History of Forest Utilization in the World Natural Heritage Area of Western Yakushima Island

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Introduction

The western lowland of Yakushima Island, the World Natural Heritage area, is covered by broad-leaved evergreen forest subjected human disturbance, such as cultivation, wood charcoal production, and camphor distillation. However, details of the forest utilization remain unclear, because most of this area was owned privately prior to 2005 with no available records for land use. Comprehension of the human impact in the past, as well as biological and ecological studies, is required for understanding the current condition of the forest and to develop an effective conservation scheme. We conducted field research and literature surveys, including interviews with local people, in order to review the history of forest utilization in the western lowland area of Yakushima Island.

Materials & Methods

The study area was located in the Han-yama and Kawahara sites in the western lowland of Yakushima Island (ranging from 0 to 300 m in altitude, and covering approximately 1 × 4 km; Fig.1). There are no settlements within the study area except a single road traversing it. Approximately, a 200-m contour line was considered a boundary for the land management: government-owned forest at the upper side, and Kagoshima prefecture-owned forest at the lower side. The latter was privately owned prior to 2005.

We referred to some documents, old maps, and aerial photographs taken in 1947 and 1969. The aerial photographs were subjected to orthometric correction using ERDAS Imagine ver.8.7, and logged sites in the photographs were surveyed with ArcGIS ver.9.

From March to August 2006, we located abandoned artificial structures, such as charcoal kilns and farm fields with stone masonry using a GPS receiver (MobileMapper Pro, Thales Navigation Inc.). Size and characteristic features of charcoal kilns were also recorded.

In order to date the period of human activities such as charcoal production and camphor distillation, we extracted tree-ring cores using an increment borer, and determined tree ages by counting tree rings under a stereoscopic microscope. For the charcoal production, we determined the tree ages of *Melia azedarach* var. *subtripinnata* standing adjacent to abandoned charcoal kilns to estimate the year of abandonment of the kilns. For the camphor distillation, we determined the ages of *Cinnamomum camphora* trees, the raw material of camphor.

Results

In the Han-yama and Kawahara sites, a total of 37 abandoned charcoal kilns were found (Fig.2). Most of the

kilns were located in concaved sites and had an oval or clam shell-shaped bottom. The horizontal and vertical inner widths ranged from 3.1 to 5.1m and 2.4 to 4.1m, respectively. Many artificially squared plots with stone masonry surrounds were recorded, mainly on gentle slopes in Han-yama and Kawahara (Fig. 2).

In total, seven *M. azedarach* var. *subtripinnata* trees were estimated at ages ranging from 44 to 86 years old, suggesting the approximate abandonment years of 1920 to 1962 for seven of the charcoal kilns (Fig. 2). The ages of 12 camphor trees in three sites of Kawahara (Fig. 2) averaged 70 years, ranging from 58 to 86 years, indicating the establishment year of around 1936 for the camphor trees in Kawahara.

From the aerial photographs taken in 1947, logged areas totaling 50.3 ha were identified, and 32.2 ha of them appeared to have been clear-felled in the period near to 1947 (Fig. 3). Areas of 44.8 ha were seen from the aerial photographs of 1969 to experience logging between 1947 and 1969 (Fig. 3). These photographs also showed bare ground (1.5 ha) due to waste soil associated with road construction in 1967. The location of houses and farm fields recorded by GPS usually fell into the clear-cut areas identified from the photographs of 1947.

Discussion

Here, we describe the history of forest utilization in the study area, taking events in chronological order. The Kamiyaku-town Local History Editing Committee (1984) stated that the area stretching from Nagata to Segire (Fig. 1) had been managed by Nagata village since early times. There is, however, no description of a village in the western part of the island on an old map drawn in 1882 (unknown publisher 1882) or a 1/200,000 geographical map drawn in 1889 (Land Survey Division 1892). Nishiwada (1894) listed the names of villages in Yakushima Island; however, the three villages, Han-yama, Kawahara, and Segire, were not included. On the other hand, we were able to find descriptions of Han-yama, Kawahara, and Segire, with symbols of accommodation units, on geographical maps drawn in 1921 (Land Survey Division 1923). Furthermore, the operation plan for the national forest (Kagoshima Regional Forest Office 1922) contained a description “Segire, farmers, three families.” The tree-ring analysis suggested that two charcoal kilns in the northern Kawahara area were abandoned in 1920 and 1921 at the latest (Fig. 2), suggesting human activities before this time. Yaku-town Local History Editing Committee (1993) said that Mr. Y. Kitazono from Kurio village (Fig. 1) had produced camphor at Kawahara in 1914–1915. According to the Monopoly Bureau (1942), at least several people were needed to work for the raw procurement and kiln management, and to stay over near to a camphor factory. For the reasons mentioned above, people appear to have first colonized these sites around 1900 to undertake cultivation, wood charcoal production, and camphor distillation.

