Session 3: Sustainable Use of Biodiversity and Land through Scientifically Integrative approach

Sustainable Use of Biodiversity and Tropical Rain Forests through Ecosystem-based Forest Management

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Most tropical rain forests in Southeast Asia are now highly degraded due to forest fire, land conversion, and commercial logging. In case of Borneo (the third largest island in the world), nearly 50% of the land was deforested and the majority of the remaining forests comprise production forests that were selectively logged for more than twice. These degraded production forests still support many endangered mammals such as orangutans and Asian elephants. On the other hand, these forests are legally designated as managed resource protected areas which are expected to commercially produce timber. Mode of the management of these forests will affect the fate of such endangered mammals and other biota. We are charged to achieve the synergy between biodiversity conservation and timber production. We have conducted a comprehensive ecological study to investigate the effects of the next-generation sustainable forest management, which employs guidelines based on many ecological principles, on biodiversity and other ecosystem properties of the tropical rain forests. Our study site is Deramakot, Sabah, Malaysian north Borneo. Foresters here harvest timber using reduced-impact logging techniques and a long-term forest management plan.

Deramakot is one of the forest management units in Sabah. Historically, Deramakot and the surrounding areas were harvested by “conventional logging” with heavy impacts. The Sabah government suspended logging in 1989 and began applying the sustainable forest management in Deramakot in 1995, while severe logging continued in the adjacent management unit 2001. We and colleagues compared forest regeneration, carbon stock, and the diversity and community composition of trees, mammals, soil microbes, soil fauna and other taxa between the two management units of contrasting logging methods.

Mean carbon density was evaluated with three different methods. The mean carbon density in the above-ground vegetation ranged from 162 to 178 Mg ha^{-1} in Deramakot, while it ranged from 112 to 126 Mg ha^{-1} in the adjacent conventionally logged forests, depending on the evaluation methods. Our conservative estimate of the mean difference was 34 Mg C ha^{-1}. This difference can be considered as the mean positive effect that is added by the sustainable forest management for 13 years from 1989 until 2001. By extrapolating for the entire area, sustainable forest management resulted in a net addition of 1.9×10^6 Mg carbon for the 55,149 ha area of Deramakot for 13 years compared with the conventional logging. Moreover, sustainable management was effective in maintaining community assemblages of all taxonomic groups. For instance, the community composition of the sustainably managed Deramakot forests was similar to that of the nearby pristine forest in a multivariate analysis. The conventionally logged forests were different from the sustainably managed forests and the pristine forests in

species composition. We conclude that sustainable forest management could maintain the community composition and thus the ecosystem integrity.

However, sustainable forest management is costly due to reduced timber yield, cumbersome pretreatments, lengthy process of management plan, and etc, discouraging many foresters and management bodies. To resolve this problem, forest certification has been introduced to Deramakot and this system functions as an economic mechanism to provide foresters with better incomes. A third-party consultant audits whether or how well Deramakot complies with the international principles and standards of forest certification. If satisfactory, the consultant certifies that Deramakot is well managed under the forest certification system. Consequently, the products will be sold in a market for a higher price due to the premium added by the forest certification. “Sustainable” forest management will not be viable and sustainable without the economic incentives provided through forest certification. Moreover, know-how and human resources are necessary to monitor, report and evaluate if the management is compatible with the international principles and standards. Our example clearly suggests that multiple benefits can be achieved in tropical rain forests if ecosystem-based management approach is combined with economic incentives and institution. Ecosystem-based approach of sustainable forest management can achieve the synergy of timber production, biodiversity conservation and reduced carbon emission. Institution and economic mechanisms keep it viable.

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Field of Study
Forest Ecology, Ecosystem Ecology