Country Name	Utilization of ALOS Images to Support Protection of the Brazilian Amazon Forest and Combat against Illegal Deforestation
Federative Republic of Brazil	

I. Project Outline

Background	The government of Brazil has utilized satellite images for conservation of Amazon tropical rainforests since 1970's. However, effectiveness of the satellite images has been limited since the optical sensor was not able to catch landscapes for around a five month period in a year with thick clouds covering the Amazon areas. Therefore, it was expected that images by the Phased Array type L-band Synthetic Aperture Radar (PALSAR)[1] could be effectively utilized since PALSAR carried by the Advanced Land Observing Satellite (ALOS)[2] enabled to catch landscapes regardless of clouds. Since 2007, the Japan Aerospace Exploration Agency (JAXA) started to provide the Brazilian Institute for Environment and Renewable Natural Resources (IBAMA: Instituto Brasileiro do Meio Ambiente e dos Recursos Natrurais Renovaveis) with the ALOS images, but interpretation technique had not been developed at a sufficient level in Brazil because the ALOS images were different from the images by the conventional optic sensor. Also, the ALOS images were not incorporated in the existing satellite monitoring system in Brazil. Therefore, the government of Brazil requested the government of Japan for a technical cooperation project aiming at establishment of the capacity and institutional building to use the ALOS/PALSAR images provided by Japan in order to protect the Amazon tropical rainforests.
Objectives of the Project	Through improvement of methodologies using the satellite (ALOS/PALSAR) images to detect illegal deforested areas and possible areas that may be illegally deforested, improvement of information sharing and transmission between the Department of Federal Police (DPF: Departomento de Polícia Federal) and IBAMA for satellite monitoring, and improvement of capacity of DPF and IBAMA staffs for detection and judgement of illegal deforestation, the project aimed at providing technical information based on the ALOS/PALSAR images about illegal deforestation in the Brazilian Amazon, thereby contributing to reinforcement of law enforcement to illegal deforestation based on technical information using the satellite images. 1. Overall Goal: Law enforcement is enhanced based on technical information from satellite images on illegal deforestation. 2. Project Purpose: Technical information based on ALOS/PALSAR images on illegal deforestation in the Brazilian Amazon is provided for law enforcement.
Activities of the project	1. Project site: Legal Amazon (9 states of Acre, Amapá, Amazonas, Pará, Rondonia, Roraima, Tocantins, Mato Grosso and a part of Maranhão state) 2. Main activities: 1) development of extraction methodologies of illegal deforestation information from the ALOS/PALSAR images and preparation of technical manuals for IBAMA and DPF, 2) improvement of monitoring mechanism and development of information sharing mechanism on illegal deforestation between IBAMA head office and regional offices as well as DPF head office and regional offices, 3) training needs assessment, preparation of training plan and revision of training contents, etc. 3. Inputs (to carry out above activities) Japanese Side 1. Experts: persons: 4 persons 2. Acceptance of trainees in Japan: 16 persons 3. Equipment: 815 sheens of ALOS/PALSAR images, 2 servers and PCs, 2 data storages, software, etc. Brazilian Side 1. Staff allocated: 15 persons 2. Land and Facilities: Office spaces

Ex-Ante Evaluation	2008	Project Period	June, 2009 – June, 2012	Project Cost	(Ex-ante) 300 million yen (Actual) 290 million yen
Implementing Agency	Department of Federal Police (DPF), Brazilian Institute of Environment and Renewable Natural Resources (IBAMA)				
Cooperation Agency or Contract Agency in Japan	Ministry of Agriculture, Forestry and Fisheries, Ministry of the Environment, Ministry of Education, Culture, Sports, Science and Technology, University of Tokyo, Forestry and Forest Products Research Institute, Japan Aerospace Exploration Agency, Remote Sensing Technology Center of Japan				

[1] PALSAR (Phased Array type L-band Synthetic Aperture Radar) is an active sensor enabling cloud-free and day-and-night land observation, which were carried in ALOS.

[2] ALOS (Advanced Land Observing Satellite) is a land observing satellite carrying a sensor enabling high precise elevation extraction, land coverage observation and day-and-night and all weather land observation, which was launched by JAXA in 2006.

