new field survey data during 2003-2006 and they have been widely used in Indonesia. Meanwhile, Ministry of Agriculture has developed the latest peatland distribution map of Indonesia (Ritung et al., 2011) using all available data collected during 1989-2011. It was authorized by Indonesian Government as a national peatland map of Indonesia in 2014.

As two peatland maps have been used widely in Indonesia, those maps were used as base map for improving accuracy of existing peatland distribution maps. The peatland map of Kalimantan Island including West Kalimantan was developed by Wetlands International in 2004 (hereinafter called WI (2004)). General information of the two maps are as follows;

<sup>3</sup> World Bank-funded Regional Physical Planning Program for Transmigration (RePPProT, 1990)



Table 15 General information of the two maps

Name of map	General description
Peta Lahan Gambut Indonesia (Skala 1:250,000) Edisi Desember 2011	<p>Provider : Ministry of Agriculture(Kementerian Pertanian, Badan Penelitian dan Pengembangan Pertanian, BBSDLP (Balai Besar Penelitian dan Pengembangan Sumberdaya Lahan Pertanian)</p> <p>Published year/data format: Dec.2011/ PDF format</p> <ul style="list-style-type: none"> <li>•Purpose is to be applied to moratorium map which is instructed by Perpes (10/2011). Peatland distribution map using available data collected during 1989-2011.</li> <li>•Determining the various data topo sheets at 1:250,000 scale, topographic map (BIG),1:250,000 geological map(Ministry of Mine and Energy), 1/250,000 soil map (LREP:Land Resources Evaluation Project), 1/100,000 soil map (PLG:Pengembangan Lahan Gambut/1 million hectares project in Kalteng), Landsat-7/ETM+</li> <li>•Different peat depth with five colors (D0:&lt;50cm, D1:50-100cm, D2:100-200cm, D3:200-300cm, D4&gt;=300cm).</li> </ul>
Maps of peatland distribution and carbon content in Sumatra, Kalimantan and Papua (2003, 2004, 2006)	<p>Provider : Wetlands International</p> <p>Published Year/ data format: 2003(Sumatera), 2004 (Kalimantan), 2006 (Papua)/ ESRI shape format</p> <ul style="list-style-type: none"> <li>•Different peat depth with six colors (H0:&lt;50cm, H1:50-100cm, H2:100-200cm, H3:200-400cm, H4:400-800cm, H5:800-1200cm) .</li> </ul>

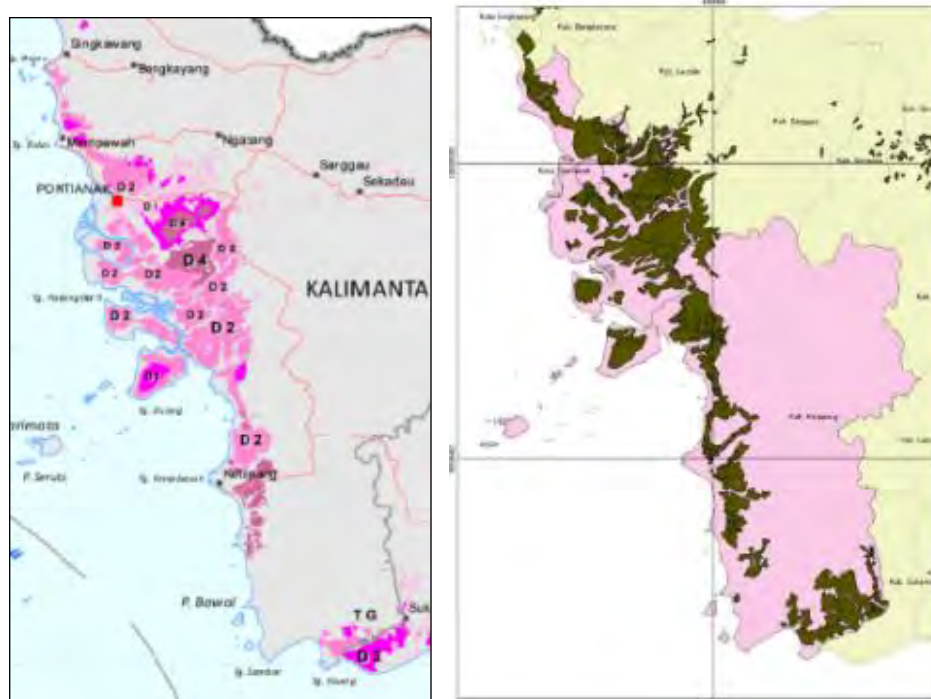


Figure 18 Peatland distribution Map (Left : Ritung et al (2011),Right : Wetlands International (2004))

## 2.2. Interview with the experts regarding peatland distribution maps

Interviews with experts were conducted to discuss the method and accuracy of existing peatland distribution map (Table 16).

Table 16 Summary of the interview survey

Name of expert/organization	Date	Content of the interview
Dr.Gusti Anshari/UNTAN	Feb 24 <sup>th</sup> , 2014	The peatland map of WI (2004) is not correct, especially at Rasau Jaya area. Field verification survey should be conducted
Mr. Nyoman/Wetlands International	May 16 <sup>th</sup> , 2014	Accuracy of WI (2004) may not be high especially for West Kalimantan due to the lack of data.
Dr. Kusumo Nuguroho/Ministry of Agriculture,BBSDLP	July 11 <sup>th</sup> , 2014	Discussion of the map integrated by Ritung et al. (2011)
Mr. NyomanWetlands International	July 11 <sup>th</sup> , 2014	Peatland distribution in the part of Jambi and Central Kalimantan were improved by the latest field survey data.
Mr. Kusumo Nuguroho/Ministry of Agriculture,BBSDLP	Sept 19 <sup>th</sup> , 2014	Peatland map of Ritung et al (2011) was authorized by Indonesian government as a national peatland map in Indonesia.

Following is a process of peatland map integration of Ritung et al (2011). However, the type and observation date of the satellite images were not specified as well as scale and reference source in the topographic map, geologic map and the existing research data.

### 【Process of peatland map integration of Ritung et al (2011)】

- 1) Review of basic peatland information
  - i) RePPPRoT, 1989 (All Indonesia)
  - ii) Soil Map Merauke-Digul-Tanah Merah, 1985-1986
  - iii) Land Resources / Land Sumatra (LREP-I), 1989/4
  - iv) Map of the Land exploration Indonesia (Puslitanak, 2000)
  - v) Potential Map of land for oil palm, Sumatra and Kalimantan, 2009
  - vi) Soil Map of Borneo 1998-2009
  - vii) Peat Wetland Map Intern Program (2004 & 2005)
- 2) Review of land resources information DB
- 3) Review of satellite data, geologic map and topographic map
- 4) Review of existing research data



- 5) Review of Riau, Jambi, Aceh, South Sumatra (2007-2010)GHG/peatland map
- 6) Review of land use map in Borneo (2010-2011)
- 7) Review of land use map in Papua/ West Papua
- 8) Review of Papua/ West Papua Agro Ecological Zone (AEZ) map
- 9) Review of survey in Mamberamo (2005)

### 2.3. Improvement of accuracy of peatland map

Accuracy of peatland distribution map is generally depending on the availability of the data sets. Satellite image is expected to contribute for improvement of accuracy. As development and canal construction have been made intensively in peat swamp forests since the 1990s, characteristics of peat swamp forest can be recognized on the satellite images before 1990s. In addition, digital surface elevation data which was taken in 2000 is available. Furthermore, by utilizing the polarization of the microwave such as PALSAR, distribution of peat swamp forest is suggested by unique signals of different scatter mechanism. Therefore, it is important to conduct field survey at the areas where available data is scarce and characteristics of peat swamp forests are clearly indicated in DEM and satellite image.

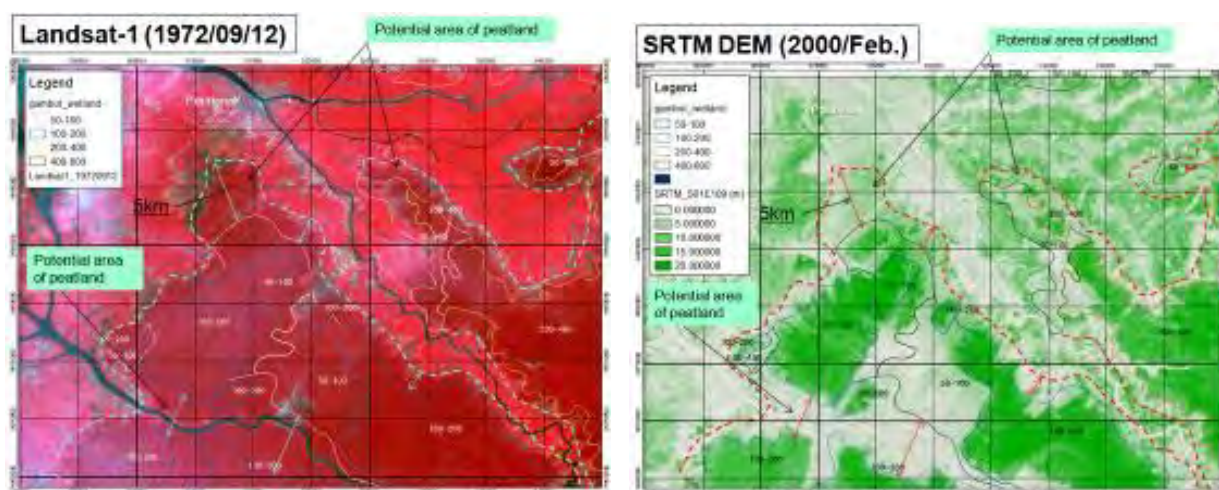


Figure 19 Characteristics of peat swamp forest on the images (left: LANDSAT in 1972, Right : SRTM/DEM)

### 2.4. Flow of satellite data analysis and selection of field verification survey area

Determination of data set was carried out for 1970-1980's satellite images (LANDSAT-MSS/TM), elevation values obtained in 2000 (SRTM / DEM), the boundary of the WI (2004) and the latest peatland distribution map of Ritung et al (2011). Furthermore, as accessibility to the field verification area is also important, the final field verification area is selected considering existing roads and drainage.

【Process of the selection of field survey area】

1. Comparison between the boundary of WI (2004) and Ritung et al (2011)
2. Comparison of geologic map, LANDSAT images (1970~1980s) and SRTM/DEM
3. Determining distribution of oil palm, plantation and drainage => high possibility of peat swamp forest
4. Determining distribution of linear and large-scale drainage=> high possibility of peat swamp forest
5. Conversion of large-scale agricultural land=> high possibility of peat swamp forest development by immigrants

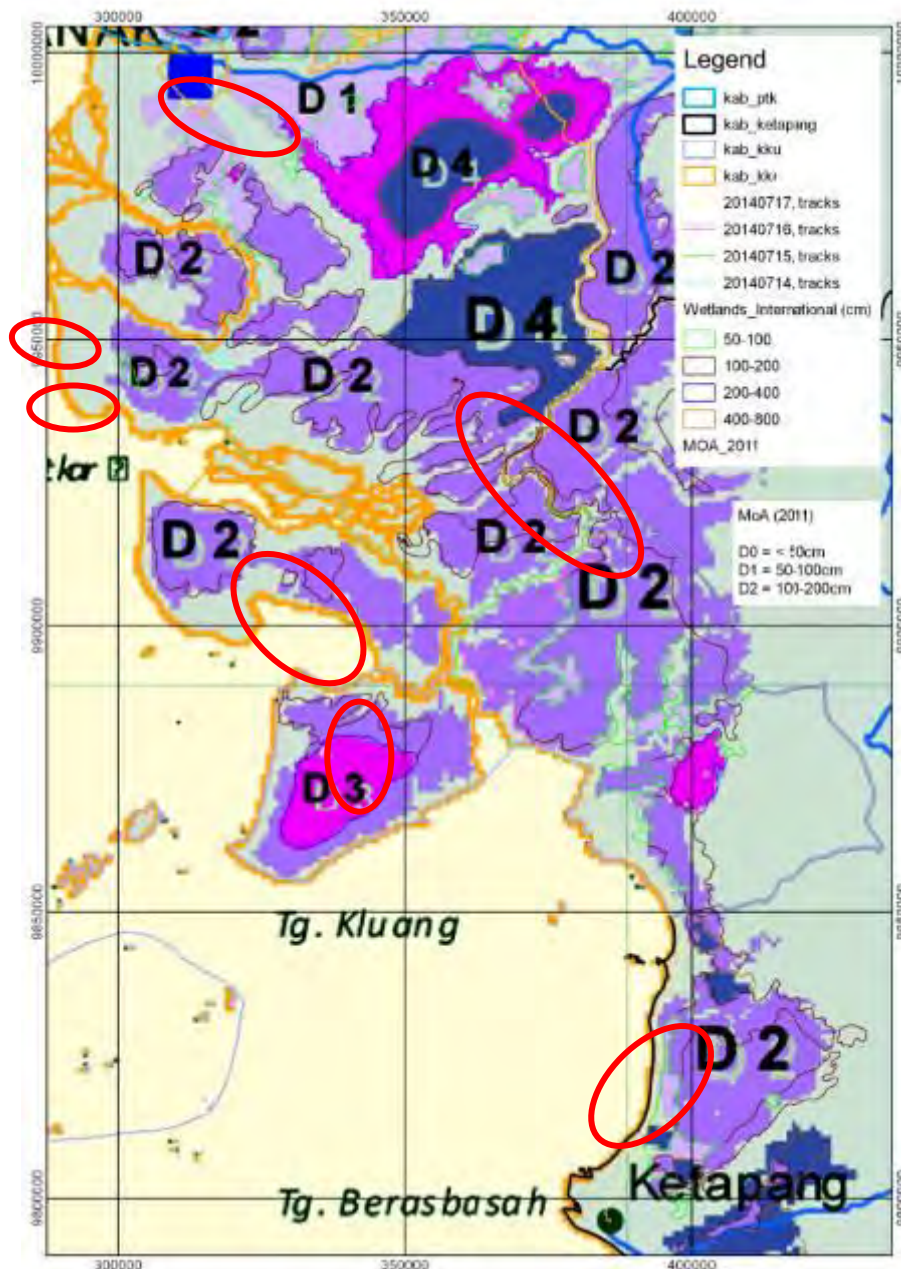


Figure 20 Different area of peatland distribution on WI (2004) and Ritung et al (2011)

## 2.5. Field verification survey

After the discussion with experts of Tanjungpura University (UNTAN), field verification survey was conducted at 22 points in the end of September. Technical advice for interpolation of survey point and making geological cross section were given. Then 324 survey points was conducted finally. Observation items are as follows.

(1) Location (UTM coordinate), (2) Depth, (3) color, (4) hardness, (5) Bulk density, (6) photo of sample



Figure 21 Field verification survey (left: coring, right: description of profile)



Figure 22 Field verification survey (Left: observation of color, Right: measuring bulk density)





Figure 23 Field verification survey (Left: boundary with clay, right: basement granite)

The purpose of the field verification survey is to make sure of peat boundaries. Since definition of peat is more than 50 cm in thickness of peat layer, thickness of peat was determined by the peat boundaries.

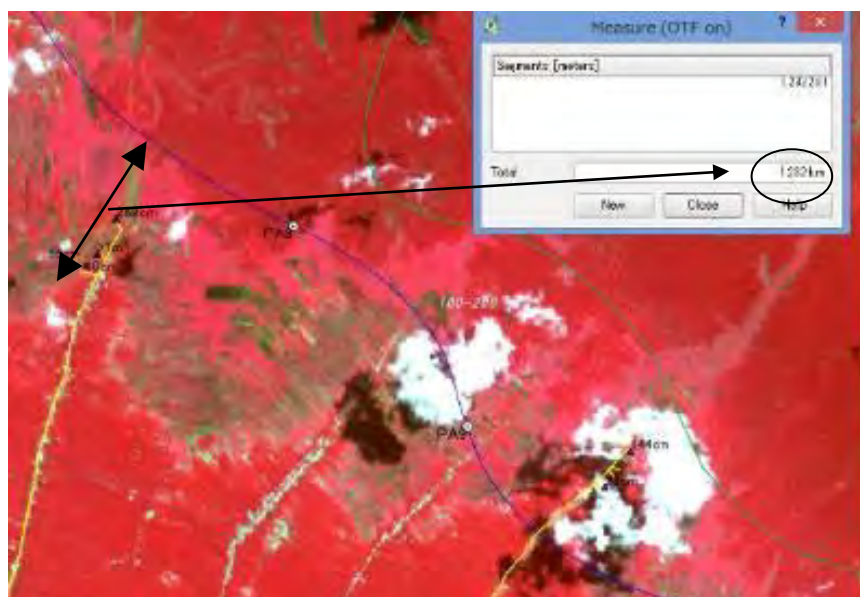


Figure 24 Field verification survey (survey direction should be perpendicular to boundary of map)

## 2.6. Revised peatland distribution map

Field verification survey was carried out at 324 points to collect information of peat boundary. For example, the result of 22 survey points which was obtained in middle of September 2014, shows the minus 4,000 m difference between WI (2004) and revised peatland distribution map prepared by IJ-REDD+ project (hereafter called as IJ-REDD+ (2015)). Also 1,500 m difference was recognized between Ritung et al (2011) and IJ-REDD+ (2015). That is, WI (2004) is relatively overestimated, and Ritung et al (2011) shows an underestimation. Furthermore, decreased area of peatland has impact on annual CO<sub>2</sub> emissions of 25,600 t (in case of emission of 20 t-CO<sub>2</sub>-e/ha/y).

Table 17 Result of the field verification survey

No	Proposed Point	Date/Time	Peat depth (cm)	X_UTM49S	Y_UTM49S	Difference (m) from WI2004	Difference (m) from Ritung(2011)	Elevation (m)
1	PA07	2014/9/17 15:52	178cm	278,735	10,041,507	90	560	2
2	PA07	2014/9/17 16:31	25cm	278,487	10,041,483			2
3	PA13	2014/9/17 17:36	136cm	291,963	10,041,066	-510	-260	9
4	PA13	2014/9/17 17:55	27cm	292,080	10,041,057			9
5	PA08	2014/9/18 9:36	289cm	280,026	10,039,148	1,230	390	8
6	PA08	2014/9/18 9:57	>1m	279,854	10,038,830			2
7	PA08	2014/9/18 10:12	10cm	279,747	10,038,726			0
8	PA08	2014/9/18 10:22	55cm	279,701	10,038,776			0
9	PA09	2014/9/18 11:40	144cm	284,595	10,037,097	-770	70	1
10	PA09	2014/9/18 12:14	23cm	284,374	10,036,780			7
11	PA01	2014/9/19 9:50	0cm	272,487	10,055,566	-780	230	0
12	PA01	2014/9/19 10:26	70cm	272,578	10,055,402			1
13	PA01	2014/9/19 11:21	Mine Pit	272,401	10,055,816			17
14	PA01	2014/9/19 11:47	Granite	271,078	10,056,918			10
15	PA02	2014/9/19 14:09	67cm	273,237	10,054,189	-740	-120	0
16	PA04	2014/9/19 15:36	0cm	274,448	10,050,917	-1,630	-80	11
17	PA04	2014/9/19 15:58	81cm	275,563	10,051,303			13
18	PA04	2014/9/19 16:05	40cm	275,498	10,051,270			12
19	PA03-04	2014/9/19 16:52	0cm	274,213	10,047,588	-210	420	0
20	PA03-04	2014/9/19 17:16	75cm	274,427	10,047,605			1
21	PA03	2014/9/19 18:12	143cm	275,561	10,045,830	-680	380	0
22	PA03	2014/9/19 18:31	12cm	275,009	10,045,731			0
Net Difference with existing maps (m)						-4,000	1,590	

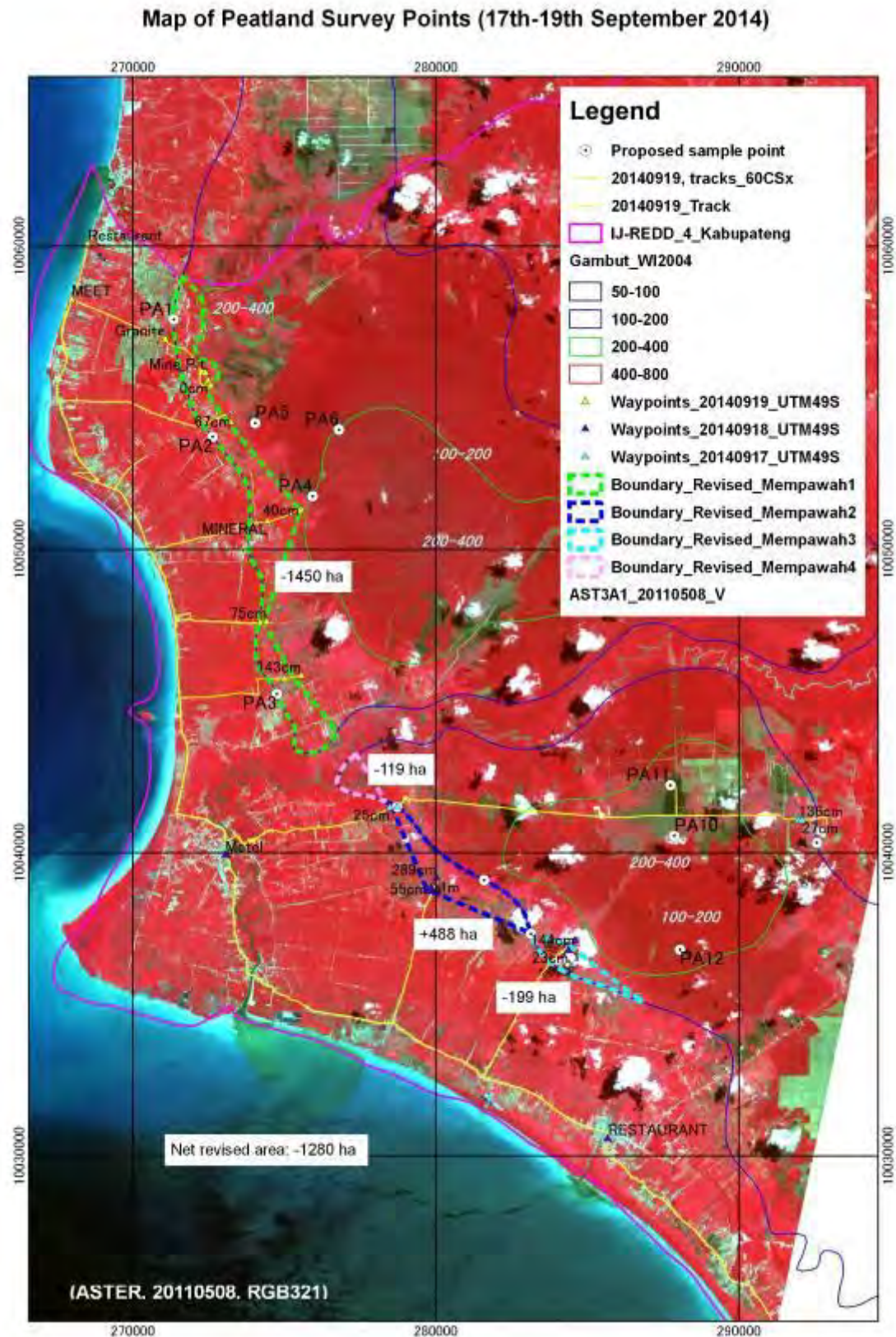


Figure 25 Revised peatland map based on the field verification survey (17th-19th September)

The area of peatland distribution was compared among the maps of WI (2004), Ritung et al. (2001) and IJ-REDD+ (2015) as shown in Figure 15 and Table 8. The result showed that peatland distribution map by WI (2004) was an underestimating of about 52,000 ha from improved peatland distribution map by IJ-REDD+ (2015). Peatland map by Ritung et al. (2011) was about 32,000 ha larger than improved peatland map by IJ-REDD+ (2015).

