quaternary

MDPI

Article

Ethnoarchaeology of Introducing Agriculture and Social Continuity among Sedentarised Hunter–Gatherers: The Transition from the Jomon to the Yayoi Period

Kazunobu Ikeya

National Museum of Ethnology, Osaka 565-8511, Japan; ikeya@minpaku.ac.jp

Abstract: This study was conducted to elucidate the introduction of agriculture and social continuity from the Jomon to the Yayoi period, from an ethnoarchaeological perspective. The Yayoi period has been divided into two types: a broad spectrum economy that relied on many kinds of resources, such as rice, millet, and nuts, and a selective economy that specialised in rice and wild boar. However, it is not clear how the livelihoods shifted from the Jomon to the Yayoi period. In this study, ethnohistorical materials were examined first. Ethnohistorical reference materials gathered worldwide have revealed three relationships between hunter–gatherers and farmers: coexistence, fusion, and assimilation. Focusing on fusion, this study examined situations of hunting, gathering, and fishing, as inferred from ruins of the Late and Final Jomon period, and assessed their relationships with agriculture using ethnohistorical reference materials of the Early Edo period. There were not many social changes caused by the introduction of field farming; however, the introduction of paddy rice cultivation had different effects on society depending on the level of investment in obtaining water from streams and springs and creating irrigation features.

Keywords: dry-field farming; first farmers; Jomon; paddy rice farming; sedentarised hunter-gatherers; Yayoi

Citation: Ikeya, K. Ethnoarchaeology of Introducing Agriculture and Social Continuity among Sedentarised Hunter–Gatherers: The Transition from the Jomon to the Yayoi Period. *Quaternary* **2021**, *4*, 28. https://doi.org/10.3390/quat4030028

Academic Editor: José Javier Baena Preysler

Received: 6 July 2021
Accepted: 30 August 2021
Published: 14 September 2021

1. Introduction and Study Location

Prehistoric hunter–gatherers who became sedentarised in western Asia are said to have begun farming and raising livestock more than 10,000 years ago [1]. Later, after farmers populated this area, hunter–gatherers and farmers coexisted [2]. The earliest clear evidence for the use of rice in the lower Yangtze region of Zhejian, China, is between 6900 and 6600 years ago [3], but this was not yet cultivated. At that time, indigenous hunter–gatherers formed a diverse array of relationships when they encountered migrant rice farmers.

In the case of the Japanese archipelago, a large shift is known to have occurred from prehistoric hunter–gatherers (Jomon people using Jomon earthenware, [4,5]) to prehistoric agricultural farmers (Yayoi people using Yayoi earthenware) except in Hokkaido. Regional differences are apparent, as the landmass extends around 2000 km from Hokkaido to Kyushu. People from the Korean Peninsula with knowledge of rice farming first settled in northern Kyushu (Figure 1). In Japan, rice cultivation was first adopted by new immigrant populations at the Nabatake archaeological site in the Fukuoka Plain of northern Kyushu during the Early Yayoi period, although this was not irrigated but rain-fed rice cultivation. Millet farming was also conducted there [6,7] The floodplain of the valley was wetland; the hills behind were evergreen forests. Under such circumstances, rice farming in the form of dry-field farming began on the lower slopes of the plain or at the edges of lowland areas. Later, in the Early Yayoi period, the Itazuke site village was established with pit dwellings and a circumjacent ring moat 5–6 m deep. Irrigated paddy rice cultivation was combined with millet fields producing *awa* (foxtail millet, *Setaria italica*) and *hie* (a kind of Japanese barnyard millet, *E. esculenta)*.

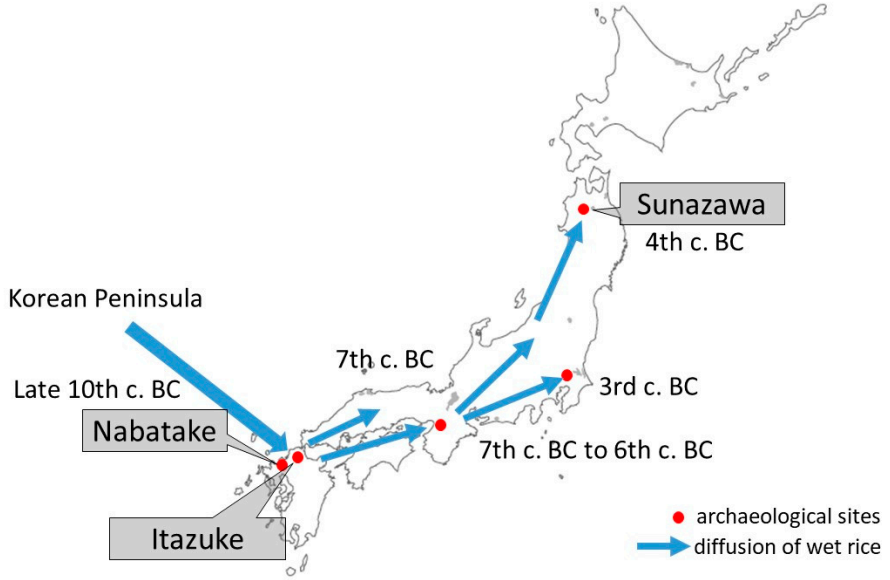


Figure 1. Diffusion of wet rice farming and archaeological sites in Japan ([8]. Used by permission).

On the other hand, according to Shitara [9], the economy in the Yayoi period can be divided into two types: an exhaustive economy that relied on many kinds of resources, such as rice, millet, and nuts, and a selective economy that specialised in rice and wild boar. However, the transition between livelihoods from the Jomon to the Yayoi period is not clear. The wet rice cultivation technique was accepted by hunter-gatherers from Honshu, Shikoku, and Kyushu over an approximately 700-year span [10]. For example, on the Fukuoka Plain, archaeological remains of paddy field farms from the latter half of the 10th century BC have been found in the downstream basin of northern Kyushu's plains. The transition process from hunter–gatherer to farmer can be classified into the following three categories [11]. In the first category, native hunter–gatherers and migrant farmers established a new settlement together in a downstream basin. Residents specialised together in paddy rice cultivation. In this case, sometimes a ring moat was built around the settlement, as in the Itazuke ruins of the Fukuoka Plain, and the settlement endured to become a local main village. In the second case, the two groups established a settlement together but later abandoned the settlement and moved to another place. The last case occurs in the context of food stress caused by a population increase, in which farmers who lived in a downstream basin moved upstream into areas populated by hunter–gatherers and started food production. Apparently, hunter–gatherers began farming after being influenced by immigrant farmers from the Korean Peninsula; that is, they were transformed gradually into farmers.

Herein, a dynamic model of the relationship between hunter–gatherers and farmers is presented based on the question of how sedentarised hunter–gatherers began farming during the transition period from hunter–gatherer to farmer in East Asia. It is said that field agriculture such as soybean and azuki bean cultivation had already been introduced in the Jomon period by the time of rice introduction [12,13], but the influence of legume cultivation on hunter–gatherer societies is not yet known. Similarly, the impact of the introduction of paddy rice cultivation on hunter–gatherer societies in the Yayoi period is not well understood. It is the objective of this paper to examine the sustainability and transformation of livelihoods and society after the introduction of agriculture, using ethnoarchaeological reference data from similar sites that are relevant to the ways that agriculture and other livelihoods were combined.

