Internal Ex-Post Evaluation for Technical Cooperation Project

conducted by Indonesia Office: October 2017

Country Name	**The Project for the Support on Forest Resources Management through Leveraging Satellite Image Information**
Republic of Indonesia	

I. Project Outline

Background	Indonesia's tropical and subtropical forests and wetlands covered the third largest area following Brazil and the Democratic Republic of Congo, and the forest areas of Indonesia was 88.5 million ha in 2005. Meanwhile, forest coverage area had been declining by 2% annually (FAO, 2005), and forest conservation and restoration became an urgent issue. Causes of deforestation were forest fires, illegal logging, timber processing and unplanned land conversion to agriculture. Behind those problems, there were following issues; (i) the limited accuracy of monitoring data on forest resources, low data reliability caused by non-integrated information about land use, (ii) lack of coordination among related government agencies on land use permits, (iii) legal and institutional turmoil due to the rapid decentralization. As effective measures to deal with issues above, it was necessary to obtain accurate and reliable forest resources information, to share such information among relevant organizations, and to develop and implement appropriate forest resource management plan. Under those circumstances, the government of Indonesia requested the government of Japan a technical cooperation project to enhance the forest resource monitoring system utilizing remote sensing techniques based on satellite image.				
Objectives of the Project	Through introduction of remote sensing technology using PALSAR (Phased Array type L-band Synthetic Aperture Radar)/MODIS (MODIS: Moderate Resolution Imaging Spectroradiometer) images, this project aimed at upgrading the capacity of the Directorate General of Forestry Planning (DJP) to conduct more reliable forest resources monitoring and assessment, thereby promoting the Sustainable Forest Management (SFM) in Indonesia.				
	1. Overall Goal: Sustainable Forest Management (SFM) is promoted in Indonesia through the upgraded forest resources monitoring and assessment 2. Project Purpose: DJP's capacity to conduct more reliable forest resources monitoring and assessment is upgraded through transfer of technology and training				
Activities of the project	1. Project site: Jakarta and UPTs (Unit Pelaksana Teknis)* (BPKHs)** 2. Main activities: Introduction of remote sensing technology using PALSAR/MODIS images in DJP's forest resource monitoring and assessment system, and training on the forest resource monitoring and assessment for DJP officers. * UPT: Unit Pelaksana Teknis (Technical Implementation Unit) ** BPKHs: Balai Pemantapan Kawasan Hutan (Branch office of Ministry of Forest) 3. Inputs (to carry out above activities) Japanese Side 1) Experts: 7 persons 2) Trainees received: 18 persons 3) Equipment: PC, software, GIS, projector and copy machine, image processor Indonesian Side 1) Staff allocated: 7 persons 2) Land and facilities: project office 3) Local cost: salaries to counterpart personnel, administration cost				
Ex-Ante Evaluation	2008	Project Period	September 2008 – September 2011	Project Cost	(Ex-Ante) 230 million yen (Actual) 223 million yen
Implementing Agency	Directorate General of Forestry Planning (DJP), Ministry of Environment and Forestry (MOEF) (former Forestry Planning Agency (BAPLAN))				
Cooperation Agency in Japan	Forest Agency				

II. Result of the Evaluation

< Special perspectives considered in the ex-post evaluation >

[Termination of the Advanced Land Observation Satellite (ALOS)]

- The provision of PALSAR data from the Japan Aerospace Exploration Agency (JAXA) has been discontinued due to termination of ALOS[1] . The designed lifetime of ALOS which launched in January 2006, was 3 years, and JAXA considered that the expected lifetime was 5 years. During the project implementation in April, 2011, the communication of ALOS became impossible caused by power anomaly and the operation of ALOS was terminated in May, 2011. Since the availability of PALSAR data is an essential requirement for the project, the above event severally affected the effectiveness and sustainability of the project.

[Redefinition of the verifiable indicators for the Project Purpose and the Overall Goal at the time of terminal evaluation]

- In order to verify achievement level of the Project Purpose and the Overall Goal, the verifiable indicators for them in the Project Design Matrix (PDM) were redefined by the both Indonesian side and Japanese side at the time of terminal evaluation. This ex-post evaluation reviewed the redefined indicators for the verification and reorganized the indicators as mentioned below.