Table 18 Comparison of peatland area with maps of WI (2004), Ritung et al., (2011) and IJ-REDD+ (2015)

Area(ha)	(1) WI2004	(2) Ritung2011	(3) IJ-REDD
KayongUtara	163,303	214,054	193,930
Ketapang	337,552	255,873	259,283
KubuRaya	410,241	519,885	503,990
Pontianak	70,889	74,755	74,441
KabPontianak	398	2,280	2,801
Total	982,383	1,066,847	1,034,445
Difference	(2)-(1)	(3)-(1)	(3)-(2)
	84,464	52,062	-32,402

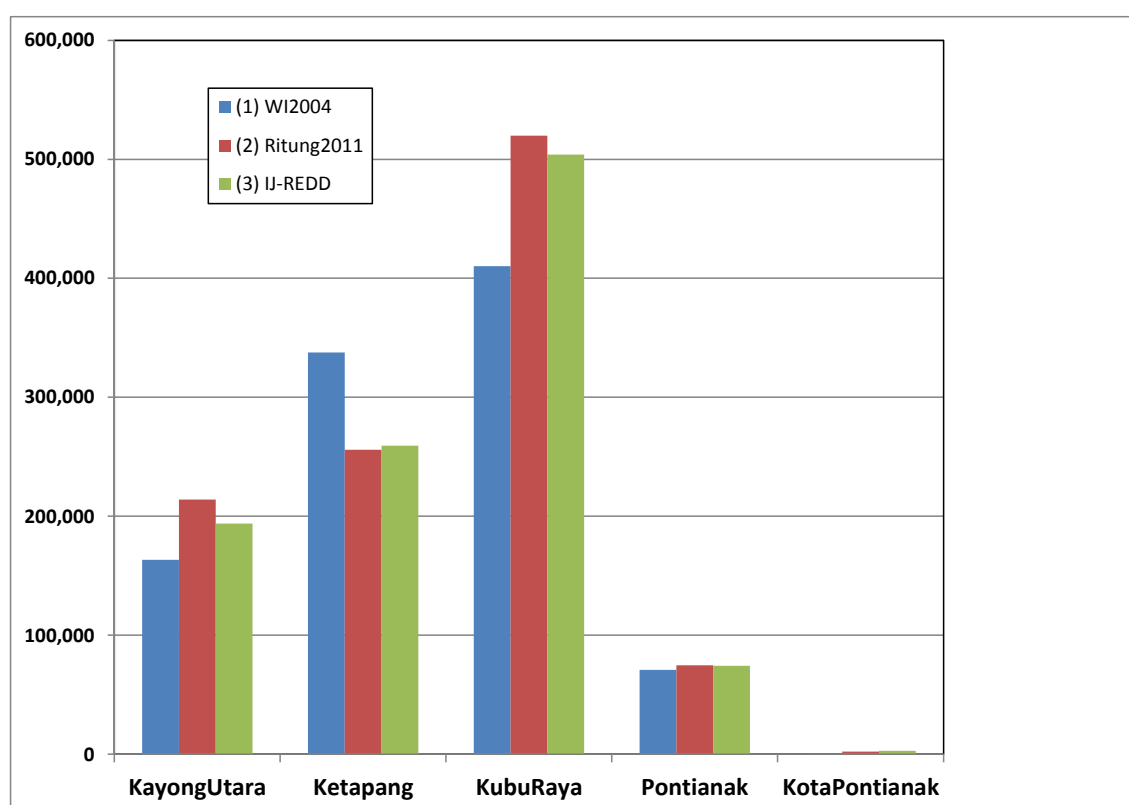


Figure 26 Comparison of peatland area with maps of WI (2004), Ritung et al., (2011) and IJ-REDD+ (2015)

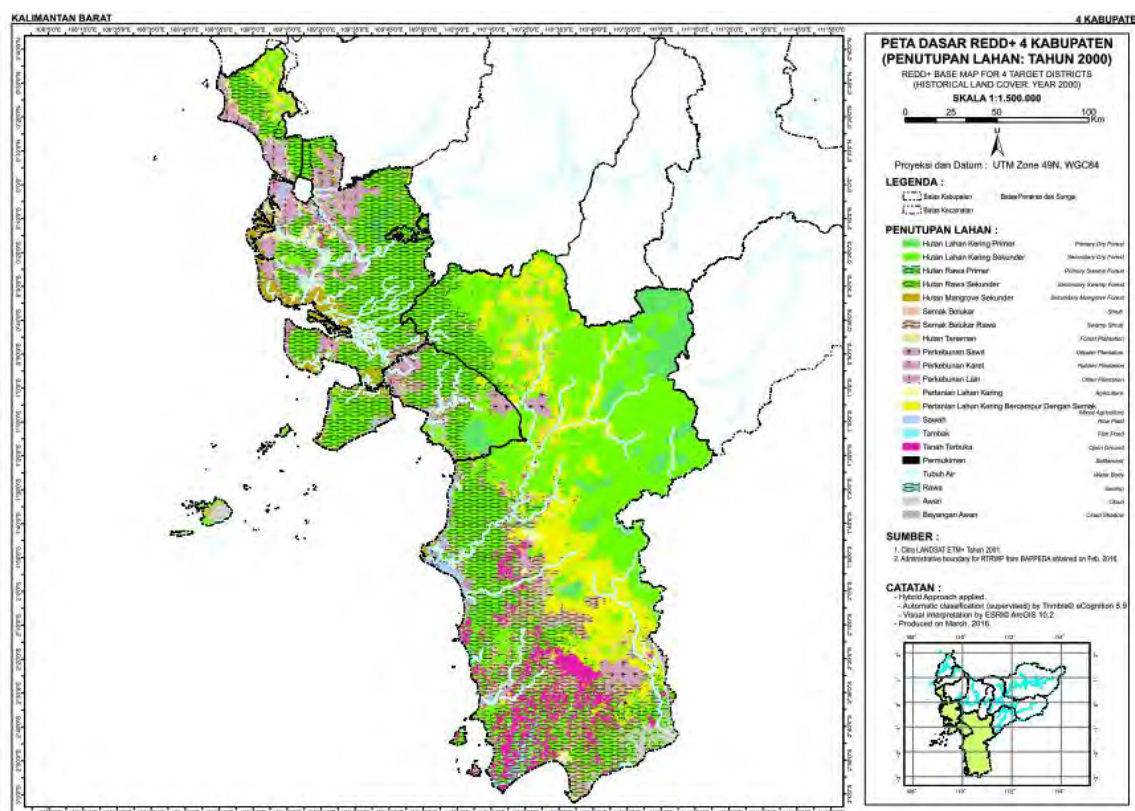


## 2.7. Land cover change and forest dynamics

### (1) Historic trend of the targeted 4 districts

Figure 27 is the scale down of the version 6 of land cover maps on the targeted four districts<sup>4</sup>. Forest dynamics is shown in Figure 28, while land cover change is shown in Figure 29.

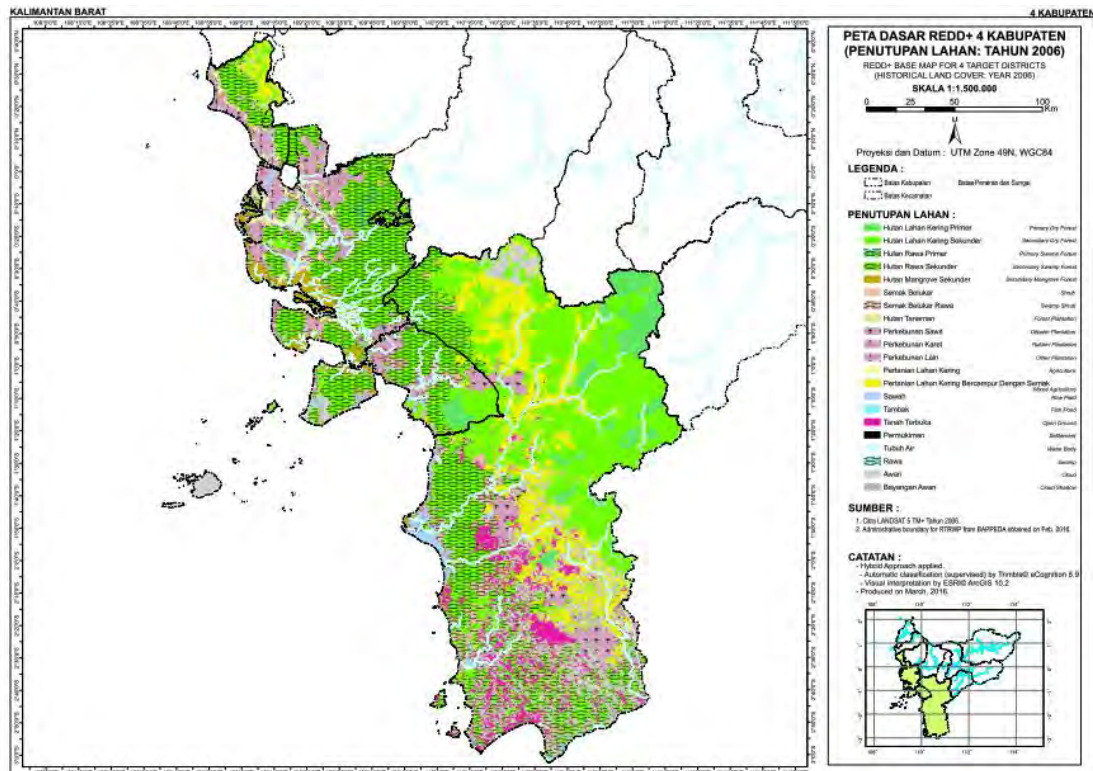
According to Figure 28, forested area in 4 districts has been decreased year by year during 2000 until 2013 period. Major trend of this period is an increase of the area that classified as "Oil palm plantation" and this is observed especially after 2009 period (Figure 27).



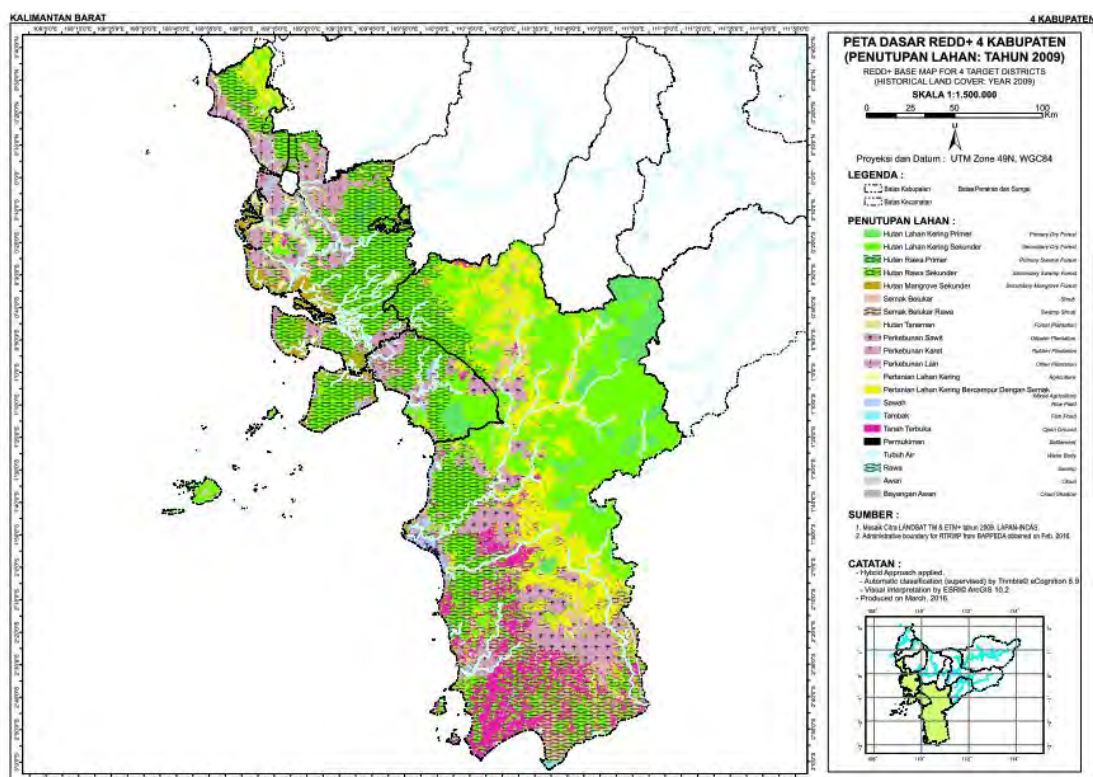
Historical land cover of target 4 districts in 2000

<sup>4</sup> The result of accuracy assessment (see Supplemental Document 2) of 2013 time of LCM Ver. 4: Overall accuracy of LCM\_V4 is 82% and Class accuracy ranges from 63 to 100%.

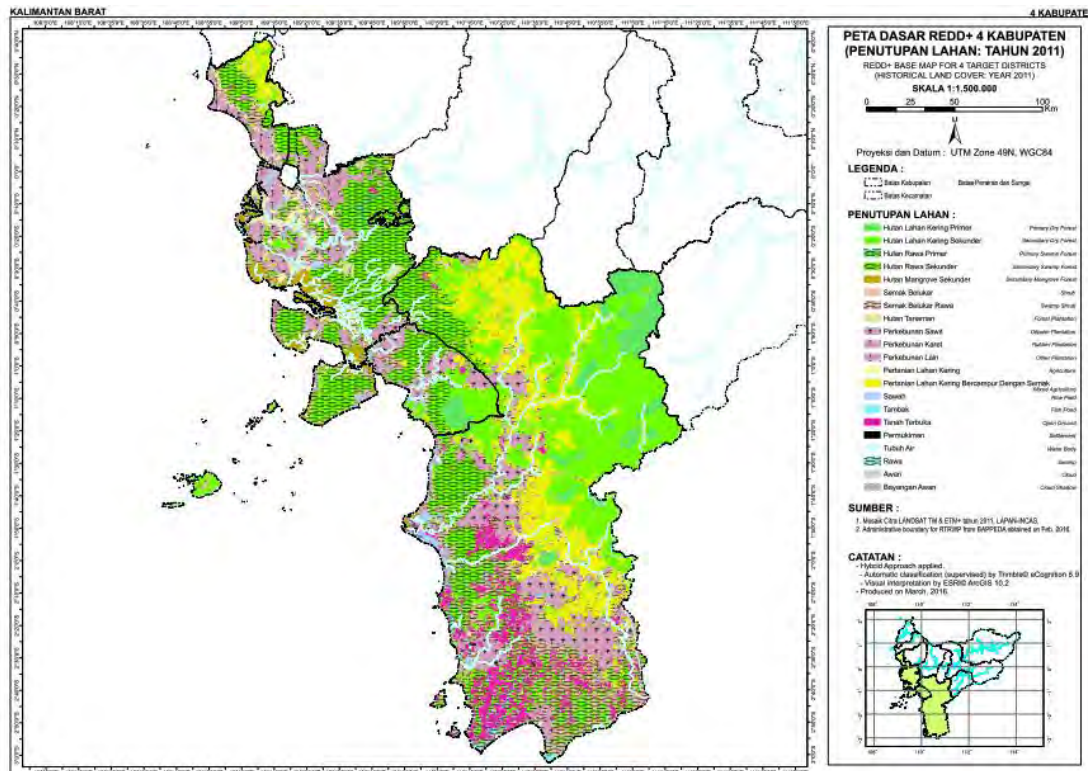




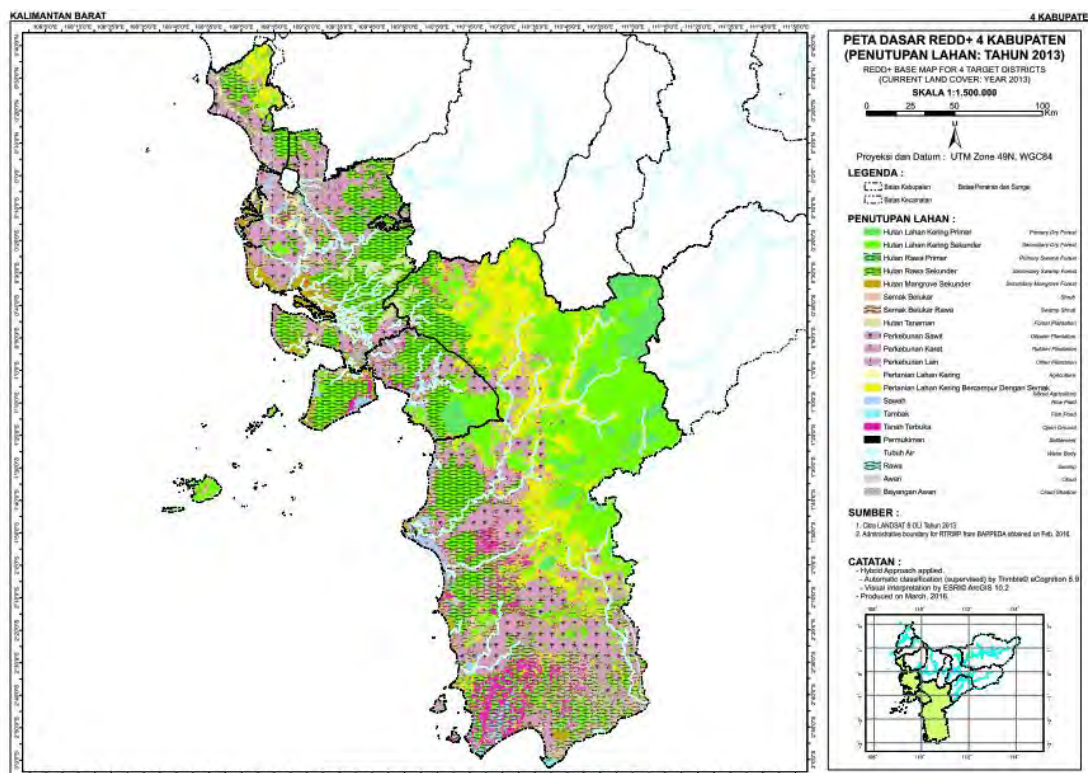
Historical land cover of target 4 districts in 2006



Historical land cover of target 4 districts in 2009



Historical land cover of target 4 districts in 2011



Current land cover of target 4 districts in 2013

Figure 27 Historic LCMs of targeted 4 districts



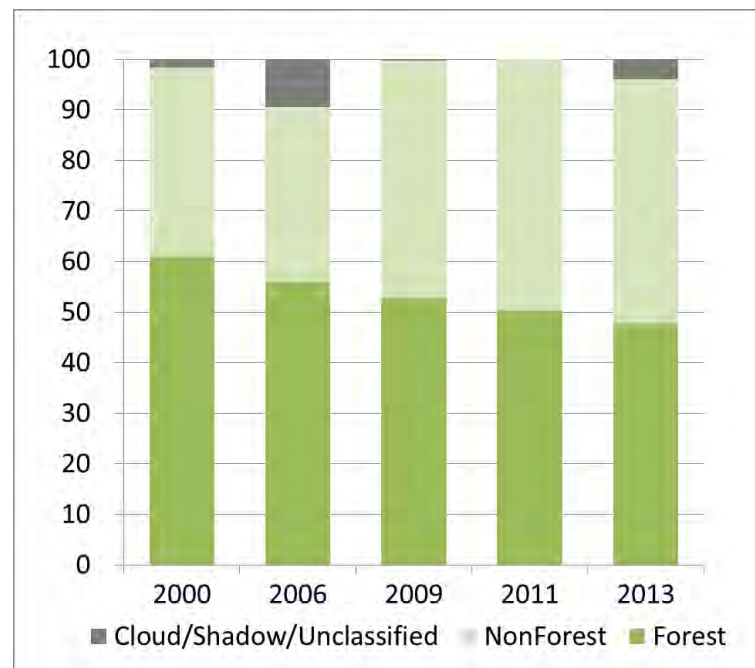


Figure 28 Forest dynamics of targeted 4 districts (LCM Ver. 6) (Unit: %)