The author has selected sites from the Late and Final Jomon periods in the Japanese archipelago where the use of resources at the time of interest can be reconstructed. Sites were also selected from early modern *Matagi* settlements, which are not from the Early Yayoi period but show the influence of the introduction of paddy rice cultivation on a

hunter–gatherer society. This is due to the fact that there is abundant information on livelihoods such as hunting, gathering, and farming in the *Matagi* settlements, which are located in almost the same locations as the Jomon sites.

The author conducted an ethnoarchaeological study on the use of people's natural resources in a remote mountain village called a *Matagi* settlement [14], which possesses both historical sites of the Late and Final Jomon periods, and archival materials on paddy rice cultivation or swidden agriculture in the 17th century. The *Matagi*, who believe in the mountain god named Yamano-kami, are hunters who combine gathering, fishing, small farming, and trading. The historical relationship between the *Matagi* and Jomon people is unclear. Actual practices and methods of resource control related to cave hunting and trapping of Japanese black bears have already been reported from ethnohistorical perspectives [15].

The study site is about 30 km upstream of the Miomote River in central Japan, which empties into the Sea of Japan. In the study site, a small flat river terrace surrounds the deep slope of the mountains in the upper Miomote River. The Motoyashiki archaeological site (Figures 1 and 2) dates to the Late and Final Jomon periods. The entire settlement (approximately 180 m east–west, and 90 m north–south) was investigated at the time of the Okumiomote Dam's construction. It consists of excavated pillar buildings, pit dwellings, buried earthenware (200), stone graves (89), and a processing facility for *tochi* (horse chestnut, *Aesculus turbinata*) including water features for leaching or removing lye from chestnuts. Large amounts of wood and wood products, bone and horn products, plant-dependent substances, and animal-dependent substances had already been excavated there, including Jomon pottery and stone tools [16].

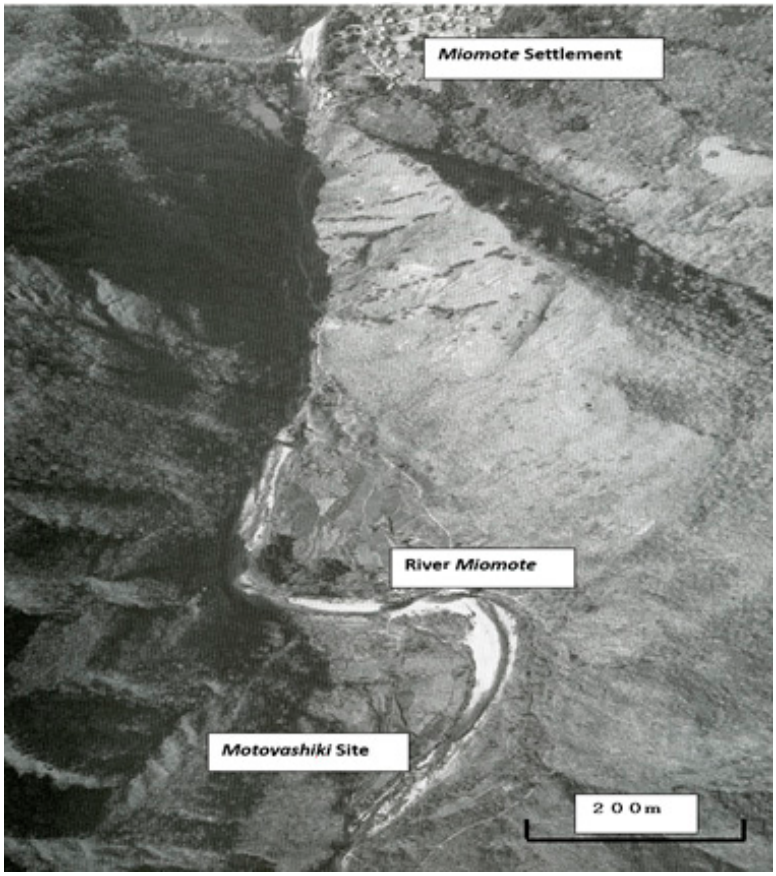


Figure 2. Study Area: Motoyashiki archaeological site at the late and final Jomon periods and Miomote settlement at the Early Edo period [16].

2. Theoretical Framework (Presumption): Transition from Jomon to Yayoi Period and Group Relationships

Studies of sedentarised hunter–gatherers have clarified two types of responses to introduced agriculture [17]. In the first, hunter–gatherers introduced agriculture into their life: they hunted and gathered while farming. In the second, hunter–gatherers maintained a coexistent relationship with farmers. In the second adaptive response, hunter–gatherers sometimes helped with farmers' activities (e.g., harvesting) and received food in return. Both types of incorporation of agriculture have been identified among the San people of the Kalahari Desert [18]. The Aka and Mbuti people in the Congo Basin, the Aeta of the Philippines, and the Mlabri of Thailand have established the latter type [19–23]. Nevertheless, it remains unknown why such a difference has arisen among hunter–gatherers.

Figure 3 presents a dynamic model of the relationship between hunter–gatherers and farmers by examining the ethnohistories of present-day hunter–gatherers (Figure 3). Earlier studies, mainly archaeological or ethnological, revealed characteristics of several individual cases which can be sorted into three types of relationships between hunter–gatherers and farmers—that is, coexistence and symbiosis, fusion, and assimilation. First, assimilation is the situation in which all cultural elements or habits of one group disappear after contact. In such a case, the //Gana San would marry into farming societies and lose their own language and traditions. Next, coexistence and symbiosis are conditions under which the hunting and gathering group was maintained even after contacting another group. For example, very few Tsila San hunter–gatherers intermarried with Kgalagadi farmers; rather, they worked in the farmers' fields and received food. Lastly, fusion is the condition by which external elements are added after contacting another group. In this case, trace characteristics of the existing group remain. For example, a //Gana San hunter–gatherer would marry a farmer, combine hunting, gathering, and farming, and use both languages. Why did such differences arise? Based on the example of hunter–gatherers in the Kalahari Desert, group size and population caused this variation, because Kgalagadi farmers migrated inside the hunter–gatherers' territory in the 18th century [18].

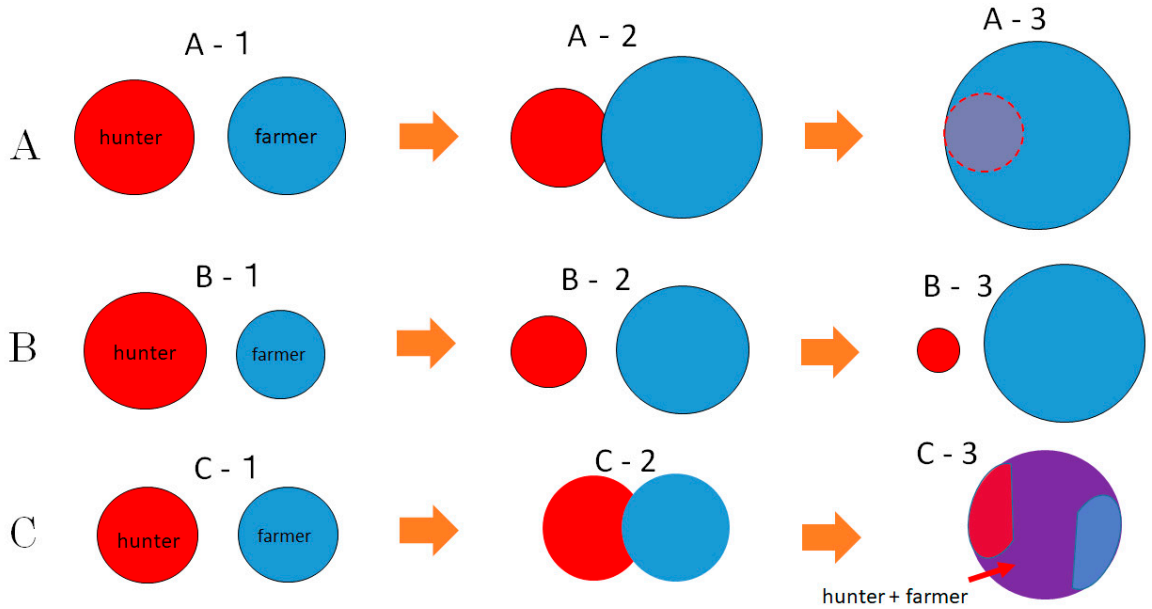


Figure 3. Dynamic model of relationships between hunter-gatherers and farmers: (**A**) assimilation; (**B**) coexistence/symbiosis; (**C**) fusion. Circle size represents the population size (made by K. Ikeya).