[Appropriateness of the verifiable indicators for the Project Purpose and the Overall Goal]

- According to the terminal evaluation, some of the verifiable indicators were considered as "inappropriate" for the Project Purpose or the Overall Goal. Therefore, this ex-post evaluation did not utilize three indicators for verification of achievement level of the Project Purpose and the Overall Goal. The reasons of inappropriateness for those indicators are as follows:
  - Indicator 3 for the Project Purpose (An estimating of a carbon amount in forest is tested.): Since estimation of carbon amount in forest was a part of the project activities to produce the Output 1 mainly focusing on capacity development for using PALSAR data to increase accuracy of

[1] ALOS was developed to contribute to the fields of mapping, precise regional land coverage observation, disaster monitoring, and resource surveying.

land cover maps, it merely represents one dimension of the monitoring and assessment capacity, and thus it should not have been a verifiable indicator for the Project Purpose.

- Indicator 2 for the Overall Goal (Utilization of land cover maps using PALSAR data for formulation of plans by the management unit level): Since the high resolution optical imaging, such as IKONOS, ENV1, ALOS PRISM, and ALOS/AVNIR, have been utilized for the forest management plans at the management unit level, information based on the land cover maps at national level using the PALSAR data (50m resolution) cannot be applied.
- Indicator 3 for the Overall Goal (Application of information based on the land cover maps using the PALSAR data to carbon accounting from forest and monitoring of illegal logging activities): Although the analysis of the PALSAR data enabled estimation of forest size at high accuracy through the project activities, carbon accounting from forest requires estimation of carbon cumulative dose per unit forest size which had not been included in the project scope. Also, the methodologies developed by the project were not applicable for monitoring illegal logging because suitable satellite images and sites were not appropriately selected in the project activities. Therefore, there is no causal relation between the indicator 3 and the project.

1 Relevance

<Consistency with Development Policy of Indonesian Government at the time of ex-ante evaluation and the project completion>

This project was consistent with Indonesia's development policy of "Improvement of natural resource management and environmental protection" as set forth in the policy documents including the Mid-term Development Plan (PRJMN) (2004-2009), PRJMN (2010-2014) and the National Development Vision and Mission (RPJPN) (2005-2025).

<Consistency with Development Needs of Indonesia at the time of ex-ante evaluation and the project completion>

This project met the development needs of Indonesia to introduce remote sensing techniques utilizing cloud-free satellite image in order to obtain reliable and precise forest resource data for proper forest resource management.

<Consistency with Japan's ODA Policy for Indonesia at the time of ex-ante evaluation>

The project was consistent with Japan's Country Assistance Program for Indonesia (2004) which stated the assistance for an appropriate natural resource management from the view point of environmental protection. In response to this, JICA considered the natural environmental protection was one of the cooperative program (2006).

<Appropriateness of project design>

The project was designed based on the premise that provision of PALSAR would be continued, even though the continuous operation of ALOS was not promised as mentioned above. The project should have considered alternatives in case of termination of ALOS, or the PDM should have been designed that the Project Purpose and the Overall Goal could have been achieved without PALSAR data at the time of project planning stage. Furthermore, there is a causal leap between the project inputs and the Overall Goal, which made difficult to verify the achievement of the Overall Goal.

<Evaluation Results>

In the light of above, the relevance of this project is fair.

2 Effectiveness/Impact

<Status of Achievement of the Project Purpose at the time of project completion>

The project purpose was partially achieved by the project completion. In terms of improvement of reliability of forest resource monitoring and assessment information (Indicator 1), it was expected that PALSAR data would be able to eliminate cloud cover appeared in the land cover map and accuracy of land cover maps would be improved. Through the implementation of the project, an interpretation manual for PALSAR data as well as a guideline for the use of PALSAR data for land cover mapping (as main satellite images) was prepared. Technically achievable accuracy based on the methods developed by the project (i.e. matching ration between the land cover types appeared on the sample land cover maps formulated based on the above manual/guideline, using only PALSAR 50-m Resolution Orthor Mosaic data, and the land cover types identified through field surveys) was more than 85%. However, the nation-wide land cover maps using PALSAR data was not created by the project completion because of (i) discontinuation of free-of-charge provision of PALSAR data by JAXA from 2010 due to change in a data provision policy of JAXA and (ii) termination of ALOS operation in May 2011. In order to cope with the above issue, the project made efforts to purchase the PALSAR data from JAXA after 2010 by the project budget until the termination of ALOS. As a result, PALSAR data were utilized in developing land cover maps based on optical sensor data as complement for the areas covered by clouds.

