Potential application of Brazilian agroforestry in Northern Thailand

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Abstract

Promotion of settled farming and conservation of the headwaters forest have been the priorities for Thai government in its efforts to preserve water resources and block soil erosion on the hills. Commercially-oriented agroforestry developed by the Japanese immigrants in the Brazilian Amazon may serve as a model for sustainable farm-income generation and the environmental conservation in the region.

Keywords: *swidden agriculture, landscape agroforestry, relay cropping, successional agroforestry, agricultural cooperative*

1. Introduction

Deforestation in Thailand came to a head after the World War II due to timber extraction, population increase, road construction, farm expansion and agricultural commercialization [1]. The natural forest coverage was over 60% of Thai territory by 1953, before the government granted timber concessions which covered half the country in 1968 [2]. During this period the rapidly increasing population converted the deforested areas to agriculture under the government policy of increasing food production and exports, and the forest coverage was reduced to 25% by 1998 [2].

As deforestation advanced to the upper tributary watersheds in the frontier areas, reduced watershed functions became a crucial issue [3]. The downstream plains where the majority of population lived on agriculture and other industries started to suffer from periodical water shortage and flooding. Thus those still carrying on their semi-subsistence swidden agriculture along margins of the remaining headwaters forests (i.e., often ethnic minorities with occasional opium cultivation) received critical attention of the lowlanders [4].

2. Conservation legislation and landscape agroforestry promotion

In order to curb deforestation and conserve nature in the ecologically valuable and sensitive areas, the Wild Animals Reservation and Protection Act was enacted in 1960, and the National Parks Act in the following year [2]. In 1968 the Forest Industry Organization, in supporting the Royal Forest Department's reforestation program, initiated the Forest Village System, a modification of the Myanmarese taungya agroforestry [5]. In 1969, the first King’s Hilltribe Project was launched by the Royal Forest Department in collaboration with Kasetsart University, which intended for the ethnic minorities to gain profits from agroforestry practice with annual crops and fruit/timber trees while maintaining the watershed environment [4].

With this backdrop the Landscape Agroforestry has become the major focus of agroforestry research and extension in Northern Thailand. It intended to establish integrated settled-farm complex on the hills to improve welfare of the ethnic people, while keeping the robust hydrological functions of the upper tributary watersheds. On behalf of World Agroforestry Centre (ICRAF) Thailand, Thomas argued in a 2003 conference that strategic arrangement of trees/forest in the landscape may be more important for runoff and erosion than total percentage of tree/forest cover, citing the research results e.g., vegetative filters in the landscape reduced sediment entering streams by 40-90%, conversion of forest to smallholder coffee did not reduce dry season stream flow, and soil surface roughness and litter characteristics were apparently more important than tree cover per se for water infiltration [3].

3. Implications of 'successional agroforestry' for landscape agroforestry

However, it was not feasible for the government to realize an ideal agroforestry landscape on the hills with its regulations to specify crops or practices, which might change in response to the variable economic and social environment [3]. Meanwhile, traditional shifting cultivators universally had incorporated in their subsistence strategy the cyclical swidden management based on plant succession and nutrient accumulation in the secondary forest biomass over several decades. Under their settled conditions today, however, with more limited land access relative to the past, intensification of cyclical management by relay cropping that mimics secondary succession, or 'successional agroforestry,' may be a potential tool for achieving the goals of Landscape Agroforestry. In 2010 such a farming model of Northeastern Brazil, practiced and published by Götsch in 1997, was introduced by Khlangsap (2010) at the Bangkok Workshop of Asia-Pacific Network for Global Change Research [6].

Another notable example of 'successional agroforestry' exists in the Brazilian Amazon, which has been developed by the Japanese immigrants and descendants in the tropical rain forest [7]. Their largest settlement called Tomé-Açu was founded in 1929 at 200km south of Belém, the capital of Pará State. It flourished with a post-World War II boom of black pepper (*Piper nigrum*) in the 1950s, but soon suffered from *Fusarium* fungal outbreak and global market fluctuation in the following decades [8]. In search for alternative species relaying black pepper monoculture, that would disperse risks of crop failure and commodity market instability through diversification, cacao (*Theobroma cacao*) with leguminous shade trees (*Erythrina* spp. and *Clitoria racemosa*) were introduced to the settlement in 1970 by the Tomé-Açu Multipurpose Agricultural Cooperative (CAMTA).

