Summary of Terminal Evaluation

<table>
<tr><td colspan="3">I. Outline of the Project</td></tr>
<tr><td colspan="2">Country: Indonesia</td><td>Project title: Wild Fire and Carbon Management in Peat-Forest in Indonesia</td></tr>
<tr><td colspan="2">Issue/Sector: Environment and Energy</td><td>Cooperation scheme: Science and Technology Research Partnership for Sustainable Development (SATREPS)</td></tr>
<tr><td colspan="2">Division in charge: Global Environment Dept.
Forestry and Nature Conservation Division 1</td><td>Total cost: 450 million Japanese Yen</td></tr>
<tr><td rowspan="2">Period of Cooperation</td><td rowspan="2">(R/D): Dec.2009 to Mar. 2014
(Extension):
(F/U) :
(E/N, Grant Aid):</td><td>Partner Country’s Implementing Organization：National Standardization Agency (BSN)、Agency for the Assessment and Application of Technology (BPPT)、National Institute of Aeronautics and Space (LAPAN)、Indonesian Institute of Sciences (LIPI)、Forestry Research and Development Agency (FORDA)、University of Palangka Raya (UNPAR)</td></tr>
<tr><td>Supporting Organization in Japan: Hokkaido University、Japan Science and Technology Agency（JST）、Japan International Cooperation Agency（JICA）</td></tr>
<tr><td colspan="3">Related Cooperation:</td></tr>
<tr><td colspan="3">1. Background of the project
In marsh area in Indonesia, there is a wide range of tropical peatland. As a result of large scale development in the late 20th century with channeling canals and cutting tropical peat forest, peat degradation has been occurred, and carbon gas emission has been rapidly increasing due to microbial degradation and fires.
The distribution of the tropical peatland in the South East Asia covers 68 % of its total area in the world, and 85 % of the South East Asia’s distribution is found in Indonesia. It is estimated that 0.81 Gt to 2.57Gt of carbon was released into the atmosphere from Indonesia, by peat-fire which is linked to El Niño occurred in 1997 and 1998.
The situation above indicates the importance of carbon emission control in peatland, and the importance of the peatland management has become widely recognized by public with the increase of international interest in the climate change and global warming issues. In addition to these environmental issues, health problems to local people caused by the fire and landslides in rainy season caused by soil erosion have become serious problems in the peatland area.
Indonesian government requested Japanese government to conduct technical cooperation project, which includes the development of a wild fire detection system and model for wildfire prediction by using satellite data, a high accuracy measurement of peat and forest area, and an effective water management and a Clean Development Mechanism (CDM), also includes making a recommendation for the adoption of REDD+.
Following the detailed planning survey on this project that carried out in March, 2009, Japanese and Indonesian Governments discussed and agreed the framework of SATREPS cooperation. The project was launched after the Record of Discussions (R/D) was signed on 10 December, 2009.
The master plan of this project was agreed when the R/D was signed, reviewed and updated in Mid-term Review held in November 2011.
Before the Project termination, the joint terminal evaluation team was formed by Indonesian and Japanese sides.

2. Project Overview

(1) Project Purpose: Peat-forest management method to reduce carbon emission is developed.

(2) Outputs
1) Fire Detection and Fire Prediction System. are established
2) Carbon Assessment System is established
3) Carbon Management System is established.
4) Integrated Peatland Management System is developed.</td></tr>
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(3) Inputs (as of October 2013)

1) Japanese side 450 Million JPY

Long-term Expert: 2 persons
Short-term Expert: 239 persons in total
Trainees received: 20 persons
Equipment: 91.9 Million USD (89.6 Million JPY)
Local operation cost: 73.0 Million USD (8,086 Million IDR)

2) Indonesian side

Project counterpart personnel: UNPAR, LIPI, LAPAN, BSN, BPPT, and FORDA
Local operation cost: Personnel expenses for the government and university officers involved
Facilities: Two office rooms (One in BSN, the other in UNPAR).

