

## Rice Growing Societies of Asia : an Ecological Approach

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### Introduction

Monsoon Asia is a rice growing region. But there is diversity in this region. In mountainous parts like Japan, rice is transplanted in well-irrigated fields. Farmers take very good care of their small holdings. It is often said that Japan's rice cultivation is gardening rather than agriculture, because of its small scale and careful cultivation. In deltaic regions, such as the Bangkok plain of Thailand, rice is broadcast on seasonally flooded low-lying delta flats. Farming here is very extensive and haphazard. On plateaux, e.g. most parts of India and the Khorat plateau of Thailand, rice is cultivated by the transplanting method. People put a lot of labor into the transplanting and weeding, but the fields are, in principle, rain-fed. This area is constantly threatened by drought and the harvest is unreliable. In this paper, the history and society of rice growing Asia will be discussed from the view point of ecology, bearing these three representative landforms in mind.

### I) Mountainous areas

#### I-1. Tributary system and distributary system

The rice cultivation of mountainous areas such as Japan, is practised in valley bottoms and intermountain basins. These are low-lying areas surrounded by mountain slopes, and are fed by small to medium streams, which are usually easily controlled and utilized as irrigation sources. The long history of irrigation in the mountain region is attributable to these topographical conditions.

The valley bottoms and intermountain basins, however, each have their own distinctive characteristics. A valley bottom has a tributary system of streams, whereas an intermountain basin has a distributary system, as shown in Fig. 1. In the tributary system, smaller streams join together and form a larger stream down stream. By contrast, in the distributary system, a trunk river splits into several distributaries. The difference in the stream pattern is important when discussing the water rights of a rice growing society. Take two farmers who have their fields at A and B on Fig. 1 respectively. Mr. A can get water from stream *a*, and Mr. B can get water from stream *b*. Since streams *a* and *b* are independent of each other in terms of the source of their irrigation water. In the case of the distributary system, however, we find a different situation. Mr. X whose fields are along stream *x* and Mr. Y whose fields

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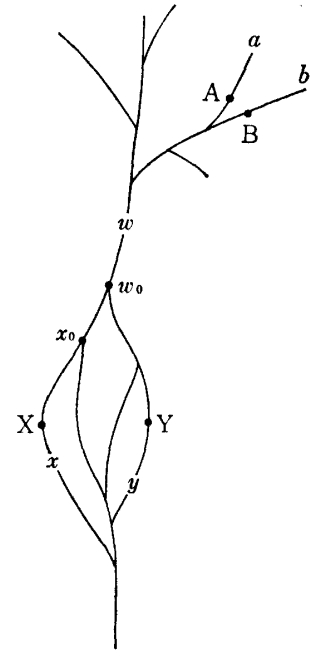
are along stream  $y$  cannot be independent of each other. This is because if Mr. X wants to have more water for his fields, he goes to the point of division of stream  $x$ , or point  $x_0$ , and blocks the other branch so that more water will flow into stream  $x$ . He can do this whenever he wants without affecting Mr. Y. But if he finds that diversion at point  $x_0$  is not enough, he has to proceed to point  $w_0$  with the aim of diverting all the water of stream  $w$  to his stream. If he does this, then this affects Mr. Y's fields directly. Mr. X has to meet the objections of Mr. Y who also needs water. Mr. X, thus cannot be independent of Mr. Y, and in fact all the farmers living in the basin cannot be independent of each other, but are interrelated just as in the case of Mr. X and Mr. Y.

A tributary system can be separated into many sections, each of which has an independent ecosystem, whereas a distributary system comprises a huge complicated ecosystem within which every segment is strictly bound to the others through the problem of the allocation of water. A valley bottom is an area of a tributary system and can be separated into small independent sections. An intermountain basin, on the other hand, is an area of a distributary system, and has system which is very complicated and works as an organism.

### I-2. History of Japan

If we divide Japanese history into four ages, the ancient age (before 1184 A. D.), the medieval age (1185-1602), the Tokugawa age (1603-1867), and the modern age (after 1868), the rice cultivation of each age can be roughly characterized as follows.