II. Result of the Evaluation

[Issues to be considered by ex-post evaluation]

● In Brazil, as a result of dismissal of the former President Roussef by the impeachment procedures in September, 2016, the then Vice President Temer, the then acting president, was promoted to the President. Under the impeachment process, the positions for the high level officers in the federal government offices were reshuffled, the newly assigned officers have not necessarily succeeded same policies taken by the former officers. The budget executions in the government offices had been suspended until the time when the prospects of the new government became clear. Under such circumstances, since the telephone lines of the IBAMA Manaus regional office had been cut off for no payment, a contact with the representative of the IBAMA Manaus office was made by a personal telephone through the IBAMA head office in order to conduct this ex-post evaluation. On the other hand, since natures of responsibilities taken by the implementing agencies of this project, IBAMA and DPF, are more technical oriented, their activities had never stopped by the change of government. Therefore, it was confirmed that the change of government had not severely affected the implementing agencies of this project at the time of ex-post evaluation.

1 Relevance

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

The Brazil's development policy of *the Plan of Prevention and Combat against Deforestation in Amazon (2004)* (the Forest Conservation Management Plan based on the President Order in 2003), which was composed of land issues, forest monitoring and control, sustainable production activities and public infrastructure plan, had been unchanged for the period from the time of ex-ante evaluation to the time of project completion and the project was consistent with the Brazil's policies.

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

The project was consistent with the Brazil's development needs of enhancement of illegal deforestation monitoring through establishment of interpretation techniques of the ALOS/PALSAR images enabling cloud-free land observation in the Amazon areas.

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

In May, 2005, when the former President Lula visited Japan, the 5 priority areas for cooperation, including "environment", were agreed between both heads of Brazil and Japan. The project was consistent with Japan's ODA policy for Brazil.

<Appropriateness of project design/approach>

Before starting the project, the agreement on *ALOS Kyoto Carbon Observation Plan* concerning utilization of ALOS/PALSAR images was concluded between the Brazilian side (IBAMA) and the side of JAXA on August 23th, 2007. However, in the ex-ante evaluation study for this project in 2008, the designed lifetime of ALOS was pointed out as one of issues to be considered for project implementation. The official designed lifetime of ALOS which was launched in 2006 was 3 years, JAXA considered that it could have been highly possible to operate ALOS after the original designed lifetime. On the other hand, it was preferable to produce the planned output as early as possible in light of assuredness of availability of the ALOS/PALSAR images. Although ALOS was operated after the expected lifetime of 5 years eventually, the communication of ALOS became impossible in April 2011, when the project was still under implementation, and the operation of ALOS was terminated in May, 2011. Since then, new images of ALOS/PALSAR and ALOS-2/PALSAR-2 have not been provided to the implementing agency. However, importance of the images provided before termination of ALOS has not been reduced even at the time of ex-post evaluation because there are many cases where they were highly important to utilize the past data as evidence data to bring charges of the current land owner's responsibilities against illegal deforestation in areas with progressed illegal deforestation. In addition, the ALOS/PALSAR images have been utilized on the database developed by the project through some measures to utilize the past images captured during the period when ALOS had been functioning combined with the current images captured by other satellites or by aerial photographs after the termination of ALOS. Therefore, it is judged that the approach of this project was appropriated.

<Evaluation Result>

In light of the above, the relevance of the project is high.

2 Effectiveness/Impact

<Status of Achievement for the Project Purpose at the time of Project Completion>

The Project Purpose was mostly achieved by the time of project completion. The number of days taken on detection of deforestation areas using the ScanSAR images[3] of ALOS by IBAMA (Indicator 1) was not confirmed because it could not confirm the number of days for data processing at the time of project completion due to the termination of ALOS in April, 2011. However, the number of days taken on extraction of deforestation information after receiving ScanSAR images was shortened to 9.5 days from more than one month[4]. In terms of the number of days taken on provisions of deforestation Polygons from the IBAMA head office to the regional offices after detection (Indicator 2) the Polygon extraction results by the head office became immediately available because of realization of real time access by the IBAMA head office and regional offices by internal information system of IBAMA at the time of project completion. For reference, the average number of days taken on transmission of deforestation information to the regional office after receiving ScanSAR images as a result of the last operation cycle of ALOS before the termination was 5.78 days. The number of forensic reports using the ALOS/PALSAR images prepared by DPF (Indicator 3) was 90 for the year from December, 2010 to November, 2011, which was over the target value of 60.