II. Evaluation Team

Members of Evaluation Team	• Mr. Kei Jinnai (Leader): Director, Forestry and Nature Conservation Division1, Forestry and Nature Conservation Group, Global Environment Department, JICA • Mr. Koji Mitomori (Evaluation Planning): Deputy Director, Forestry and Nature Conservation Division 1, Forestry and Nature Conservation Group, Global Environmental Department, JICA • Mr. Tetsuya Saito (Evaluation and Analysis): Nippon Koei Co. Ltd,. • Mr. Makio Nakamura (JST Project Evaluation): Japan Science and Technology Agency	
Period of Evaluation	From 13 October 2013 to 31 October 2013	Type of Evaluation: Terminal Evaluation

III. Results of Evaluation

3-1. Summary of Achievements

1) Achievement of the project outputs

Major achievements to date for each output are as follows.

(Output 1)"Fire Detection and Fire Prediction System are established

The project has almost achieved the target of output 1 The fire detection and fire prediction system was established and the trial installation of the systems have already been made. Further accuracy test needs to be carried out on the prediction models by the end of the project period.

(Output 2) Carbon Assessment System is established

The project has almost achieved the target of output 2. Carbon assessment was conducted by 1) aerial laser survey, 2) the analysis of correlation between net-annual CO^2 balance and groundwater level, and 3) terrestrial ecosystem model. The assessment 1) and 2) are completed, and 3) is under development utilizing the monitoring data collected by the project as soon as completion of indicator 2.

(Output 3) Carbon Management System is established

The project has almost achieved the target of output 3..

・A modular three-dimensional finite-difference ground-water flow model (MODFLOW) was developed in the target area of 70km^2, and which clearly simulates the distributions of groundwater level before or after the construction of canal or dam. According to the MODFLOW, the distribution map of appropriate water level was compiled (50m mesh).

・It was revealed that the implementation of 1) fire control, 2) peatland restoration, and 3) reforestation are effective along with for the appropriate water level control for the reduction of carbon emission.

・The amount of groundwater under the peat layer was measured by pumping test, as a result, the adequate amount of water for firefighting was confirmed. When its water quality was analyzed, it revealed that this water contains humic acid and is not suitable to drink unless water clarification system is improved. In addition, a compact firefighting system was proposed and under trial in the target local firefighting teams. Supply route of used fire hoses from Japanese companies was initiated. The system will be proposed to National Agency Disaster Management (BNPB).

(Output 4) Integrated Peat Management System is developed

The project has almost achieved the target of output 4.

Many research outputs were published and the database of the research was developed.

・56 original articles were published and many others have already been submitted to journals for review. Some articles were published in journals with high impact factor, and the outputs were presented in many international and local (both in Indonesia and in Japan) conferences and seminars.

The Web GIS was installed to the server of Hokkaido University to develop the prototype of the database, in which various image data has been integrated such as satellite images and thematic maps produced and obtained during the project. Based on the wide variety of field works and long-term observations, the researchers of Japan and Indonesia concluded that the carbon balance assessment in peatland needs monitoring on following 8 factors; 1) carbon dioxide flux, 2)observation of hotspot, 3) mapping of forest degradation and inhabitant species, 4)changes in deforestation and biomass, 5)groundwater level and soil water, 6)identification of peat dome and thickness of the peat layer, 7)peat subsidence, and 8)water soluble organic carbon This is the first proposal of comprehensive monitoring system for the management of the peatland carbon balance.

・2) The carbon balance model of which error rate is less than 20%, will have been established when the activities of output 2 are completed by the end of the project. In addition, various measures such as hyperspectral remote sensing and subsidence monitoring are considered and compared to propose the integrated Measurement, Reporting and Verification (MRV) system fulfilling both the easiness and cost efficiency.

・3) Carbon management method which can contribute to the reduction of total carbon emission into 1/3 to 1/5 will be developed by the end of the project mainly based on the results from output 3

・4) BSN suggested to set an international standard for deforestation at the technical committee 207 (Environmental Management) of International Organization for Standardization (ISO/TC) - held in Cairo, Egypt in June, 2009. After this, the Indonesian Government has approached the international society to establish the standard for deforestation. The effort on the establishment of national standard for deforestation in Indonesia was initiated by BSN and the draft standard will be prepared by the end of the project. International seminars and workshops were organized to form an international researchers' network, and series of roundtable on MRV were held with National Council for Climate Change (DNPI).