Rice cultivation was widespread in the ancient age. But population density was not high and rice was cultivated only in those places where water was readily available. At this time, there was still plenty of vacant land suited for rice growing left uncultivated and the pressure on the land was not so great. Under these conditions, no substantial differences appear between valley bottoms and intermountain basins as regards human activities, because the intermountain basins were not yet fully inhabited, and thus there are as yet no tensions among the inhabitants. This period may be called the period of pre-saturation. It is said that during this period all the paddy land and all agricultural tools such as hoes and sickles were owned by a small group of aristocrats and most of the common people worked as landless laborers, if not slaves.<sup>1)</sup> Historians term this period the Monarchic age.



**Fig. 1** Tributary system and distributary system

1) Furushima, T. 1947. *The History of Technology in Japanese Agriculture* (in Japanese: Nihon Nogyo Gijutsushi), Tokyo: Yokendo.

Japan's medieval ages were turbulent. But the common people, rather than being a political force, expanded the areas of settlement as the population grew and saturated many parts of the intermountain basins. People became anxious to secure water for their own fields. If the planted acreage increases while the water resources remain fixed, then naturally the allocation of those resources becomes an acute problem. One of the most distinctive characteristics of the medieval age is the emergence of this concept of the allocation of resources. Water rights, which had had no meaning in the ancient age, came to hold a definite position in Japan's agricultural society in this medieval age, particularly in the intermountain basins where the distributary system occurs. Another characteristic of the medieval age is the emergence of peasants. The old system of land holding by aristocrats deteriorated markedly, and farmers who succeeded in forming more or less autonomous villages united themselves to strive for a better life as owner farmers. Villages started to act as irrigation associations, and through this the solidarity of the village developed to a very high degree, and so the consensus that water rights belong to villages was established.

During the Tokugawa age, which is in fact the height of the feudal age in Japan, all parts of Japan were brought under the strict reign of feudal lords, who in turn were controlled by the Shogunate. Village based water rights, which had been established during the medieval age, did not degenerate for all the political change from the turbulent medieval age to the feudal age. Those water rights were stabilized and even intensified by the feudal lords. As the population increased more the pressure for water became far stronger. In the village community this resulted in an intensification of village solidarity. Society developed in such a way at this period that all individuals lost their freedom.

A modern capital-intensive technology characterizes the modern age. This too, has affected rice growing societies. The new technology created completely new water resources and brought them to the water-bound society. The introduction of pump-irrigation is the best example of this. With traditional technology, gravity irrigation, where the water is tapped by weirs and led to the fields below, was the only way to secure water. The water at levels lower than the fields had no value for the farmers, because they had had no means of utilizing it. Pumps, however, changed this situation. Quite a few farmers began to exploit groundwater and low-lying water. Of course this time, groundwater and most low-lying water was thought to be dead water and it did not belong to anyone. The discovery of large new resources, that is groundwater and low-lying water, affected rice-growing society greatly in such a way as to loosen the tightly developed allocation system for water resources.

The above is a short history of Japan from the view point of rice cultivation and water resources. The Japanese intermountain basins, have thus experienced four

distinctive stages; 1) the age of non competition for water resources, 2) the age of the consolidation of the village through the development of water rights, 3) the age of further intensification and development of a society bound by water rights, and 4) the age of the collapse of this society.