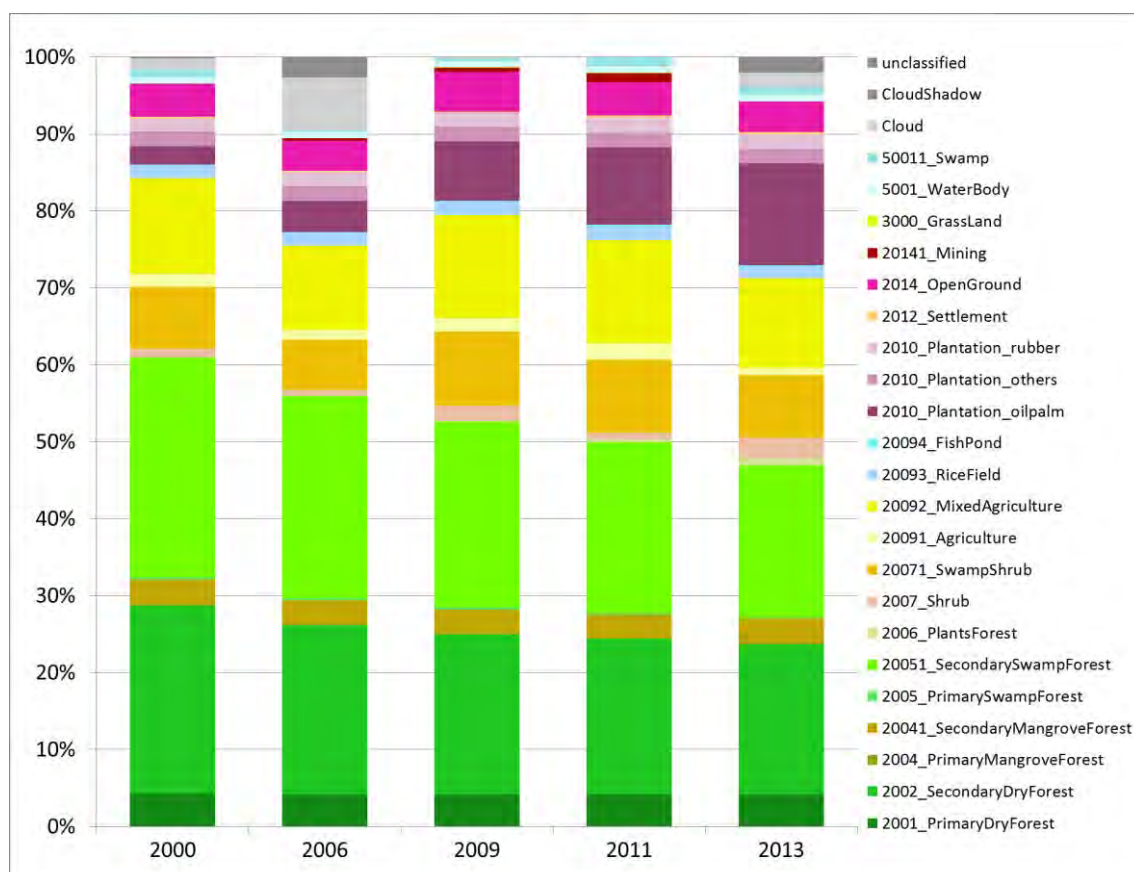


Figure 29 Land cover change of the targeted 4 districts (LCM Ver. 6) (Unit: %)

## (2) Historic trend of each district

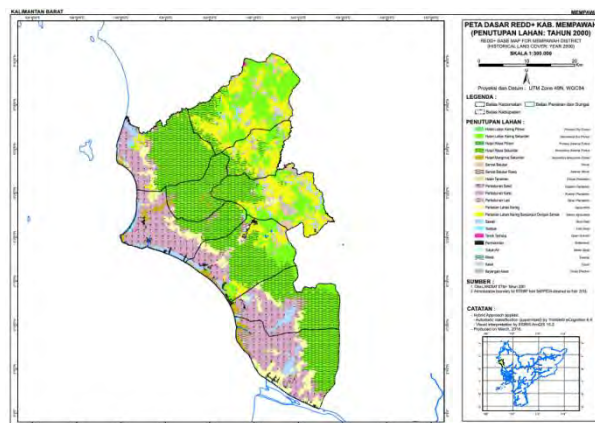
Historical trend of land cover is shown in Figure 30, Figure 31, Figure 32 and Figure 33 are the scale down of the Version 6 of land cover maps of each district.

Land cover change of northernmost district of Mempawah is shown in Figure 30. Mempawah district is characterized by the stable land cover area of coconuts palm plantation that classified in "Plantation\_others". Oil palm plantation is mainly located in the southern part of this district.

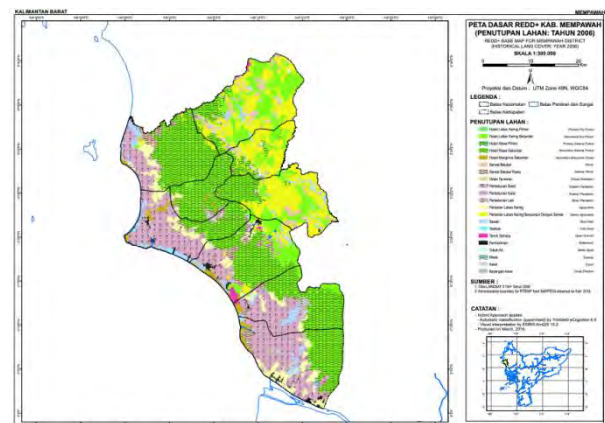
Figure 31 shows historical land cover map of Kubu Raya district. Low and swampy vegetation like mangrove forests, swamp forests and swamp shrubs are dominated in this district. Almost all inland region of Kubu Raya district is covered with "Secondary\_Swamp\_Forest".

Land cover change of Kayong Utara district is shown in Figure 32, GPNP is established in the southern mountainous region of this district. Primary dry forests grows in the GPNP area and dry land vegetations cover south-western part, but mainland of this district is covered with wet land vegetation.

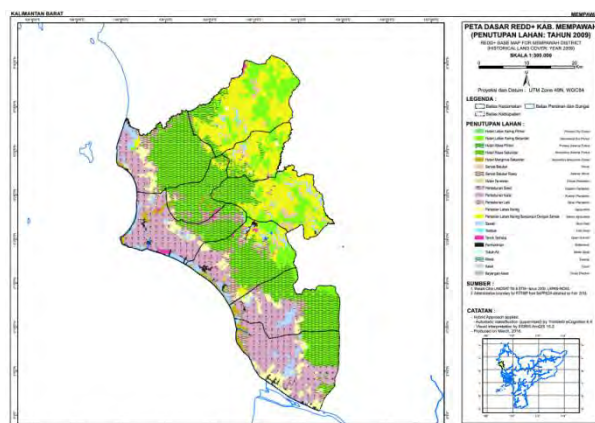
Ketapang district is the largest district in the target districts. This district also has primary dry forests in the north-eastern mountainous region. "Open ground" land cover is extensively spread out in the southern most area of this district.



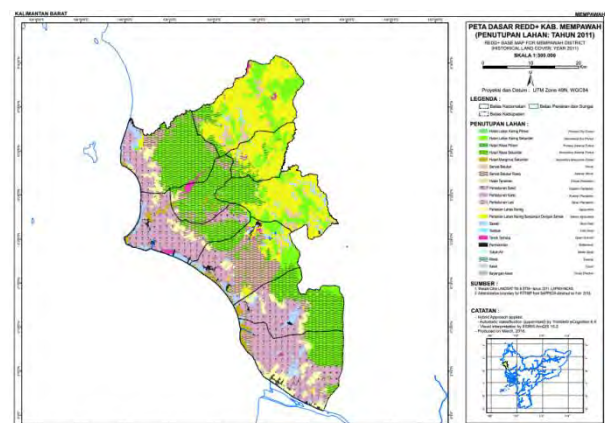
(a) 2000



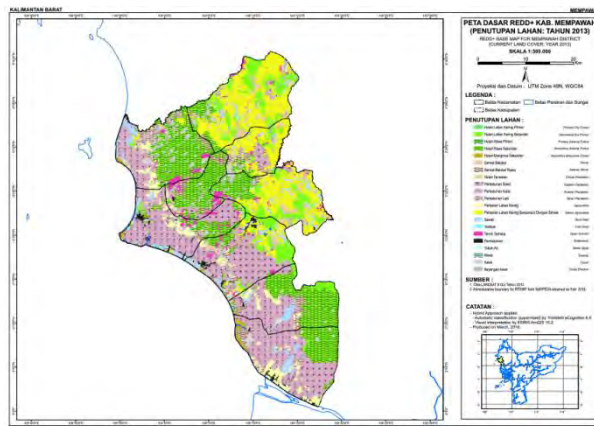
(b) 2006



(c) 2009

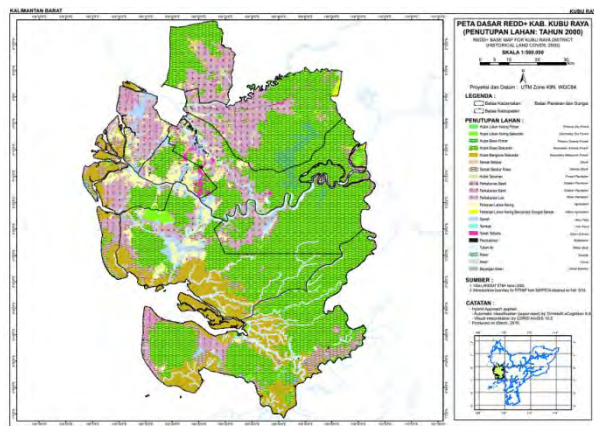


(d) 2011

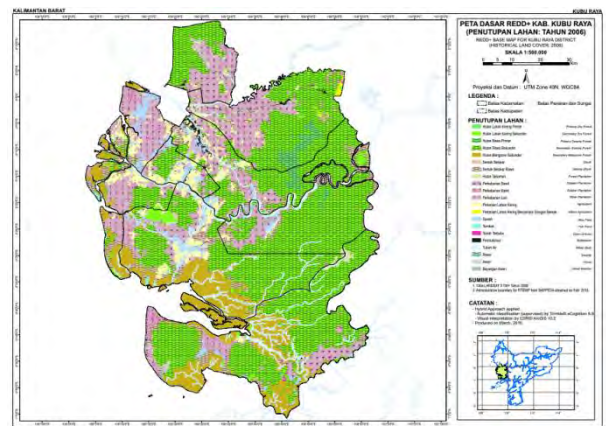


(e) 2013

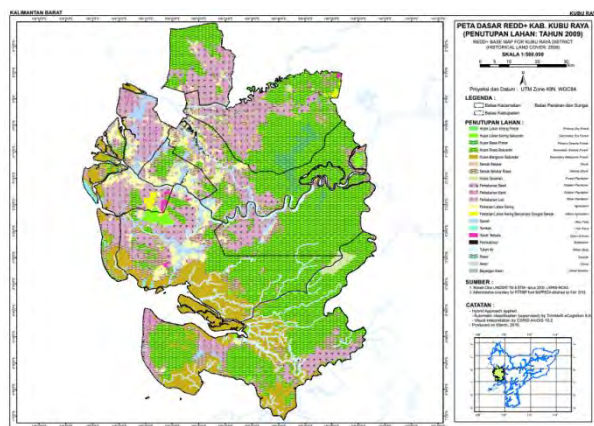
Figure 30 Historic LCMs of Mempawah district (LCM Ver. 6)



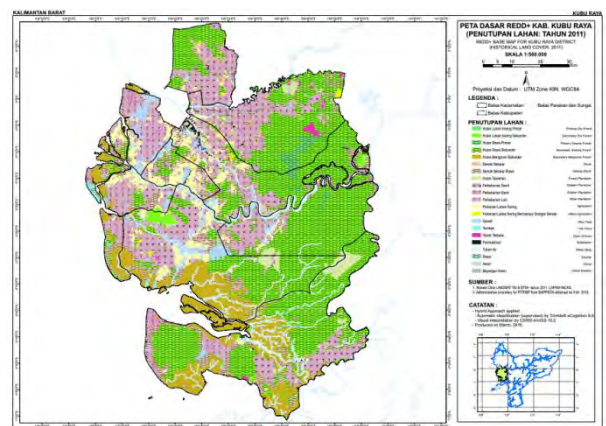
(a) 2000



(b) 2006

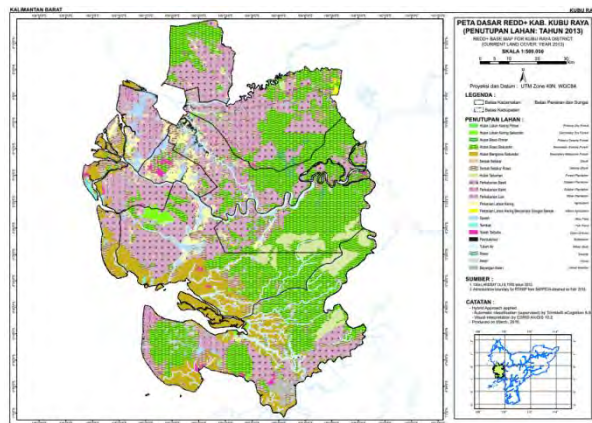


(c) 2009



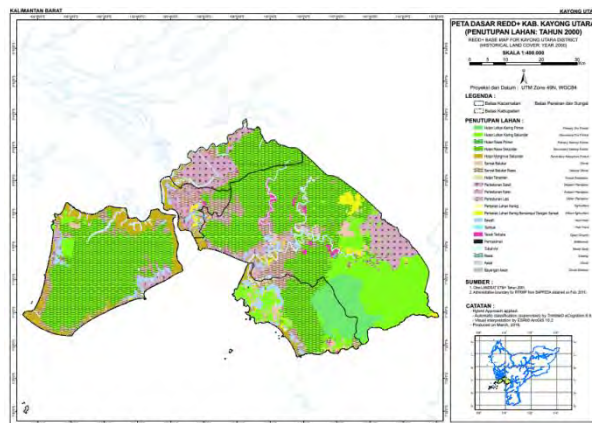
(d) 2011



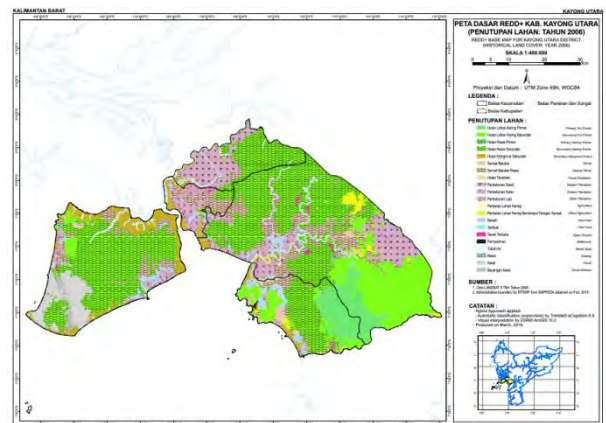


(e) 2013

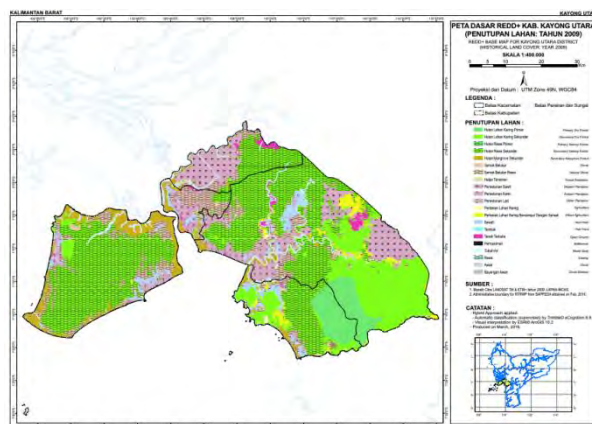
Figure 31 Historic LCMs of Kubu Raya District (LCM Ver. 6)



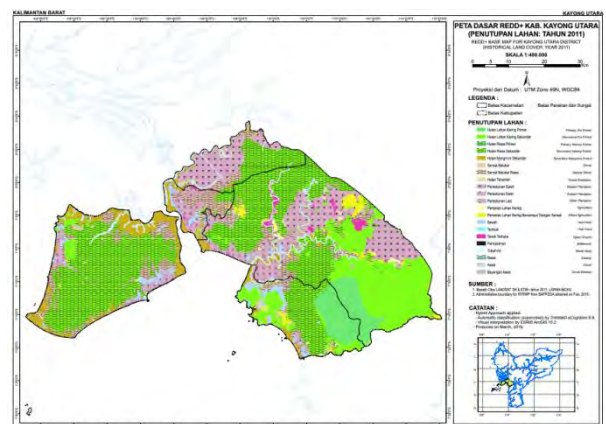
(a) 2000



(b) 2006

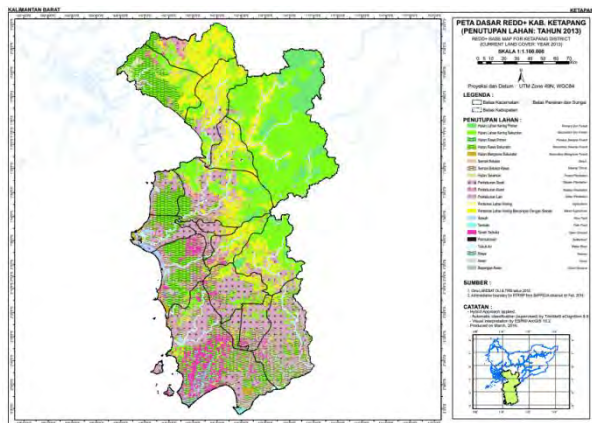


(c) 2009



(d) 2011





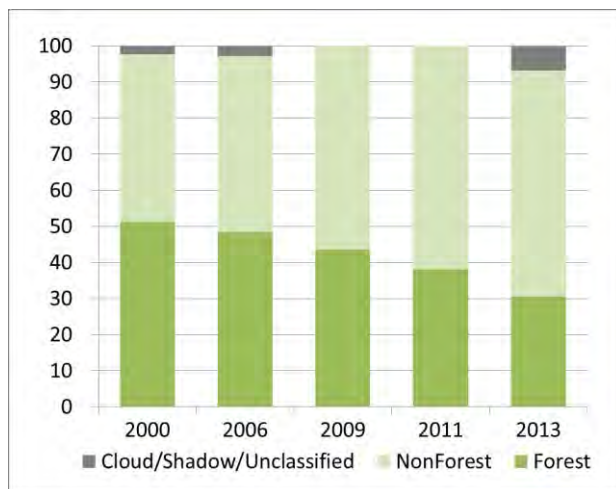
(e) 2013

Figure 33 Historic LCMs of Ketapang District (LCM Ver. 6)

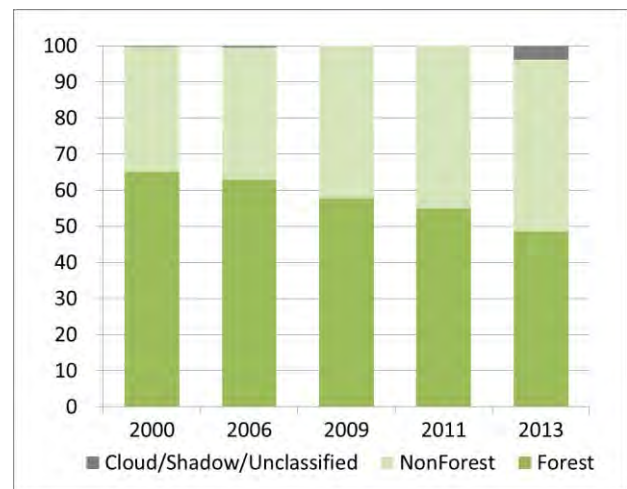
#### a. Forest dynamics

Forest dynamics in targeted area is shown in Figure 34, while land cover change is shown in Figure 35.

Mempawah and Kubu Raya districts have relatively clear trends of deforestation. These districts are located in the northern part of target region and near the city of Pontianak, provincial capital.