With regard to capacity development of UPTs/BPKHs (Indicator 2), according to the terminal evaluation, 11 officers participating in the advanced training courses, were supposed to be capacitated to formulate land cover maps using PALSAR data based on the manuals and guidelines developed by the project since they acquired practical knowledge and skills to use PALSAR data for preparation of land cover maps. However, they could not have opportunities to be engaged in the work for development of land cover maps using PALSAR data. On the other hand, 37 officers who participated only in the basic training courses at were not sufficiently capacitated since the basic training courses delivered just very basic knowledge and skills which were not a sufficient level to apply the work for preparation of land cover maps using PALSAR data.

<Continuation Status of the Project Effect at the time of ex-post evaluation>

MOEF is well aware of the limitation of reliability of LANDSAT images because the optical sensor used by LANDSAT is weak to image the areas covered by cloud. Therefore, PALSAR data were considered as one of the useful alternatives to scrutinize the accuracy of land cover maps using LANDSAT data. Although the land cover maps using PALSAR data were not created during the project period as well as after project completion, PALSAR images acquired during the project period have been continuously utilized for scrutinizing the accuracy of land cover maps for the areas covered by clouds which were made by using LANDSAT data.

JAXA launched ALOS-2 in May 2014 as a successor satellite of ALOS, and PALSAR-2 data were to be provided by ALOS-2. DJP has never received images of PALSAR-2 because DJP did not have cooperation with JAXA to purchase PALSAR-2 images after project completion. Until the time of this ex-post evaluation, DJP does not have a plan to initiate cooperation with JAXA in order to receive PALSAR-2.

<Status of Achievement of the Overall Goal at the time of ex-post evaluation>

The information acquired form land cover maps formulated by LANDSAT images supplemented by PALSAR images are used in the forest resource management continuously. However, it could not be confirmed how the PALSAR images acquired by the project has been

utilized in development of forestry sector policies and plans.
<Other Positive and Negative Impacts>
The project has a positive impact on human resource development in the area of PALSAR image utilization. Through involvement in the project activities, students and lecturers of the Faculty of Forestry, Bogor Agricultural University (IPB: Institut Pertanian Bogor) obtained the practical skills and knowledge of use of PALSAR data, in particular for utilization of radar system and interpretation of PALSAR images. No negative impact on natural environment was observed and no land acquisition and resettlement of people was implemented.

In light of the above, the Project Purpose was partially achieved which was attributed to the project design heavily relying on the utilization of PALSAR data. Since the failure of causal relation between the project activities and Overall Goal and the achievement level of Overall Goal cannot be fairly verified at the time of ex-post evaluation, the issue is evaluated as a part of "Relevance" from the aspect of appropriateness of the project approach. As a result, this ex-post evaluation focused on assessing the achievement level of the Project Purpose and continuation of the project effects. Therefore, the effectiveness/impact of the project is fair.