Coexistence and symbiosis occur when the respective population sizes of the two groups are similar. However, although the population of the Mlabri hunter–gatherers remained smaller than that of the farmers, they maintained their culture and identity [22]. Fusion occurred when the farmer group became larger than the hunter-gatherer group, although hunter–gatherers continued to maintain their cultural traditions strongly. Assimilation also occurred when the farmer group was larger than the hunter–gatherer group.

We may now ask, what type of relationship did hunter–gatherers and farmers establish during the transition from the Jomon to the Yayoi period? First, one must consider the time during which hunter–gatherers met farmers in northern Kyushu, approximately 600 BC. It is unknown whether the two groups coexisted with no mutual relationship, or whether they shared a symbiotic condition with some kind of trade or exchange. As already described, an assimilation type of relationship occurred in the Fukuoka Plain after hunter–gatherers encountered farmers. At the same time, coexistence or symbiotic relationships also formed. Finally, a fusion type of relationship might have arisen between them after the end of their existence as hunters and farmers. This suggests that the relationships between the same groups could change over time based on circumstances.

In the example of the Osaka Plain, hunter–gatherers and farmers made contact in the sixth century BC, after which the two groups formed a coexistent relationship. Although we found a wooden farming tool at the farming site in the plain, which used Yayoi earthenware of the 'Ongagawa' type, remains of wood materials were to be found [24]. We surmise that the farmer would have taken the wooden farming tool from the hunter–gatherer site at the foot of the mountains. In the fifth century BC, they mingled increasingly. Subsequently, a group of people identifiable as Yayoi farmers emerged in the fourth century BC [25]. This sequence of events corresponds with the assimilation model. The transition from coexistence to assimilation evidently took approximately 200 years.

The farmers then spread to the eastern region of the main island (Honshu) of Japan by the fifth century BC. Indigenous hunter–gatherer groups gradually mingled with the farmers. The subsequent development varied among regions; it stopped at the fusion stage in some regions, while in other regions, hunter–gatherers assimilated with farmers. Paddy fields continued to spread to eastern Japan and the Tohoku region along the plain, including the Niigata region, except in the mountainous areas. The northernmost area is the Sunazawa ruins in the Tsugaru Plain of Aomori Prefecture. Paddy field farmers had long been unable to live in this area, a situation that may be explained using the coexistence model. In this habitat, survival was possible with only hunting and gathering. The Yayoi farming society was established throughout Honshu and Kyushu by the first century BC.

This context partly explains how hunter–gatherers became involved in farming. First, the mutual relationship between coexistence and symbiosis appeared during this period. Activities such as exchange, trade, intermarriage, and entrusting of labour, such as farming, presumably arose during this period. Recovering archaeological evidence of entrusted labour being practised in prehistory is difficult, although it might be inferred ethnographically. Another part of the context is the discovery of the responses of hunter–gatherers that are related to their foraging occupation while being influenced by farmers. Understanding the responses of these societies to the introduction of agriculture is especially important.

3. From Sedentarised Hunter-Gatherers to Early Farmers: Transition and Changes of Fusion Types C-1, C-2, and C-3

An examination of the transition from Jomon to Yayoi shows that the timing of the introduction of paddy fields varies considerably within the Japanese archipelago. Paddy villages developed during the Yayoi period in some areas such as the Fukuoka Plain, but paddy field farming did not begin on a full scale until the Edo period in the mountainous region near the Sea of Japan. Documents from the Early Edo period about paddy fields are available for research in that region. Although the habitat and socioeconomic contexts are different, certain characteristics about the onset of early paddy field farming can be examined using Edo-period reference information. Documents about rice and vegetable farming of the time are expected to have utility for framing factors that influenced Japan's

first farmers while taking into account the effects of the Tokugawa Japan domain called *han* in the Edo period (1603–1868).

The study area is a village upstream of the Miomote River in the northern region of Niigata Prefecture. This place is known for the Motoyashiki ruins from the latter half and final phase of the Jomon period, and 19 other sites of Jomon ruins sitting on river terraces (C-1). At the time, groups of hunter–gatherers maintained coexistence and symbiosis with each other. It remains unknown when and how upland farming and paddy farming were subsequently introduced into the area because no Yayoi ruins have been found. It is likely that farmers practising small paddy farming immigrated to Motoyashiki during the mediaeval or Early Edo periods. In other words, although the C-2 stage is assumed to have occurred, informative archaeological materials to verify this fact are lacking. This suggests that both dry-field farming and paddy field farming were being practised by the Early Edo period, which shows the C-3 phase. This shows the possibilities of the transition from the C-1 to the C-3 fusion types.

3.1. Combined Occupations of Sedentarised Hunter-Gatherers (C-1): Latter Half and Final Phase of the Jomon Period

The 19 Jomon sites used in this study are located in three areas: Motoyashiki, along the Miomote River (Figure 2), Shimokubo, near the confluence of the Miomote and Suezawa Rivers, and Doromatasawa, along the Doromata River. Rock shelters are located in the mountains upstream of Iwaisawa, a tributary of the Miomote River [26]. Many pieces of earthenware, stone slabs for crushing nuts (hereafter, grinding stones), animal bones, charcoal, and other artifacts have been excavated from these 19 sites. By the Late Jomon period, the Shimokubo and Maeda sites from the Middle-Jomon period had been abandoned, although the rock shelters continued to be used. The Motoyashiki site, covering an area of 100 m east–west and 70 m north–south, replaced them. Artifacts such as stone spear points, monuments, stone plates, whetstones, clay figures, chipped stone axes, and ground stone axes have been excavated from Motoyashiki.

Plant remains representing 15 species were discovered at the Motoyashiki site. These included edible plants (nine types) and inedible plants (six types) [27]. Among the edible plants, horse chestnuts were excavated in the greatest quantities. They comprised approximately 28% of the total (3039 pieces) plant remains. Horse chestnuts were followed by beech, which comprised approximately 20% of the total amount (2212 pieces). Other plants discovered include Japanese walnuts, chestnuts, Japanese pepper, acorns, *Vitis* (grape) spp., Leguminae, and dogwood.

The following animal remains (calcined/whitened from high heat) were excavated at the Motoyashiki site: Japanese serow, Japanese deer, boars/Suidae (only one), badgers, Japanese raccoon dogs, Japanese red foxes, rabbits, flying squirrels, Japanese black bears, and other mammals [28]. Among the mammals, the relative weights of the excavated remains of Japanese serows and Japanese black bears were higher than that of Sika deer (Figure 4). Among the fish remains, Salmonidae and *Salvelinus* accounted for 44.4%. Fishing tools made of bones and horns were excavated as well. In addition, large amounts of frog remains were unearthed.