<Continuation Status of Project Effects at the time of Ex-post Evaluation>

The project effects have been mostly continued since the project completion. IBAMA and DPF were not provided

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[3] SAR images is images recorded by SAR satellites which do not require sunlight for observation and enable to observe on any weather conditions and in the night time by utilization of micro wave penetrating clouds. Since PALSAR was equipped with ScanSAR (wide imaging mode to observe wide range of 350 km by one time observation), the ScanSAR images were provided to the project.

[4] It was expected to be shortened to 2 working days if semi automation for a part of processing would have been completed by March, 2013 as planned.

ALOS-2/PALSAR-2 images by JAXA at the time of ex-post evaluation though ALOS-2 was launched in May, 2014 and has been in operation since then. Although IBAMA discussed with JAXA about utilization of images at the annual meeting, an agreement on provision of images was not concluded eventually[5]. DPF decided not to receive new ALOS-2/PALSAR-2 images since they have utilized optical images purchased by the Ministry of Environment of Brazil from other satellite such as LANDSAT and those images were sufficient for preparation of the Environment Forensic Reports.

Under these situations, ALOS/PALSAR images were not utilized for obtaining illegal deforestation information by the IBAMA head office. However, the past images at the time of operation of ALOS became an important tool to check the past situation, and they have been utilized for detection and extraction of illegal deforestation areas by combination with other optical images provided by other satellite. The number of days taken on detection and extraction of illegal deforestation reduced to 1-2 days. In addition, the number of days taken on provision of deforestation information by the IBAMA head office to the regional offices from the detection has been sustained within 1 day.

For the preparation of forensic report on illegal deforestation by DPF, as mentioned above, the other optical images from the other satellite have been utilized. However, since the past ALOS/PALSAR images were useful for criminal investigation as well, the past images were utilized for preparation of the forensic reports at the time of ex-post evaluation. The number of forensic report prepared by the DPF head office decreased from 101 in 2012 to 47 in 2013 and has been sustained at the same level. The DPF Manaus regional office has prepared 7 forensic reports a year on average. The number of reports prepared in 2016 is the ones compiled as of August, 2016. However, it is expected that the number of forensic report using the ALOS/PALSAR images will decrease since usefulness of the past images will be lowered over 5 years.

The techniques introduced by the project have contributed to illegal deforestation control activities because of their importance though new ALOS-2/PALSAR-2 images have not been utilized. In particular, in the North Amazon with significant cumulus development, the technical transfer of extraction techniques for illegal deforestation information from ScanSAR images by the project brought a unique technique to detect and prevent illegal detection through penetration of clouds. Also, although the new images by ALOS-2/PALSAR-2 have not been utilized, the fact indicates that the past images have been still useful.

<Status of Achievement for Overall Goal at the time of Ex-post Evaluation>

The Overall Goal has been partially achieved. The surveillance of illegal deforestation in the Brazilian Amazon using the techniques developed by the project (Indicator 1), has applied the knowledge of radar image analysis introduced by the project but used the optical images by the other satellite at the time of ex-post evaluation because of the Ministry of Environment's decision not to receive deforestation polygons from JAXA. The application of the techniques developed by the project on deforestation observation in other areas (Indicator 2) has not been carried out in IBAMA due to the complication of the image analysis techniques introduced by the project and the lack of human resources. On the other hand, the DPF Manaus regional has applied and utilized AVNIR[6], an optical image analytical technique as a part of ALOS's functions for Caatinga region in the East Amazon. Although utilization and reference of ALOS/PALSAR images and ALOS-2/PALSAR-2 images for environment forensic report prepared by DPF (Indicator 3) were limited to only using the past ALOS/PALSAR images provided during the project implementation as mentioned, the number of environment forensic report using optic images except ALOS/PALSAR images increased from 166 in 2012 to 730 in 2016 and those report referred the past ALOS/PALSAR images.