From the tree-ring analysis of 12 camphor trees in the Kawahara site, these trees seemed to have been established around 1936, suggesting logging for camphor trees until this point of time. As mentioned earlier, we were only able to obtain information for camphor production in Kawahara for 1914-1915, and there is a time discrepancy of approximately 20 years between the documentary information and the tree ages. Yaku-town Local History Editing Committee (1993, 1995, 2003) said that camphor production had been an active form of industry in Yakushima Island in the 1920s and 1930s, and that camphor factories in Nakama village (Fig. 1) had obtained raw materials from various sites, including Ohko near to Segire. Camphor trees

in Kawahara may have been felled around the 1920s and 1930s for factories in remote areas, such as Nagata and Kurio.

Dr. J. Miyamoto, a folklorist who visited Yakushima Island in 1940, described the situation as follows, “Kawahara village is deserted now, and Han-yama village is almost abandoned with a few farmers (Miyamoto 1974).” We could not find any information on the status of Segire village at that time. In the period around 1940, it seems that few activities were conducted in connection with charcoal production and camphor distillation in the study area.

We obtained information from local people about logging at Kawahara for military purposes in the early 1940s, during World War 2. The information gleaned was as follows: Mr. D. Hidaka from Nagata worked as a punch marker for logs; a Korean group of 50–60 or even 70–80 loggers lodged in Kawahara; and Mr. Kim, a 75-years-old Korean, received a letter in 1942 from his father who was working at Kawahara (Nishinihon news-paper, 2006.08.06). Logging at Kawahara in the early 1940s must be a fact, although there is no available documentation telling of this activity. Logging for military purposes in the early 1940s presumably caused the large-scale deforested areas in the Kawahara site found in the aerial photographs of 1947 (Fig. 3).

In the late 1940s, people lived in Han-yama for sweet-potato cultivation and charcoal production (Ankei & Ankei 2000). At that time, the “Satsuma method,” promoted by Kagoshima prefecture, was employed widely in Yakushima Island (Uchida 1952, Kamiyaku-town Local History Editing Committee 1984, Yaku-town Local History Editing Committee 1993, 2003). Some abandoned charcoal kilns found in the study area had distinguishable features that accorded with the Satsuma method kiln, such as the clam shell bottom shape and one exhaust port on the back side. Using a Satsuma method kiln could produce approximately 1,750kg of charcoal (70 strew bags) twice a month (Yaku-town Local History Editing Committee 2003). Yield percentage was reported at approximately 20% for this method (Kagoshima Foresters Association 1925, Uchida 1952), so that 8 to 9 t of raw wood was needed for one charcoal burning. According to the above-ground biomass data recorded at the research plot located in the upper side of Han-yama (Forestry and Forest Products Research Institute, http://fddb.ffpri-108.affrc.go.jp/index.html), the forest contained approximately 103 t/ha biomass of tree species for good charcoal such as *Pinus thunbergii*, *P. densiflora*, *Quercus phillyraeoides*, *Q. salicina*, *Castanopsis sieboldii*, *Lithocarpus edulis*, *Rhaphiolepis indica* var. *umbellate*, *Rhus javanica* var. *roxburghii*, *R. succedanea*, and *Distylium racemosum*. Assuming the continuous running of a charcoal kiln, a 4-ha of raw material would seem to have been depleted over 2 years. Some charcoal kilns were located as close as approximately 100m apart from each other in the study area (Fig. 2), because of which charcoal makers may have built a new kiln every few years.