The Choja-Iwaya Rock Shelter Site is located approximately 8 km northeast of the Motoyashiki site. The small amount of grinding stones discovered at the site suggests that rock shelters are unlikely to have been used for long-term residence [26]. Although the grinding stones reflect a combination of types during the Jomon period, they are not time diagnostic. Analysis of animal teeth identified a large number of Japanese serows, along with Japanese black bears and Japanese macaques. In the case of the Japanese serows, the growth lines on the cementum of the lower jaws facilitated estimation of the animals' ages; estimation of the time of death indicated hunting activity from the end of winter to early spring. These findings indicate that this rock shelter was most likely a hunting camp.

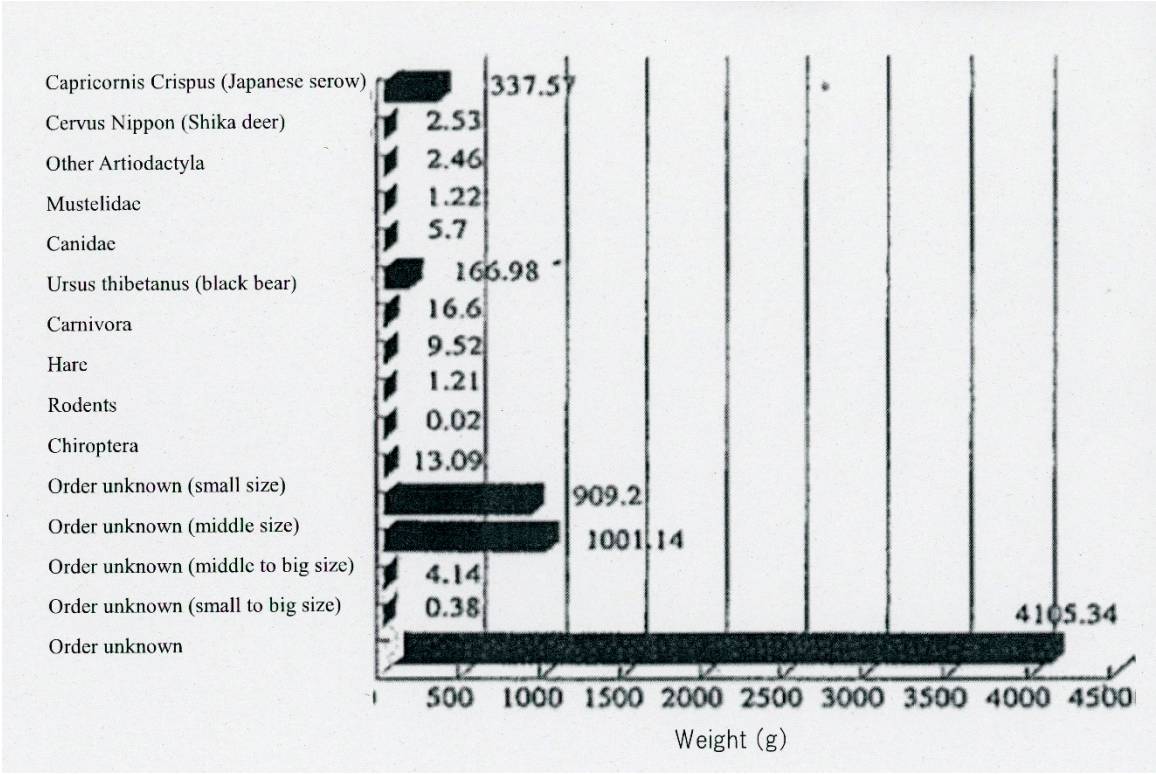


Figure 4. Weights of excavated animal remains [29].

Large quantities of chestnuts, walnuts, and horse chestnut endocarps were excavated at the Motoyashiki site, which was actively settled approximately 3000 years ago. The genetic diversity score obtained from DNA analyses of the excavated chestnut fruits was 1.517, which is similar to those of the Sannai-Maruyama Special Historical Site in Aomori Prefecture and the Sakuramachi site in Toyama Prefecture [30]. These results imply that the chestnut–people relationship termed "plant husbandry" or woodland management [31] had developed to a considerable degree. Although chestnuts are larger in western Japan and smaller in eastern Japan, those found at Motoyashiki were small. The excavated walnuts were identified from DNA analysis results as Japanese walnuts and heartnuts.

Artifacts brought from outside the local area have been discovered at the Motoyashiki site. An example is shark teeth; no vertebrae have been discovered. This suggests that people likely used the teeth as accessories and status symbols, rather than consuming shark meat as food [28]—although preservation issues might skew the findings regarding teeth. At the same time, the absence of the canine teeth of Asian black bears in the excavation implies that they were removed from this site. The discovery of a large number of unfinished ground stone axes suggests that the axes were being exported from this region and that there was a group specialising in their production (Sato et al. 2002). Furthermore, the percentage of excavated obsidian ore, which was used as material for various objects, was as follows: 20% (10 pieces) were produced in Itayama in the city of Shibata, 20% (10 pieces) were produced in Mt. Gassan in Yamagata prefecture, and 6% were produced in Mt. Kirigamine in Nagano Prefecture (Figure 5). This discovery implies that these were traded goods brought in from the outside. Additionally, appraisal of the gems excavated from the site indicates that the jade was light green to green in colour and was produced in the Oumi area of Itoigawa [32].

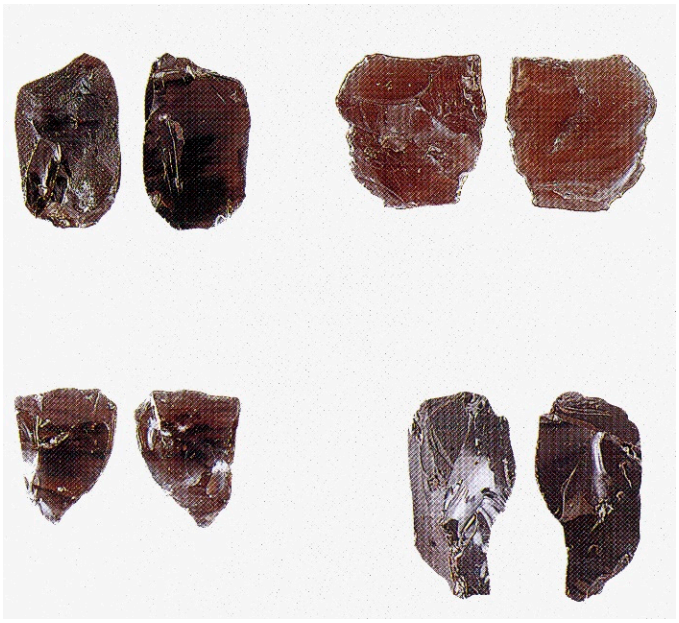


Figure 5. Obsidian from the Motoyashiki site [29].

Based on the discussion presented above, the following combination of occupations can be inferred from the archaeological resources of the Motoyashiki site (latter half and final phase of the Jomon period) (Table 1). The first is the addition of exchange and trade activities to hunting, fishing, and nut and fruit gathering. With regard to hunting, the animal bones found at the Choja-Iwaya Rock Shelter Site suggest that the favoured prey were Japanese serows, bears, and monkeys, rather than wild boars and deer, which had been commonly hunted during the Jomon period. As the furthest upstream area for salmon migration in the Miomote River did not reach the Motoyashiki site, people more likely fished for trout rather than salmon. It is unclear whether there is a relationship between the Choja-Iwaya site in the mountain and the Motoyashiki site near the river. It is assumed that there was a social network during the same period.