Achievement of project purpose and overall goal

Aim	Indicators	Results
(Project Purpose) BAPLAN's capacity to conduct more reliable forest resources monitoring and assessment is upgraded through transfer of technology and training	(Indicator 1) Reliability of forest resources monitoring and assessment information is improved. (Redefinition) Information acquired from the land cover maps of DJP using PALSAR data, such as forest size, size of deforestation, size of each land cover types, is referred to in official documents of the Government of Indonesia more often than pre-project period.	(Project Completion) partially achieved • Despite the termination of ALOS operation in May 2011, PALSAR data was utilized in developing land cover maps based on optical sensor data as complement for the areas covered by clouds. • No official document citing the information using PALSAR data was confirmed by the project completion because the redefined indicator heavily relies on the availability of PALSAR data. (Ex-post Evaluation) Partially continued. • No official document citing the information using PALSAR data was confirmed. • The PALSAR images provided by the project have been continuously used at DJP in order to complement LANDSAT images with clouds.
	(Indictor 2) Capacities of UPTs are enhanced. (Redefinition) Officers of BPKHs are capable of formulating land cover maps, using PALSAR data, based on the PALSAR interpretation manual & PALSAR data use guideline developed by the project.	(Project Completion) Partially achieved • 37 UPTs/BPKHs officers participated in the basic training courses giving basic knowledge and skills, but the level of their knowledge and skills were not sufficient to apply them to their work. According to the terminal evaluation report, it was supposed that they had not been able to formulate land cover maps using PALSAR data themselves. • 11 officers participated in the advanced training courses giving more practical knowledge and skills. According to the terminal evaluation, it was supposed that they had been capacitated to formulate land cover maps using PALSAR data based on the manuals and guidelines developed by the project. (Ex-post Evaluation) Partially continued • Even though UPTs/BPKHs officers are not able to formulate land cover maps using PALSAR data after project completion, they are capable to utilize e PALSAR images acquired during the project period for scrutinizing the accuracy of land cover maps for the areas covered by clouds which were made by using LANDSAT data.
	(Indicator 3) An estimating of a carbon amount in forest is tested.	(Project Completion) Not verified. • An estimating of a carbon amount in forest was already tested as one of the project activities during the project period. (Ex-post Evaluation) Not verified.
(Overall goal) Sustainable Forest Management (SFM) is promoted in Indonesia through the upgraded forest resources monitoring and assessment	(Indicator 1) Development of forest sector policies and plans by using forest resources monitoring and assessment information from the upgraded system is realized. (Redefinition) In three years after termination of the project, information acquired from land cover maps, using PALSAR data, is used in development of forestry sector policies and plans.	(Ex-post Evaluation) Not achieved • The ex-post evaluation could not confirm how the PALSAR images acquired by the project have been utilized in development of forestry sector policies and plans.
	(Indictor 2) Application of the upgraded forest resource monitoring and assessment information and the	(Ex-post Evaluation) Not verified

	management at the management unit level plans are realized. (Redefinition) In three years after termination of the project, information acquired from land cover maps, using PALSAR data, is used in formulation of management unit level plans.	
	(Indicator 3) Application of the upgraded forest resources monitoring and assessment information of the carbon accounting from forest monitoring of illegal activities is realized. (Redefinition) In three years after termination of the project, information acquired from land cover maps, using PALSAR data, is applied (i) to carbon accounting from forest and (ii) to monitoring of illegal logging activities.	(Ex-post Evaluation)Not verified.

Source: Terminal evaluation report and information provided by DJP.

3 Efficiency

Both project cost and project period were within the plan (97% and 100% respectively), therefore, efficiency of the project is high.

4 Sustainability

<Policy Aspect>

The improvement of the natural resource and environmental management has been prioritized in the current RPJPN (2005-2025). The Indonesian government has continued dispatching training participants from relevant institutions, including MOEF, National Institute of Aeronautics and Space (LAPAN), Geospatial Information Agency (BIG[2]), IPB, to training programs on Synthetic Aperture Radar (SAR) technologies in Japan. This shows the Indonesian government's continuous support/interests for SAR technologies through dispatch of officers from the stakeholders to trainings in Japan in order to sustain their skills and knowledge in SAR technologies.

<Institutional Aspect>

DJP is responsible for making land cover maps based on satellite data. The project provided the advanced-level training to 11 officers and the basic-level training to 37 officers in UPTs/BPKHs under DJP. However, it was difficult to confirm whether the above trained DJP officers continued to work in DJP or not because DJP was unable to provide the information of each individual officer. MOEF explained that the officers who received the training have worked continuously in MOEF. Furthermore, each UPT/BPKH had one officer who joined the PALSAR training during the project period, but the number of officers who still maintain the practical skills and knowledge of the method using PALSAR at the time of ex-post evaluation is unknown. DJP has not been able to come up with a clear post-project strategy on the use of PALSAR data in land cover mapping including use of PALSAR-2 data with the cooperation of JAXA.

<Technical Aspect>

As stated earlier, DJP officers utilize PALSAR images for scrutinizing the accuracy of land cover maps for the areas covered by clouds which were made by using LANDSAT data by deploying the skills and knowledge gained through the project. However, none of them had an experience to formulating the nation-wide land cover maps using PALSAR data themselves at the time of ex-post evaluation. No systematic technical transfer among DJP officers took place due to discontinuation of PALSAR data provision and the subsequent budget decision, technical transfer has happened through day-to-day work in non-systematic ways. Meanwhile, the trainings on SAR technologies and land cover maps have been conducted by JICA, LAPAN and DJP as well as relevant institutions continuously dispatching their officers to these programs in order to maintain the skills and knowledge. The above JICA training included the Thematic Training "Satellite Remote Sensing Data Analysis Technology for Disaster/Environmental Monitoring" in 2011 and "Remote Sensing of Forest Resources" in 2012, 2013 and 2015. Due to the problems with availability of PALSAR data rather than technical issues, DJP does not utilize the manual and guidelines developed by the project such as (i) PALSAR data interpretation manual, (ii) Guideline for the use of PALSAR data for land cover mapping, and (iii) Training Guideline, but these materials are available for use.