2)Achievement towards the Project Purpose

To establish a peat-forest management model in Indonesia will be accomplished from output 1 to 4 by the end of time of project termination.

The carbon assessment models which reduce the amount of the carbon emission level from 1/3 to 1/5 are assumed to be established. The carbon reduction method and integrated MRV system for the actual application to society need further effort on interpretation and moderation of the outputs into a model or package by the end of the project.

1-3. Five Criteria Evaluation

(1) Relevance:

The relevance of the project is very high.

・At the COP 15 of the United Nations Framework Convention on Climate Change (UNFCCC) in December 2009, the President of Indonesia stated that the country will reduce greenhouse gas (GHG) emission by 26% from Business as usual (BAU) by 2020 with domestic resources, and will reduce by 41% with the support of international community. More than 60% of GHG emission is caused by land use change and forestry sector in Indonesia, it is therefore considered in the DNPI report (2010) that more than 75% of the reduction potential of the GHG emission is attributed the activities on Land use, Land-use change and Forestry (LULUCF) and peatland.

・In 2010, Presidential Working Unit for Supervision and Management of Development (UKP4) and Indonesia REDD+ Task Force were established, and REDD+ Agency was established in 2013. Moreover, the president signed a decree on two-year moratorium in May 2013 for the conservation of primary forests and the peatland.

・The Central Kalimantan was designated as a pilot province for REDD+ activities in December 2010, in association with this activity, Central Kalimantan REDD Task Force (KOMDA REDD+) was established as the implementing agency of Central Kalimantan REDD+ activities.

・With regard to the implementing agencies of the project, all of them have strong willingness for promoting the carbon reduction in the peatland and the forest.

・Regarding Japanese side, Country Assistance Policy for the Republic of Indonesia published by Ministry of Foreign Affairs of Japan in April, 2012 states that "Japan will offer assistance for Indonesia to address global issues such as environmental conservation and climate change." Japan and the Republic of Indonesia signed the bilateral document to start Joint Crediting Mechanism (JCM) on August 26th, 2013. Japan and Indonesia

have also agreed to promote REDD+ in Indonesia and started IJ-REDD project in West and Central Kalimantan Province.

(2) Effectiveness:
The effectiveness of the project is evaluated to be medium to high.
・The effectiveness of the project is evaluated medium to high, based on the revised master plan after the mid-term review. This is because the indicators of the project purpose and the four outputs were not fully verified (especially quantitative figures) or explained to the stakeholders as of the Terminal Evaluation in October 2013.
・Although the establishment of quantitative indicators was considerable challenge while it is effective in achieving the accountability of the project, the project still needs further examination on the meaning of the indicators and the method of the verification, for the mutual understandings of the project target.
・In general, under the activities of four outputs in-depth and innovative research activities were conducted and each output is assumed to be achieved by the end of the project in March 2014.
・However, Indonesian side commented that the overall integration of the outputs (Output 4 and Project Purpose) are not clear enough, resulting in facing difficulties for them to apply the achievements of the project into policy and decision-making process.

(3) Efficiency:
The efficiency of the project is high.
・Activities of Japanese experts are well recognized by the counterparts for their smooth implementation and effective management. The equipment provided through the project has been used for the activities such as measuring the data and improving wild-fire control.
・The input of human resources is evaluated as efficient by the counterpart agencies, in terms of expertise, and the timing and durations of the input. The input of equipment was also evaluated as efficient because it meets the needs of the counterpart agencies.
・A number of training programs in Japan were highly appreciated by the counterpart agencies. The trainees were evaluated by the contribution to the project after they returned to Indonesia.
・It is noted that Japanese side (Hokkaido University) and Indonesian side (Palangka Raya University) have been building a relationship since 1983 and have been working together to collect precious field data continuously. This project provides opportunities to boost the accumulation, compilation and publication of the previous research's outcomes.
・It is indicated that the communication among the project participants needs to be improved. The project purpose, outputs and activities of the project are so broad that many of Indonesian counterparts could not understand these things or the relationships among them clearly. In addition, the implementation structure of the project has not been clear enough, though some effort was made by the project after the mid-term review. As a result, developing a common understanding of the project and clarifying roles and responsibilities of counterparts were not evaluated as efficient despite some improvement.
・Inputs from Indonesian side are mostly in-kind contribution including the provision of office space and equipment. In particular, it is noted that inputs and efforts of UNPAR staff were significant in terms of staff and time to execute actual implementation of activities on the ground. Some projects members commented the shortage or lack of counter-budget of their agencies.