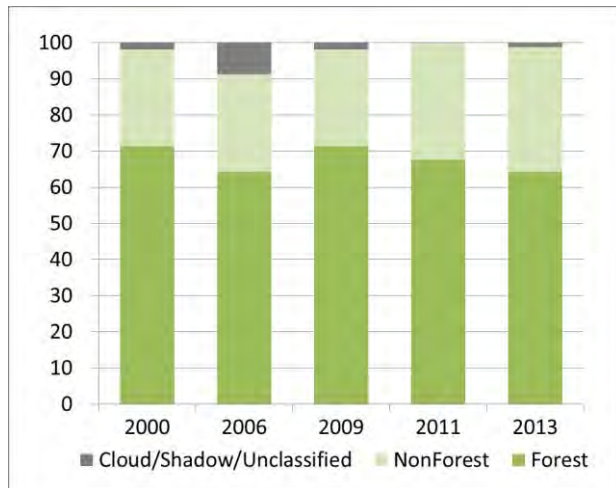


Mempawah

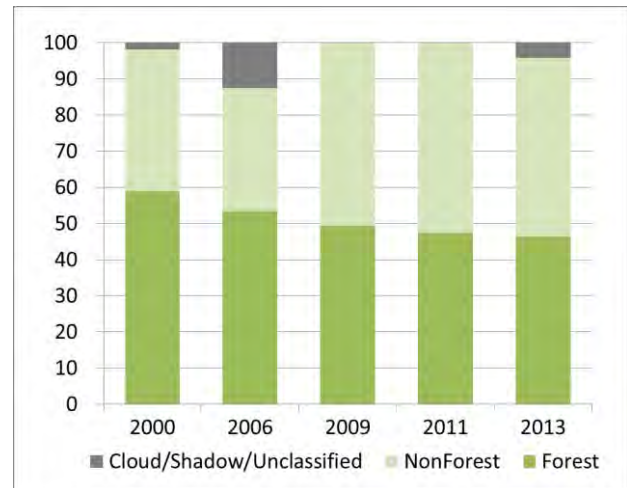


Kubu Raya





Kayong Utara

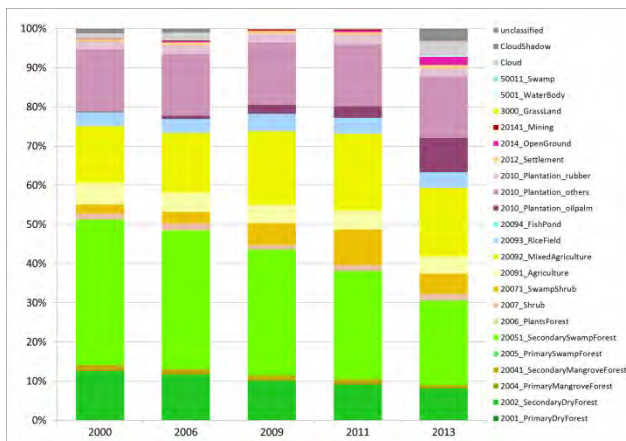


Ketapang

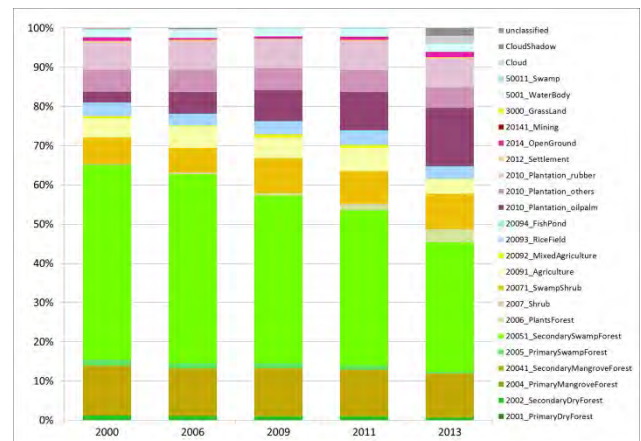
Figure 34 Forest dynamics of each district (LCM Ver. 6) (Unit: %)

### b. Land cover class change

Land cover change is shown in Figure 35. Mempawah district has expanding area ratio of agricultural land covers like “Mixed Agriculture” or “Agriculture” (light yellowish color). Notable area ratio of classified as “Secondary Mangrove Forest” land cover (colored dark brown) is still kept in the swampy Kubu Raya and Kayong Utara districts. As mentioned, Ketapang district has relatively large area of dry vegetations (colored darker green) and the ratio of "Secondary Dry Forest" (colored brighter green) shows decreasing trend.



Mempawah



Kubu Raya

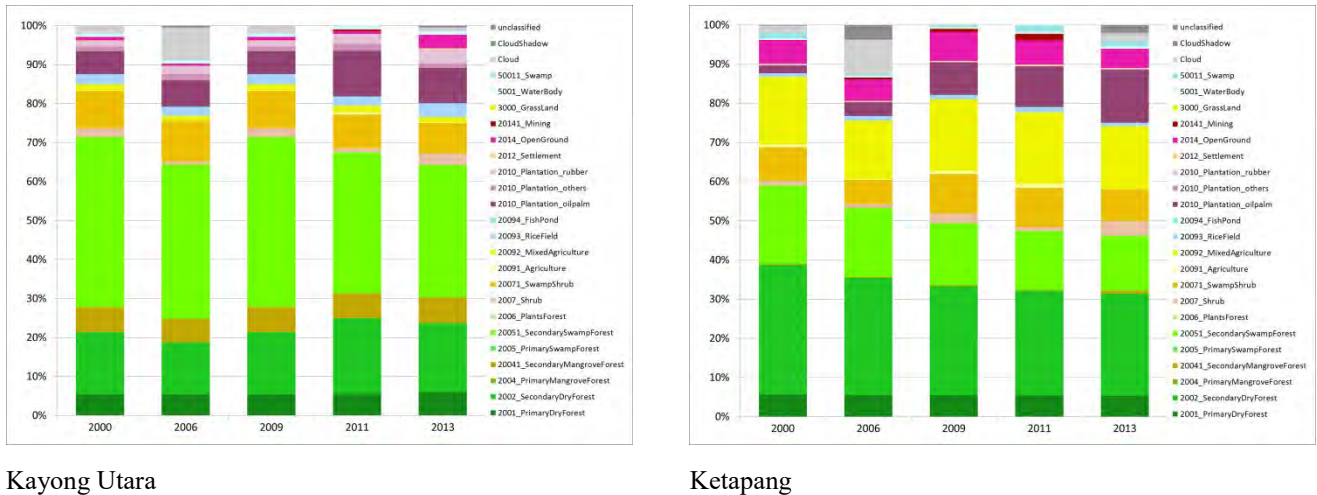


Figure 35 Land cover change of each district (LCM Ver. 6) (Unit: %)

### 3. Trial calculation of FREL of the targeted 4 districts

#### 3.1. Basic concept of methodology

This study was divided into the targeted 4 districts (Mempawah, Kubu Raya, Kayong Utara and Ketapang) as the model area of West Kalimantan Province and the pilot site for REDD+ Development of GPNP and its Landscape. For setting reference levels, the methods applied is showed in Figure 36.

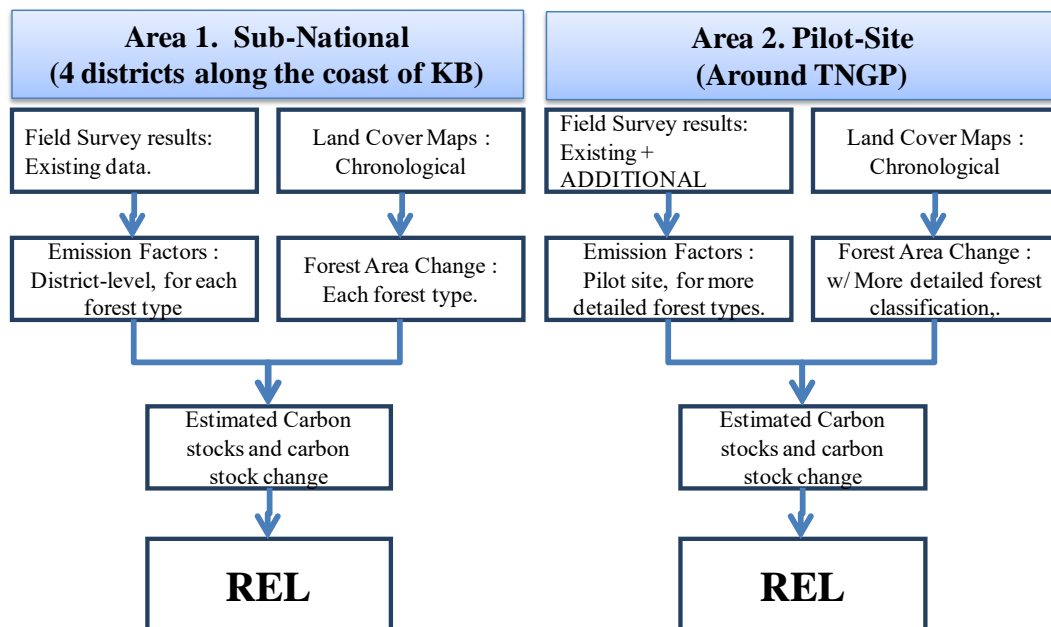


Figure 36 Flow of developing trial FRELs for the targeted 4 and pilot site of GPNP and its Landscape

#### 3.2. Emission factors

As the result of collecting information regarding emission factors, the West Kalimantan Province does

not have any original emission factors. But Indonesia has original emission factors applied to all provinces to make the RAD-GRK (Table 19). Then they are available to be used in this project.

Table 19 Emission factors shown in a guideline of the RAD-GRK

Land and forest class (Bahasa)	Land and forest class (English)	Carbon stock per hectare (t-C/ha)
Hutan Lahan Kering Primer	Primary Dryland Forest	195.4
Hutan Lahan Kering Sekunder	Secondary Dryland Forest	169.7
Hutan Rawa Primer	Primary Swamp Forest	196.0
Hutan Rawa Sekunder	Secondary Swamp Forest	155.0
Hutan Mangrove Primer	Primary Mangrove Forest	170.0
Hutan Mangrove Sekunder	Secondary Mangrove Forest	120.0
Semak/Belukar	Bush	30.0
Hutan Tanaman	Plant Forest	64.0
Perkebunan/Kebun	Plantation	63.0
Semak/Belukar Rawa	Swamp Bush	30.0
Rumput	Meadow	5.0
Pertanian Lahan Kering	Dryland Agriculture	10.0
Pertanian Lahan Kering Bercampur dengan Semak	Mixed Dryland Agriculture	30.0
Sawah/Persawahan	Rice Field	2.0
Tambak	Fishpond	0.0
Permukiman /Lahan terbangun	Settlement	5.0
Transmigrasi	Trans mitigation	10.0
Tanah Terbuka	Open land	2.5
Pertambangan	Mining	0.0
Tubu Air	Water body	0.0
Rawa	Swamp	0.0
Bandara/Pelabuhan	Airport/Harbor	0.0

National based reference level use GHG emissions from 2000 to 2013 respectively, and GHG emissions in each year is estimated by using default emission factors in each island (Table 19).

Table 20 Emission factors (carbon per hectare) applied in reference levels

Forest type according to Indonesian forest inventory	Above-ground (t-C/ha)	Below-ground (t-C/ha)	Total Tree (t-C/ha)
Primary Dry Forest	269.4	36.6	306.0
Secondary Dry Forest	203.3	27.6	230.9
Primary Mangrove Forest	208.5	28.4	236.9
Secondary Mangrove Forest	124.7	17.0	141.7
Primary Swamp Forest	274.8	37.4	312.2
Secondary Swamp Forest	170.5	23.2	193.7
Plants Forest	120.0	16.3	136.3

### 3.3. Prediction of trial FREL

Setting a RL requires calculation of GHG emissions in the past. For calculating GHG emissions in West Kalimantan Province, the RAD-GRK uses a stock-change/difference method, calculating GHG emissions by carbon stock estimated by land area of each forest type and existing emission factors at some time points from 2010 to 2011. Therefore this project was in accordance with this method.

In this study, reference level in each district which is tentative version and applied simple approach (i.e. using mean GHG emissions in past) also use default emission factors (Table 19) and developed reference levels are shown in Figure 37.

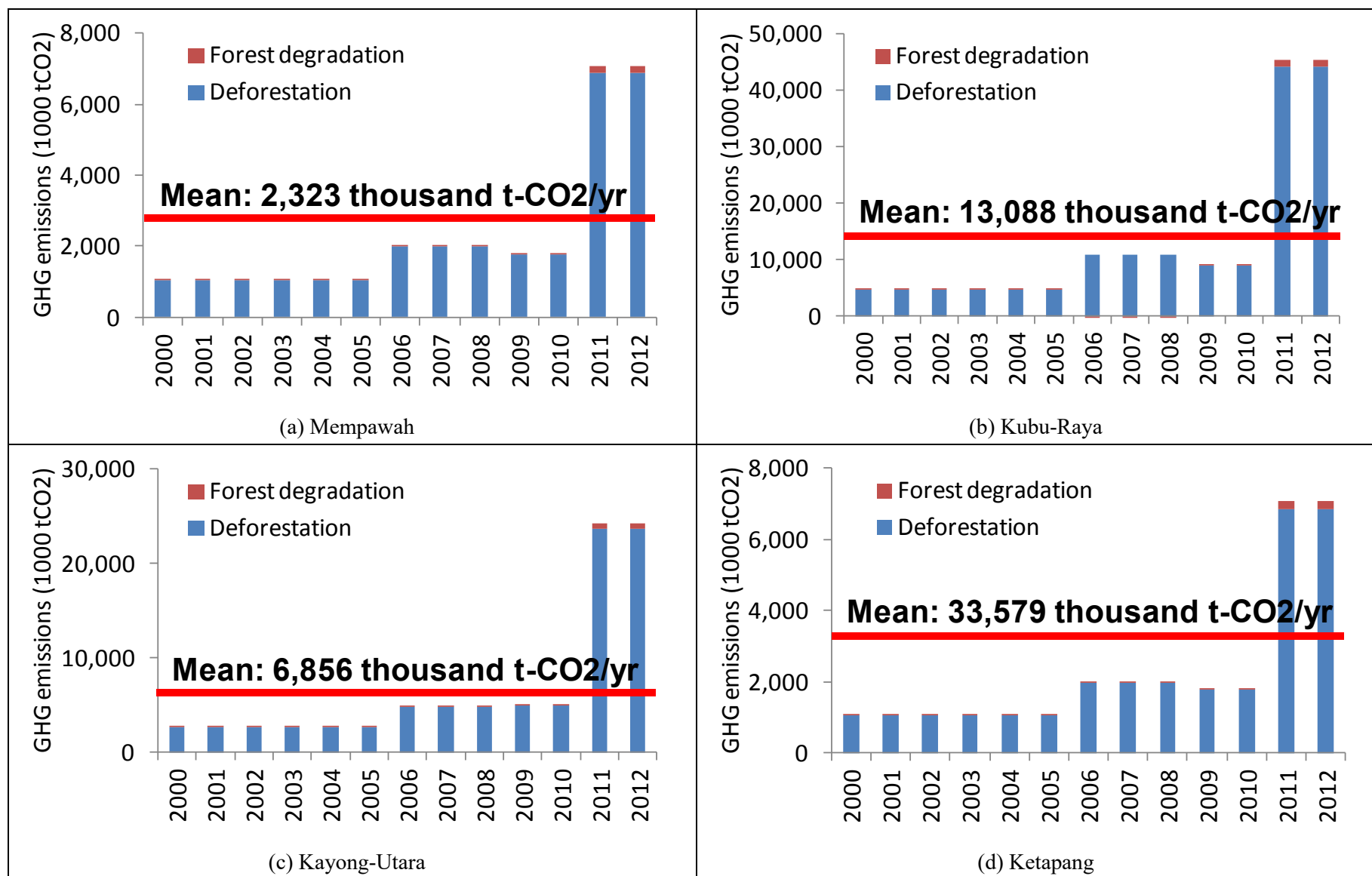


Figure 37 Tentative reference levels in 4 districts which applies simple approach (applying mean GHG emissions in past)

## Activity 1-6 Develop a monitoring plan and implement it

### 1. Review for drafting Sub-national level forest ecosystem carbon monitoring plan in West Kalimantan Province

#### 1.1. Existing methodology and previous research

Before drafting forest ecosystem carbon monitoring plan, the progress of examination and implementation of sub-national base MRV as well as previous research was reviewed in addition to review of development of international discussions.

##### (1) Legal basis of sub-national MRV in Indonesia

Table 21 shows the laws and regulations relating to MRV of sub-national base in Indonesia. It can be inferred that an integrated system and/or mechanism that is combined by GHG inventory administration as compulsory duty in local autonomy administration, and of forest inventory administration mainly handled by central authorities as the following legal development.

- a) Forest inventory administration as the basis of forest ecosystem carbon monitoring has a system conducting monitoring more than once five year in each central, provincial and district level
- b) GHG inventory including forest ecosystem carbon has a system to report through province by district once a year
- c) Monitoring GHG emissions in environmental pollution and devastation control is compulsory administration of local government. While the revision of Local Administration Law in 2014 will influence development of a system that forest inventory in forestry sector is conducted by mainly central government.

Table 21 Summary of laws and regulations relating to Sub-national MRV

Law & Regulation	Summary	Remarks
Law No. 41/1999 on Forestry <sup>5</sup>	<ol style="list-style-type: none"> <li>a) "Forestry Planning" in Forestry Administration Field (Article 10)</li> <li>b) "Forest Inventory" in "Forest Planning Sub-field" (Article 12)</li> <li>c) Forest inventory must be classified into national, regional, watershed and forest management unit level (Article 13)</li> </ol>	<p>Governmental Regulation on Forestry Planning<sup>6</sup> prescribes the details</p> <ol style="list-style-type: none"> <li>a) Regional level: to be implemented by the Governor and District Governor</li> <li>b) Frequency: more than once 5 years</li> </ol>
Presidential Regulation No.	a) The central authorities covers planning, implementation, monitoring and evaluation of GHG reduction action plan to	Basis of planning, implementation, reporting

<sup>5</sup> Undang-undang Republik Indonesia Nomor 41 Tahun 1999 tentang Kehutanan (30 September 1999)

<sup>6</sup> Peraturan Pemerintah Republik Indonesia Nomor 44 Tahun 2004 tentang Perencanaan Kehutanan (18 Oktober 2004)

Law & Regulation	Summary	Remarks
61/ 2011 on National Action Plan for GHG Reduction of GHG(RAN-GRK ) <sup>7</sup>	<p>give standard in formulating Local GHG Reduction Action Plan by the Local Authorities (Article 3)</p> <p>b) The Governor must formulate provincial level GHG reduction action plan (Article 6)</p> <p>c) The Minister/ Head of Central Institution reports to The Coordinating Minister of Economy in order to report the President once a year (Article 10)</p>	(once a year) of climate change mitigation measures nationwide
Presidential Regulation No. 71/2011 on Implementation of National GHG Inventory <sup>8</sup>	<p>a) The Governor conducts “GHG inventory in provincial level”, “coordination of implementation of GHG inventory in District/City level” and “instruct duty to technical implementation unit covering environment field” (Article9)</p> <p>b) The District Governor/Mayer conducts “implementation of GHG inventory in district/city level” (Article 10)</p> <p>c) The District Governor/Mayer reports once a year “results of GHG inventory to the Governor” and the Governor reports “results of GHG inventory from district/city to Minister”(Article 12)</p> <p>d) Proponent having potential GHG emissions/ removals report GHG inventory data to the Governor, District Governor/ Mayer once a year (Article 15)</p>	System to implement and report (once a year) GHG inventory in subnational level from district level through provincial level
Ministerial Decree No. 15/ 2013 on MRV of Climate Change <sup>9</sup>	<p>a) Climate change mitigation action conduct through MRV (Article 3).</p> <p>b) The achievement of mitigation action is measured by the increase/decreases of GHG emissions in comparison with baseline emission(Article 4)</p> <p>c) The responsible party of mitigation action must prepare achievement report (Article 5). MRV report must report to the Minister (Article 8).</p> <p>d) Report must be verified (Article 6).</p> <p>e) The Environmental Minister organizes National MRV Committee and implement evaluation of MRV results and national registry system of mitigation actions (Article 10).</p>	Planning of revision in DG of Climate Change Control, MoEF in 2015 <sup>10</sup>
Law No. 23/2014 on Local Administration <sup>11</sup>	<p>a) Environment field is the compulsory administration in local autonomy while forestry field is the selective administration in local autonomy(Article 12)</p> <p>b) Administration sensitive to ecological impact (Forestry, Oceanology, Energy and Mineral field) is shared by central and provincial government (Article 14)</p> <p>c) Central administration implement directly, dis-concentration to local government, assistance administration by local government (Article 19)</p> <p>d) Sharing forestry administration indicate that forest inventory administration assigned to central level (Annex B.B.1.)</p>	The district government still has authority to Tahura (Great Forest Park), one of conservation forests.

<sup>7</sup> Peraturan Presiden Republik Indonesia Nomr 61 Tahun 2011 tentang Rencana Aksi Nasional Penurunan Emisi Gas Rumah Kaca (20 September 2011)

<sup>8</sup> Peraturan Presiden Republik Indonesia Nomr 71 Tahun 2011 tentang Penyelenggaraan Inventarisasi Gas Rumah Kaca Nasional (5 Oktober 2011)

<sup>9</sup> Peraturan Menteri Negara Lingkungan Hidup Republik Indonesia Nomor 15 Tahun 2013 tentang Pengukuran, Pelaporan, dan Verifikasi Aksi Mitigasi Perubahan Iklim (29 Desember 2013)

<sup>10</sup> According to the results of interviews in Directorate of GHG Inventory and MRV, Directorate General of Climate Change Control, MoEF on 23 Nov. 2015(Head of Sub-directorate of MRV)

<sup>11</sup> Undang-undang Republik Indonesia Nomor 23 Tahun 2014 tentang Pemerintahan Daerah (30 September 2014)



## (2) Development of MRV methodology in Indonesia

### a. Background and history

The National REDD+ Task Force (Satuan Tugas Persiapan Kelembagaan REDD+) under the Presidential Working Unit for Supervision and Management of Development (Unit Kerja Presiden bidang Pengawasan dan Pengendalian Pembangunan or UKP4) was established in 2011 and this task force has made great effort to organize Indonesian REDD+ MRV system. REDD National FREL (2015) is based on their efforts. The REDD+ Task Force worked to complete “REDD+ National Strategy”, implement “Moratorium” area, set Central Kalimantan as pilot province for REDD+ and so on. After the task force finished its mandate, the Special REDD+ Team (Tim Khusus REDD+) took over the task, and finally Indonesian REDD+ Agency was established in August, 2013.

There are two governmental movements related to REDD+. The RAN-GRK and the RAD-GRK are maintained by UKP4/REDD+ Agency and more international oriented frame work. And the SRAP (Strategi dan Rencana Aksi Provinsi, Provincial Strategy and Action plan) is the regional oriented frame work which Provincial Governments have initiative. The Provincial Government of West Kalimantan has addressed SRAP in December, 2013 and the plan describes the relationship between the RAN-GRK, the RAD-GRK and the SRAP. It is needed to coordinate and harmonize those two frame works when implementing the nation-wide MRV system in Indonesia. The national strategic plan for implementing MRV draws the role of stake-holders. The UKP4 has been integrating and standardizing geographical information as “One Map” policy. The REDD+ Agency was also combined into the merged Ministry of Environment and Forestry (MoEF)<sup>12</sup>.