## II) Delta region

### II-1. Area of seasonal inundation

The deltaic areas show a sharp contrast to the mountainous areas. A delta is flat, low-lying and monotoneous, but it is wide terrain. Deltas with a monsoon climate, such as the Ganges-Brahmaputra, Irrawaddy, Maenam Chao Phraya and the Mekong deltas, have another peculiarity. They have yearly cycles of inundation during the rainy season and parching during the dry season. When inundated, the entire deltaic area, except for a few areas of natural levee, is submerged under flood water. The flood is so mighty that no one can control it. The only way to survive it is to wait on a levee until the flood goes. During the dry season, the drought is so severe that no water remains on the surface except in major rivers. Thus the natural levees along the course of the major river are the only place for human beings to survive in the harsh environment of the monsoon delta. Some parts of the delta are even more difficult for human survival, because they lack natural levees. For instance the main portion of the Bangkok plain of Thailand is so flat and lacking in natural levees that the whole area is completely submerged during the rainy season and dries up completely during the dry season.<sup>2)</sup> If people want to live in such places they have to prepare their living quarters by building an artificial mound in order to escape from the flood, and they have to dig ponds to secure drinking water. The portion of the delta which has natural levees is called the upper delta and the portion without levees the lower delta.

The monsoon delta's environment is advantageous for rice plants. Inundation to about 1 m is not too bad for some varieties of tropical rice. They grow tall, thriving on the flood, and bear grain when it recedes. It must be noted, however, that rice cultivation has a special pattern in deltas. Rice is carefully transplanted in the intermountain basins, but it is broadcast haphazardly in the deltas. Broadcasting is adopted because there is not enough time for transplanting. No one can predict exactly when the flood will arrive; when farmers realize the flood is coming near, it is already too late for them to prepare for transplanting. The flood submerges all the delta in a very short time. Under such conditions, all the farmers can do is to broadcast seeds on uninundated fields well in advance of the flood so that the seeds, using moisture from ephemeral showers, germinate and grow tall enough to survive the flood when it arrives. Cultivation is so rough and ready that during the early stages

2) Takaya, Y. 1971. "Physiography of Rice Land in the Chao Phraya Basin of Thailand," *Tonan Ajia Kenkyu* (South East Asian Studies), Vol. 9, No. 3, Kyoto.

rice grows with weeds on a dry field, and occasionally cattle can be seen grazing on the fields. The flood, however, drowns the weeds, and then the entire delta changes to a boundless expanse of the green of young rice plants.

So the delta is a peculiar area. It is not suited for human habitation but is, in a sense, optimal for rice growing.

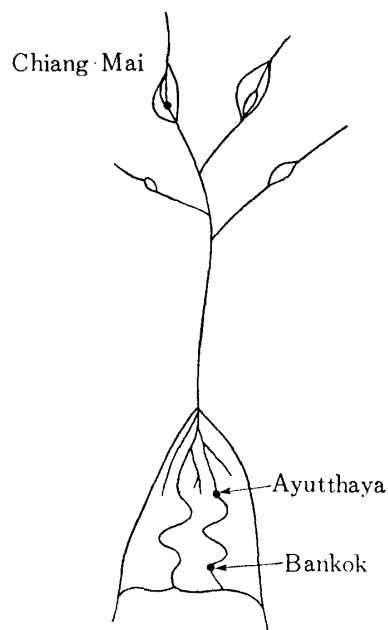
## II-2. Reclamation of delta

Based on information from the Chao Phraya delta of Thailand, the history of delta development is reviewed very briefly below.

Before looking at delta development, we need to localize the relative position of the delta more clearly in the longer span of history. Roughly speaking, Thai history can be divided into three periods; the pre-Ayutthaya period (before 1349 A. D.), the Ayutthaya period (1350-1767), and the Bangkok period (after 1768).

During the pre-Ayutthaya period, the center of human activities, both political and cultural, were in intermountain basins, as represented by such petty kingdoms as Chiang Mai and Sukhothai. At this time the delta was not a human domain.