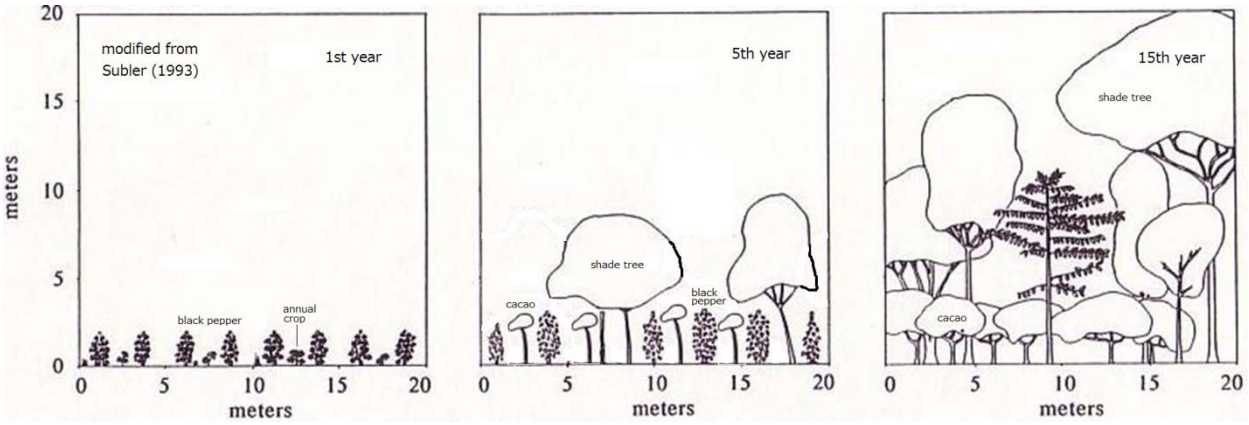

Fig. 1 Successional agroforestry development by relay cropping

Initially farmers planted cacao seedlings in the planting pits of dead black pepper, and the residual fertilizer in the pits facilitated quick growth of young cacao trees. Later they advanced cacao intercropping, with their incorporated knowledge of black pepper's life span for five to six years, and the cacao seedlings took advantage of shade and windbreak furnished by the mature black pepper vines. Thanks to their pepper seed production, farmers frequented the plantation for harvest and took care of the intercropped cacao trees simultaneously. Thus much labor cost was saved for developing cacao orchard, and the cacao seedlings were guaranteed regular attention in its early and critical growth stage. When black pepper production eventually ended as all vines had died, cacao was already producing fruits and seeds. Between the cacao trees, permanent shade trees were planted as shown in Figure 1, which was modified from Subler 1993, and they eventually grew to the heights from 20 to 40 meters [9].

The nitrogen-fixing leguminous shade trees, recommended by the public research and extension institutions, were gradually replaced by the multi-purpose tall trees (MPTs) that produced nuts, fruits, latex, oil, wood, etc. (Figure 2), as the producers of black pepper for international market had access to nitrogen fertilizers. The understory cacao was replaceable by other *Theobroma* species such as cupuaçu (*T. grandiflorum*), and other fruit/medicinal shrubs and herbs. Black pepper was substituted or accompanied by perennial vines such as passionfruit (*Passiflora edulis*). Thus numerous crop association types developed by farmers through their adaptive research emerged at each phase of 'successional agroforesty,' from annual grain/tuber/vegetable crops, perennial vines, fruit shrubs to MPTs [10].

Fig. 2 Thirty year-old agroforest with cacao (*Theobroma cacao*) and brazilnut (*Bertholletia excelsa*) in Tomé-Açu

Today CAMTA runs a juice factory that processes 14 kinds of tropical fruits, and ships annual 4,000MTs of frozen pulp to regional, national and global markets. Besides it operates a seed oil mill, a warehouse for dried black pepper and cacao seeds, and a workshop for producing artisanal products such as homemade sweets, jams, bio-jewelry, and batik with natural dyes. Such cooperative processing and marketing approach is essential in developing 'successional agroforestry' that produces diverse products with small quantity at each affiliate farm. In 2010, the Brazilian government awarded CAMTA a special prize for its contributions to sustainable rural development in the region (Ministério da Integração Nacional, 2010) [11].

4. Discussion and recommendation

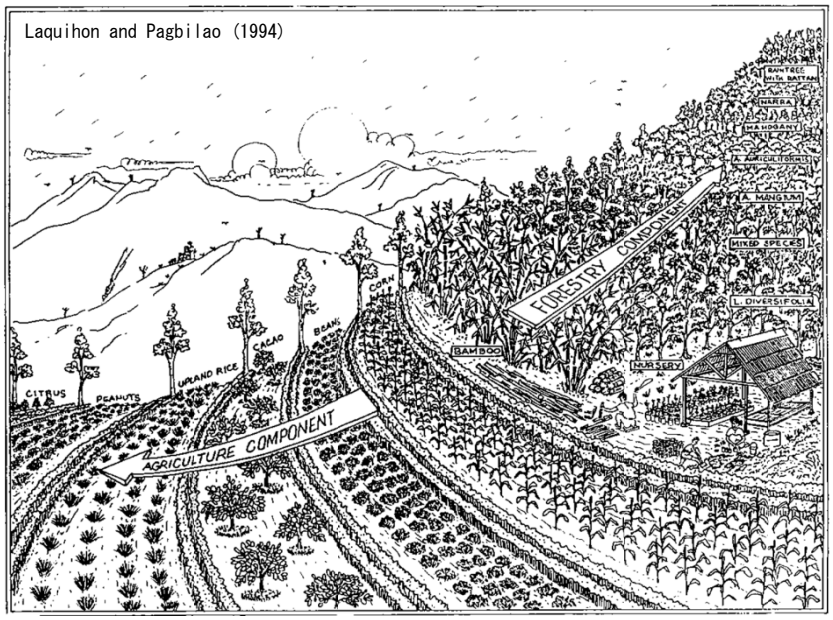

Fig. 3 Sloping Agricultural Land Technology (SALT) in the Philippines

While the emphases of landscape agroforestry in tropical Asia have been on landscape designs as shown in Figure 3 (Laquihon and Pagbilao, 1994) and ecological benefits such as flood and erosion control (for which limitations showed up last year in Indochina under extraordinary precipitation conditions), more attention should be paid to farm management and institutional arrangements so that the production system may become viable for small holders [12]. The Brazilian model of 'successional agroforestry' with cooperative back up may provide useful clues for fostering landscape agroforestry in the Northern Thailand, which currently witnesses rapid expansion of plantations with cacao, coffee (*Coffea* spp.), spices and herbs, thanks to emerging demand on them from the BRICs economies.

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