<Financial Aspect>

DJP and BPKH have allocated budget on land cover mapping using satellite data though DJP has no plan to purchase PALSAR-2 images. LAPAN also allocates sufficient budget for any kind of satellite data for their data users, including DJP. <Evaluation Result>

In light of the above, some issues have been observed in terms of the institutional and technical aspect of the implementing agency. Therefore, the sustainability of the effectiveness through the project is fair.

5 Summary of the Evaluation

The relevance of the project is fair because the project should have taken measures in case of the termination of ALOS. Furthermore, there is a causal leap between the project inputs and the Overall Goal.

The project has partially achieved the project purpose. The project introduced the remote sensing technology using PALSAR technology for forest resource monitoring and assessment system, established the related manuals and provided a technical training for DJP officers. As a result, the cloud cover appeared in the land cover maps was eliminated by using PALSAR data and the technically achievable accuracy based on the methods developed by the project became more than 85%. However, the land cover maps (covering the entire Indonesia) using PALSAR data were not created by the project completion because of the termination of ALOS operation in May 2011. With regard to capacity development of DJP, PALSAR images acquired during the project period have been utilized for scrutinizing the accuracy of land cover maps for the areas covered by clouds which were made by using LANDSAT data. However, updating of land cover map by utilizing

[2] Badan Informasi Geospasial.

PALSAR data became difficult due to unavailability of PALSAR data.

Regarding sustainability, some issues have been observed in terms of the institutional and technical aspect of the implementing agency because DJP does not have clear post-project strategy on the use of PALSAR data in land cover mapping; it is uncertain how many DJP officers trained by the project have continued to work for DJP. Nevertheless, institutionally accumulated technical knowledge and skills are expected to be utilized for current operation of monitoring systems and for future policy on a better monitoring methodology.

Considering all of the above points, this project is evaluated to be partially satisfactory.

III. Recommendations & Lessons Learned

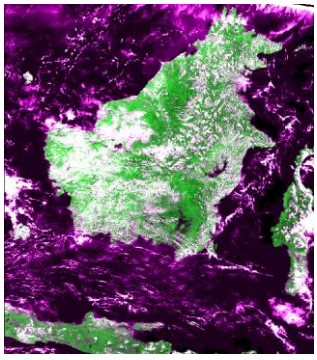
Recommendation to the Implementing Agency

JICA or JAXA will have trainings on advanced GIS technologies on a regular basis. Active participation from Indonesian stakeholders who play a part in analyzing and developing GIS information, satellite data in particular, would be highly appreciated.

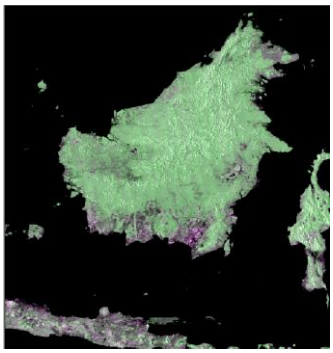
Lessons learned for JICA

(1) In this project, the achievement of Project Purpose was limited because of the project design heavily relying on the utilization of PALSAR data. The continuous provision of PALSAR data was a critical requirement for this project, it must have been carefully examined at the project planning stage about the possible availability of PALSAR data after the project completion as well as a countermeasure against the discontinuation of PALSAR data provision, taking into consideration of the designed lifetime of the satellite. Moreover, a measure for how to obtain and utilize PALSAR-2 data should have been proposed by the project before the termination of the project.

(2) The remote sensing technology using PALSAR/MODIS technology introduced by the project was a new methodology. Therefore, when introducing such new technologies to other countries, its applicability to the partner countries must be carefully examined in consideration with their capacities and type of cooperation schemes. For future projects, other cooperation schemes, such as development study or Science and Technology Research Partnership for Sustainable Development (SATREPS), which are more focused on verification of new technologies, should be also considered as an options ,although SATREPS was not available at the time of this project



(Image of Kalimantan developed by LANDSAT data)



(Image of Kalimantan developed by PALSAR data)