

Variation in the use of ecosystem services by local people in Borneo: Social and ecological factors

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Non-timber forest products (NTFPs) are important ecosystem services provided by natural forests. Utilization of NTFPs by local people is rapidly decreasing and/or changing throughout the world with economic globalization, the prevalence of a monetary economy, and decrease and degradation of forest ecosystems. Potential causes and consequences of the decrease and changes, however, have rarely been examined using quantitative sociological data. In this study, we investigate the effects of social and environmental characteristics of villages and households on the utilization of NTFP by households, in Sarawak, Malaysia.

In Sarawak, primary forests were exploited by indigenous people through swidden agriculture (slash-and-burn agriculture) and collection of wild animals and plants before the modern economic transformation, which started in the 1960s. In the last few decades, however, commercial logging and the development of oil-palm plantations have changed the land cover drastically. On the other hand, many indigenous people today have migrated to urban areas, or even outside of Sarawak. Village life has also changed in various ways, and local people depend on natural forests less and less.

We conducted questionnaire survey in 22 and 69 villages in the basins of the Rajang and Bram rivers in the state of Sarawak, as part of the project of "Collapse and Restoration of Ecosystem Networks with Human Activity" (Research Institute for Humanity and Nature, Kyoto Japan). When consent was obtained, the surveyors interviewed a representative of the village (the village head, if available) and 16-20 households in each village and filled questionnaires in Malay. We analyzed the data together with land cover dataset, the proportion of the land covered by forests surrounding the villages was estimated based on the land cover map based on satellite images.

We analyzed the data using hierarchical Bayesian modeling. The modeled NTFP variables were (a) presence and absence of catches of (a) wild boars (*Sus barbatus*) and (b) sambar deer (*Rusa unicolor*) in the previous year, and frequency of (c) firewood, (d) wild-fruit, (e) wild-mushroom and wild-vegetable collections. The explanatory variables included in the model were (1) forest cover, (2) economic condition of the household and (3) village accessibility.

The results show that forest cover significantly explains the variation in the usage of most NTFPs, while other factors are also responsible for the variation. For example, economic conditions of the households affect negatively or positively depending on NTFP types.

Not only are NTFPs essential for subsistence, collection and utilization of NTFPs are often important cultural and social activities for people. This study demonstrates that multidisciplinary approach of collaboration of social and natural scientists are necessary to understand extensive repercussions of land cover changes on lives of local people.

Keywords: Ecosystem services, Borneo, Tropical Forest, NTFP, Land cover