Meisei Timber, a civil corporation, purchased the private land in the western lowland of Yakushima Island from Shinwa Timber in 1951. According to someone who worked as a field overseer, Meisei Timber conducted intensive logging for wood pulp mainly in the Segire site, and cut down trees of the two species *Cryptomeria japonica* and *P. armandii* var. *amamiana* in Kawahara. Matsuda (1997) suggested that the forest in the Han-yama area also experienced logging by Meisei Timber in around 1955. Logged areas shown in the aerial photographs of 1969 (Fig. 3) are additional indications of the accuracy of information about pulp logging. From the scattered distribution of abandoned charcoal kilns in the gaps of logged areas

shown in aerial photos, it was deduced that almost the entire area of the Han-yama and Kawahara sites experienced logging of varying intensity for charcoal and wood pulp between the 1940s and the end of the 1950s. The logging operations of Meisei Timber continued in the Segire site until around 1965 (Ohyama 2006).

In 1958, only Mr. & Ms. Tanaka lived in Han-yama, and they stayed there until around 1965 for potato cultivation and mushroom growing, as well as fuel wood gathering. However, someone was conducting charcoal production and rosin collection in Han-yama between 1960 and 1964 (Ankei & Ankei 2000). The evidence of resin collection was backed by fallen trees with V-shaped scars in Han-yama and Kawahara. There are no records of dwellers in the western lowland of Yakushima Island after 1965, except for around the Nagata lighthouse. Other than for the road construction in 1967, the Han-yama and Kawahara sites have been free from organized logging since around 1960.

Acknowledgements

We are grateful to staff at the Yakushima Nature Conservation Office, Yakushima Forest Environment Conservation Center, Kagoshima Prefecture, and Kami-Yaku town for granting permission to conduct our research activity.

References

All listed documents are written in Japanese.

Ankei Y. & Ankei T. (2000) Life in Han-yama colony – interview with Mr. F. in Nagata, Kamiyaku-town. Seimeino-shima 52: 71-80.

Kagoshima Foresters Association (1925) Wood charcoal production. Kagoshima Foresters Association, Kagoshima.

Kagoshima Regional Forest Office (1922) Operation plans for the north, east, and south blocks of Yakushima. (Details unknown)

Kamiyaku-town Local History Editing Committee (1984) Local history of Kamiyaku-town. Kamiyaku-town Education Board, Kamiyaku-town.

Land Survey Division (1892) 1:200,000 geographical map “Yakushima.” Land Survey Division, surveyed in 1889.

Land Survey Division (1923) 1:50,000 geographical map “South-western Yakushima,” and “North-western Yakushima.” Land Survey Division, surveyed in 1921.

Matsuda T. (1997) Mysterious stories in Yakushima, the World Natural Heritage. Shusaku-sha Publishing, Tokyo.

Miyamoto J. (1974) Yakushima folklore. The inclusive edition of Johichi Miyamoto 16, Mirai-sha, Tokyo.

Monopoly Bureau eds. (1942) Lectures for camphor production. Monopoly Bureau.

Nishiwada K. (1894) Report for adventure trips to Tanegashima and Yakushima. (publisher unknown).

Ohyama Y. (2006) Transition of the western area of Yakushima. (In Ohsawa M., Tagawa H., and Yamagiwa J. eds., Yakushima the World Heritage – Nature and ecosystem of subtropical), Asakura Shoten, Tokyo.

Uchida K. (1952) Wood charcoal and processed charcoal. Asakura Shoten, Tokyo.

Yaku-town Local History Editing Committee (1993) Local history of Yaku-town 1 – Rural community 1. Yaku-town Education Board. Yaku-town.

Yaku-town Local History Editing Committee (1995) Local history of Yaku-town 2 – Rural community 2. Yaku-town Education Board. Yaku-town.

Yaku-town Local History Editing Committee (2003) Local history of Yaku-town 3 – Rural community 3. Yaku-town Education Board. Yaku-town.

Details unknown (1882) Old map of Yakushima, owned by the Kagoshima prefecture library.

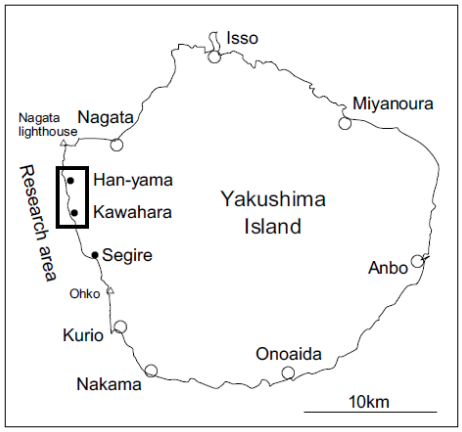

Fig. 1. Location of study site in the western lowland of Yakushima Island.
Black circle, abandoned villages; white circle, major towns; triangle, places related to text.

