


Eco-DRR as Learned from Local History

Traditional and Local knowledge of Eco-DRR in dispersed villages located in the Sho River basin of the Tonami Plain





**Traditional and Local
knowledge of Eco-DRR
in dispersed villages located
in the Sho River basin
of the Tonami Plain**

Photo courtesy of Eco-DRR Project

Foreword

The Tonami Plain, shaped by the Sho and Oyabe Rivers, is a landscape of dispersed villages. The beautiful scenery, which changes from season to season and from moment to moment, has been cherished by the local people in their daily lives and will remain in the hearts of those who visit the area. This landscape was created over a long period of time by the activities of the people living in the Tonami Plain, and is a cultural landscape raised by the relationship between people and nature in each of the houses, villages, and communities. The splendidly built houses and the small forests that surround them dotting the gently spreading plain of Tonami look as if they were created from scratch for the sake of the beauty of the landscape. However, this is not the case. It is the result of many years of accumulated wisdom and skills of the people who have responded to the sometimes harsh natural environment and skillfully used the rich blessings of nature. The history of daily lives has created this special landscape. It is truly a regional treasure.

The natural environment of the Tonami Plain and the relationship between the nature and the local people, which are the basis for the creation of the characteristic dispersed village landscape. They are linked not only to the beautiful landscape, but also to the agriculture and traditional industries that support the region, flood control to deal with river flooding, and the use of stones around houses. The region has been shaped by the topography created by the rivers and the skillful use of the abundant water gathered from the deep mountains, while at the same time devising ways to avoid disasters related to river flooding. When we consider the landscape of dispersed villages in the context of the entire Tonami Plain, we can see not only the value of its beautiful scenery, but also various other values. On the other hand, the landscape of the



There is also a beautiful view at the foot of the premises forest



One of the blessings of nature brought about by the premises forest

area is changing, and these changes are likely to continue in the future. The value of the village landscape will change over time, but its role in responding to weather changes associated with climate change is being reevaluated. I feel that new local knowledge is needed on how to pass on to the next generation the traditional and local knowledge that enables us to enjoy the blessings of nature while avoiding natural disasters. I believe that this special landscape, created by the history of daily lives, will be utilized with new values. There are many signs of this taking place throughout the region.

The Sho River basin in the Tonami Plain is featured in the third booklet of the series "Eco-DRR as Learned from Local History ". If this series can contribute to building improved relationships between human and nature amidst the current climate and socioeconomic changes by considering the history of the relationship between people and nature that has played out in this region, then the hard work of all those involved in its publication will be rewarded. Although we have a long way to go, steady progress is being made in this endeavor.

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The Sho River provides an abundance of water blessings

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【Traditional and Local knowledge of Eco-DRR in dispersed villages located in the Sho River basin of the Tonami Plain】

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Traditional and local knowledge of the Tonami Plain Sho River basin

-Local wisdom and technology to manage the blessings and disasters of nature

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FUKAMACHI Katsue



Photo 1. Dispersed village landscape of Tonami Plain
(Photo: DOYAMA Choji)



Photo 2. Sho River in winter (near Yanaze, Tonami City)



Photo 3. Stone pagoda near Matsu-kawayoke
(Kaminakano, Tonami City)

The Sho River, which flows through the Tonami Plain in Toyama Prefecture, has a history of turbulence, changing its course with each flood, with flood control projects having been carried out as administrative measures for many years. It is said that the flow of the Sho River was fixed in 1714 after the completion of the "Matsu-kawayoke dike" in front of Benzaiten in Shogawa town. The "Onkawa-yoke Jizo" is made of local Kanaya stone and was built in the mid-Edo period to pray for the safety of the "Matsu-kawayoke" embankment. In the villages around the Sho River, there are many stone Buddhist statues related to such beliefs and stone walls to mitigate damage caused by floods and other natural disasters. In order to cope with disasters, people chose locations that were less prone to flooding and built their houses in specific ways, such as placing mounds of earth facing the Sho River and arranging trees and stonewalls for protection.

