Abstract No: A-047

EVALUATION OF CARBON EMISSION FROM TROPICAL PEATLAND IN CENTRAL KALIMANTAN, INDONESIA AND TECHNOLOGY TRANSFER OF THE EVALUATION METHOD

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SUMMARY

As a part of a technical cooperation for REDD+ in Indonesia, the authors organized existing methodologies into a set of estimation models that can be utilized by Indonesian authorities for estimating carbon emission from tropical peatland. Annual carbon emissions from peat decomposition and peat burning were estimated by groundwater levels, whose spatial distribution had been estimated from soil moisture data. Twice five-day-long on-site training courses were held to transfer these methodologies to Indonesian authorities. In addition, five members who are capable of operations on GIS and satellite imagery were selected from the trainees and dispatched to Japan to deeply learn the model calculation. The advantage of the models applied in this study is their dependency on groundwater level, the most important regulation factor in a wetland ecosystem. Although the applied methodologies were rather simplified and their precision was still rough, estimating carbon emission by the local authorities themselves is a big step toward their enhanced consciousness of the peatland management and expansion of monitoring systems for carbon emission and groundwater level.

Keywords: *carbon emission, groundwater level, REDD+, technology transfer, and tropical peatland*

INTRODUCTION

Indonesia ranks the third in the world for its greenhouse gas (GHG) emissions after US and China, if land-use change is included (World Bank, 2007). In recent decades, a lot of peatland areas have been developed for agricultural use and caused ecosystem degradation, aerobic decomposition of peat carbon, and a huge scale peatland fire. Thus, action plans to prevent deforestation and development of peatland are an urgent issue in tackling climate change problems. Because tropical peatlands have large storage of carbon and also larger impact they get from water level change, the uncertainty in estimating total GHGs emission may become fairly large.
Recently, in the international discussion on climate change, Reducing Emissions from Deforestation and Forest Degradation (REDD) including the role of conservation, sustainable management of forests and enhancement of forest carbon stocks (REDD+) has become highly important. An effective implementation of REDD+ mechanism is essential for the conservation of tropical peatland in Indonesia. For the purpose of enhancing Measurement, Reporting, and Verification (MRV) system in a provincial level, the authors developed and formulated a series of methodologies for evaluating carbon emissions and related parameters, and transferred the related techniques to Indonesian stakeholders.

MATERIALS AND METHODS

1. Development of estimation models

In the study area, previous studies have already found relationships between the lowest value of monthly-averaged groundwater level (GWL) and annual net ecosystem exchange (NEE; Hirano *et al.*, 2016) and annual peat carbon

loss by peat burning (Takahashi *et al.*, 2013). Based on these existing information, the monthly lowest GWLs were used to estimate carbon emissions from the peatland. Spatial distribution of GWL was estimated from soil moisture data provided by European Centre for Medium-Range Weather Forecast (ECMWF). Boundaries of peatland and mineral soils were identified based on a peatland map provided by Wetlands International (Wahyunto and Suryadiputra, 2008). Three different peatland types were identified by the analysis of satellite imageries.

2. Technology transfer

On-site trainings were held twice. In the first training course held in August 2015, the trainees conducted fieldwork and laboratory work including installation of GWL monitoring apparatus. In the second training course in December 2015, the trainees conducted PC exercises on the estimation of carbon emissions from peat decomposition and peat burning. To make the technology transfer more effective and efficient, five trainees were selected as core-members and invited to Japan to learn the PC exercises before the second training. The core-members were also involved in the processes of formulating the methodologies of carbon emissions estimation as a guidebook and translating it to Indonesian language.

RESULTS AND DISCUSSION

(1) Estimation of carbon emission from peatland

Actual monitored GWLs in the three peatland types were investigated to observe the linear correlations with the ECMWF soil moisture data. All of them showed good correlations (r = 0.59 – 0.67). A regression analysis was conducted between annual NEE presented by Hirano *et al.* (2016) and GWLs estimated for each peatland type. These regression equations were applied to convert estimated GWLs to annual NEE. The total amount of annual CO_2 emission was 5.37 MtC/year.

A regression analysis was also conducted between the estimated GWLs and annual carbon emission from peat burning from the ex-Mega Rice Project (MRP) area, which was reported by Putra and Hayasaka (2009). Very good correlation was obtained (r = 0.90). The estimated lowest monthly average GWL in 2012 was 0.2856 m below the ground surface, so the carbon emission from peat burning in 2012 in the ex-MRP area was 0.0421 Gt C.

(2) Technology transfer

The core-team members played a great role not only as the teaching assistants in the Advanced Training Course, but also the formulation and translation of the guidebook. In addition, the core-team members presented the contents in the guidebook and the training courses by themselves. From the viewpoint of technology transfer, on how to involve local participants is quite important. In any international cooperative program, however, insufficient communication between Japanese lecturers and the trainees from developing countries is likely to occur. Selection of core-team members would be one of the promising methods for this purpose.

CONCLUSIONS

So many computer-based numerical ecological models applicable for carbon and water balance estimation have been presented. Although many of the models reveal their calculation procedures in academic papers, these procedures are too difficult and complex to understand and utilize at an administrative level. The GWL-based linear regression approach adopted in this study may be very simple relative to the other approaches; however, all the trainees in the second training courses actually succeeded to trace all the steps of calculation and estimate carbon emissions by themselves. This must be a big step toward the utilization of the model at the administrative levels and the improvement of the model in the future.

ACKNOWLEDGEMENT

This study was conducted as a part of Indonesia-Japan Project for Development of REDD+ Implementation Mechanism (IJ-REDD+) supported by Japan International Cooperation Agency (JICA) and Indonesian Ministry of Environment and Forestry (Kementerian Lingkungan Hidup dan Kehutanan, KLHK). The authors greatly thank Muhammad Abdul Qirom, Albertus Sulaiman, Firmanto, and Dedy Irawan for their reading roles in the formulation of the guidebook and in the training courses.

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