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An Ecological Overview of the Dynamics of the Swidden Systems in the Larger Islands of Melanesia

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Introduction

Fundamentally, this paper is based on the observations and interviews in several larger islands of Melanesia during the short visits to those islands in the years, 1981, 1982, and 1983. Brief descriptions of the swidden systems in Malaita (Solomon Islands) and the mainland of Papua New Guinea have already been published (Nakano, 1983, and 1984). Although, owing to unfavorable circumstances, quantitatively precise data cannot be shown below, some dynamic features of the swidden systems in larger islands of Melanesia will be described, and an attempt at a theoretical discussion concerning the trend of changes of subsistence horticulture in Melanesia will be made.

Boserup (1965) put forward an attractive theory with regard to the dynamics of agricultural systems starting from swidden farming. She arranged respective farming systems as a function of population growth and claims that population be treated as an independent variable. Furthermore, her theory has developed in its application to the real world using published data (Boserup, 1981). Her theory aroused much discussion among interdisciplinary circles all over the world.

Population and Swidden Systems in Larger Islands of Melanesia

Boserup (1981) graded population density into 10 groups as follows:

Density	Density group	Persons per km^2
Very sparse	1	0- 1
〃	2	1- 2
〃	3	2- 4

(continued on the following page)

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Sparse	4	4- 8
〃	5	8- 16
Medium	6	16- 32
〃	7	32- 64
Dense	8	64-128
〃	9	128-256
Very dense	10	256-512

That is to say, the upper limit of the population density (persons/km^2) of each group is equal to $2^{(n-1)}$, where a natural number, n, represents the grade of the group and must be less than or equal to 10. According to her rearrangement of a study made by other authors, the types of agricultural systems, namely, forest-fallow, bush-fallow, short-fallow, and annual cropping systems are closely related to the population density for 29 tropical communities. "Among the nine sparsely populated communities, all but one used long-fallow systems. The three communities in density groups 1-3 all used the forest-fallow system, while the bush-fallow system predominated in communities with density 4-5. Bush fallow was also the predominant system in nearly all the communities with medium population density, while most of the densely populated ones had short fallow" (Boserup, 1981, p. 21).

Let us turn our attention to larger islands of Melanesia on the basis of the foregoing analysis. First, we find most of them belonging to sparse density groups. Table 1 shows their population density. Of those islands in this table, only the main islands of Fiji reach the medium level in Boserup's scale shown above. Generally speaking, Boserup's (1981) findings seem to apply to the horticultural situation of Melanesia. Once the territories and the areas suitable for farming have been fixed, the frequency of utilization of a farming plot is to be quite logically correlated to their populations. Accordingly, as the populations grow, the fallow periods will be reduced.

Many reports of swiddening in Papua New Guinea have been made. Also with respect to this country, combining the two maps by Vasey (1981) and King (n. d.), we find that the forest-fallow system is predominant in most horticultural areas with low population density if Ohtsuka's (1984) view that sago exploitation should be excluded from the category of horticulture is approved although many Sago palms are planted by the inhabitants. In the Highlands where gross population density often reaches medium or even dense level (King, n. d.) of Boserup's grades, however, grass-fallow systems with shorter fallow periods are very popular (Vasey, 1981 ; Nakano, 1984). My observations in Guadalcanal and Malaita of Solomon Islands where gross population density remains sparse (Table 1) indicate that long-fallow systems are dominant in the subsistence systems there. In regard to the situation of subsistence horticulture in Viti Levu and Vanua Levu in Fiji where population is not sparse (Table 1), a generalized conclusion cannot be reached partly because there was no chance to make a careful survey in remote areas. Insofar as I observed, however, forest-fallow systems with very long fallow periods were rather rare. Some informants stated that the vast grassland in

Table 1. Gross population density of some larger islands in Melanesia.

Country	Island*	Boserup's (1981) density group
FIJI	Viti Levu	7
〃	Vanua Levu & Taveuni	6
SOLOMON IS.	Guadalcanal	5 (4**)
〃	Malaita & Maramasike	5
〃	Santa Ysabel	3
P. N. G. ***	Mainland	4
〃	New Britain	4
〃	New Ireland	4

*Since the islands shown here respectively imply the total areas of the administrative districts concerned, their populations and areas include those of small islands around them.
**The value when the population and the area of the national capital are excluded.
***Papua New Guinea
Data Source:
Fiji and Solomon Islands; 1976 Censuses. P. N. G.; 1980 Census.

the northwestern part of Viti Levu and the northern part of Vanua Levu was caused by cattle grazing after the European contacts. This explanation seems reasonable. It is also a fact, however, that the physiognomically obvious difference of the present vegetation in both Viti Levu and Vanua Levu corresponds considerably to precipitation.

In summary, macroscopically, population growth seems to be an intrinsic factor in determining the features of the swidden systems in the larger islands of Melanesia, too.

Changes of Crops and Tools for Swiddening in Melanesia

It is well known that the staple food in Melanesia is traditionally starchy plant organs grown underground (Barrau, 1958). Taros and yams have been especially important. In some regions, however, sweet potatoes have become the staple crops (Vasey, 1981 ; Nakano, 1983). We cannot say that climatic factors have brought about such change of staple crops because sweet potatoes are being abundantly harvested in both lowlands and highlands in Melanesia though more tolerable of low temperature than Melanesian varieties of taro and yam. Informants in Malaita stated some more favorable points in cultivation of sweet potatoes than taros (Nakano, 1983). In other words, sweet potatoes are superior to taros and yams in both long-term land and labor

productivity. Therefore, if the difficulty of taste acceptance is overcome, the cultivation of sweet potatoes will increase. Insofar as my informants in Malaita and Guadalcanal are concerned, the taste of sweet potato has been or is being accepted. The superiority of long-term land productivity implies that this crop is very favorable for the people who inhabit a community with population pressure (Nakano, 1983), as frequently pointed out (for example, Vasey, 1981). Such may be the case with cassava.