Table 1. Occupation calendar at the Motoyashiki site (latter half and final phase of the Jomon period).

	Month											
	4	5	6	7	8	9	10	11	12	1	2	3
Hunting												
bear	.....											
serow											.....	
Gathering												
royal fern (*zenmai*)	.....											
bracken (*warabi*)	.....											
horse chestnut (*tochi*)						.....						
walnuts						.....						
chestnuts						.....						
maitake mushroom						.....						
Fishing												
trout				....								
char				....								

Source: Information about the timing of hunting, gathering, and fishing was obtained from studies of animal and plant remains [26,28,30]. (Illustration by K. Ikeya).

3.2. Combined Occupations among Early Farmers (C-3): Early Edo Period (1655)

Archival information about the hunting, gathering, fishing, and trading conditions during the Edo period (1603–1868) is described below. People hunted commercially by hunting hibernating bears in early spring and trapping bears in the fall. The commercial value of bear gall bladders was high at the time. Notably, each household was assigned its own bear trapping area, according to documents from the Edo period [15]. Hunting of bears in early spring and serows in the coldest part of winter was conducted in groups. It was a ritual practice; hunters were required to use specific mountain words when in the mountains. The practice of serow hunting is evidenced by the fact that a villager by the name of Kanshichi presented serow fur as a year-end gift to the daimyo's councillor in charge of his master's castle. A man named Sagoemon from an area called Kiriba, who is mentioned in a cadastral register of the time, trapped bears.

Regarding gathering, the commercial gathering of sedge and chestnuts was conducted. Sedge was valued as a material for mats. Regarding chestnuts, people were granted certain rights to use shared chestnut forests. To explain further, the mountainous area on the opposite side of a river (termed foothills) consisted of chestnut forests. The area of forests shared by the village was approximately 10 ha [33]. Gathering activities were conducted based on village rules. During the fall harvesting season, the chief of the district would determine the gathering day and then notify each household of the date and time. The gathering period would be approximately two weeks, during which the gathering would be conducted six or seven times. On the morning of the specified day, one person from each household would collect all the chestnuts gathered by all the participants at the house of the district chief, who would then distribute them based on the number of household members.

Moving on to fishing, there was a productive salmon fishery. A skilled person could sometimes catch more than 10 salmon per day. Trout was the most important fish, and August through September was the best fishing season. There were two types of hunting methods: one was to dive and stab trout gathering in the depths using a double-headed spear, and the other was to place a fishing trap in the shallows.

The distribution of farmland during the Early Edo period can be estimated from a cadastral register of 1655. Figure 6 depicts the distribution of arable land for rice crops and shifting cultivation in the Early Edo period (1655). Rice fields were distributed near the Miomote settlement (Table 2 and Figure 6), with shifting cultivation fields in Motoyashiki (where a Jomon archaeological site is located). Incidentally, Kamimukai and Nakadouri in this region were used for shifting cultivation until the 1950s (Figure 6). This diagram shows that rice farming was concentrated in most of the area around the Miomote village, whereas both slash-and-burn farming and rice farming were conducted in the area around the Motoyashiki site. The two types of farming were also distributed in the area near the Suezawa River. As slash-and-burn farming continued into the 1950s, the following information about the condition of slash-and-burn farming is useful as a frame of reference.

Slash-and-burn farming, called *Kano*, was conducted on shared lands. Around 20 July, during the hottest part of summer, land users would go to a site together and assign households to farming areas by drawing lots. This farmland assignment was called *Kappatsuke*. Slash-and-burn farming was conducted by mowing grass in each person's assigned lot, leaving green grass only at the boundaries, drying the lot for three to five days, then burning the area. Swiddens were also visible on a steep hill with a 30° slope. As a crop, buckwheat (soba) was planted on a flat field in the first year. Buckwheat can grow in a cool climate, is unaffected by soil conditions, and can be grown easily without much labour. The growth period is short: seeds planted in summer mature in slightly over two months. During the second and third years, people would make ridges and plant soy, adzuki beans, and foxtail millet (awa). They would subsequently move the swidden field elsewhere on a rotating basis.

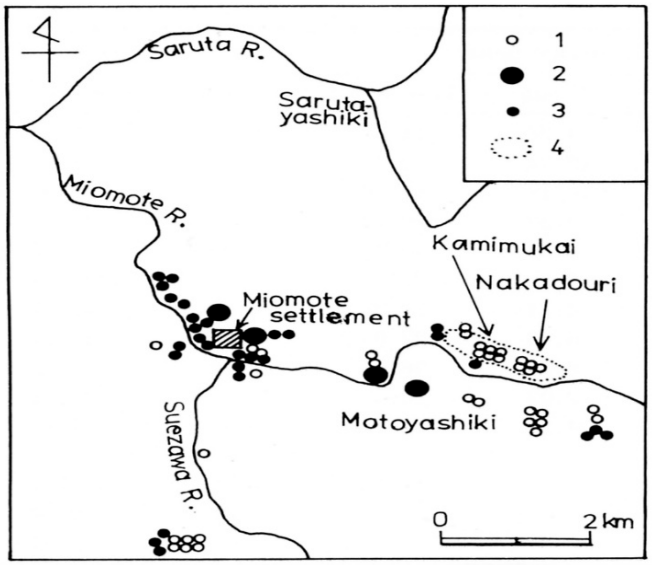


Figure 6. Distribution of shifting cultivation and rice fields in 1655: 1, one shifting cultivation field; 2, ten rice crop fields; 3, one rice crop field; 4, distribution of shifting cultivation later, in approximately 1955 [34].

Table 2. Occupation calendar of the Miomote settlement (Early Edo period).

	Month											
	4	5	6	7	8	9	10	11	12	1	2	3
Hunting												
bear	....						.....					
Serow											.....	
Gathering												
royal fern (*zenmai*)		.....										
bracken (*warabi*)		.....										
horse chestnut (*tochi*)							.....					
walnuts							.....					
chestnuts							.....					
maitake mushroom							.....					
Fishing												
trout					....							
char					....							
Farming												
rice			.....				.....					
Japanese millet			.....				.....					
millet												
azuki beans		.....				.....						
Soybeans		.....				.....						
buck wheat					.....		.....					

Source: Information about the timing of hunting, gathering, fishing, and farming was obtained from studies of animal and plant remains [33,35,36]. (Illustration by K. Ikeya).

Similarly, the following reference information is useful for paddy field farming. Tasks in a year would include, in order, ploughing in May, rice planting in June, paddy field management from July to September, and harvesting in October. Short-handled hoes were used for ploughing before the period of high economic growth. Rice planting was conducted through mutual assistance of a group, with the head family and branch families. Water management was necessary after rice planting. The water would be cold because of the mountainous location, and therefore, a method called *Nurume* was used to raise the water temperature. Long, winding irrigation channels were built to expose water to

sunlight for long hours. Subsequently, the people would weed the fields. Harvesting was conducted through a mutual assistance relationship.

A registry of the registered rice paddies, new paddies, and wet and dry fields was established in the Miomote village by 1655. All 16 households owned paddy fields, permanent fields, and swiddens, despite some differences among households in terms of upper and middle paddy fields. The swidden areas of households ranged considerably, from 3 to 100 terraces, with an average of 42 ridges [34]. Disparities among paddy field areas of households were also evident. New rice fields had not been developed at the time.