In the Sho River alluvial fan area, blessed with abundant water and fertile alluvial soil, rice paddies have been developed since ancient times. The development of rice paddies began in the micro uplands between the river channels, where there was little danger of flooding, and gradually spread out. People built houses and cultivated the surrounding rice paddies by drawing irrigation canals, resulting in the establishment of dispersed villages with houses built irregularly at intervals of 50 to 150 m. In order to cope with natural disasters while continuing to farm, the dispersed villages have devised ways to prevent and mitigate disasters, such as placing forests and stone walls around the houses. The forests functioned as windbreaks and snowbreaks, and also provided fuel and building materials. The landscape of the villages with these premises forests and stone walls has changed with the passage of time.



Photo 4. Farmland and farming in the dispersed village landscape (Goromaru, Tonami City)



Photo 5. Report meeting of the survey in Goromaru, Tonami City (March, 2017)



Photo 6. Farmhouse interview (Photo: WANG Wen)

This booklet focuses on traditional and local knowledge in the dispersed villages of the Sho River basin, and introduces various "regional wisdom and techniques for facing the blessings and disasters of nature" from the past, present, and future, based on accumulated research from a variety of academic fields. In our research, we have received great cooperation from the relevant administrative bodies of Tonami City, especially Goromaru, and other local people. The booklet consists of five sections: "Dispersed Village Landscapes of the Tonami Plain", "Flood Control and Water Utilization in the Sho River Basin", "Residential Forests in Dispersed Villages", "Life in Dispersed Villages and its Changes: A Case Study of Goromaru in Tonami City", and "Traditional and Regional Knowledge in the Tonami Plain". It aims to comprehensively capture the process which established the dispersed village landscape, methods to cope with natural disasters learned through history, and how the blessings of nature have been utilized. In addition, we hope to deepen understanding of the issues associated with changes in land use and administrative measures, and to provide an opportunity to think about landscape preservation and community development that make use of traditional and local knowledge.

An important keyword in this booklet is "Ecosystem-based Disaster Risk Reduction (Eco-DRR)," a concept that has emerged in international disaster prevention and mitigation efforts. Healthy and abundant ecosystems can play a role in directly reducing the risk of disasters and indirectly mitigating their effects. We would like to discuss how we can cope with future natural disasters while valuing healthy and rich local ecosystems and the unique local cultures they produce.

Historical timeline and maps of the Sho River basin and the period covered in each chapter