According to Bourke (n. d.), *Colocasia* taro is being replaced in Papua New Guinea by recently introduced *Xanthosoma* taro. My informants told that the latter is more tolerable of shade than the former. Therefore, *Xanthosoma* taro can be satisfactorily harvested in a swidden where big trees were not felled, but underwent ring-barking and remain dead and standing. It must be noted that this type of swidden should be darker than the ordinary one where most trees are felled. Swidden farming using ring-barking method has been the cause of much discussion among the researchers who are concerned with the chronology of agriculture. Many people doubt that big trees were felled with stone axes or adzes for clearing forests. For example, Sauer (1952) emphasized the ring-barking method in the earliest days of agriculture rather than felling trees, although he assumed that the beginning of agriculture was in the Mesolithic period when the efficiency of stone axes would have been worse than those in the Neolithic period. In response to such doubts, Iversen (1956) and his collaborators including a few archaeologists made an experiment using Neolithic flint axe blades from the National Museum in Copenhagen, Denmark, and those archaeologists

Fig. 1. Shovel-like tool with steel blade for planting and harvesting sweet potatoes. Note the big buttress stump in this sweet potato swidden. Taken at a village 10 km west of Honiara, Guadalcanal Island, in December, 1982.

"concluded that the Neolithic men could have cut large clearings in the forests with their flint axes without great difficulty". In some parts of Papua New Guinea, steel axes were recently introduced. Koishi (1984) reports that stone axes or adzes are, even at the present time, sometimes being used at the Highlands village where he stayed. Steensberg (1980) collected evidence that Papua New Guineans cleared forests with stone axes or adzes though less efficiently than steel axes. Considering these facts, we cannot necessarily conclude that the ring-barking method was, in Papua New Guinea, more popular in old times than the present. Rather, it may be that this method has become somewhat more popular since the introduction of *Xanthosama* taro.

Nowadays, of course, steel tools for gardening activities are ubiquitously used in Melanesia. Not many years ago, dibble-like wooden sticks were used for planting and harvesting taros in Malaita (Burt, 1981). Such sticks have almost been completely replaced by shovel-like tools with steel blades (Fig. 1). It is noteworthy that planting or harvesting starchy plant organs under the ground surface should result in greater disturbance of soil surface than the case of cereals, and that efficient digging tools should be considered more necessary for such swiddeners than ones who grow cereals. My informants in Guadalcanal told me that their steel axe blades still in use were given by American army in the days of World War II.

Boserup (1965) affirms that labor-saving technologies without changing the basic frameworks of agricultural systems in subsistence economy incline to be more easily accepted rather than production-increasing ones which need some alterations of the frameworks unless population pressure forces the farmers to adopt the latter ones. All the foregoing examples in this section seem to support her assertion. Introduction of

Fig. 2. Fertilizer in a commercial taro swidden. Taken in the neighborhood of Suva, Fiji, in January, 1982.

new crops is regarded here as adoption of new technologies.

Effects of Modernization on the Changes of Swidden Systems

The concept of modernization includes here the transformation of a subsistence economy into monetary economy, commercialization, and urbanization. Some swiddens where taros were harvested specifically for market production with chemical fertilizer applied were actually seen around Suva, the capital of Fiji. In this case as well, they are also abandoned after a few years' production in spite of the application of fertilizer (Fig. 2). As often pointed out, taro or other starchy organs under the ground surface are not convenient for inland mass-transportation under poor traffic and road conditions. Fiji is now in such a situation. That is, urbanization is noticeably in progress, but traffic and road conditions for mass-transportation are still poor. Therefore, it can be very profitable to make swiddens of taros for city-dwellers in the neighborhood of an urban area. The fallow periods of such swiddens seem rather short though not necessarily grass-fallow. In the cases which I know, those swiddens were managed by merchants in Suva.

Malaita is sparsely populated as a whole (Table 1). However, some villages along its coastal line have a remarkable population as exemplified by Nakano (1983). This concentration seems to be brought about by "modernization". My informant told of the activities of Christian missionaries which attracted people and made them settle in the village. In olden days, they inhabited the inland in small groups, frequently had battles between them, and often changed their hamlet sites in the forests. After World War II, many people moved to coastal villages for the easier way of life which Christian missionaries provided. A similar subject was also reported by Burt (1981). Furthermore, Australian aid furnished them with a continuous and convenient supply of water. As a result of the population concentration, the fallow periods have been shortened to three or four years (Nakano, 1983). At present, however, re-migration is occuring (Nakano, 1983). This is quite reasonable because the land for swidden which promises adequate production can be found without great difficulty only by moving inland.

Concluding Remarks

As has already been pointed out, natural population growth should be considered an intrinsic factor in determining the features of the swidden systems in larger islands of Melanesia, whereas the acceptance of labor-saving crops and tools, and modernization can be extrinsic factors for such changes. Macroscopically, Boserup's (1965) theory seems to be fairly applicable to the subsistence horticulture in the larger islands of

Melanesia, as Carlstein (1982) also recognizes on the basis of the data in another book. It may be partly because those islands have very few wet paddy fields which were suggested to be out of Boserup's model (Nakano, 1980).

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