Irrigation technology is particularly important for paddy field farming; Figure 7 depicts the distribution of irrigation channels in Miomote. The dates of construction for most of the channels are unknown, but they were clearly constructed in the Edo Era because they are listed in the land register ('Tochi-daicho') of the Early Meiji period. This canal network has four sources of water: mountain streams, springs, marsh and pond water, and rivers. The canals extended throughout the flatlands of the settlement.

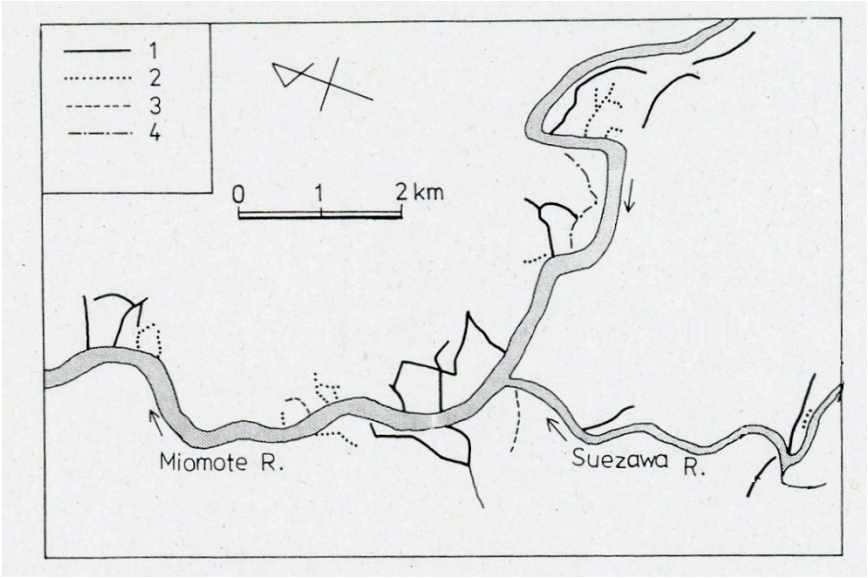


Figure 7. Distribution of irrigation channels: 1, mountain stream water; 2, spring water; 3, marsh and pond water; 4, river water [34].

This information suggests that the increase in rice yield, achieved during the Edo period, was accomplished by virtue of changes in irrigation technology. Irrigation using water drawn from a river, pond, or wetlands presumably existed before the Edo period (1655). During the Edo period, long-distance irrigation from the foot of mountains and using water drawn from rivers was likely developed. In the case of one canal for the mountain streams, water from the Tochidaira and Umahiki streams enters at the foot of the mountain and flows into the rice field along the Suezawa River. The canal length is more than one kilometre. The elders of the village say that the rice field was for common use. It is likely that the villagers originally dug the canal at the foot of the mountain.

The discussion presented above suggests that people of the Edo period combined their occupations, which included hunting, gathering, fishing, slash-and-burn farming, paddy field farming, and trade. The emphasis here, however, is on the position of farming in society. As the study region was mountainous, the amount of rice production was unstable, and no village had been developed. Products obtained from hunting and gathering were commercialised, and the villagers were thus actively engaged in hunting and gathering. Consequently, although the hunter–gatherers' valued practice of equally distributing shared resources was maintained strongly in hunting and gathering activities, disparities in terms of land ownership among households were evident in slash-and-burn farming

and paddy field farming. In other words, the organisation of early farmers in this period entailed strong ideas of egalitarianism in the economies surrounding natural resources, partly because of the economic importance of hunting and gathering. This finding clearly reflects the characteristics of the fusion model.

4. Results and Discussion: Establishment of Farming by Sedentarised Hunter-Gatherers and Social Continuity

Based on current knowledge regarding the initial transition of sedentarised hunter–gatherers to farming between Japan's Jomon period and Yayoi period, this study has presented dynamic models of intergroup relationships between hunter–gatherers and farmers. Ethnoarchaeological reference data regarding the ways people combined farming and other occupations, and how they maintained and changed their occupations and society after introducing farming, were considered in terms of the dynamic fusion models, to refine expectations for modes of the transition. More specifically, the study specifically addressed the upstream mountainous area of the Miomote River area, a unique location where it is possible to assess detailed information about the archaeological site from the latter half and final phase of the Jomon period and ancient writings about slash-and-burn farming and paddy fields from the early Edo period at the same location in the Japanese archipelago. This study's results suggest the following three findings:

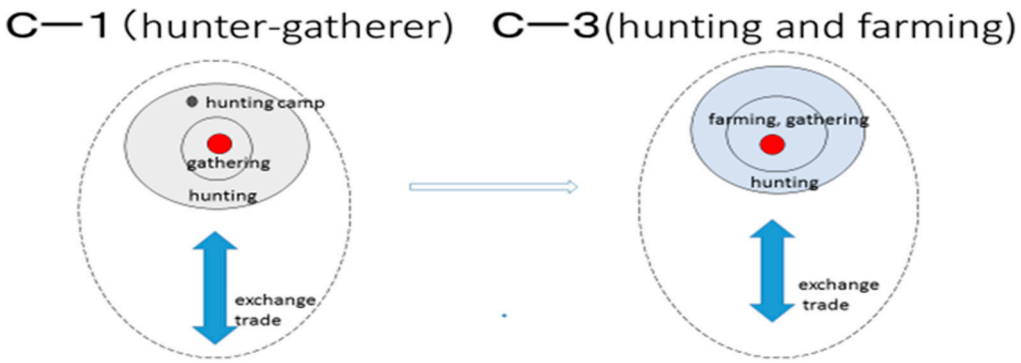
(1) A dynamic model of intergroup relationships between hunters and farmers.

Three relationship types are found in ethnohistorical resources for hunter–gatherers and farmers: coexistence and symbiosis, fusion, and assimilation. Coexistence and symbiosis are states in which the integrity of groups' lifeways is maintained after contact between the two groups. Fusion occurs in cases in which other factors are mixed in the contact between the groups. Assimilation occurs when the cultural factors and customs of one group disappear because of intergroup contact. Factors such as the population size of each group, the presence of intermarriage relationships, and the level of power to maintain a group culture are likely to be related to differences among these three relationships.

(2) How farming and other occupations were combined for the Jomon Period: Support for the fusion model.

Occupations in the latter half and final phase of the Jomon period included exchange and trade in addition to hunting, fishing, and gathering of nuts and fruits. These were combined depending on the season.

With regard to hunting, the animal bones found at the Choja-Iwaya Rock Shelter Site suggest that people primarily hunted Japanese serows, Asian black bears, and Japanese macaques rather than wild boars and deer, which were commonly hunted during the Jomon period [31,37]. Regarding gathering, large amounts of horse chestnuts and beech were found in excavations. Chestnuts were also used, and are distinguished by mechanisms of social control. Cereals have not been found. The spatial aspects of these activities indicate that gathering was conducted around the villages, and hunting was conducted around the gathering areas. In addition, the space for exchange and trade extended outside the hunting areas. This finding is presented as a three-layered concentric circle. People of the Edo period combined the occupations of hunting, gathering, fishing, slash-and-burn farming, paddy field farming, and trade. These activities also formed a three-layer structure consisting of farming and gathering around villages, hunting, and trade (Figure 8).



