

## A MODEL-BASED ASSESSMENT OF THE IMPACTS OF LAND-USE CHANGE IN SOUTHEAST ASIA FOR MITIGATION AND ADAPTATION

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Rapid vanishment of tropical forests is one of the most serious global environmental issues with respect not only to biodiversity loss but also to carbon emission to the atmosphere. Therefore, the Reduction of Emission from Deforestation and forest degradation in Developing countries (REDD) should play a substantial role as a practical mitigation measure. However, total carbon budget as a result of land-use change in tropical forests, such as conversion from pristine forest to oil-palm plantation, is still difficult to evaluate at a regional scale, leading to uncertainties in implementation of REDD activities.

We have developed and applied a process-based terrestrial ecosystem model, VISIT (Vegetation Integrative Simulator for Trace gases), at both global and local scales. First, we applied the model to a landscape in Pasoh, Malaysia, which contains a natural forest reserve surrounded by oil-palm plantations (Adachi et al. 2010, Biogeosciences). As a result of land-use conversion, ecosystem carbon stock decreased apparently, even though oil-palm trees grew up and recovered biomass accumulation. The estimated long-term carbon budget was sensitive to changes in the amount of debris production. Second, the model was applied to Borneo Island in conjunction with satellite-derived maps of forest/non-forest distribution (Yamagata et al. 2011). Although the satellite-based forest detection is subject to cloud contamination, our simulation implied that the recent forest reduction in this area resulted in a considerable amount of carbon emission. Third, the model was also applied at the global scale, in which historical land-use change data were used. In addition to interannual variability related to ENSO and other climatic events (Ito and Oikawa 2000), spatial and temporal distribution of carbon emission caused by land-use change was simulated. These model-based studies are clearly effective to evaluate the broad-scale carbon budget, especially to estimate a baseline for the REDD implementation. In contrast, few studies have been done for the adaptation issue of the tropical forests, because of difficulties in considering effective adaptation options (e.g., installation of refugia and corridors, adaptive transplantation, and seeding) in these areas.

Further researches are required to develop a reliable model for discussing mitigation and adaptation of tropical forests in Southeast Asia. For example, it is still difficult to evaluate carbon accumulation and emission from tropical peat lands in this area. Total accounting of net greenhouse gas exchange, including CH<sub>4</sub> and N<sub>2</sub>O, is also a challenge for ecological modeling. To overcome the issue of data deficiency in tropical regions, we should deepen discussion on effective data management and sharing policies.