West Kalimantan Province has participated in Governor’s Climate & Forests Task Force; GCF-TF which was established in 2008. Using the fund from GCF Fund established by GCF, a project for “Strengthening Indonesian Capacity for Developing National Forest Carbon Inventory, Mapping and MRV Technical Systems” mainly in East Kalimantan. This project aims at capacity building for GCF provinces to conduct forest carbon inventory, measurement, monitoring and reporting at jurisdictional scales.

### b. Methodology

Following Table 22 shows the methodology relating to sub-national MRV. It can be inferred that activity data with minimum scale level at least 1:250,000 and improving emission factors toward Tier 3 will be prioritized as the following methodology development.

The land cover change maps as the basis forest ecosystem carbon monitoring satisfying at least

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<sup>12</sup> Based on the following laws and regulations.

- a) Presidential Regulation No. 165/2014 on Decision of Duty and Function of “Work Cabinet” (27 Oct. 2014): Ministry of Environment and Ministry of Forestry were merged.
- b) Presidential Regulation No. 16/ 2015 on Ministry of Environment and Forestry (21 Jan. 2015): Climate Change Council (DNPI) and REDD+ Agency (BP-REDD+) were combined into MoEF.
- c) Environment and Forestry Ministerial Decree 2015 (P.18/KemenLHK-II/2015) on Organization and Duty Control (14 Apr. 2015): The organization of Directorate General of Climate Change Control was established.



minimum scale 1:250,000

- a) To contribute to monitoring by the bottom-up approach as RAD-GRK and SIGN in a short term
- b) To estimation of forest carbon removal with Tier 3 according to Indonesian National Standard in a long term
- c) To respond the area for improvement of National FREL in a future
- d) To synchronize software for simulation of land-based GHG emissions developed by international institutions as Michigan State University and World Agroforestry Center

Table 22 Summary of Methodology relating to MRV

Methodology (Published year)	Prepared by	Features	Remarks
Forestry Ministerial Decree No. 67/2006 on Criteria and Standard of Forest Inventory (2006) <sup>13</sup>	Ministry of Forestry (MoF)	Inventory standard by level (Mapping scale, inventory items etc.)	a) Provincial level should be conducted by the Governor, while district level should be conducted by the District Governor. b) Mapping scale of national level at least 1:500,000, provincial level is at least 1:250,000, while district level is at least 1:100,000
Land cover classification (2010) <sup>14</sup>	Indonesian National Standard Agency (SNI)	Land cover (LC)/ Land Use (LU) class	a) Classification according to FAO and ISO19144-1 (Geographical Information-Classification System) b) Detailing classification according to mapping scale
Standard on Carbon Measurement to Support Application of REDD+ in Indonesia (2010) <sup>15</sup>	MoF	Sorting international methods	Proposed methods on monitoring is limited.
Measurement and Calculation of Carbon Reserve –Field Measurement to Estimate Forest Carbon Reserve –(2011) <sup>16</sup>	SNI	Sample survey method on biomass	a) Applying Tier 3 forest carbon removal monitoring b) According to IPCC methodology c) Including peat lands
Preparation of Allometric Equation to Estimate Forest Carbon Reserve based on Field Measurement (2011) <sup>17</sup>	SNI	Method of destructive survey of sample trees to estimate biomass	Based on SNI 7724 and IPCC 2003,2006
Strategy and Implementation Plan for REDD+ Measurement, Monitoring, Reporting, and	National REDD+ Task Force	Concept of REDD+MRV	Assuming feedback to central level from monitoring in sub-national level with higher accuracy

<sup>13</sup> Peraturan Menteri Kehutanan Republik Indonesia Nomor: P.67/Menhut-II/2006 tentang Kriteria dan Standar Inventarisasi Hutan (6 Nopember 2006)

<sup>14</sup> Badan Standardisasi Nasional. 2010. SNI 7645:2010 Klasifikasi Penutup Lahan

<sup>15</sup> Tim Perubahan Iklim Badan Litbang Kehutanan. Kementerian Kehutanan. 2010. Pedoman Pengukuran Karbon untuk Mendukung Penerapan REDD+ di Indonesia. Pusat Penelitian dan Pengembangan Perubahan Iklim dan Kebijakan. Badan Penelitian dan Pengembangan Kehutanan

<sup>16</sup> Badan Standardisasi Nasional. 2011. SNI 7724:2011 Pengukuran dan Penghitungan Cadangan Karbon-Pengukuran Lapangan untuk Penaksiran Cadangan Karbon Hutan-

<sup>17</sup> Badan Standardisasi Nasional. 2011. SNI 7725:2011 Penyusunan Persamaan Alometrik untuk penaksiran cadangan karbon hutan berdasarkan pengukuran lapangan

Methodology (Published year)	Prepared by	Features	Remarks
Verification (MRV) in Indonesia (2012) <sup>18</sup>			
National GHG Inventory Implementation Standard (2012) <sup>19</sup>	Ministry of Environment (MoE)	GHG emission inventory in national/provincial, district/ city level aiming at report to UNFCCC (biannual report and national communication)	a) Basis of national GHG inventory system (SIGN) b) Bottom-up approach from district through province c) Recommendation to conduct inventory since 1994 if possible but at least since 2000
REDD Abacus SP(2012)	World Agroforestry Center	Software to calculate BAU and scenario of land-based GHG emission	Recommendation to utilize in preparing RAD-GRK
Standard on Monitoring and Evaluation, and Reporting of Implementation of Local GHG Emission Reduction Action Plan (RAD-GRK) (2013) <sup>20</sup>	National Development and Planning Agency (Bappenas)	Standard of annual report of RAD-GRK	Mainly reporting format
Implementation of Demonstration Activity of REDD+ in Indonesia (2013) <sup>21</sup>	SNI	Standard to be applied for demonstration activity	a) Applicable for demonstration activity b) Recommendation of SNI and IPCC Guideline
Technical Standard for Calculation of Land-based GHG Emission in Preparing BAU and Scenario of Mitigation Action (2013) <sup>22</sup>	Bappenas	Standard to prepare REL and RL for RAD-GRK	a) 2006-2011 base period b) RL: 2011-2020 c) Emission factors are average of nationwide. This is one of area for improvement. d) There is a plan to revise RAN-GRK in 2016. RAD-GRK will also be required to revise based on the revision of RANN-GRK <sup>23</sup> .
Calculation Method on Forest Cover Change based on Visual Interpretation of Optical Satellite Imagery (2014) <sup>24</sup>	SNI	Procedure of visual interpretation of optical satellite imagery	To be applied in national level
GCF Forest Carbon Inventory Toolbox (2014)	Michigan State University-GC F Fund	Web-based software to collect, process and use data to support REDD+ MRV on line	a) Project information management toolkit b) Plot sample design toolkit c) Geographic data management toolkit d) Forest carbon measuring toolkit i. Plot inventory manager ii. Allometric equation library iii. Forest carbon (Emission Factor)

<sup>18</sup> Tim Kerja MRV Satgas REDD+. 2012. Strategi dan Rencana Implementasi Pengukuran, Pemantauan, dan Pelaporan yang Terverifikasi (MRV) untuk REDD+ Indonesia. Satuan Tugas Persiapan Kelembagaan REDD+

<sup>19</sup> KLH. 2012. Pedoman Penyelenggaraan Inventarisasi Gas Rumah Kaca Nasional (INV/KLH/290612)

<sup>20</sup> Bappenas. 2013. Pedoman Umum & Petunjuk Teknis Pemantauan, Evaluasi dan Pelaporan Pelaksanaan RAD-GRK

<sup>21</sup> Badan Standardisasi Nasional. 2013. SNI 7848:2013 Penyelenggaraan Demonstration Activity REDD+

<sup>22</sup> F. Agus, I. Santosa, S. Dewi, P. Setyanto, S. Thamrin, Y. C. Wulan, F. Suryaningrum (eds.). 2013. Petunjuk Teknis Penghitungan Emisi Gas Rumah Kaca Sektor Berbasis Lahan Pada Skenario BAU dan Aksi Mitigasi: I. Landasan Ilmiah. Badan Perencanaan Pembangunan Nasional, Jakarta

<sup>23</sup> Information collected at the meeting of drafting team from Ex IJREDD+ GIS Trainees held on 21-22 Dec. 2015 (A participant from Provincial Local Development and Planning Agency [Bappeda])

<sup>24</sup> Badan Standardisasi Nasional. 2014. SNI 8033:2014 Metode Penghitungan Perubahan Tutupan Hutan berdasarkan Hasil Penafsiran Citra Penginderaan Jauh Optik secara Visual

Methodology (Published year)	Prepared by	Features	Remarks
			reporting
Indonesian National Carbon Accounting System (INCAS) (2015) <sup>25</sup>	MoF	Accounting system of GHG emission and removal in land sector (including REDD+)	a) Public consultation done in Oct. 2015 b) Covering the follows (Base period 2001-2012) i. Peat fires ii. Peat oxidation and other than carbon iii. Other REDD+ activity (SMF, Enhancement of forest carbon stock)
REDD National FREL (2015) <sup>26</sup>	REDD+ Agency	National FREL	a) Base period: 2000-2012, Only deforestation and forest degradation b) Area for improvement i. Activity data ii. Forest emission factors iii. Peat emission factors iv. Peat fire emission v. Covering other REDD+ activity
REDD National FREL (2015) <sup>27</sup>	MoEF	National FREL	a) Base period: 1990-2012, Only deforestation and forest degradation b) Area for improvement i. Activity data ii. Forest emission factors iii. Peat emission factors iv. Peat fire emission v. Covering other REDD+ activity
SOP to Arrange Measurement Plot and Data Collection-Forestry Carbon Inventory-East Kalimantan (2015) <sup>28</sup>	Michigan State University-East Kalimantan Climate Change Council	Sample plot survey method for forest carbon survey	Utilizing GCF Forest Carbon Inventory Toolbox (Forest Carbon Inventory Toolbox) (2014)

In addition to REDD Abacus mentioned in the above table, a training on Lumens software (using Q-GIS) improved from REDD Abacus were conducted in 2015.

## 1.2. Reviews on Sub-national Institutional arrangement for forest ecosystem carbon in West Kalimantan Province

### (1) MRV strategy in West Kalimantan Provincial level

<sup>25</sup> Krisnawati, H., Imanuddin, R., Adinugroho, W.C. and Hutabarat, S. 2015. Standard Methods for Estimating Greenhouse Gas Emissions from the Forestry Sector in Indonesia (Version 1) Indonesian National Carbon Accounting System (INCAS)

<sup>26</sup> BP-REDD+, 2015, National Forest Reference Emission Level for Deforestation and Forest Degradation in the Context of the Activities Referred to in Decision 1/CP.16, Paragraph 70 (REDD+) Under the UNFCCC: A Reference for Decision Makers, Published by BP-REDD+ Indonesia

<sup>27</sup> MoEF. 2015. National Forest Reference Emission Level for Deforestation and Forest Degradation: in the Context of Decision 1/CP.16 para 70 UNFCCC (Encourages developing country Parties to contribute to mitigation actors in the forest sector), Directorate General of Climate Change, The Ministry of Environment and Forestry, Indonesia

<sup>28</sup> Michigan State University dan Dewan Daerah Perubabahan Iklim Kalimantan Timur. 2015. POS untuk Penyusunan Petak Ukur dan Pengumpulan Data-Inventarisasi Karbon Hutan-

The following strategies implicate the assumption that Provincial Local Development and Planning Agency (Bappeda Prov.) arrange the report on mitigation action while Provincial Local Environmental Agency (BLHD Prov.) handles monitoring and reporting on GHG. Provincial Local Environmental Agency sets developing methods and organizations of MRV as one of top priority in the short run.

Table 23 Summary on strategy relating to MRV in West Kalimantan Provincial level

Strategy (Published year)	Main in-charge organization	Summary of MRV Strategy	Remarks
RAD-GRK (2012)	Provincial Local Development and Planning Agency (Bappeda)	1) A team organized by Provincial BLHD conduct setting baseline and calculation of GHG emission (once a year), 2) A team organized by Bappeda to coordinate, monitoring, reporting, evaluation of implementation of GHG reduction activity (already organized <sup>29</sup> ). 3) Reporting is conducted from the each local administration unit (SKPD) to Bappeda.	Reviews and evaluation in each 3 to 5 years
Provincial REDD+ Strategy and Action Plan (SRAP REDD+) (2013) <sup>30</sup>	Provincial Environmental Agency (BLHD)	1) To develop method and organization of MRV 2) To prepare MRV method based on academic 3) To prepare technical standard and SOP of establishing REL and MRV system 4) To develop MRV networks 5) To develop and organize Integrated Information Center on REDD MRV, Finance and Spatial Plan (One roof, One Data, One Map)	Priority in the short run

## (2) Overview of institutional arrangement for monitoring in West Kalimantan Province and the Targeted Districts

The following table shows the outline of institutional arrangement for monitoring in West Kalimantan Province and the targeted districts. There are organizations in provincial level concerned with monitoring. Such organizations have started preparation to strengthen institutional arrangement for MRV. According to the experiences of monitoring RAD-GRK, the monitoring results seem to be utilized a little to design reduction action with additionality based on the monitoring results<sup>31</sup>.

Table 24 Summary of needs and examples of Sub-national forest ecosystem carbon monitoring in targeted Provinces and Districts

Level	Main in-charge Organization	Needs for Monitoring	Cases	Remarks
Province	Local Development	a)Monitoring and evaluation, and	a) Every year the local administration unit (SKPD) is	

<sup>29</sup> Keputusan Sekretaris Daerah Provinsi Kalimantan Barat Nomor 2/BAPPEDA/2015 tentang Pembentukan Tim Fasilitasi dan Koordinasi Rencana Aksi Daerah Penurunan Emisi Gas Rumah Kaca

<sup>30</sup> Tim Penyusun (Gusti Hardiansyah, Adi Yani, Fahrizal, Yosef Lego Ngo, Boy Manuputty, Arifin, Hendarto, Darmawel, Rosadi Jamani, Zuhry Haryono, Iskandar, Idham, Ilyas, Zailani, Yoslinda, Yenny, Rifwan, Micahel Jenro, Eny Septia Sati, Sholatiana, Asnan Fauzi Irvanto). 2013. Strategi dan Rencana Aksi Provinsi REDD+ KALBAR

<sup>31</sup> According to the results of interviews in Provincial Local Development and Planning Agency [Bappeda] on 18 Nov. 2015 (Head of Division of Regional Infrastructure Planning)

Level	Main in-charge Organization	Needs for Monitoring	Cases	Remarks
	and Planning Agency (Bappeda)	reporting of implementation of RAD-GRK (PEP) b)Monitoring of spatial plan	requested to report but the data submitted is not be usable to reporting by the targeted time. Bappeda must prepare figures for the convenience of reporting by the deadline <sup>32</sup> . b)Agency for Coordination of Spatial Plan Control is organized <sup>33</sup>	
	Local Environmental Agency (BLHD)	"Reduction of GHG emission (Nature Resources Conservation and Protection Program)" as indicator <sup>34</sup>	a) Compiling provincial budget 2016 for organizing institutional arrangement of MRV based on SRAP REDD+ <sup>35</sup> b) Planning establishing 8 sample areas (2 plots/area) based on SRAP REDD+ and the results of meeting of participating provinces in Indonesia 2015 <sup>36</sup>	PT. Suka Jaya Makmur (Natural forest business Company) a) PT. Muara Sungai Landak (Industrial plantation business company) b) PT. Sinar Mas (Industrial plantation business company) c) PT. Cipta Usaha Sejati (Estate crop business company) d) PT. Mitra Aneka Sejati (Estate crop business company) e) Sylba UNTAN (Arboretum) f) Pastor Samwel Sidin, Rumah Pelangi Sei Ambawang (Private forest) g) Lembaga
	Forestry Office (Dishut)	a)"Reduction of area of Critical Land (Lahan Kritis)(Plantation forest development and forest restoration program)" as indicator <sup>37</sup> b)"Data on settlements in State Forest (13 districts)",	a) Proposing provincial budget to collect and process data on devastation of state forests in provincial level (Forest devastation control and security program) <sup>39</sup> b) Starting revising Provincial Mid-term Development Plan as the important basis to propose provincial budget	

<sup>32</sup> According to the results of interviews in Provincial Local Development and Planning Agency [Bappeda] on 18 Nov. 2015 (Head of Division of Regional Infrastructure Planning)

<sup>33</sup> Badan Koordinasi Penataan Ruang Daerah (BKPRD). Ad-hoc institutional arrangement organized to support implementation of Law No. 26/2007 on Regulation of Space (Undang-undang Nomor 26 Tahun 2007 tentang Penataan Ruang).

<sup>34</sup> Pemerintah Provinsi Kalimantan Barat. Tahun 2013. Rencana Pembangunan Jangka Menengah Daerah Provinsi Kalimantan Barat Tahun 2013-2018. Tabel 8.1. Program Prioritas Penyelenggaraan Urusan Pemerintah Daerah

<sup>35</sup> According to the results of interviews in Provincial Local Environmental Agency [Bappeda] on 13 Nov. 2015 (Head of Sub-division of Environmental Impact Study)

<sup>36</sup> Surat Kepala Badan Lingkungan Hidup Daerah Provinsi Kalimantan Barat selaku Ketua II Lingkungan Hidup Pokja REDD Plus Kalimantan Barat Nomor 660.1/713/BLHD-A Prihal Pembuatan Sample Plot Pengukuran Karbon  
Based on the following stratification.

"Man-made forest", "Primary Natural Forest", "Secondary Natural Forest", "Old Woodland (Belukar tua)", "Young Woodland (Belukar muda)", "Private estate crop", "Estate crop business company"

<sup>37</sup> Pemerintah Provinsi Kalimantan Barat. Tahun 2013. Rencana Pembangunan Jangka Menengah Daerah Provinsi Kalimantan Barat Tahun 2013-2018. Tabel 8.1. Program Prioritas Penyelenggaraan Urusan Pemerintah Daerah

Level	Main in-charge Organization	Needs for Monitoring	Cases	Remarks
		“Arrangement of data on potential of superior forest resources (5 districts)” (Development of forestry information system, Optimizing sustainable natural forest management, Enhancement of control and strengthening of utilization of State Forests) as indicator <sup>38</sup>	for forest carbon monitoring <sup>40</sup> c) Implementing potential surveys on superior trees in natural forests, monitoring of boundary piles of Protection Forest and profile survey on Protection Forest by Forest Inventory and Mapping Unit by provincial budget <sup>41</sup>	
Districts				
(Ketapang District)	Forestry Office (Dishut)	-	a) Monitoring mainly Protection Forest (using satellite imagery and field surveys) by District Budget b) Possible patrols by forest rangers (Polhut)	GIS skill holder: about 5 persons
(Kayong Utara District)	Forestry and Estate Office (Dishutbun)	-	a) Constructing post for guard of Protection Forest using national budget subsidy with designated use (DAK) b) Compiling data on critical lands (Lahan Kritis) (in cooperation with Watershed Management Office [BPDAS], a branch of MoEF)	GIS skill holder: about 1 person

### (3) Challenge to develop sub-national forest ecosystem carbon monitoring in West Kalimantan Province

The following figure is the overviews of issues and expectation to sub-national MRV based on the review results mentioned above. It is expected to be more accurate and more appropriate to local needs in comparison with national MRV.

<sup>39</sup> According to the results of interviews in Provincial Forestry Office [Dishut Prov.] on 16 Nov. 2015 (Nature Resources Protection Division)

<sup>38</sup> Dinas Kehutanan Provinsi Kalimantan Barat. 2013. Rencana Strategis Satuan Kerja Perangkat Daerah Dinas Kehutanan Provinsi Kalimantan Barat Tahun 2013-2018

<sup>40</sup> Information collected at “Workshop for Preparation of Provincial Forest and Land Monitoring Team in West Kalimantan Province” participating from Ex IJREDD+ GIS Trainees held on 28-29 Oct. 2015 (A participant from Provincial Forestry Office [Dishut Prov.]

<sup>41</sup> According to the results of interviews in Provincial Forestry Office [Dishut Prov.] on 17 Nov. 2015 (Forest Inventory and Mapping Unit)



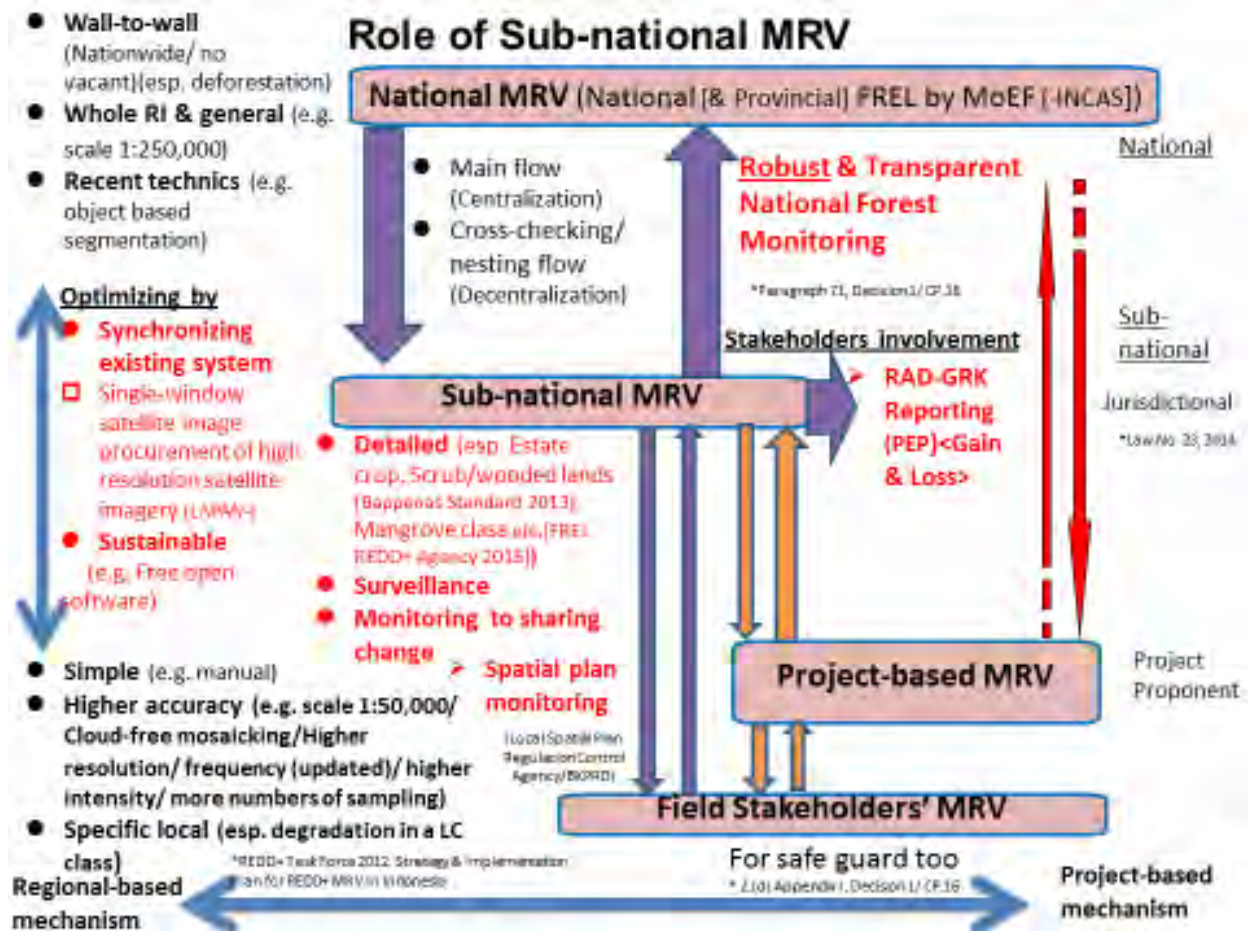


Figure 38 (Draft) Summary of challenging conditions to role of Sub-national MRV

### (1) Stakeholder analysis

According to a stakeholder analysis on REDD+ in West Kalimantan provincial level, BLHD is inferred one of key players having interests and being influential.