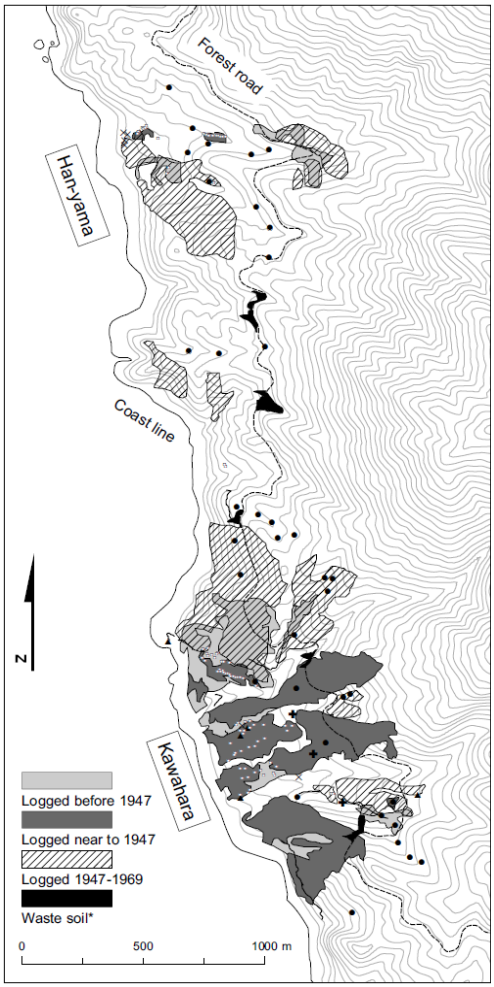

Fig. 2. Location map of abandoned artificial structures such as charcoal kilns, houses, farm fields, and trails with stone masonry. Numbers on some stone kilns indicate the year of abandonment, estimated by tree-ring analysis for *Melia azedarach* var. *subtripinnata* standing adjacent to a kiln.
* Camphor trees, *Cinnamomum camphora* trees extracted tree-ring cores (12 trees at 3 sites).
** Pine stumps, fallen trees and stumps with V-shaped scars to collect resin.
The forest road was constructed in 1967. Contour interval is 20 m.

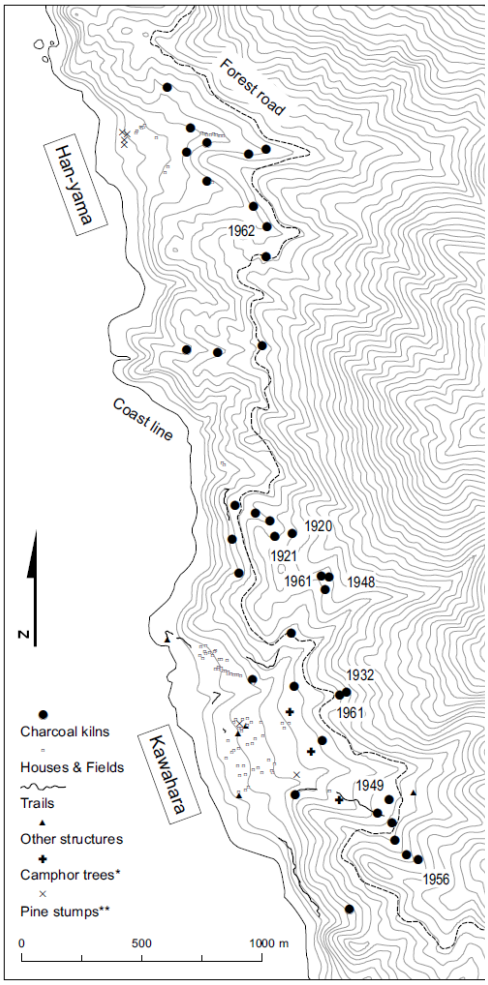

Fig. 3. Logged areas derived from aerial photos taken in 1947 and 1969.
Waste soil, bare ground due to waste soil associated with road construction in 1967.
See legends of Fig. 2 for the other symbols.