Type Period Subsistence Land use
C - 1 late and final Jomon hunting, gathering, fishing, exchange commons
C - 3 early Edo hunting, gathering, fishing, exchange commons
millet farming commons
paddy rice farming private land

Figure 8. Transition from hunter–gatherer (C-1) to early farmer (C-3) (C, fusion type). (Illustration by K. Ikeya).

Changes in combinations of occupations due to the introduction of farming are apparent in the comparison of the two periods. At the research site, the combination of farming activities, gathering edible wild plants in the spring, fishing in the summer, and gathering mushrooms and fruits in the fall would not cause an overlap of the periods of the various associated occupations (refer to Tables 1 and 2). In the Edo period, however, hunting methods and resource distribution for more concentrated use of resources had developed due to the commercialisation of forest products and social control methods of managing such activities. This particularly affected the trapping of bears and gathering chestnuts in the fall.

(3) Maintenance and changes in occupations and society after the introduction of farming: validation of the fusion model.

In this case, study, hunting, gathering, and fishing were maintained even after the introduction of farming. At the time, equal distribution of the shared resources of local residents, a method characteristic of hunter–gatherers, was practised during the hunting of bears and the gathering of sedge and chestnuts. Farmland, however, was divided into paddy fields, dry fields, and slash-and-burn farming. Disparities among households were evident in their areas of land for slash-and-burn farming and paddy field farming because irrigation systems and water management are fundamentally important for paddy fields. An ethos of land ownership had presumably developed by this time.

Therefore, hunter–gatherers most likely did not become rice farmers (assimilation type) despite the customs related to rice farming [35]. In other words, these findings suggest that although hunter–gatherers combined occupations and engaged in hunting as well as gathering and farming, the idea of egalitarian resource allocation that is characteristic of hunter–gatherers would be strong in the local community (characteristics of the fusion type). Paddy rice farming depended heavily on a high degree of social cooperation, community cohesion, and reciprocity, and thus resisted the development of social hierarchies [37].

A similar case is the San people, hunter–gatherers living in the southern region of Africa, who combined hunting and gathering with farming. A new combination of occupations was created by combining farming with hunting and gathering, even after small-scale agriculture was introduced [38,39]. Rather than becoming farmers, they maintained the values of the hunter–gatherer society. For instance, when certain households had harvested cultivated watermelons, the household that harvested a large amount temporarily stored

the watermelons [39]. Subsequently, the watermelons harvested from the household's farm were distributed to other households.

In the Japanese archipelago, the modes of introduction for paddy field farming vary among regions. The common occupation in rice farming villages of the plains is the paddy field method. Although fishing in paddy fields was allegedly combined in some cases [40], the percentage of hunting and gathering was not large. This is a case of the assimilation type. In contrast, in mountainous regions such as the area studied here, it is expected that a lack of land suitable for paddy fields and the small volumes of rice production encouraged the combination of slash-and-burn farming and paddy field farming with hunting, gathering, and fishing to maintain subsistence. This case illustrates the fusion type.

As described in the examples presented above, agriculture can be combined with other pre-existing occupations by conducting it during different seasons. Moreover, cereal farming and paddy field farming (water management and land ownership) relate to the land very differently. The values of the hunter–gatherer society are maintained if the ratio of paddy field farming is low. If the ratio is high, then it is expected that the shift to the assimilation type would be based on how closely people are related to the land. There were not many social changes caused by the introduction of field farming; however, the introduction of paddy rice cultivation had different effects on society depending on the level of investment in channelling water from streams and springs and creating waterways. Based on these findings, regional diversity among the first farmers during the transition from the Jomon period to the Yayoi period can likely be explained by the types of mutual interaction between hunter–gatherers and farmers, the extent of investment in paddy field farming, and limiting characteristics of the habitat.

Funding: This study is a part of the Cultural History of PaleoAsia-Integrative research on the formative processes of modern human cultures in Asia project and is supported by the Japan Society for the Promotion of Science (Grant Number: 16H06409).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: I am very grateful to Shin'ichiro Fujio and Jun Takakura, who provided information and advice. Additionally, I am grateful for the funding support from the Cultural History of PaleoAsia-Integrative research on the formative processes of modern human cultures in Asia project. I am also grateful for the support from the Center for Northeast Asia Area Studies at the National Museum of Ethnology.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Miyake, Y. Hunter-Gatherer Societies in the Prehistoric West Asia. In *Global Environmental History from the Perspective of Hunter-Gatherers: Coexistence with Nature, Neighbors, and Civilization (Shuryo Saishumin kara mita Chikyu Kankyo-shi)*; Ikeya, K., Ed.; University of Tokyo Press: Tokyo, Japan, 2017; pp. 58–73; ISBN 978-4-13-060317-1. (In Japanese)
2. Bar-Yosef, O.; Meadow, R.H. The Origins of Agriculture in the near East. In *Last Hunters-First Farmers: New Perspective on the Prehistoric Transition to Agriculture*; Price, T.D., Gebauer, B., Eds.; School of Advanced Research Press: Santa Fe, NM, USA, 1995; pp. 39–94.
3. Fuller, D.Q.; Qin, L.; Zheng, Y.; Zhao, Z.; Chen, X.; Hosoya, L.A.; Sun, G.-P. The Domestication Process and Domestication Rate in Rice. *Science* **2009**, *323*, 1607–1610. [CrossRef] [PubMed]
4. Habu, J. *Ancient Jomon of Japan*; Cambridge University Press: Cambridge, UK, 2004; ISBN 978-0521776707.
5. Habu, J. Resource Use by Jomon People and Long-Term Changes of Their Culture. In *Hunting-Gathering Culture in Japan (Nihon no Shuryo Saishu Bunka)*; Ikeya, K., Ed.; Sekaishiso-Sha: Kyoto, Japan, 2005; pp. 45–72; ISBN 978-4790711285. (In Japanese)
6. Nasu, H. The Initial Form of Rice and Millet Cultivation during the Final Jomon-Yayoi Transition Era from the View of Archaeobotanical Weed Assemblages. *Bull. Natl. Mus. Jpn. Hist.* **2014**, *187*, 95–110. (In Japanese)
7. Nasu, H.; Momohara, A. The Beginnings of Rice and Millet Agriculture in Prehistoric Japan. *Quat. Int.* **2016**, *397*, 504–512. [CrossRef]
8. Fujio, S. *History of Yayoi Period (Yayoi Jidai no Rekishi)*; Kodansha: Tokyo, Japan, 2015; ISBN 978-4062883306. (In Japanese)