## Matrix interest and influence stakeholders in REDD + activities in West Kalimantan Province

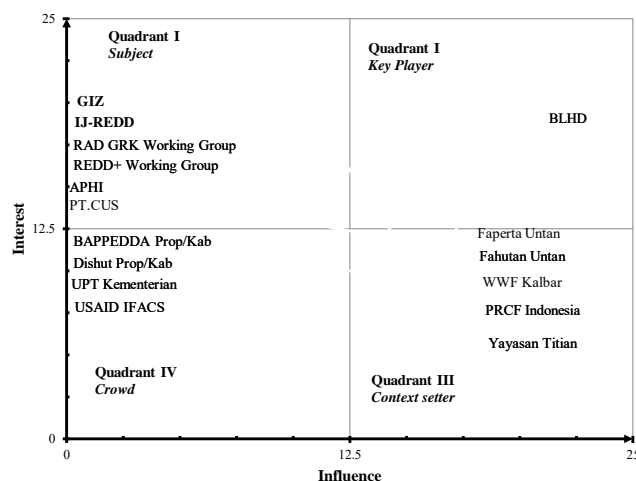


Figure 39 Overviews of Main Stakeholders on REDD+ in West Kalimantan Province<sup>42</sup>

### (2) Facilitation to reactivate REDD+ Working Group and establishing monitoring organization and formulating MRV plans

In order to facilitate formulating provincial forest ecosystem carbon monitoring by participatory planning of stakeholders, concept of organizing “(temporary named) provincial forest and land forest and land monitoring team” (see the figure below) as institutional arrangement of authorities concerned with monitoring and MRV was prepared.

<sup>42</sup> Tim Peneliti (Gusti Hardiansyah, Emi Roslinda, Fahrizal, Farah Diba). 2015. Laporan Penelitian Analisis Stakeholder dalam Pelaksanaan Program REDD+ di Kalimantan Barat. IJREDD-Fakultas Kehutanan Universitas Tanjungpura-JICA



### Proposed Image of Strategic Strengthening of Subnational Institutional Arrangement for REDD+

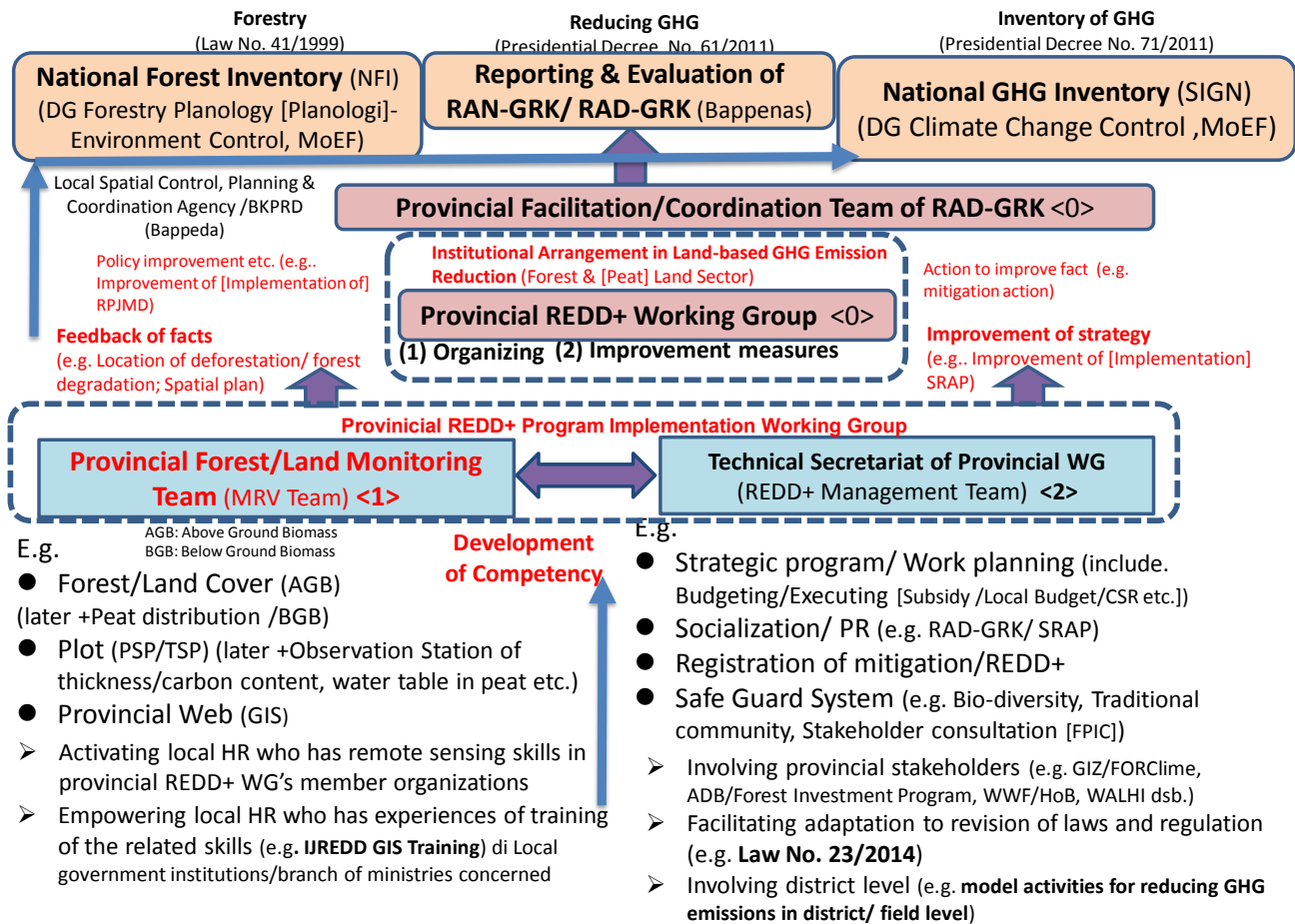


Figure 40 (Draft) Concept of role of (temporary named) provincial forest and land monitoring team using the concept, brainstorming by visit interviews was conducted (Oct.-Nov. 2015).

- Members of REDD+ Working Group in Provincial Local Development and Planning Agency, Local Environmental Agency, Forestry Service and Estate Crop Service
- Branches of MoEF, Nature Resources Conservation Office (BKSDA), State Forest Consolidation Office (BPKH)
- Ex trainees of IJREDD+ GIS training

These activities aims at activating stagnant provincial REDD+ working group<sup>43</sup> which seems to be inactive after merger of REDD+ agency.

And workshops were also held as follows.

<sup>43</sup> Keputusan Gubernur Kalimantan Barat Nomor 115/BLHD/2012 tentang Pembentukan Kelompok Kerja Pengurangan Emisi dari Deforestasi dan Degradasi Hutan (Pokja REDD+) di Kalimantan Barat (18 Januari 2012)

Table 25 Summary of facilitation to organize (temporary named) provincial forest and land monitoring team

Time	Activity	Summary of facilitation	Remarks
Oct. 26-27, 2015	In-house training on final coordination of base maps	Proposing utilization of base maps in monitoring	There was a suggestion to increase accountability of base maps by preparing an explanation of process and method of preparation of base maps.
Oct. 28-29, 2015	Workshop toward Organizing Monitoring Team in West Kalimantan Province	Proposing ex IJREDD+ GIS trainees playing an important role in monitoring	There was an idea to use developing base maps for monitoring.
Dec.21-22, 2015	1 <sup>st</sup> Meeting of Drafting Team from Ex IJREDD GIS Training to Prepare Monitoring SOP	Facilitating Drafting Team make a draft activity plans for 2016 for preparation purpose of monitoring	Supporting drafting team's activity plan of 2016 was postponed by the IJREDD+ Management at the beginning of 2016 until setting role of IJREDD activities reconfirmation of visions etc. of the following important stakeholders. Directorate General of Climate Change Control, MoEF a) Provincial REDD+ Task Force in West Kalimantan Province b) GCF-TF Secretariat

As a result, the following letters to establish monitoring organization and formulating MRV plan in January 2016 by Head of Provincial Local Environmental Agency as the representative of Governor.

- a) Request of cooperation to IJ-REDD<sup>44</sup>. The followings are the summary of requested activities.
  - i. Preparing Web site to disseminate information of provincial REDD+ activities
  - ii. Forest and land monitoring surveys at model area
  - iii. Revising SRAP
  - iv. Establishing REDD+ organization
  - v. Capacity development of human resources concerned with REDD+ in provincial level
  - vi. Establishing MRV mechanism applicable in the province
  - vii. Meetings and discussions to consolidate team
- b) Restarting Meeting of Provincial REDD+ Working Group (26 Jan. 2016)<sup>45</sup>. The agenda covers evaluation and planning REDD+ Working Group and revising SRAP.

One of the conclusion at the meeting on 26 Jan. 2016 started to examination of Draft Governor's Decision to organize REDD+ Program Implementation Working Group, whose one of duties are MRV.

After the meeting, activities of the Provincial REDD+ Working Group and preparation for cooperated activities with IJREDD+ was started as follows.

<sup>44</sup> Surat Kepala Badan Lingkungan Hidup Daerah Provinsi Kalimantan Barat a.n. Gubernur Kalimantan Barat Nomor 660.1/38/BLHD-A Prihal Pengajuan Dukungan Kerja Sama (22 Januari 2016)

<sup>45</sup> Surat Kepala Badan Lingkungan Hidup Daerah Provinsi Kalimantan Barat a.n. Gubernur Kalimantan Barat Nomor 660.1/06/BLHD-A Prihal Undangan Pertemuan REDD+ (22 Januari 2016)

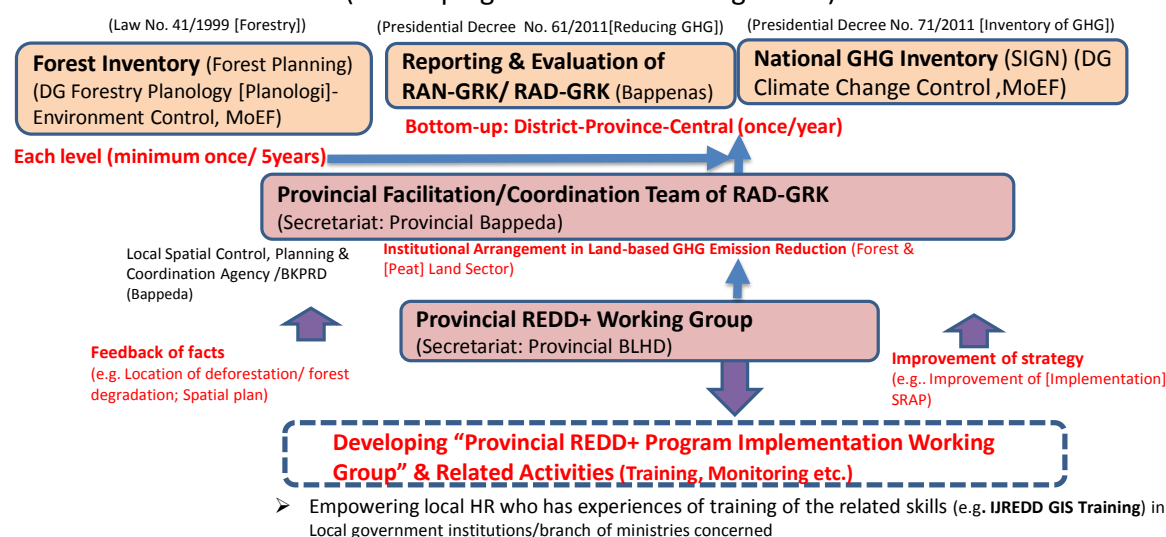
- a) Holding the training<sup>46</sup> on inventory analysis related with carbon monitoring on 10 Feb. 2016 involving approximately 20 persons of human resources in provincial level mainly from the former participants of IJ-REDD+ GIS Training<sup>47</sup>
- b) Proposing Draft TOR on cooperated activities with IJREDD in March 2016<sup>48</sup>

(3) (Proposed) Basic plan of annual forest carbon monitoring (forest ecosystem monitoring) by the (developing) Provincial REDD+ Program Implementation Working Group

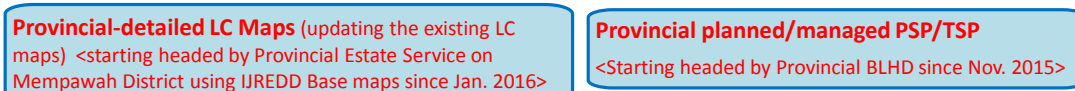
Using the review results, the following basic structure and procedures are proposed to plan forest ecosystem carbon monitoring applicable to provincial level taking into consideration harmonization to national level.

## (Proposed) Basic Structure of Subnational Monitoring

### (Developing Institutional Arrangement)



### I. Prioritized Target (Provincial BLHD): Annual Provincial Monitoring



### II. Future Target: Field Level Monitoring (Safe guard/ Prevention for better SFM/Forest Protection [to Adapt Law No. 23/2014 too])

III. (mainly Protected Area/ State Forest without Actual Field Manager e.g. Protection Forest [HL] etc.)

Figure 41 (Proposed) Structure of monitoring (data collection and management system plan) by “(developing) Provincial REDD+ Program Implementation Working Group”

<sup>46</sup> Surat Kepala Badan Lingkungan Hidup Daerah Provinsi Kalimantan Barat a.n. Gubernur Kalimantan Barat Nomor 660.1/09/BLHD-A Prihal Undangan Pelatihan Analisis Inventarisasi (5 Februari 2016)

<sup>47</sup> There is information that after the training, a meeting held by Provincial BLHD on 15 Feb. 2016 to prepare for Indonesia GCF Member Province Meeting (held on 18 Feb. 2016).

<sup>48</sup> Surat Kepala Badan Lingkungan Hidup Daerah Provinsi Kalimantan Barat Nomor 660.1/219/BLHD-A Prihal Pengajuan KAK Proyek REDD+ (4 Maret 2016)

Table 26 (Proposed) Basic points of implementation of Provincial Annual Forest Carbon Monitoring by  
“Provincial REDD+ Program Implementation Working Group in West Kalimantan”

Component	(Draft) basic plan	Remarks
Activity Data	<p>The existing base maps<sup>49</sup> will be corrected and improved in 5 years one cycle (approximately 1/4 area of the province per one year) as follows.</p> <p>a) The recent geographical information (e.g. project location maps) possessed and/ or prepared by the land based local administration unit (SKPD) and branches of MoEF will be collected through Provincial BLHD.</p> <p>b) The changed sites around a) above will be checked using the recent satellite imagery (procurable freely by the authorities).</p> <p>c) The ground truth surveys will be conducted on the sites necessary according to b) above.</p> <p>d) The base maps will be updated on the results above using GIS (using Q-GIS etc. which can be usable freely ). The result including recapitulation of area calculation will be shared through Provincial BLHD.</p>	<p>a) The USGS has established a no charge Web access archive.</p> <p>b) The Indonesian Governmental Organization can procure high resolution satellite imagery as SPOT freely based on the Presidential Instruction<sup>50</sup></p> <p>c) The 5<sup>th</sup> year is to update the remaining area in the 4<sup>th</sup> year and edit the whole province.</p>
Emission Factor	<p>The existing sample plots will be repeatedly measured in order to calculate and update provincial average of emission factors. The result will also be shared through Provincial BLHD.</p>	<p>a) 8 areas set for GCF-TF as mentioned above</p> <p>b) BPKH has also established Permanent Sample Plot.</p>
GHG equivalent calculation	<p>GHG equivalent values will be calculated and shared through Provincial BLHD.</p>	<p>The data will be utilized for reporting RAD-GRK by Provincial Bappeda.</p>

(4) (Proposed) Basic method of field level forest carbon monitoring (village-based forest monitoring) by “(developing) Provincial REDD+ Program Implementation Working Group”

Because of revised laws on local administration (see “Table 13), forest management authority shifts to National and Provincial Governments. From such situation, it can be expected that only forest administration authorities are difficult to conduct monitoring up to field level. Thus the following field level monitoring mainly on Activity Data (forest degradation etc.) by collaboration with Provincial Forestry Service and village administration is can be proposed in order to supplement updating base maps and continuous surveys of sample plots mainly “(developing) Provincial REDD+ Program Implementation Working Group” and contribute social safeguard (see the figure above and below).

The developing a method of village-based monitoring by involving community will contribute to adopt “Village Head is obliged to develop nature resources potential and to protect environment” stipulated in Acticle 26 (4) Clause, “Local administration in district/ city level etc. are obliged to involve village administration in developing rural regions related with village spatial plans (RTR Desa) of “Law on Village No. 6, 2014<sup>51</sup>”.

<sup>49</sup> The LC maps prepared as the REDD+ base maps in the course of IJREDD (Current time is 2013) are also utilizable. As far as the information obtained from the former participants for IJREDD+ GIS Training in Feb. 2016 (the representative from the Provincial Estate Office [Disbun] etc.), the LC maps of REDD+ base maps was utilized to update LC of Mempawah District etc. And also they would like to utilized the LC maps of REDD; base maps in other districts.

<sup>50</sup> Instruksi Presiden Republik Indonesia Nomor 6 Tahun 2012 tentang Penyediaan, Penggunaan, Pengendalian Kualitas, Pengolahan dan Distribusi Data Satelit Penginderaan Jauh Resolusi Tinggi

<sup>51</sup> Undang-Undang Republik Indonesia Nomor 6 Tahun 2014 tentang Desa (15 Januari 2014)

- a) A model, which is developing in GPNP and its Landscape pilot site (Output 2), can be applied to facilitate daily monitoring of forest degradation (patrol and watching out etc.) by collaborative management (see Activity2-1).
- b) Facilitators will be the personnel of units and forest rangers of Provincial Forestry service for landscapes other than national parks. The target sites will be the surrounding the open access State Forest where no any actual management implementers on the ground as Protection Forests. Collaborative management with the surrounding village will be developed.

(Proposed) **2 Ways of Approaches for Village-based State Forest** (Protection Forest etc.) **Collaborative Monitoring in Field Level**  
(GPNP Landscape)

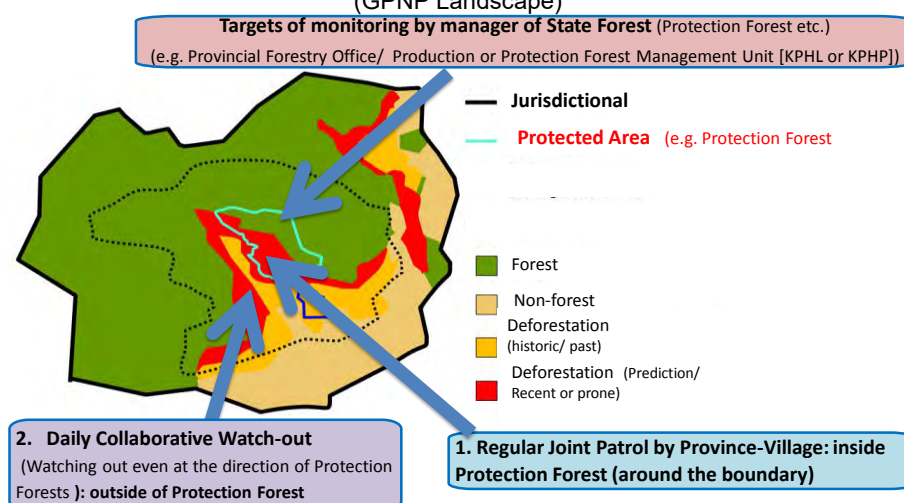


Figure 42 (Proposed) Overview of village-based forest monitoring method by “(developing) Provincial REDD+ Program Implementation Working Group”

### 1.3. Proposed necessary capacity building measures for implementation of Provincial Forest Ecosystem Carbon Monitoring

#### (1) Capacity building measures for establishing provincial annual forest carbon monitoring

The following activities are proposed as the necessary capacity building based on the discussion in 2.1 (2) above.