	Japanese Calendar	Year											
Edo Period	Tensho	13	1585	▼ Great Earthquake / Sho River moves east	Physical environment of Tonami Plain ...p14	Establishment of Tonami dispersed settlement ...p20	Villages and stone walls in the Sho River alluvial fan ...p66						
	Keicho	13	1608	▼ Sho River flooding									
	Kanei	7	1630	▼ The Sho River becomes a major river after entering from the west of Benzaiten due to flooding									
	Jyoo	2	1651	● Kaga Clan designates a part of Takanosu Village's premises forest as "oyabu"									
	Keian	4	1653	● Yanaze Fushin begins.									
	Meireki	1	1655	▼ Senbo River flooding causes heavy flooding in downstream villages									
	Kanbun	11	1671	■ Tonami County (利波郡) was changed to Tonami County (砺波郡)									
	Shotoku	4	1714	● Completion of the Matsu-kawayoke									
	Around the 18th century												
	Meiwa	9	1772	● Seed rice production began in Tonami County during the Horeki (1751-1764) - Anei' (1772-1781) Era (There are various theories)									
	Tenmei	2	1782										
	Tenpo	4	1833	▼ Matsu-kawayoke is cut off and flooded				A Bird's-eye view of dispersed villages in the Meiji Period...p30	Land use changes in goromaru, Tonami City since the Meiji Period ...p116	Famine and Food for the hungry in old documents - The case of former Inokuchi village ...p42	Flood control and water utilization in the Sho River basin ...p48	The premises forest in the Edo Period- Oyabu in Takanosu village ...p88	Construction of mansions and use of local materials in the Meiji Period ...p132
Meiji		4	1871	■ Tonami County belonged to Kanazawa prefecture due to abolition of clans and establishment of prefectures, and then three prefectures, Kanazawa, Nikawa and Nanao were established and Tonami County became Nikawa prefecture									
		5	1872	■ Nanao Prefecture is abolished and all of Echu Province becomes Nikawa Prefecture									
		8	1875	● Tonami County is subject to land tax revision									
		9	1876	■ Nikawa Prefecture incorporated into Ishikawa Prefecture									
		16	1883	■ Toyama Prefecture Establishment									
		19	1886	● Cholera outbreak in Imaisurugi Town, Tonami / Outbreak in the Toyama Prefecture									
		22	1889	■ Goromaru, Kanoshima, and Aratakaya villages merge to form Gokaya Village									
		24	1891	▼ Rivers in the Toyama Prefecture flooded in July and again in September									
		28	1895	▼ Rivers in the Toyama Prefecture overflowed, the Sho River also flooded									
		29	1896	■ Tonami County was abolished and Higashi-Tonami County (county office is in Inami Town) and Nishi-Tonami County (county office is in Isurugi Twon) were established									
		31	1898	▼ Sho River flooding / Chuetsu Railway nearing completion washed away / Over 70 houses washed away in Nakajima Town, Takaoka City									
		32	1899	▼ Sho River Flood									
	43	1910	▼ Rivers in the Toyama Prefecture overflowed, the Sho River also flooded										
Taisho		3	1914	● World War I begins.									
		6	1917	▼ Heavy snowfall causes chaos throughout Toyama Prefecture									
		7	1918	● MIZUNO Bunzo and others began growing tulip bulbs in Shoge Village									
		8	1919	● Sho-gawa Hydroelectric Power Co. established									
		10	1921	● Construction of a waterworks system begins in Demachi and is completed in 1924									
Showa		13	1924	● Completion Ceremony of Waterworks in Demachi, Higashi-Tonami County									
		5	1930	● Ground-breaking ceremony and groundbreaking ceremony for the prefectural Sho water supply joint project are held at Benzaiten Kawahara in Nakano Village / Flooding of Komaki Dam begins.									

▼ Disasters
 ■ Establishment of the Administration
 ● Other

This chronology is based mainly on the information contained in the text

■ 【Dispersed village scenery of the Tonami Plain】
 ■ 【Flood control and water utilization in the Sho River basin】
 ■ 【The premises forest in dispersed villages】
 ■ 【Life in a dispersed village and its changes: A case study of Goromaru, Tonami City】

