

論文の内容の要旨

生圏システム学 専攻

平成19年度博士課程 入学

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論文題目 The management and characteristics of fallow fields of the shifting cultivation
landscape of the Kalahan Forest Reserve, Luzon, Philippines

(フィリピンルソン島・カラハン森林保護区の焼畑耕作域における
休耕地の管理および特性)

Shifting cultivation, also called swidden agriculture and slash-and-burn farming, refers to any temporal and spatially cyclical agricultural system that involves clearing of land—usually with the assistance of fire—followed by phases of cultivation and fallow, during which land is seldom cultivated, the natural vegetation regenerates, and soil nutrients are restored. Fallows of the shifting cultivation cycle can play a number of complex roles within a farming system, depending on the interplay between biophysical constraints and the socioeconomic factors that affect fallow duration and management. The Kalahan Forest Reserve is 14,730 ha of public forest land and part of the ancestral domain of the *Ikalahan-Kalanguya* indigenous people of Nueva Vizcaya, Luzon, Philippines. The reservation was established in 1974 under a pioneering agreement with the government which legitimized the prior and vested rights of the indigenous people over their ancestral lands, giving them complete control and authority to manage its natural resources. The Kalahan Forest Reserve landscape is a dynamic mosaic of fields, fallows, and forests at different stages of succession. The community is actively pursuing biodiversity

conservation and watershed protection activities, while developing various forest-based livelihoods. Such a scenario is assumed to depend on further increase and/or maintenance of a number of forest types in the landscape. Because farmers' decisions to keep lands in secondary forest fallow shape the local landscape and determine the extent of ecological benefits associated with secondary forest, it is important to elucidate fallowing behaviour and the resultant fallow management systems of farmers, and to know the consequences on the formation of fallows and secondary forests and the implications to the community's multiple production, ecological and socioeconomic goals. The main objectives of the study were: (1) to determine the present trend in fallow management among households of the Kalahan Forest Reserve; (2) to analyze the consequences of present fallow management systems on the recovery process of fallow fields; and (3) to discuss how fallow management of households affect the overall landscape patterns emerging from the way land is utilized in the Reserve.

Through household surveys, interviews, focus group discussion and field observations, the current farming system, basic socioeconomic characteristics and farm portfolios of households of selected villages within the Kalahan Forest Reserve were described. This is to make clear if differences in factors such as population densities, biophysical conditions and access to infrastructure correspond to differences in incomes and livelihoods, the production factors utilized by households, and fallow duration and management. Results show that shifting cultivation is still widely practiced in the Reserve, as part of the indigenous culture of the community and to meet both subsistence and cash needs of households. However, at present, farmers cultivate a lesser number of swidden fields within more confined areas in the Reserve, and complement farming with other income-generating activities. All of the villages studied, regardless of differences in biophysical and socioeconomic attributes, were highly dependent on farming and off-farm-based incomes, and have high utilization rates of products from fallow fields and forests, particularly firewood, especially the remotest village which has households with the lowest incomes and fewer alternative livelihood sources. On the other hand, the village nearest to the town center has shown the greatest tendency towards more intensive land use, with changed production technologies associated with commercial vegetable gardening. There was no apparent difference in fallow management practices among the villages; although in the central village farmers favor the planting of particular species in their fallow fields. Farmers recognize the value of fallowing in restoring soil fertility, and utilize fallow fields and forests as source of firewood, small timber for construction, fruits and other non-timber forest products.

Farmers have applied different cropping and fallowing periods on their fields. These depend on a number of factors such as inherent fertility and other characteristics of sites, urgency to clear land for farming, and individual farming skills. Case histories of selected elderly farmers showed that, over time, more fields are left in fallow for long periods after being cultivated once. Those fields that remain utilized have high crop/fallow ratios, indicating the stabilization of shifting cultivation. Data from field measurements and land use histories indicate that farmers can afford to apply fallow periods (15-20 years) that are perceived to be adequate for recovery of woody growth and soil fertility. There is similarity among villages in terms of distribution of fallow fields in terms of age, majority being left for 15 years since last cultivation.

There are no basic ecological data regarding the recovery process of vegetation and soil in fallow fields, which are predominant in the Kalahan Forest Reserve due to the long history of shifting cultivation and other agricultural activities. Using structured interviews and field measurements (chronosequence approach), the effects of fallow age on plant species composition, vegetation structure and soil properties were examined in the eastern portion of the Kalahan Forest Reserve within the same villages included in the household survey where agriculture and agroforestry activities are actively practiced. Thirty-two fallow fields or sites of varying fallow ages were sampled using a nested design. Results show a linear increase in basal area (m^2/ha) and stem density with fallow age, but no apparent fallow age dependency of species richness (no. of species/100 m^2), diversity (Shannon Index) and soil C:N ratio. The tree layer (stems > 5 cm DBH) are dominated by members of Euphorbiaceae, Moraceae and Fabaceae. The dominant species (based on Importance Values) are those with value for commercial or household use that are deliberately introduced by farmers, or early successional species. While there was an increase in the number of species appearing in older fallow sites, there was no distinct pattern of change in species composition. The same group of species dominated the tree community regardless of fallow age or fallow age grouping. These indicate that species diversity in fallow sites of various ages in the Reserve is largely a result of management by the farmers. In terms of aboveground biomass storage, while the high variability in the biomass data needs to be addressed, the patterns that can be gleaned agree with findings regarding biomass growth of secondary tropical forests. Fallow fields appear to accumulate biomass at a rapid rate extending to 15 years or more from the time of abandonment.

The results indicate that, aside from years of site abandonment, other factors such as individual farm practice, land use history, and inherent biophysical site differences maybe more important in determining site structure and composition, although the space-for-time substitution approach may not be optimal in a highly heterogeneous landscape such as the Kalahan Forest Reserve. The findings also imply that current fallow management practices may adequately recover biomass lost during the cultivation phase, but not species composition that is comparable to that of similarly-aged mature intact forests.

Current land utilization for farming, in general, is still below the limit (10-ha) imposed by the community for families in the Kalahan Forest Reserve and is likely to remain this way in the future because of inherent physical limitations in the extent of land suitable for farming. Other factors that could limit further expansion of shifting cultivation fields are direct interventions in the form of community rules and regulations on the size, location and manner of preparation of fields, and permanent protection of former cultivation sites that already achieved secondary forest growth; declining population trend in the more remote villages; and changing livelihood activities and lifestyles of households within the Reserve. The landscape implication is that while a larger area of households` fields remain under long fallow or undisturbed, areas that continue to be preferentially cultivated may run the risk of over-intensification.

Current land utilization and fallow management implemented by households appear to be favorable with the community`s goals of rehabilitation and protection of forest resources in the Kalahan Forest Reserve. Their participation in payments-for-ecosystem services schemes such as forest-based carbon sequestration projects are also beneficial, as potentially large areas of land may be included in such activities. However, it is important to address the high dependency of households on farming for livelihood, and on fallow fields and forests for daily needs such as firewood. Ultimately, the net benefits for the participation of the community in such activities should provide enough incentive for farmers to minimize, if not totally stop, the clearing of forests for farming.