<Other Impacts at the time of Ex-post Evaluation>

At the time of ex-post evaluation, positive impacts of this project were confirmed. IMABA conducted the third country trainings for Latin American countries supported by JICA as a part of efforts to disseminate deforestation surveillance techniques using SAR images.

In addition, since InteliGeo, an information sharing system of DPF developed by the project, have been available for all the regional DPF offices and the techniques for preparation of forensic report have been opened in the system, it has been utilized in other areas besides the target areas of this project. Furthermore, in DPF, it has contributed to reduction of cost for preparation of environmental forensic reports. Before the introduction of InteliGEO, DPF needed to conduct site survey to check all possible sites of illegal deforestation. However, utilization of optical images reduced 70% of the cost for them.

According to the IBAMA Manaus office, comprehensive effects for deforestation control, including other efforts besides the project effects since the improved precision of images transmitted from the head office enabled monitoring during the rainy season.

Moreover, according to the IBAMA head office, they recognize that the image analysis techniques are useful despite of the lifetime of satellite. On the other hand, since the cross border efforts are critical because the Amazon forests cover various countries, the importance of such techniques was confirmed at the regional conference of JICA-JAXA Forest Early Warning System in Tropics (JJ-FAST[7]) held in Peru in December, 2016. Brazil

InteliGEO: coverage by satellite and status of site survey

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[5] In the annual meeting between JAXA and IBAMA, although discussions about transmitting preprocessed images for Polygon data from JAXA to IBAMA had been progressed, it was revealed that the transmission of images was practically impossible due to the excessive volume of image data. JAXA proposed to transmit processed polygon data to IBAMA. However, the Ministry of Environment of Brazil rejected the proposal on provision of polygon data by JAXA because there would be issues of national security in case where data processing would not be carried out by the Brazilian side.

[6] AVNIR (Advanced Visible and Near Infrared Radiometer) is a high resolution optical sensor to observe sunlight from visible light reflected from land and coastal area to near infrared light. It is expected that observation data of AVNIR will be utilized to detect and monitor noticeable phenomena as current major environmental problems such as deforestation in tropical forests, desertification and water contamination, and further for exploitation areas including land use and resource exploitation in future.

[7] JJ-FAST is a service by JICA and JAXA, providing easy access from PC and smart phones through internet to information to monitor deforestation of rainforests and their changes by using ALOS-2. It was started in November, 2016.

introduced the techniques acquired through the project to other Amazon countries. It is expected that Brazil having such technique will make enormous contribution in conservation of vast Amazon rainforest requiring cross border countermeasures. The positive impacts, such as exertion of leadership by Brazil using the image analysis techniques acquired through the project, have been confirmed in international alliance and cooperation for conservation of the Amazon forests. No negative impact has been observed.

<Evaluation Result>

In light of the above, the project mostly achieved the Project Purpose and the Overall Goal through the utilization of ALOS/PALSAR images for illegal deforestation surveillance despite of no utilization of ALOS-2/PALSAR-2 images after the project completion because of the termination of ALOS during the project implementation. In addition, in the cross border alliance with other Amazon countries, Brazil is expected to use image analysis for cross boundary conservation of Amazon rainforests. Therefore, the effectiveness/impact of the project is high.