In the Ayutthaya period, the delta appeared for the first time in the history of Thailand. The ways the delta featured were: 1) the city of Ayutthaya was build at the lowest edge of the upper delta, as shown in Fig. 2, and it functioned as a river port, 2) outside the capital city lived farmers scattered on natural levees who broadcast rice, and 3) the lower delta was left untouched, except for a water way linking the Ayutthaya port and the sea. During this time, the king and the farmers, who were both in the upper delta, seem to have been independent of each other, at least in terms of rice production. The farmers were living in a more or less subsistent manner, while the king was relying very heavily on foreign trade, rather than on taxation of the farmers. The town was ideally located for trade, having access to the sea, and with the old petty kingdoms as its hinterland. The Ayutthaya kings were all very eager to dig canals as shortcuts along the Chao Phraya, but they never built irrigation canals<sup>4)</sup> All these facts support the premise that Ayutthaya was a kingdom strongly oriented to-



**Fig. 2** Three core places in Thai history; Chiang Mai of the pre-Ayutthaya period (→1349), Ayutthaya of the Ayutthaya period (1350→1767) and Bangkok of the Bangkok period (1768 →)

3) Takaya, Y., 1975. "An Ecological Interpretation of Thai History," *Journal of Southeast Asian Studies*, Vol. 6, No. 2, Singapore.

4) Tanabe, S. 1973. "Historical Development of the Canal System in the Chao Phraya Delta (part 1) (in Japanese: Chao Phraya Delta no Unga Kaihatsu ni kansuru Ichikosatsu, I)," *Tonan Ajia Kenkyu* (South East Asian Studies), Vol. 11, No. 1, Kyoto.

wards trade rather than agriculture. It could be said that the delta at this period was exploited as a water way to the sea for trading purposes.<sup>5)</sup>

A similar policy was followed by the Rattanakosin dynasty of Bangkok in its early period. But suddenly a new influence from the outer world arrived in the mid 19th century. At this time Thailand happened to be the focus of a great demand for rice from her neighbors who were plantation economies under colonial powers. Thailand did not miss this chance. She quickly responded and started to convert the lower delta, which had quite a potential for rice growing, into a rice producing area. The construction of canals for drainage was systematically started in the 1870's and within 50 years almost all of the lower delta of nearly one million hectares was brought under rice cultivation. Development was explosive. This is the history of the reclamation of the delta, which is nowadays called the rice bowl of Asia. We can see, today, that farmers colonized along the man-made canals, forming typical ribbon-type village, and the entire delta is covered by rice.

### III) Plateaux regions

#### III-1. Pond dependent terrain

A plateau is elevated and table-shaped terrain. The ground surface may be uneven, but it does not slope steeply. A plateau lacks the large mountains from which streams and rivers originate, so that it is generally streamless. A plateau surface is usually covered by sandy or gravelly materials. Such streamless sandy ground is, of course, not suited for vegetation growth. Trees are in general not tall and not dense and are occasionally replaced by grasses. All these features give the area a somewhat desolate feeling.

Streamless land shows another characteristic landscape too. After heavy rains, water drains from higher places and accumulates in the near-by lower places to form ponds, and some of these ponds remain during the dry season, supported by a constant inflow of groundwater from surrounding heights. Thus a plateau often shows a mosaic of relatively dry swells and moist swales with scattered ponds. From the view point of agricultural landuse, these moist swales are suited for growing rice, although irrigation is impossible as there are no streams. So plateaux are suitable for rain-fed paddy growing.

#### III-2. Man's impact on plateaux environments

Although there is no definite proof as yet, I suppose that there were not many ponds on plateau areas before they were occupied by human beings. The first occupants carried out shifting cultivation and this was then developed into a more or less sedentary type of farming. But this was on a stream- and pond-less surface.

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5) Ishii, Y. (ed.) 1975. *Thailand: a Rice-Growing Society* (in Japanese: *Thaikoku: Hitotsu no Inasaku Shakai*), Tokyo: Sobunsha.

Archaeological data indicate that rice cultivation on plateaux is the oldest of the three landforms of monsoon Asia. The oldest rice grains found so far in the world are those excavated at Non Noktha in Northeast Thailand, which are dated as 3500 to 4000 years B. C.<sup>6)</sup> The rice is said to be small and of a primitive type.<sup>7)</sup> Rice of this time was most probably not yet differentiated into upland rice and paddy rice. It seems most likely that people sowed the seeds on unlevelled ground, and some of the seeds grew like upland rice when they dropped on dry land, while others grew like paddy rice when they dropped in the damp, water-logged swales. Even today, we can see a peculiar method of rice cultivation in the vicinity of Non Noktha. Local people there sometimes do not level the ground, though they make bunds. When inundation takes place at the lowest part of a plot, they transplant in this part, and a week, or maybe two weeks later, when the next part gets wet, they transplant there. Thus a plot is transplanted stage by stage according to the soil moisture conditions. This method of rice cultivation may well resemble the farming of olden days in the area.