Table 27 (Draft) Capacity building measures for implementation of Provincial Annual Forest Carbon Monitoring

Component	Targets	Necessary capacity	(Draft) Building measures	Remarks
Activity Data	Those who is related in implementatio	Capacity to update LU/LC using GIS based on the ground	Training	a) Trainer will be one of MRV technical stakeholders of provincial REDD+ working group

Component	Targets	Necessary capacity	(Draft) Building measures	Remarks
	n of provincial monitoring	truth, and then to calculate the area		b) With field practices
Emission Factor	Those who is related in implementation of provincial monitoring	Standardization of measurement method. Especially ● Accuracy level ● Stratification ● Size of sample plot ● Location/distribution of sample plot ● Frequency of measurement ● Method of QA/QC	Preparation/improvement of SOP for specific for West Kalimantan use	a) By improving SOP to Arrange Measurement Plot and Data Collection-Forestry Carbon Inventory-East Kalimantan prepared by GCF-TF (2015) b) Requiring synchronization/harmonization of other methodology as SNI including on setting sample plot (see the figure below) c) Required newly drafting other LU/LC than forest as Oil Palm Estate for RAD-GRK use
	Local stakeholders having potential to participating in monitoring implementation (private company, NGO, university students)	Capacity to conduct inventory surveys and to calculate its results	Training	a) Trainer will be one of MRV technical stakeholders of provincial REDD+ working group a) With field practices (9 model area set in 2015)
Mechanism	The persons relating to Provincial REDD+ Working Group	Planning mechanism of MRV/Monitoring	Observation visit for case study	a) Other provinces and district where in process of developing mechanism of sub-national MRV like East Kalimantan Province b) Cooperation on REDD+ in ASEAN Countries like Vietnam

## Example of Needs of Synchronization/ Harmonization of Methodology (Square Plot)

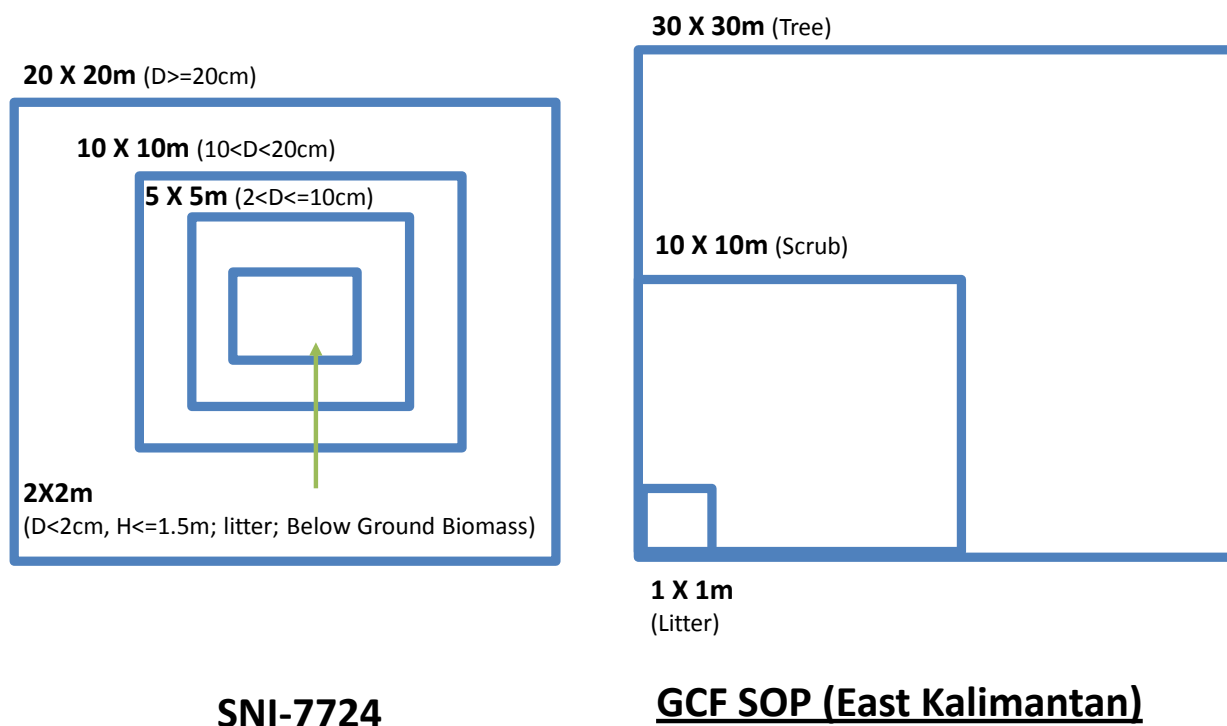


Figure 43 Example of needs of synchronization/harmonization of methodology

### (2) Capacity building measures for provincial field level forest carbon monitoring

The following activities are proposed as the necessary capacity building based on the discussion in 2.1 (3) above.

Table 28 (Draft) Capacity building measures for implementation of provincial field level forest carbon monitoring

Component	Targets	Necessary capacity	(Draft) Building measures	Remarks
Activity Data	Field implementers of Forest Inventory and Mapping Unit of Provincial Forestry Service; Forest rangers of provincial and	Capacity to locate the position with GPS And report on field monitoring information	Training	a) Trainer will be one of MRV technical stakeholders of provincial REDD+ working group b) With field practices



Component	Targets	Necessary capacity	(Draft) Building measures	Remarks
	district level			
	Forest rangers of provincial and district level	Capacity to facilitate collaborate with community at open access sites without actual forest management implementers like Protection Forests	a) Training b) Observation visit for case study (GPNP etc.)	a) Trainer will be one of ex IJREDD facilitator trainees of GPNP b) With field practices (Protection forests having REDD+ potential [See the table below and Activity 2-7])

Table 29 (Proposed) Candidate sites for field practices of field level forest carbon monitoring

District	Protection Forest	Forest Management Unit (KPH)	Remarks
Mempawah	Serindung	Unit VIII-KPHP	Larger deforestation around Protection Forest
	Pemangkat	Ditto	Ditto
	Timahobe	Ditto	Ditto
Kubu Raya	Pemancing - G. Ampawang	Unit XXXIII-KPHP	Larger deforestation around Protection Forest+ Smaller deforestation in Protection Forest
	S. Ambawang Kecil	Ditto	Larger deforestation around Protection Forest
	P. Pinang Luar	Ditto	a) Larger deforestation around Protection Forest
			b) One are belongs in the former FCP targeted village (Kuala Dua)
Kayong Utara	Dusung Besar	Unit XXV-KPHP	Larger deforestation around Protection Forest
	S. Kapar Kecil	Ditto	Larger deforestation around Protection Forest
	S. Durian Sebatang - S. Mendawak - S. Dawak	Ditto	Larger deforestation around Protection Forest
Ketapang	G. Juring	Unit XXVI-KPHP	Larger deforestation around Protection Forest
	Jelayang	Ditto	Larger deforestation around Protection Forest
	Mentekeh	Ditto	Larger deforestation around Protection Forest
	Temaenggung	Ditto	Larger deforestation around Protection Forest
	G. Batu Menangis	Unit XXX-KPHP	Larger deforestation around Protection Forest
	Lembuding	Unit XXIX-KPHP	Larger deforestation around Protection Forest
	Bukit Beladang Tujuh	Unit	Larger deforestation around Protection Forest

District	Protection Forest	Forest Management Unit (KPH)	Remarks
		XXXI-KPHP	
	G. Raya	Ditto	Larger deforestation around Protection Forest

## Activity 1-7 Identify potential REDD+ sites and compile information for future REDD+ projects

### 1. Implementing methods

To identify REDD+ suitable sites, firstly, it is required to develop identification methodology. In this process, selection of criteria is a key component of the work. It significantly varies depending on whether project considers emission reductions from deforestation and forest degradation or enhancement of forest carbon stock is chosen. Although the REDD+, which this study proceed with, focuses on reducing GHG emissions caused by land use and land cover changes especially in peatlands areas, it is also necessary to consider land and forest management systems (e.g. a system for issuing concession) and the land use plan (Tata Ruang) to proceed with activities for controlling GHG emissions.

In Vietnam, suitable sites were identified in JICA projects. Based on the knowledge gained from such studies, this study used criteria below (Figure 44) as a reference to identify suitable areas.

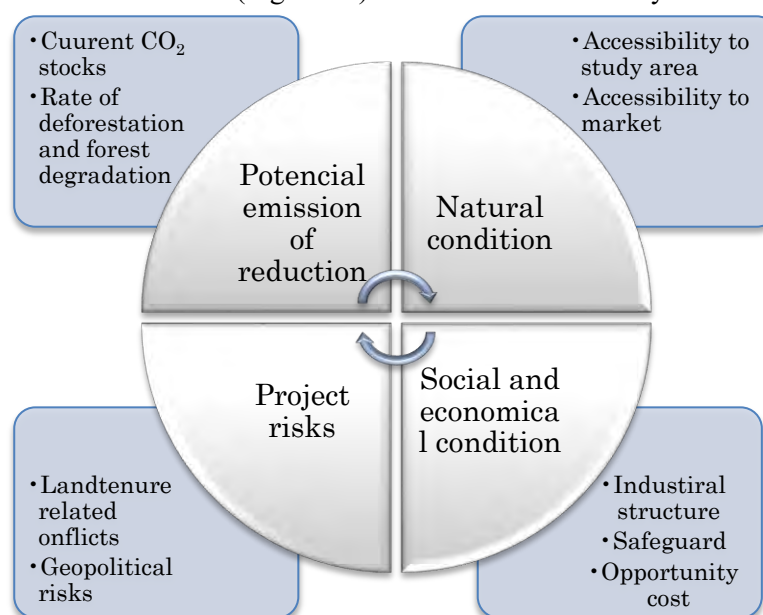


Figure 44 Criteria selection for REDD+ suitable area

Taking GHG emission reductions as an example, areas, where currently have large amount of forest carbon stock and show high deforestation and forest degradation rate due to surrounding area's situation, actually have high effects of GHG emission reductions. As a result, these areas would be selected as suitable sites. On the other hands, those areas where conflicts between community people and public

administration exist should be excluded from suitable sites because, in fact, it is difficult to carry out the project. Moreover, cost efficiency of project implementation is indispensable. Cost of driving force of GHG emissions and cost of countermeasure against GHG emissions should be balanced and this precondition would be a key to identify REDD+ suitable sites. Based on such criteria, preliminary attribute needs to be clarified. Under this process, it is necessary to arrange the functional classification of forest and a unit of measure for it. That is, it will be thoroughly discussed that the smallest unit should be totaled up based on which administrative unit (e.g. province, district or village level), natural condition (ecological condition), and land and forest management system (such as a system for issuing concession).

Firstly, district level base-maps are created for potential REDD+ sites (areas of which the expected effectiveness of conservation is high due to the presence of the high deforestation pressure) in the four western districts of West Kalimantan Province. The potential REDD+ sites are extracted by analyzing current status of land use and forest disturbance. Therefore, base-map is configured as a basic information maps layered changes in forest dynamics and current forest disturbance, which is delivered from satellite imagery analysis, on various special information (e.g. land use map, vegetation map, moratorium map) (Figure 45, Figure 46, Figure 47, Figure 48, Figure 49). Information to be used is concluded through discussion with such as the counterpart and partners.