Showa	7	1932	● Began construction of Akasofu Reservoir, completed in 1944	Land use changes in Goromaru, Tonami City since the Meiji Period ... p116 Shogawa "storm" and seed rice production...p36 Flood control and water utilization in the Sho River basin ...p48 Shogawa River confluence project...p50 Villages and stone walls in the Sho River alluvial fan ...p56 Living with premises forest ...p76 Premises forest in the Tonami Plain ...p80 Trends in policies for the conservation and utilization of premises forests ...p106 Historical transformation of houses and premises forest since the Showa Period ...p160
	9	1934	▼ Sho River flood, Ota Bridge washed away	
	11	1936	▼ Heavy snow and blizzard damage traffic	
	12	1937	● Second Sino-Japanese War begins	
	14	1939	● Construction completed on a new aqueduct for the left bank of the Sho River	
	15	1940	▼ The Sho River frozen over due to heavy snowfall	
	16	1941	● Pacific War begins	
	17	1942	● Governor's Instructions on the Campaign to Supply Wood for Military Needs by Cutting Down the premises forest	
	18	1943	● Sho River water supply joint project completed	
	20	1945	▼ Heavy snowfall and bad harvest in Tonami Plain ● End of the Pacific War	
	23	1948	● Gokaya Agricultural Cooperative established	
	27	1952	■ Tonami Town, Johana Town, new Fukuno Town and Shogawa Town Establishment	
	28	1953	■ Isurugi Town Establishment	
	29	1954	● Tonami City, Inami Town, Tochu Town, and new Fukuno Town Establishment	
	34	1959	▼ Typhoon Vera (also known as the Isewan Typhoon)	
	35	1960	● High economic growth and the shift of farmers to dual employment began around this time.	
	36	1961	▼ Super Typhoon Nancy (also known as the 2nd Muroto Typhoon)	
	37	1962	● Farm land consolidation begins in Tonami Plain	
	38	1963	▼ The 38 heavy snowfalls	
	41	1966	● Sho River becomes a first-class river due to the revision of the River Law	
	44	1969	● All lines of the Hokuriku Main Line are double-tracked and electrified	
	45	1970	● Farm land consolidation begins in Goromaru	
	48	1973	● Tonami - Kosugi stretch of the Hokuriku Expressway opens	
	51	1976	▼ The Sho River rises sharply for the first time in 43 years due to torrential rains caused by Typhoon Fran ● Tonami Wide-area water supply begins	
	53	1978	● The Konadegawa Dam is completed	
	56	1981	▼ The 56 heavy snowfalls	
Heisei	3	1991	▼ Typhoon Mireille	
	7	1995	● Tonami City, Shogawa Town, Fukuno Town, Inami, Inami Town Yamano, and Toga Village agricultural cooperatives merge to establish Tonamino Agricultural Cooperative	
	12	2000	● Fukumitsu-Chuo and Fukumitsu Town Credit Agricultural Cooperative merge to form Fukumitsu Agricultural Cooperative	
	13	2001	● Nanto, Johana Credit, Inokuchi Village, Taira Village, and Kamitaira Village Agricultural Cooperatives merge to establish an agricultural cooperative	
	14	2002	● Komaki Dam is designated as a National Tangible Cultural Property	
	16	2004	▼ Typhoon Tokage / Damage from fallen trees in the premises forest in the Tonami region ■ Tonami City and Shogawa Town merged to form Tonami City	
	18	2006	● Tonami Sankyoson Museum opened in Tonami City according to the concept of Tonamino Plains Country Museum.	
	20	2008	▼ Torrential rains cause extensive damage in the Nanto Mountain Range ● Tokai-Hokuriku Expressway fully opened	
	26	2014	● Tonami City enforced "Tonami City Landscape Town Development Ordinance" and "Tonami City Landscape Town Development Plan".	
	3	2021	● Tonami City Sets "The premises forest Preservation Month" for future generations.	
Reiwa			Reading the topography of the Tonami Plain using a drone...p26 Thermal environment of the residence and the premises forest ...p100 Windbreak effects of the layout of the premises forest ...p96 Types and distribution of premises forest ...p90	