9. Shitara, H. *From the Jomon Period to the Yayoi Period, Iwanami Lecture, Japanese History*; Iwanami Shoten: Tokyo, Japan, 2013; Volume 1. (In Japanese)
10. Fujio, S. Early Grain Cultivation and Starting Processes in the Japanese Archipelago. *Quaternary* **2021**, *4*, 3. [CrossRef]
11. Fujio, S. The Formation of Yayoi Culture in Fukuoka Plain. *Bull. Natl. Mus. Jpn. Hist.* **1999**, *77*, 51–84. (In Japanese)
12. Nakayama, S. *Plant Archaeology and Origins of Japanese Agriculture (Shokubutsu Kokogaku to Nihon no Noko no Rekishi)*; Doseisha: Minato City, Tokyo, 2010. (In Japanese)
13. Obata, H. *Northeast Asian Paleoethnobotany and Jomon Agriculture (Touhoku Ajia Kominzoku Shokubutsugaku to Jomon Noko)*; Doseisha: Minato City, Tokyo, 2011. (In Japanese)
14. Ikeya, K. Bear Ritual of the Matagi and the Ainu in Northeastern Japan. In *Circumpolar Animism and Shamanism*; Yamada, T., Irimoto, T., Eds.; Hokkaido University Press: Sapporo, Japan, 1997; pp. 55–63.
15. Ikeya, K. Mobility and Territoriality among Hunting-Farming-Trading Societies: The Case Study of Bear Hunting in Mountain Environments of Northeastern Japan. In *Beyond Affluent Foragers: Rethinking Hunter-Gatherer Complexity*; Grier, C., Kim, J., Uchiyama, J., Eds.; Oxbow Books: Oxford, UK, 2006; pp. 34–44.
16. Education Board of Asahi Village. *Excavation Report of the Archeological Sites related to Okumiomote Dam Construction, IV (Okumiomote Dam kanren Iseki Hakkutsu Chosa Hokokusho 4), Motoyashiki Ruins*; Education Board of Asahi Village: Murakami, Japan, 1995. (In Japanese)
17. Yatsuka, H.; Ikeya, K. Farming Practices among African Hunter-Gatherers: Diversifying without Loss of the Past. In *Rethinking African Agriculture: How Non-Agrarian Factors Shape Peasant Livelihoods*; Hyden, G., Sugimura, K., Tsuruta, T., Eds.; Routledge, Taylor and Francis Group: London, UK, 2020; pp. 49–63.
18. Ikeya, K. The Historical Dynamics of the Socioeconomic Relationships between the Nomadic San and the Rural Kgalagadi, Botswana. *Notes Rec.* **1999**, *31*, 19–32.
19. Turnbull, C. *The Forest People*; Simon & Schuster: New York, NY, USA, 1961.
20. Terashima, H. Economic Exchange and the Symbiotic Relationship between the Mbuti (Efe)Pygmies and the Neighbouring Farmers. *Sprache Gesch. Afr.* **1986**, *7*, 391–405.
21. Headland, T.N.; Reid, L.A.; Bicchieri, M.G.; Bishop, C.A.; Blust, R.; Flanders, N.E.; Gardner, P.M.; Hutterer, K.L.; Marciniak, A.; Schroeder, R.F.; et al. Hunter-Gatherers and Their Neighbors from Prehistory to the Present [and Comments and Replies]. *Curr. Anthropol.* **1989**, *30*, 43–66. [CrossRef]
22. Ikeya, K.; Nakai, S. Historical and Contemporary Relations between Mlabri and Hmong in Northern Thailand. In *Senri Ethnological Studies 73 Interactions between Hunter-Gatherers and Farmers: From Prehistory to Present*; Ikeya, K., Nakai, S., Eds.; National Museum of Ethnology: Osaka, Japan, 2009; pp. 247–261.
23. Takeuchi, K. Interethnic Relationships between Pygmies and Farmers. In *Hunter-Gatherers of the Congo Basin: Cultures, Histories, and Biology of African Pygmies*; Hewlett, B.S., Ed.; Transaction Publishers: Piscataway Township, NJ, USA, 2014; pp. 299–320. ISBN 1412853613.
24. Harunari, H. *The Beginning of the Yayoi Period*; Tokyo University Press: Tokyo, Japan, 1990; ISBN 978-4130241113.
25. Fujio, S. Interaction between the Jomon Farmer and the Yayoi Farmer in the Beginning of the Yayoi Period along the Old Kawachi Lake. *Bull. Natl. Mus. Jpn. Hist.* **2009**, *152*, 373–400. (In Japanese)
26. Ono, A. (Ed.) *Choja-Iwaya Rock Shelter Site*; Education Board of Asahi Village: Niigata Prefecture, Japan, 1993. (In Japanese)
27. Education Board of Asahi Village. *Excavation Report of the Archeological Sites Related to Okumiomote Dam Construction (Okumiomote Dam kanren Iseki Hakkutsu Chosa Hokokusho) XIV, Motoyashiki Site II Upper*; Education Board of Asahi Village: Murakami, Japan, 2002. (In Japanese)
28. Tomioka, N.; Asari, H. Analysis of Animal Remains Excavated from Motoyashiki Site in Niigata Prefecture. In *Excavation Report of the Archeological Sites Related to Okumiomote Dam Construction (Okumiomote Dam kanren Iseki Hakkutsu Chosa Hokokusho) XIV, Motoyashiki Site II Upper*; Education Board of Asahi Village: Murakami, Japan, 2002; pp. 334–340. (In Japanese)
29. Education Board of Asahi Village. *Excavation Report of the Archeological Sites related to Okumiomote Dam Construction, I(Okumiomote Dam kanren Iseki Hakkutsu Chosa Hokokusho 1), Shimozori Ruins*; Education Board of Asahi Village: Niigata Prefecture, Japan, 1990. (In Japanese)
30. Sato, Y. *Castanea crenata and Its DNA Analysis Excavated from Motoyashiki Site in Niigata Prefecture Excavation Report of the Archeological Sites Related to Okumiomote Dam Construction (Okumiomote Dam kanren Iseki Hakkutsu Chosa Hokokusho)XIV, Motoyashiki Site II Upper*; Education Board of Asahi Village: Niigata Prefecture, Japan, 2002; pp. 357–365. (In Japanese)
31. Crawford, G.W. Advances in Understanding Early Agriculture in Japan. *Curr. Anthropol.* **2011**, *52* (Suppl. 4), S331–S345. [CrossRef]
32. Miyajima, H. Identification of Beads Excavated from the Motoyashiki Site. In *Excavation Report of the Archeological Sites Related to Okumiomote Dam Construction (Okumiomote Dam kanren Iseki Hakkutsu Chosa Hokokusho) XIV, Motoyashiki Site II Upper*; Education Board of Asahi Village: Murakami, Japan, 2002; pp. 414–418. (In Japanese)
33. Watanabe, S. (Ed.) *Okumiomote: A Mountain Village of Uetsu Boundary (Uetsu Kokkyo No Sanson Okumiomote)*; Yamagata Chiri-Danwakai: Yamagata, Japan, 1979. (In Japanese)
34. Ikeya, K. Rice Crops and Shifting Cultivation in Miomote, Murakamihan in the Edo Era. *Sci Rep. Tohoku Univ.* **1987**, *37*, 41–51.
35. Education Board of Asahi Village (Ed.) *Folklore of Asahi Village (Asahi Mura No Minzoku) II*; Education Board of Asahi Village: Murakami, Japan, 1984. (In Japanese)

36. Ikeya, K. *Social Monograph among Wild Plant Gatherers: Natural Resource Use and Territoriality (Sansai Torino Shakaishi-Shigen Riyo to Teritori)*; Tohoku University Press: Miyagi, Japan, 2003; ISBN 4-925085-75-1. (In Japanese)
37. Kaner, S.; Yano, K. Early Agriculture in Japan. In *The Cambridge World History*; Barker, G., Ed.; Cambridge University Press: Cambridge, UK, 2015; pp. 353–386.
38. Ikeya, K. Dry Farming among the San in the Central Kalahari. *Afr. Study Monogr. Suppl.* **1996**, *22*, 85–100.
39. Ikeya, K. Environment and Resource Management among the San in Botswana. *Nomadic Peoples* **2001**, *4*, 67–82. [CrossRef]
40. Yasumuro, S. *Japanese Livelihood (Nihon Minzoku Nariwai Ron)*; Keiyusha: Tokyo, Japan, 2012; ISBN 978-4-87449-093-8. (In Japanese)