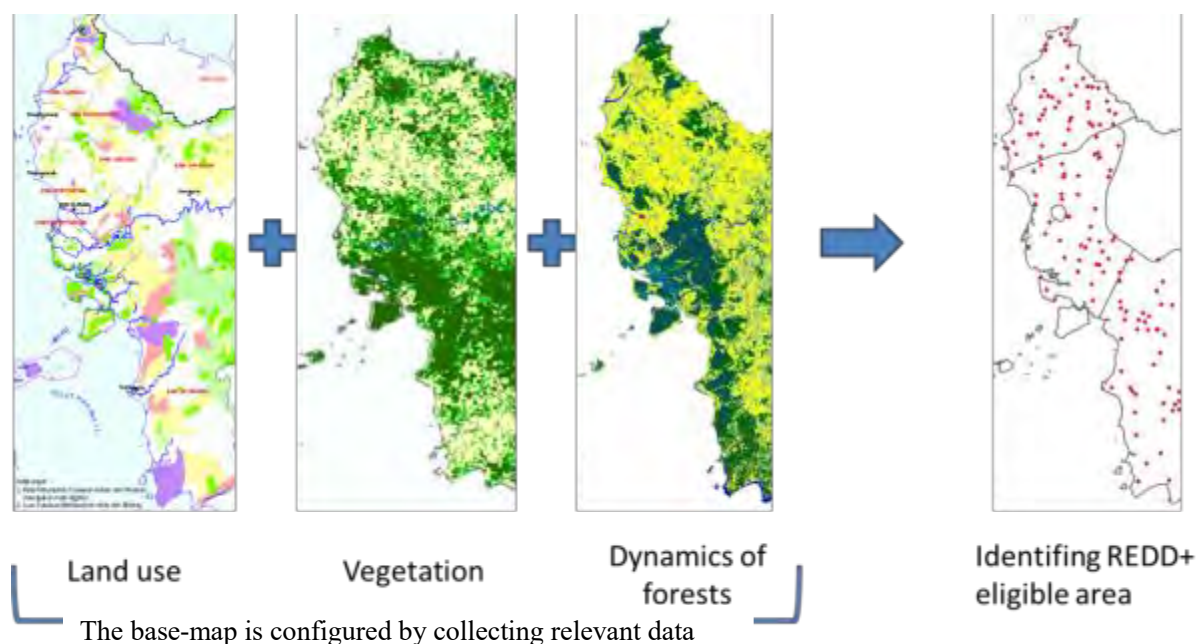


Figure 45 Concept of the base-map

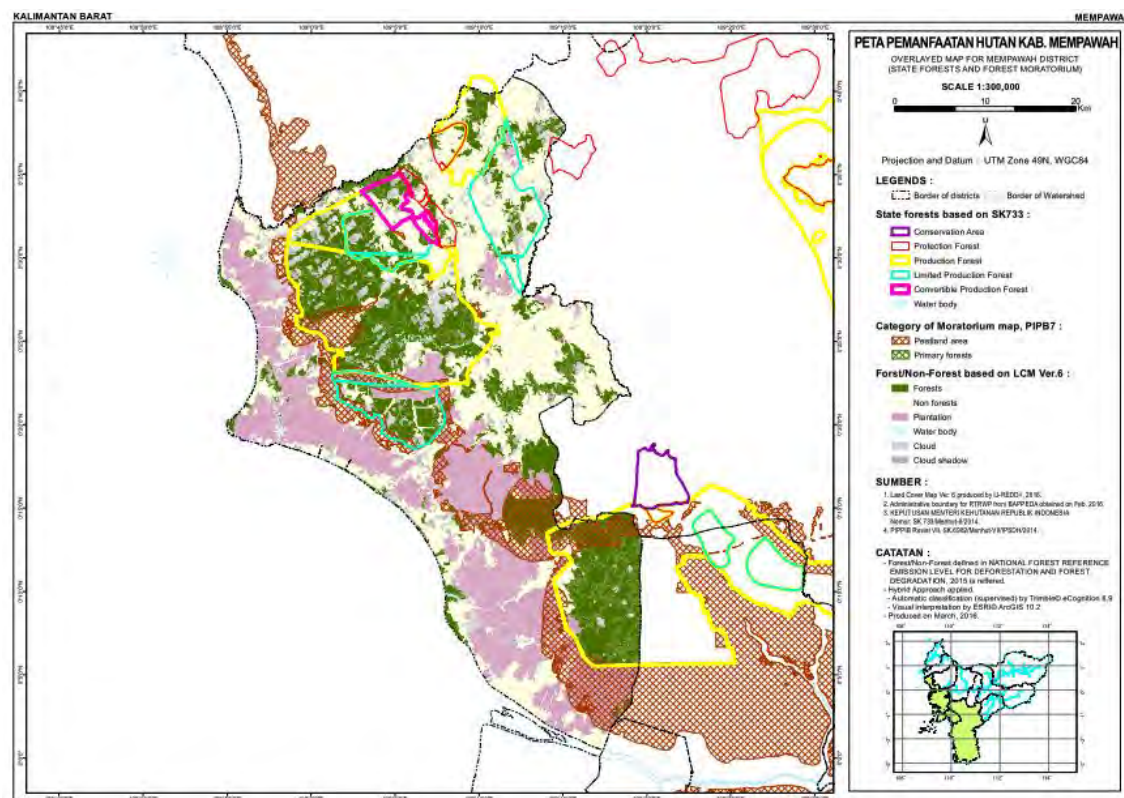


Figure 46 District level base-map for Mempawah district

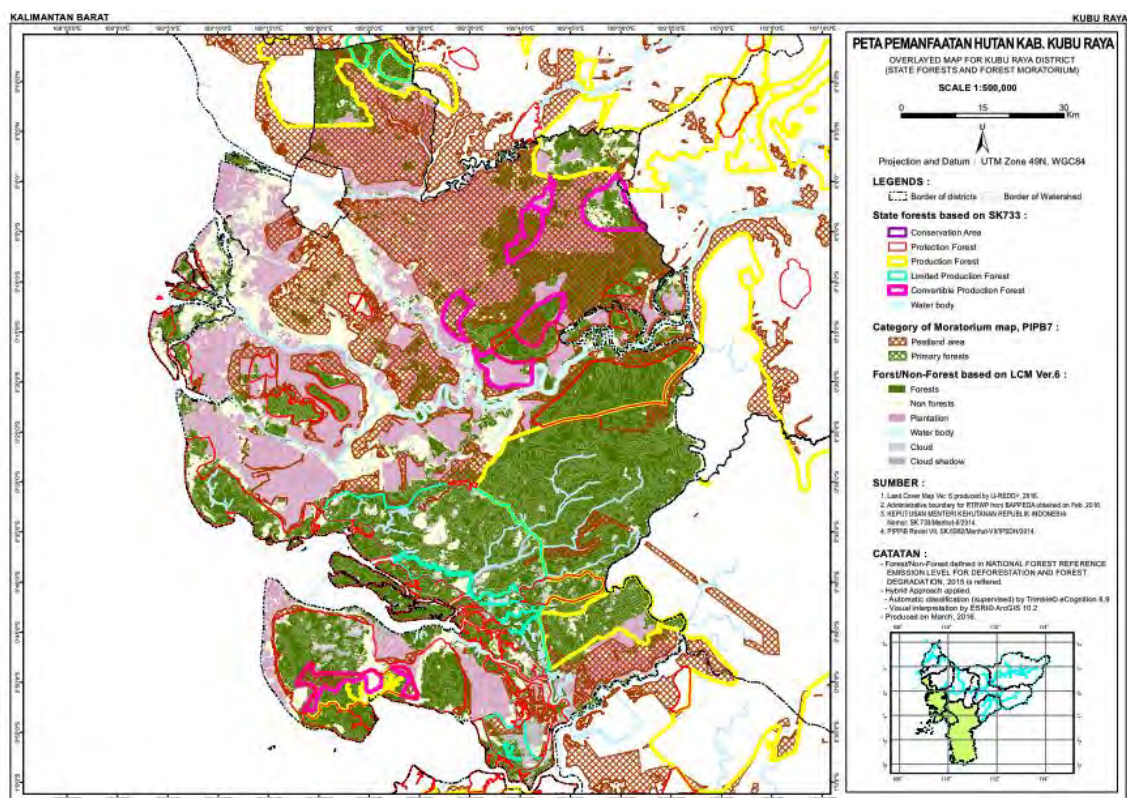


Figure 47 District level base-map for Kubu Raya district



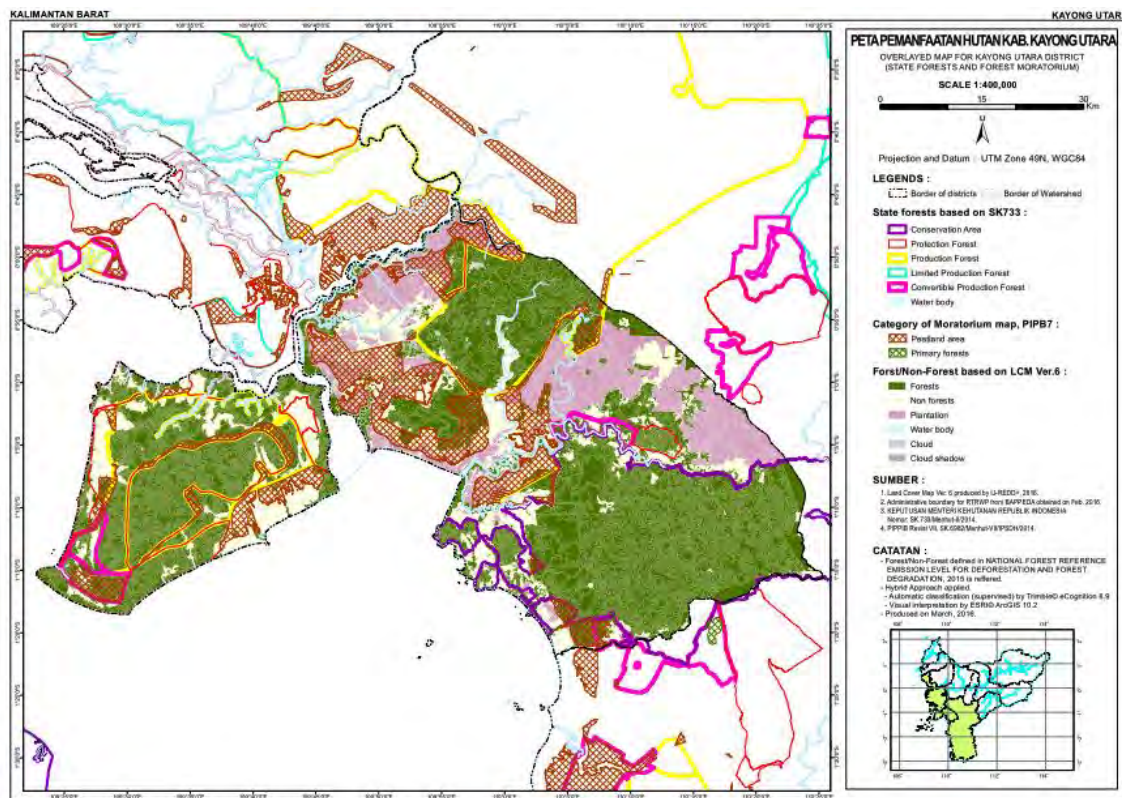


Figure 48 District level base-map for Kayong Utara district

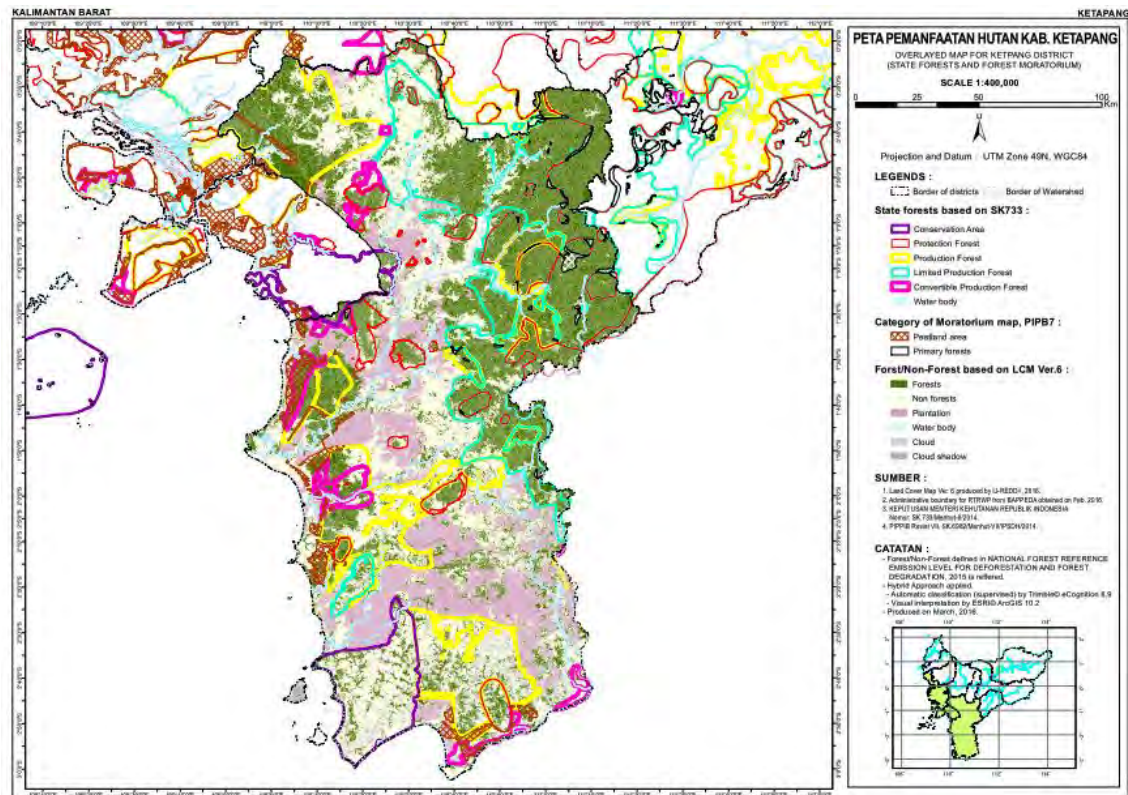


Figure 49 District level base-map for Ketapang district

## 2. Identifying potential REDD+ sites

On the basis of the spatial information prepared, the process to identify suitable sites was organized in general terms (Figure 50).

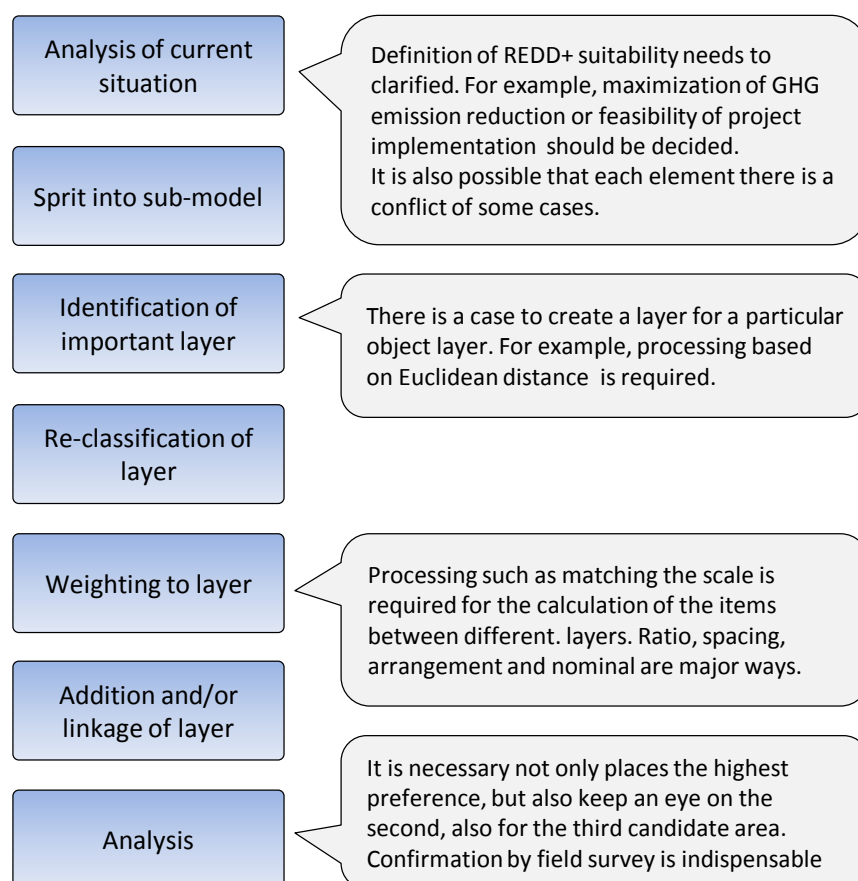


Figure 50 Flow of REDD+ suitable sites identification

In this general process, weighting for key layer is the most important step. This weighting process greatly influences results of suitable sites identification. Therefore, trial and error in conjunction with field verification is necessary.

Based on general process mentioned above, selection of high GHG reduction potential site carried out taking into consideration of criteria on Figure 50.

Meanwhile, discussion among counterpart and IJ-REDD+ experts has been made and pointed out that one of the challenges is protection forest and deforesting in neighbor area. In the forest transition theory, they said that “High forested and High deforested area” could be a major candidate of REDD+ potential site (Figure 51).

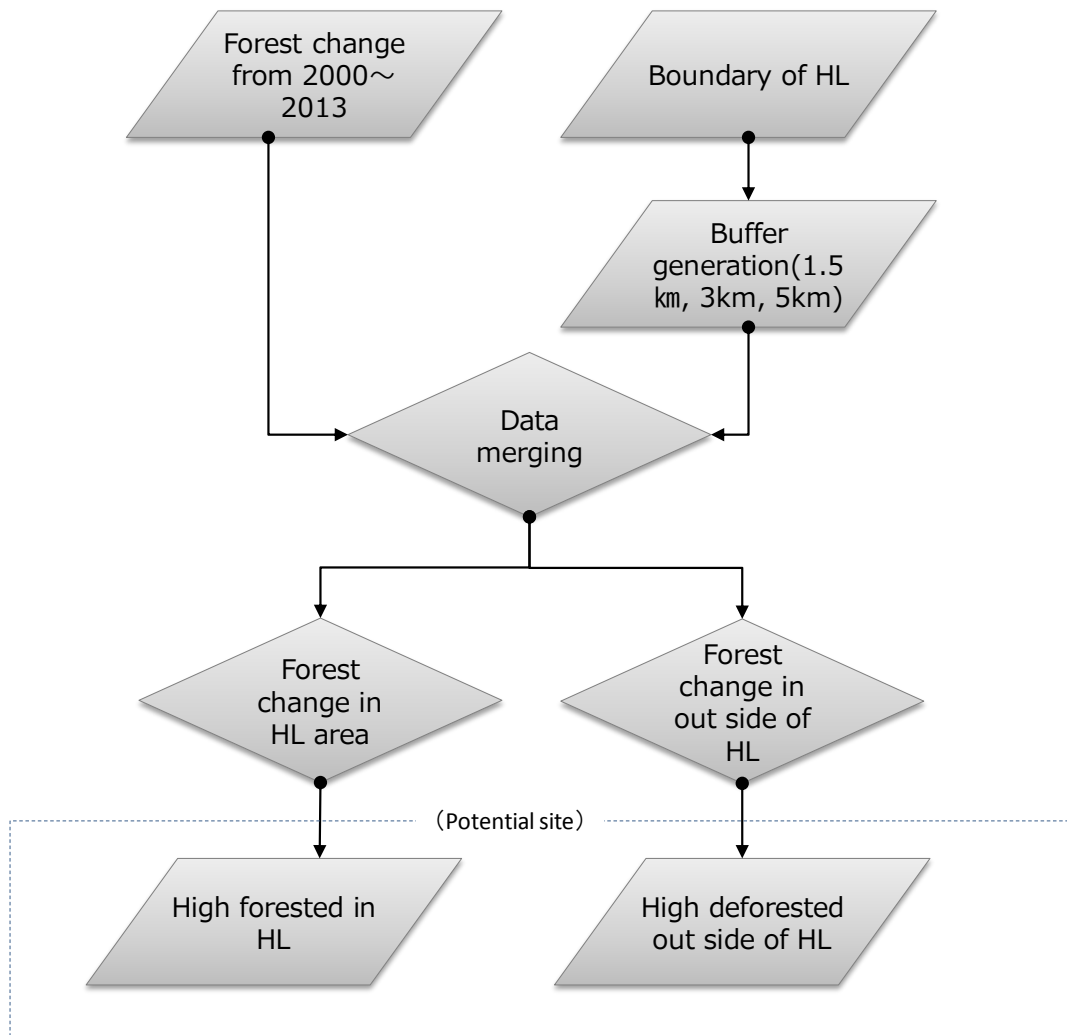


Figure 51 Selection of REDD+ potential site (in aspect of forest resources change)



Table 30 shows forest change between year 2000 and 20013 within protection forest area and neighbor area with buffering analysis.

	HL (inside)		HL (outside)					
			1.5km		3km		5km	
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)
HL Badung	89	5	-475	-24	-1,348	-26	-2,698	-25
HL Batu Dayeuh	-93	-19	-91	-5	-513	-14	-1,636	-28
HL Berubayan	-1,164	-15	-556	-10	-1,566	-14	-3,956	-19
HL Bukit Batu Nyambu	-859	-4	-769	-8	-1,634	-8	-2,136	-6
HL Bukit Belaban Tujuh	-1,526	-75	-331	-99	-393	-98	-603	-99
HL Bukit Kajang Berendam	-14	-1	-21	-1	-23	-1	-97	-1
HL Bukit Kerai Kundang	-3,316	-10	-887	-7	-2,077	-8	-3,497	-9
HL Bukit Penintin - Bukit Mancung	-639	-6	-195	-4	-296	-3	-655	-4
HL Bukit Perai	-401	-4	-65	-1	-189	-2	-441	-2
HL Bukit Tetundung	-24	-0	-49	-1	-97	-1	-225	-1
HL Dusun Besar	-463	-39	-1,053	-63	-2,204	-53	-4,579	-51
HL G. Ambawang	-294	-6	-1,721	-31	-4,046	-33	-6,438	-31
HL G. Batu Menangis	-1,986	-21	-2,072	-70	-5,841	-80	-11,202	-81
HL G. Biwa	-502	-25	-614	-25	-1,104	-21	-2,161	-23
HL G. Bukit Bebiau	-5	-0	-35	-1	-104	-1	-175	-1
HL G. Dangkul	-27	-4	-57	-4	-310	-11	-1,148	-20
HL G. Juring	-1,926	-16	-2,029	-59	-4,466	-58	-8,724	-53
HL G. Kepyayang	-56	-2	-779	-23	-1,899	-30	-3,375	-32
HL G. Pemancing - G. Ambawang	-109	-3	-1,157	-53	-3,468	-55	-8,619	-62
HL G. Pemangkat	-434	-33	-1,211	-62	-2,222	-58	-3,139	-58
HL G. Pering Melawi Condong	-144	-7	-200	-11	-333	-8	-622	-8
HL G. Raya	-2,809	-32	-895	-51	-2,377	-56	-4,898	-60
HL G. Serindung	-263	-65	-1,142	-69	-1,911	-62	-3,502	-55
HL G. Tais	-91	-6	-497	-33	-776	-30	-2,292	-35
HL G. Tarak	-3,877	-21	-3,103	-35	-8,147	-44	-14,763	-45
HL G. Tohe	-1,051	-33	-611	-48	-1,190	-37	-3,433	-45
HL Gandawalan	-855	-44	-1,746	-46	-3,360	-35	-6,524	-32
HL Haur - Mungguk Linang	-224	-14	-1,218	-16	-3,669	-17	-7,781	-16
HL Jelayan	-119	-51	-699	-80	-1,563	-88	-2,454	-90
HL Kemungkau	-1,188	-18	-1,830	-44	-2,985	-35	-5,154	-34
HL KH. G. Naning/G. Burung/Lubuk Lintang	-3,772	-4	-1,258	-8	-1,802	-6	-2,733	-6
HL Konar	0	0	-176	-76	-541	-76	-2,001	-66
HL Lembudung	-246	-25	-1,464	-87	-3,214	-86	-6,290	-72
HL Mentakeh	-48	-86	-1,502	-92	-4,233	-93	-7,958	-91
HL Menyumbung	-388	-3	-460	-6	-1,128	-8	-2,086	-8
HL P. Berembang	-195	-7	-698	-15	-1,500	-12	-2,929	-12
HL P. Beruan, Simpang Cabai	-240	-6	-633	-9	-1,965	-11	-4,323	-12
HL P. Betingah Tengah	-1,270	-34	-589	-20	-1,760	-28	-2,890	-27
HL P. Karunia	-102	-10	-301	-36	-1,087	-41	-2,015	-37
HL P. Limbung	-37	-3	-1,084	-45	-2,404	-46	-4,096	-37
HL P. Maya	-13,076	-43	-7,289	-48	-13,720	-50	-21,171	-51
HL P. Nyamuk - Parit Kelabau	-74	-5	-957	-25	-2,670	-28	-5,708	-32
HL P. Panjang I - P. Panjang II	-84	-2	-150	-4	-499	-5	-1,044	-6
HL P. Panjang III - P. Panjang IV	-86	-2	-245	-5	-950	-8	-3,013	-12
HL P. Periling	-80	-6	-261	-11	-444	-7	-1,226	-9
HL P. Pinang Luar 1-1	-264	-72	-537	-98	-841	-97	-1,789	-94
HL P. Pinang Luar 1-2	-124	-100	-252	-84	-1,162	-90	-2,087	-79
HL P. Pinang Luar 2	-817	-39	-2,336	-89	-4,691	-80	-7,411	-77
HL Padang Tikar	-4,046	-15	-2,291	-25	-4,866	-30	-7,069	-28
HL Padu Ampat - Lebak Kerawang	-3,539	-33	-10,108	-44	-26,902	-48	-57,823	-53
HL Pawan Hulu - Jelai Hulu	-0	-42	-179	-27	-607	-23	-1,030	-14
HL S. Ambawang Kecil	-435	-23	-2,810	-89	-4,881	-71	-7,396	-65
HL S. Bumbun	-17	-100	-973	-96	-3,049	-90	-6,599	-80
HL S. Durian Sebatang - S. Mendawak - S. Dawak	-140	-7	-1,716	-53	-3,002	-47	-5,514	-46
HL S. Jelai	-5,212	-36	-2,770	-49	-5,097	-48	-8,316	-48
HL S. Jenuh	-997	-17	-804	-13	-1,841	-13	-2,792	-11
HL S. Kapar Kecil	-2,594	-61	-2,492	-66	-4,628	-53	-7,883	-54
HL S. Kerabai	0	0	0	0	0	0	-39	-0
HL S. Lebak - S. Kerawang	-347	-17	-163	-5	-1,308	-14	-5,267	-25
HL S. Mendawak dsk	-197	-1	-763	-7	-2,708	-14	-5,546	-18
HL S. Tebedak	-111	-9	-596	-20	-1,787	-26	-2,876	-21
HL S. Tengar - S. Pesaguan	-580	-13	-868	-27	-1,608	-25	-4,585	-33
HL S. Tikus	-15	-2	-347	-17	-675	-13	-1,575	-15
HL Seruat - P. Tiga	-1,682	-14	-1,882	-26	-3,874	-31	-7,540	-38
HL Teluk Batang	-538	-9	-1,821	-34	-3,224	-34	-4,526	-32
HL Temenggung	-76	-30	-254	-29	-1,536	-62	-3,122	-62
HL Timahobe	-455	-48	-1,141	-56	-2,460	-53	-6,673	-57
HL Tj. Prapat Muda	-291	-5	-577	-11	-1,199	-12	-2,178	-13
HL Tukul	-65	-7	-202	-8	-586	-9	-2,190	-18

Note: HL: Hutan Lindung (protection forest)

Green colored cell indicate “low deforestation in protection forest” and red colored cell indicate “high deforestation in neighboring area”. To sum up, colored cell shall be candidate of REDD+ potential site. Figure 52 is mapping of potential site selection result.

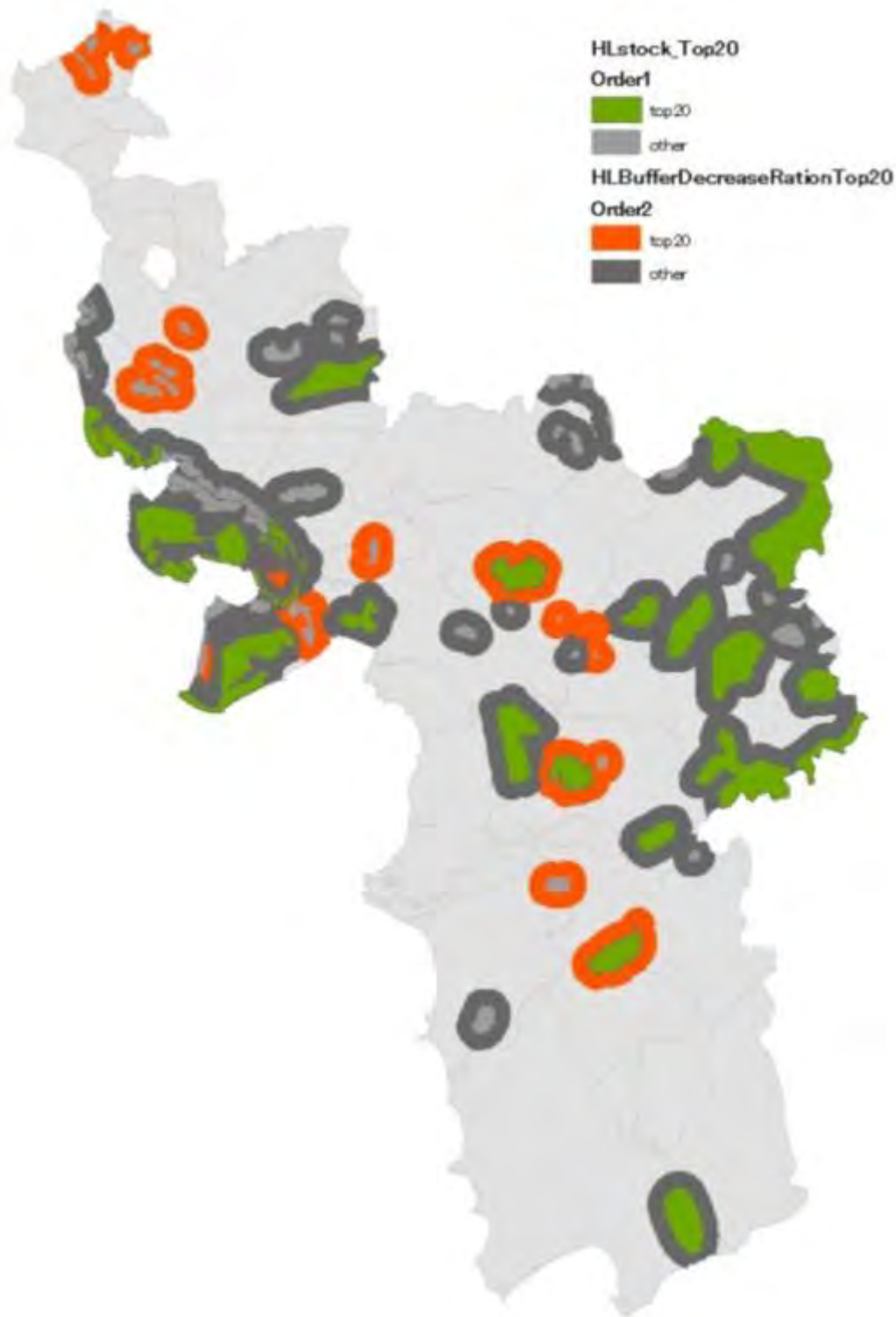


Figure 52 Forest change from 2000 to 2013 on HL and neighboring area.

Red color shows top 20 of high remaining forest within protection area and gray color shows the others. About neighbor area of protection forest, orange color shows top 20 of high deforestation area and gray color shows the others. As a result, protection forest with green color and/or neighbor are with orange color could be high potential site of REDD+ implementation. Above mentioned methodology and process of REDD+ potential site selection was carried out only focus on forest resource dynamics. To take shape of potential site and more practical, socio economic condition also shall be taking into account in selection process.

**Activity 1-8 Identify areas of strategic cooperation other than RL/REL and carbon monitoring.**

*(Not addressed by REDD+ planning study team)*

**Activity 1-9 Provide policy and technical assistance for the execution of strategic cooperation.**

*(Not addressed by REDD+ planning study team)*