(4) Impacts:
The impact of the project is very high.
・BSN is preparing the proposal of environmental management for ISO, which titled "Guideline for good practical approach against the soil degradation and the deforestation".
・Prof. Osaki, the leader of the project, was selected to the one of the lead authors of wetland section in the 5th Guideline of The Intergovernmental Panel on Climate Change (IPCC), also invited to make a presentation on the integrated MRV system studied in the project, in SABSTA 38 held in Bonne, Germany under UNFCCC.
・The output from the project is applied in three feasibility study (FS) projects on REDD+ supported by the Ministry of Economy, Trade and Industry and the Ministry of the Environment of Japan and Prof. Osaki takes the role of technical advisor for these 3 FS projects.
・The inventory information on 394 flora species was derived from permanent observation plots, and were

shared and utilized to develop the Indonesian Biodiversity Strategy and Action Plan (IBSAP).

・Since the public awareness on the importance of the fire control in the peatland had been increasing, Hokkaido Association for Fire Defense Equipment donated 3,000 fire hoses and 50 nozzles to the project.

・At the local level, Kalimantan University Network was formed with the support of the project, which aims to establish an integrated carbon management, education, and research network among five universities in Kalimantan. This idea is planned to be expanded to the national level.

・"Japan Society of Peatland" was established in October 2013 and Prof. Osaki was appointed to the first .president of the society. This society expected to extend the collaboration with "International Peat Society" and "Indonesian Peat Society".

・The project also provides information and advice to UKP4 and DNPI.

・A working group of local experts organized by the project prepared "REDD COE Kalteng", an outline of an activity plan for REDD+ implementation in Central Kalimantan Province. The outline was submitted to KOMDA REDD+ in August, 2011.

・The International field data transmission system (SESAME system) was developed through the project, and was evaluated as useful and applicable to other projects. This system was installed in a dam near Jakarta for the measurement of water level and data transmission.

・The project performed important functions to link existing resources, to have an exchange of view, and to enhance cooperation by the large participation of organizations and experts. Consequently, the project has left a positive impact.

(5) Sustainability:

The sustainability of the project is high.

The project has worked to catch up with the current situation of REDD+ in Indonesia, which had been changing drastically in these years, and the effort of the project is recognized.

・The president and the government of Indonesia expressed strong commitments on the carbon management in peat forest. Furthermore, the institutional structures of REDD+ in Indonesia is being developed.

・Through the project, 20 staff of the counterpart organizations took training in Japan. Since the capacity improvement of these organizations is recognized after their participation of the training in Japan, further improvement is expected in the future. This capacity development is expected to contribute to sustainability.

・The utilization of equipment provided by the project are confirmed as appropriate. The maintenance of the equipment is inevitable to ensure the sustainability, the training for the maintenance therefore was carried out. The monitoring and management of the equipment utilization is also important to sustain the enhanced capacity by new equipment. Some precision equipment need to be installed under the decent condition for it From the human resource aspect, the number of staff who can handle the equipment is limited, thus further effort on capacity development and manual preparation is needed. From the financial aspect, UNPAR should continue to participate research projects and to utilize the equipment effectively so that the activities of REDD+ and the peatland will continue to attract international interests in the future. There are many findings and technology developments by the project which can be applied in many issues. However, these can be utilized later on, followings will be required to enhance the sustainability, such as interpretation of such technologies for the potential users, preparation of manuals and brochures together with public information, packaging the related technologies as one system, and so on.