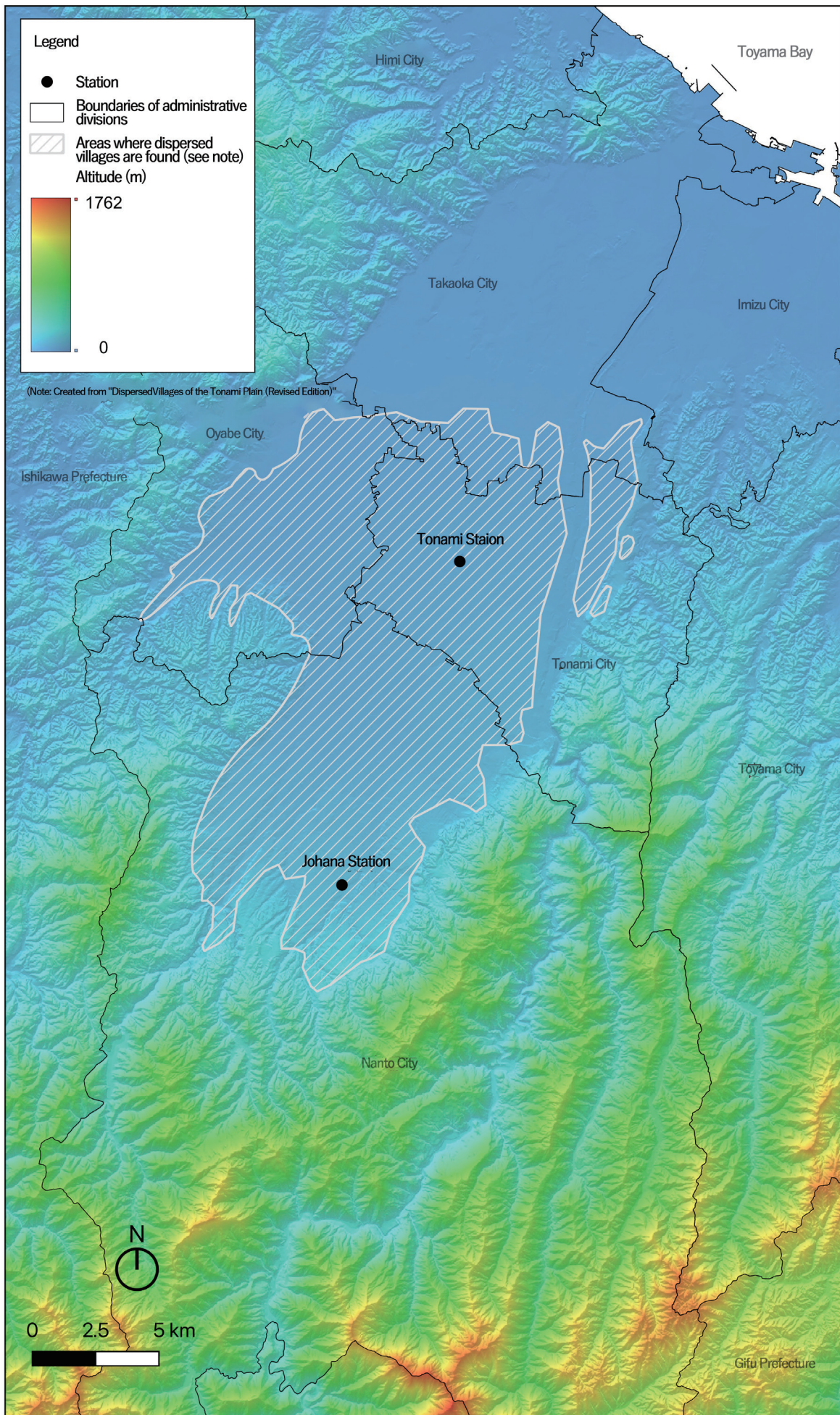


Fig. 1 Overall map of Tonami (1) (Additions to the GSI Numerical Elevation Model)