Achievement of project purpose and overall goal

Aim	Indicators	Results
(Project Purpose) Technical information based on ALOS/PALSAR images on illegal deforestation in the Brazilian Amazon is provided for law enforcement.	(Indicator 1) By the Project end, deforestation areas are detected within 3 working days after receiving the ScanSAR images of ALOS/PALSAR by IBAMA.	Status of the achievement: Partially achieved (Project Completion) • Not confirmed the number of days taken for data processing due to the termination of ALOS in April. 2011. • Although it took more than one month to extraction of deforestation information after receiving the ALOS ScanSAR data, it was shortened to 9.5 days. (Ex-post Evaluation) Continued [The number of days taken to detection of illegal deforestation area after receiving the images (using optical images)] <table><tr><td>2012</td><td>2013</td><td>2014</td><td>2015</td><td>2016</td></tr><tr><td>1-2 days (information from the head office)</td><td>1-2</td><td>1-2</td><td>1-2</td><td>1-2</td></tr></table>
	(Indicator 2) By the Project end, the location and size of the detected deforestation areas (i.e. Deforestation Polygons) are provided to the relevant IBAMA regional offices within 2 working days after their detection.	Status of the achievement: Achieved (Project completion) • At the time of project completion, the Polygon detection results by the head office became immediately available at the regional offices since the real time access of the IBAMA regional offices and the head office by web-link had been realized. However, specific data of the number of days from detection of illegal logging to provision of data to the regional offices at the time of project completion were not obtained due to the termination of ALOS in April, 2011. (Ex-post Evaluation) Continued [The number of days taken to provision of deforestation Polygons for the regional office from detection of illegal deforestation area] <table><tr><td>2012</td><td>2013</td><td>2014</td><td>2015</td><td>2016</td></tr><tr><td>Within 1days (information from the head office)</td><td>Within 1day</td><td>Within 1day</td><td>Within 1day</td><td>Within 1day</td></tr></table>
	(Indicator 3) By the Project end, ALOS/PALSAR images (mainly high-resolution ones), are utilized/referred to in 60 Forensic Reports produced by DPF per year.	Status of the achievement: Achieved (Project completion) • 90 environmental forensic reports using the ALOS/PALSAR images were prepared for the period from December, 2010 to November, 2011. (Ex-post Evaluation) Partially continued • The ALOS/PALSAR images have been utilized for checking the past situation. However, since the information within the last five years is effective, the usefulness of the images before that have been decreasing and the number of forensic reports using the ALOS/PALSAR images have decreased, but the ALOS/PALSAR images have been supplementary utilized as reference for preparation of the reports based on other optical images. [The number of forensic reports prepared by the DPF head office] <table><tr><td>2012</td><td>2013</td><td>2014</td><td>2015</td><td>2016</td></tr><tr><td>101</td><td>47</td><td>42</td><td>47</td><td>18</td></tr></table>

(Overall goal) Law enforcement is enhanced ground on technical information based on satellite images on illegal deforestation.	(Indicator 1) Deforestation of Brazilian Amazon is monitored with use of SAR images, including ScanSAR images of ALOS/ALOS-2 at every Cycle, using/applying the methodologies developed through the Project.	Status of achievement: Partially achieved (Ex-post Evaluation) ● IBAMA has been receiving images by the optical satellite and monitoring deforestation by using those images. ● The knowledge of radar image analysis introduced by the project has been applied for surveillance using the optical satellite.
	(Indicator 2) The techniques acquired through the Project are adapted and used for monitoring of deforestation in at least 2 sites different from Amazon.	Status of achievement: Partially achieved (Ex-post Evaluation) ● The relevant techniques have not been applied by IBAMA for other areas. ● The analytical technique of optical images using AVNIR, a function of ALOS has been applied and utilized by DPF for Caatinga Region in the eastern Amazon under the Manaus regional office.
	(Indicator 3) SAR images and high-resolution images are utilized/referred to in 100 Environmental Forensic Reports on illegal deforestation produced by DPF per year.	Status of achievement: Partially achieved (Ex-post Evaluation) [The number of forensic reports using/referring SAR/high resolution images]

	2012	2013	2014	2015	2016
No. of forensic reports based on SAR images/high resolution images	101	47	42	47	18
No. of forensic reports based on other optical images	166	240	290	471	730

Source : Project completion report, interviews with IBAMA head office, IBAMA Manaus regional office, DPF head office and DPF Manaus regional office

3 Efficiency

Although the project cost slightly exceeded the plan (ratio against the plan: 107%), the project period was as planned (ratio against the plan: 100%). Therefore, efficiency of the project is fair.

4 Sustainability

<Policy Aspect>

Although the new Forest Law was passed in 2012, no change in the policies and the regulations on supervision and law enforcement against illegal deforestation has been made. However, in terms of utilization of SAR images for surveillance and law enforcement against illegal deforestation, prospects on continuity of the activities related to the project has been unclear due to no agreement for provision of images concluded between JAXA a provider of images and IBAMA and DPF, the implementing agencies of Brazilian side.