・Hokkaido University, the implementing agency of this project, has worked with UNPAR and LIPI for many years. Currently, Hokkaido University is proposing to various budget sources to continue the collaboration work in Central Kalimantan Province, and this effort greatly contributes to the sustainability of the project. UNPAR is planning to launch an education program on peatland that based on the project outcomes.

・IJ-REDD project was started in 2013 as 3-year project, and pilot activities in West Kalimantan Province and the activities of capacity development for the government of Central Kalimantan Province will be conducted. This IJ-REDD Project will also contribute to the sustainability.

2. Factors that promoted realization of effects

(1) Factors concerning to Planning
The long-term relationship and stored data between Hokkaido University and UNPAR contributes greatly to the high-efficiency of achievements through the concentrated inputs by the Project.

(2) Factors concerning to the Implementation Process
Although the institutions and organizations related to REDD+ in Indonesia which is changing drastically in these years, the Project collaborated with various organizations and appealed to international society following these changes, which contributed to high positive impact.
The networking of many stakeholders and integrated the inputs of training, collaborative research, and equipment procurement contributed to the capacity development of Indonesian side and sustainability of the Project.

3. Factors that impeded realization of effects

(1) Factors concerning to Planning
Although the indicators for each output are expected to be achieved by the end of the Project, it was indicated that the evaluation indicators set through the midterm review were not clearly recognized by the Project members and some quantitative indicators were not yet met as of the terminal evaluation.

(2) Factors concerning to the Implementation Process
To promote further collaboration with Indonesian side, integration of the various achievements from the Project is required so that Indonesian side can discuss more on the carbon reduction model for peatland and integrated MRV system. By the end of the Project, it is recommended to conduct packaging and moderating for better understanding of stakeholders in Indonesia to enhance social applicability.

4. Conclusion
The project has been pursuing the project purpose with various outcomes from four research components. The international exposure of project outputs, e.g. “Effects of disturbances on the carbon balance of tropical peat swamp forest, is regarded as a notable achievement of the project. Since the good management system of the project has been established both in Indonesian and Japanese side, the project is being properly implemented with collaboration among various researchers and institutions.

The project is in line with the policy directions of Indonesian government so that the relevance is rated high. International interest to REDD+ further increased the relevance of the project. To pave the way for social application of the project outcomes toward the relevant policies in Indonesia, the project is expected to integrate the research outputs into “management system/method” in the rest of the project period. It is concluded that the project must be completed by the end of the project term as planned.

5. Recommendations
The team found that Indonesian government expects a lot to the project outcomes, but their understanding of the project results does not reach the stage to utilize them for policy/decision-making process. The team recommends that the project has to be translated and moderate to policy- formulators how to apply research outcomes, e.g. peat-forest management method and MRV system, by the end of the project. It is also recommended that the project will prepare official brief policy paper for conveying the project outcomes to policy/decision makers.

The land use planning is the key to the decision-making of the carbon management of the Province of Central Kalimantan. Simulating future land use change is one of the major concerns of national and provincial governments of the Indonesia. In that context, the team would like to re-emphasis the importance of the socio-economic aspects to achieve the project purpose, i.e. “management method”, in considering socio-economic research has made under several components.

The organization which will take over each research component after the project should be designated, and

the operation manuals of activities, e.g. peat-fire control and tree planting, should be prepared by the end of the project.

The verifiable indicators set in the mid-term evaluation helped to clarify the project purpose and outputs. The team found that the achievements of some quantitative indicators are not well verified and recommended to prepare the evidence of the quantitative indicators by the end of the project.

The evaluation team confirmed the proper utilization and maintenance of research equipment that provided by the project. Some of the equipment that Hokkaido University had directly bought and sent to Indonesia was not on the list of the equipment record. The team hence requested to add the equipment on the list immediately.

5. Lessons Learned

The project of science and technology cooperation, SATREPS, should take into account the socio-economic aspects such as relationship to land use policy, as well as natural science aspect, to apply the outcomes of the cooperation into the implementation by the society.

In the SATREPS project which has quite a number of stakeholders, assigning of administrative officers who have good understandings of the project and good communication with project members, is crucial to implement the project smoothly and to maximize its outcomes.