So, the earliest rice growers most probably cultivated rice in this semi-upland type of farming. Once we accept the upland type rice cultivation of these ancient people, then we have to make the conclusion that they were, unconsciously but unavoidably, on the path to ruin. Much data suggests that upland farming does not last long under monsoon conditions, because of soil erosion. Soils are washed away from the higher positions by heavy rains and deposited in near-by low positions. This erosion from the hillocks and deposition in the depressions results in a new environment in the course of time. The moisture retaining capacity of the hillocks becomes much lower after the loss of the clayey surface soil, consequently the run-off from the high places becomes impetuous. The result is the desolation of the swells and the accumulation of water in the swales. This new environment, of course, affects the pattern of agriculture. Cultivation cannot be continued on the barren swells, while the swales which are now richer in soil and more moist than before are more advantageous for wet rice growing. This series of changes must lead to the collapse of upland farming. The upland type of farming thus ceased. We may call this the first round of the land-use history of plateaux areas.

The first stage of the Khorat plateau of Thailand was carried out by the Mon-Khmer group and collapsed sometime around the 14th century A. D. After that the Lao group took over the area. The Lao are paddy cultivators. They cultivated the low places around the ponds. Slopes and swells which used to be extensively exploited by the Mon-Khmer group were neglected by these newcomers. The typical landuse pattern of the Lao group is as follows. There is a pond in the lowest part of a swale, and next to the pond are relatively well-watered paddy fields, and then

6) Solheim II, W. G. 1972. "An Earlier Agricultural Revolution," *Scientific America*, Vol. 226, No. 4.

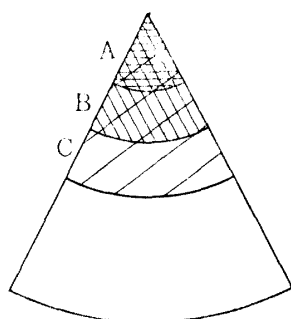
7) Watabe T. of Kyoto University, Japan: Personal communication.

there is the outer zone of water-deficient paddy fields, which merge into open forest. The general tendency is for the land to become more inferior, the further away from the pond and the higher it is. In some fields of the outer zone, cultivation can be carried out only once every few years, when the rainfall is exceptionally abundant. Houses are built as near to the pond as possible for the convenience of getting drinking water.

**IV) The pattern of economic development in the three areas**

The afore-mentioned three landforms seem to have their own patterns of economic development; they may be called uni-nuclear, non-nuclear and multi-nuclear, respectively.

The uni-nuclear type occurs in the intermountain basins which are characterized by the distributary system. As previously mentioned, a distributary system forms an integrated ecosystem in which every part is closely interrelated to each other part. The nucleus occurs at the apex in this system. If a man controls the apex, he can exert his influence over all the rest of the basin through the allocation of water. Let me describe how the apex develops as the nucleus. Fig. 3 shows the mechanism



zone	1st stage	2nd stage	3rd stage
A	a	a+0.2b	a+0.2b+0.3c
B		0.8b	0.8b+0.2c
C			0.5c

**Fig. 3** Wealth accumulation in a distributary area

of the accumulation of wealth at the apex. Usually the development of a distributary area is started from the area near the apex where water is abundant, and this is expanded downstream. At the first stage of development, an investment of amount "a" is made in zone A, in order to build weirs and canals for irrigating the area. At the second stage, zone B is opened with a budget of "b". However, the whole amount of "b" cannot be spent for zone B, even if it is raised by the occupants of zone B. Only a portion, say "0.8b" is put into zone B for two reasons; one is that part of "b" is used to build new weirs and canals within zone A and the other is that part of "b" is used to buy water concessions from zone A. At the third stage, zone A has accumulated the sum of "a+0.2b+0.3c" with zone C as the newcomer. At this stage, zone B has accumulated "0.8b+0.2c" and zone C has only "0.5c". So the nearer to the apex a zone is located, the more improvements that zone receives. In the intermountain basins there exists a downward sloping gradient, from the apex down stream, in political



and economic power.