<Institutional Aspect>

(IBAMA)

In IBAMA, while the Remote Sensing Center (CSR; Centro de Snsorlamento Remoto) is responsible for image analysis and processing in order to detect illegal deforestation sites, the regional offices are responsible for surveillance over illegal deforestation. There is no change in this organizational structure. In terms of staff assignment, 15 staffs are deployed for CSR and 4 out of them are engaged in analysis and processing of SAR images. For the IBAMA Manaus regional office which is responsible for the target area of this project, 3 staffs are deployed and only 1 staff out of them is engaged in activities related to SAR images. As the activities related to the project have been less prioritized compared to other works, the number of staffs assigned has not been sufficient. The Ministry of Environment expects future improvements on staffing through enhancing forest management, such as establishment of the National Forest Origin Certification System (Sinaflor: Sistema Ncional de Controle da Origem dos Produtos Florestais) though the administration change by the impeachment of the President affected staffing in the government organizations.

(DPF)

In DPF, the Technical-Scientific Directorate (DITEC: Directoria Tecnico-Cientifica) is responsible for information management, including transmitting satellite images to the Technical-Scientific Units (SETEC: Sector Tecnico-Cientifico) of the regional offices, and conducts surveillance and law enforcement comprehensively. SETEC implements activities for law enforcement in Amazonas region in accordance with instructions by DITEC. The Regional Office for Environment, Wildlife and Heritage (DELEMAPH: Delegacia do Meio Ambiente) is in charge of environment crime control jointly with DITEC and SETEC. The staff assignment of DPF was not confirmed because provision of such information is prohibited by decision of the Command. According to the DPF head office, they have deployed the minimum number of staffs for surveillance and law enforcement of illegal deforestation derived from the project. However, according to the DPF Manaus regional office, they have insufficient number of staffs assigned, in particular for analyzing SAR images. DPF has requested that the government opens a selection process in 2017 to hire more policemen. DITEC and many SETECs are also facing staff shortage caused by the large number of cases to be dealt with and the pressure of works which are not a problem specific to the Manaus regional office. Currently, since DPF is reconsidering divisions of role between the head office and the regional offices, better coordination of human resource allocation is expected.

(Cooperation with relevant organizations)

The cooperation between IBAMA and the Operations and Management Center of the Amazonian Protection System (CENSIPAM : Centro Gestor e Operacional do Sistema Proteção) has been continued and they have jointly obtained X-band images and analyzed them for specific sites in Pará and Amapá. DPF has implemented joint activities with the National Institute

for Space Research (INPE: Instituto Nacional de Pesquisas Espacial) and CENSIPAM as necessary in despite of no official agreement.

<Technical Aspect>

(IBAMA)

In terms of IBAMA's capacity for illegal deforestation surveillance and law enforcement using SAR images, the staffs of CSR are highly capacitated through trainings at JAXA and the activities of the project. In addition, two of them received the master degree in the area of radar image analysis. The staffs of the Manaus regional office have sustained necessary ability. However, capacity improvement of the staffs has not caught up with the progress of necessary techniques though CSR has delivered basic trainings. Although no related trainings has been currently delivered in the IBAMA head office, there is a plan to deliver two trainings courses a year at each level of basic, intermediate and advanced for 10 participants for each course. The manuals developed by the project have not been utilized since ALOS/PALSAR images have not been provided and there is difficulty to apply them for analysis of other optical images. In addition, GPS provided by the project for the IBAMA head office were not utilized at the time of project completion due to the aged deterioration. Currently, although there were some impacts by the administration change by impeachment of the president, the Ministry of Environment has enhanced forest management including establishment of Sinaflor. Since IBAMA is reconsidering divisions of responsibilities between the head office and the regional offices, necessary equipment and necessary skills and knowledge to use them is expected to be installed through coordination between the head office and the Manaus regional office and reviews on the activities for illegal deforestation surveillance and law enforcement to be conducted by the regional office.

(DPF)

The DPF staffs have sustained necessary ability and conducted analysis of more simply optical images without any problems since they have continuously prepared environment forensic reports using the ALOS/PALSAR images at the time of ex-post evaluation. The SETEC and DELEMAPH of the Manaus regional office have sustained necessary ability and utilized images transmitted from DITEC without problem. While trainings on utilization of InteliGEO have been delivered in DITEC, no training was delivered in SETEC because the forensics experts traveled to DITEC to receive training and DITEC has not been able to deliver trainings in SETEC. The training of staff allocated in SETECs was done in DITEC because it was more efficient to deliver courses for 10 experts from different SETECs at DITEC than to deliver a greater number of courses for 2 to 5 experts in each unit. Other reasons for that are that the experts have a chance to communicate with other colleagues from other units and gather more experience, and equipment and classrooms of DITEC are very good, which contribute to better learning. The manual for analysis of optical images developed by the project has not been utilized as GEOfit, a system with more simplified process, was introduced. Although various equipment such as PCs, servers and software for image processing were provided by the project, many of them have not been in use and the software has not been utilized due to the expiry of the license. On the other hand, since the works related to software has been concentrated in the head office, the activities of DPF has not been interfered at the time of ex-post evaluation. Currently, DPF is considering divisions of responsibilities between the head office and the regional offices as mentioned above, necessary equipment and skills knowledge to use them is expected to be installed through coordination between the head office and the Manaus office.

<Financial Aspect>

(IBAMA)

The estimated annual budget for IBAMA is 12 million reais and 25% of the budget (approximately 4 million reais) is allocated to all the regional offices including the CRS Amazon area office. The budget amount cannot be considered as sufficient compared to the amount of necessary cost. However, it is expected that the issue will be improved through the stabilized situation after the administration change and the ensured budget by alliance with external organization including JJ FAST.

(DPF)

By the decision of the DPF Command, the detailed budget allocation is confidential, so only the overall DITEC and regional offices budgets was available for the evaluation. According to the DPF head office, the necessary budget has been allocated for implementation of surveillance and law enforcement on illegal deforestation derived from the project.

<Evaluation Result>

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

5 Summary of the Evaluation

The project mostly achieved the Project Purpose and the Overall Goal through institutional development and capacity improvement for surveillance and law enforcement on illegal deforestation and enhancement of law enforcement on illegal deforestation. Although the ALOS/PALSAR images have not been provided since the termination of ALOS during the project implementation, ALOS/PALSAR images have been supplementary used for monitoring activities for illegal deforestation through referring the past ALOS/PALSAR images and the image analysis technique transferred to Brazil is expected to contribute to cross border conservation of Amazon rainforests. As for sustainability, although the image analysis techniques obtained through the project have been sustained, the manuals developed by the project have not been utilized because the ALOS-2/PALSAR-2 images were not provided by JAXA at the time of ex-post evaluation. In addition, the staff assignment and budget allocation for surveillance and law enforcement on illegal deforestation using optical images have not been sufficient, in particular on site. As for efficiency, the project cost slightly exceeded the plan.

In the light of above, this project is evaluated to be satisfactory.

III. Recommendations & Lessons Learned

Lessons learned for JICA:
- The project was implemented in order to improve capacity for surveillance and law enforcement on illegal deforestation using the ALOS/PALSAR images provided by JAXA and the institutional development. At the project planning stage, it was

expected that the target lifetime of ALOS would be end during the project implementation since the operation of ALOS started in 2006 and its designed lifetime was 3 years and the target lifetime was 5 years. Eventually, during the project implementation, ALOS was terminated though it had been operated beyond the target lifetime. Then, the provision of ALOS/PALSAR images was stopped. Therefore, in case where the project activities are planned to use satellite data using unique technologies which solely exists in the world, it is necessary to consider risk of termination of provision of the satellite data and alternatives at the time of project planning, such as utilization of other satellite data, which may not be a perfect alternative but can be a supplemental countermeasure, in order to prepare against risks such as breakdown of satellite that interfere utilization of data because the termination of satellite significantly affects effectiveness and impacts of the project and their sustainability.

Illegal Deforestation Surveillance Map (IBAMA)

Staffs of the DPF Manaus regional office conducting activities in an illegal deforestation site