In the deltas, once a man can secure a mound and a pond he can live there quite easily as long as he does not want a luxurious life. Problems appear in the delta when he wants to improve his life by improvement of the environment. In the delta this means control of the flood. But this is, as mentioned before, extremely difficult, in fact, almost impossible, at least at the present level of communal technology.

The delta is, however, undergoing an environmental change. For instance in the case of Thailand, the government has built flood control reservoirs in the past few decades, and the delta environment has been gradually changing. Is the delta society also changing? The answer is that the society seems to be changing much more slowly than the environment. I feel that the government has been working hard to tame the hostile delta environment but the local people are rather reluctant to change their way of life, being indifferent to the project. There are several reasons for this attitude. The simplest reason is that the dam sites are all located far away from the delta, like the Bhumibol dam and the Sirikit dam on the Chao Phraya, and the farmers cannot see them for themselves, thus they cannot actually realize what is going on. Secondly, the farmers are not very concerned as they do not have to finance the project directly; it is a government project. And thirdly, the farmers are usually more or less satisfied with the traditional farming conditions of the deltaic flood regime, and they do not appreciate the project very highly, although the government is trying to win them over. All these things are in sharp contrast to the intermountain basins, where the local people control nature by themselves for themselves.

In terms of a nucleus of development, the government has created some nuclei, but they are all outside the delta, in the form of huge reservoirs. These huge capital investments were made far upstream, deep in the mountains and are usually several hundred kilometers from the delta. Within the delta itself we cannot see any nucleus so far. So the delta situation may be called the non-nuclear type.

The plateaux have finished the first phase of their history and are now in the second phase. In this second phase, as stated before, ponds are essential. People live together, around the ponds and cultivate paddy. Thus the pond and its immediate surroundings form the nucleus of the plateau. When the area near a pond is saturated, there is overflow to the outer zones. Expansion to the outer zone is rather easy and free. A family or two just goes out to a wooded plot, clears it and sows maize or some other grains. A few years after the initial clearing they finish leveling the ground and building dikes, and then the plots become paddy fields. After the completion of the paddy fields, the farmers do not claim water rights for the new fields. Plateau farmers are always satisfied with rain-fed paddy fields. Thus expansion to the outer zone is carried out easily without much interference from other people.

Another characteristic of the plateau is that farmers tend to keep their houses

near the pond, even after the opening of quite a large acreage in the outer zone, probably for convenience and maybe partly for security reasons. They grow rice in the new fields in a careless manner. They plough, sow or transplant, and then let the rice plants take their chances with the rain, without any further care except for weeding once or twice. The harvest is taken back to the houses by the pond. Thus farming in the outer zone is a kind of despoliation. To the old paddy fields near the pond, however, farmers pay much better attention. It seems that farmers consider the old fields around the pond as their proper property while the newly opened ones in the outer zone are subordinate. They also seem to believe that the pond and the area near it are the center of life and consequently must be improved while the outer zone can be neglected, or must be exploited for the sake of the center. As the population grows, the center becomes more and more compact and intensive, while the outer zone expands further and further with no sign of intensification. There are many pond-based communities of this type on plateaux. Plateaux may be called to be the multi-nuclear type of human domain.

Rice growing societies of Asia, thus, may be categorized into uni-nuclear, non-nuclear and multi-nuclear types, which correspond to the societies located in mountainous, deltaic and plateaux regions respectively.

All the above discussion, I hope, makes clear how the natural environments have controlled and shaped the history and society of rice growing Asia.