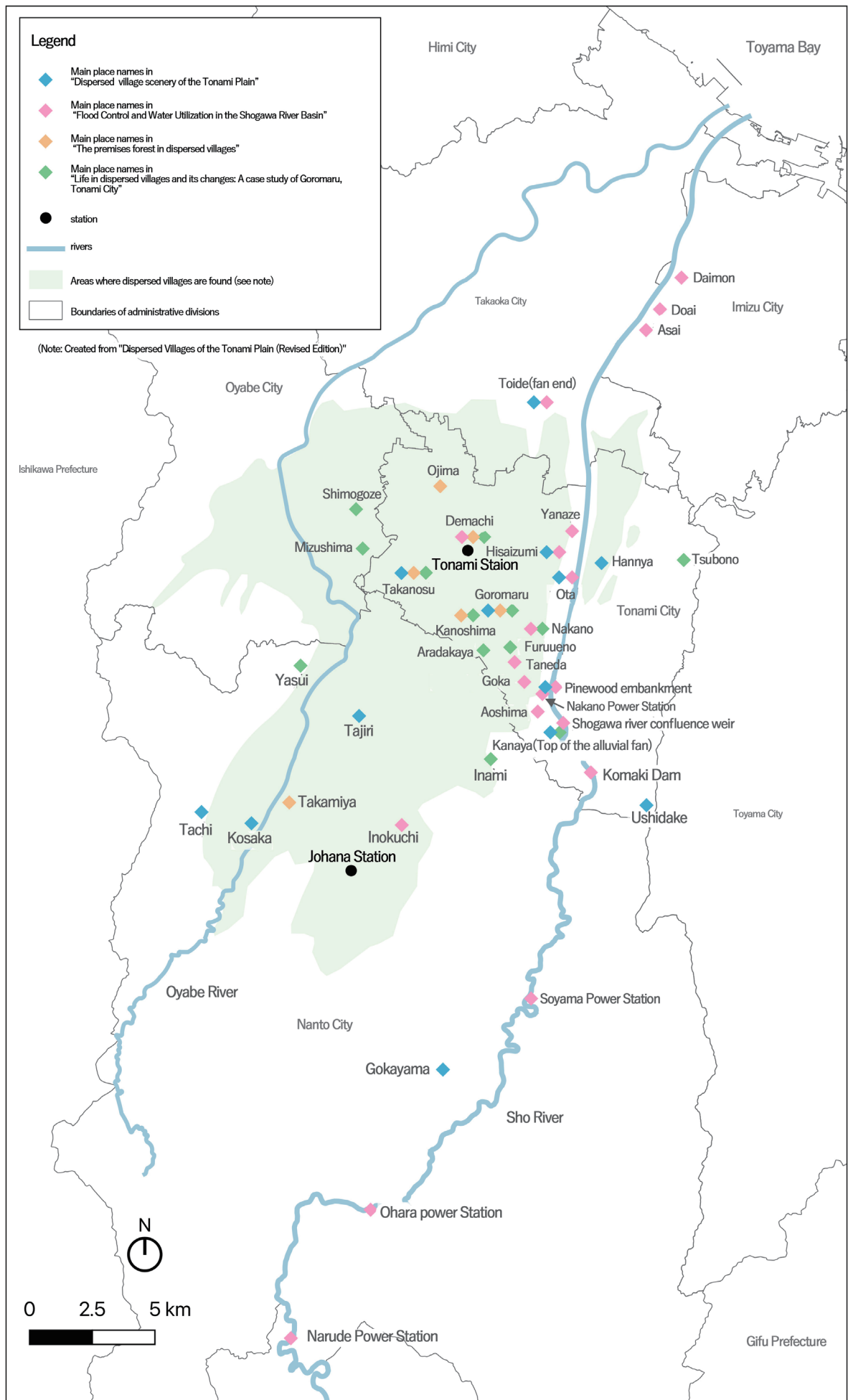


Figure: 2 Overall map of Tonami (2)

【Dispersed village scenery of the Tonami Plain】





Photo courtesy of Eco-DRR Project

Physical environment of Tonami Plain

Kyoto Institute, Library and Archives

KINDA Akihiro

Characteristics of the Tonami Plain

The Tonami Plain is surrounded on three sides by the Shoto Mountains, the Takashozu Mountains, and the mountains stretching from Mt. Ioh to Mt. Sekidoh. At the foot of the mountains are the Pleistocene Terraces (also known as the Diluvial Uplands).

Most of the central part of the plain is an alluvial fan, created by the flooding of the Sho River. The town of Demachi, Tonami City, is located near the center of the fan which area is about 100 m above sea level near the mouth of the river valley (fan top, Kanaya, Tonami City) and about 20 m above sea level at the northern end (fan end, near Toide town, Takaoka City). The fan area has a radius of about 12 km from the fan top.

The present river channel of the Sho River has been created by a landslide caused by a major earthquake in 1585 and a subsequent flood. The present river channel has been fixed by the construction of artificial levees during 1670 and 1714, by the Kaga Domain ruling the Tonami Plain,

Prior to that time, the central channel of the Sho River is thought to have been in the vicinity of what is known as the Senbo River course. A large 8th century irrigation channel was found at the Hisaizumi archeological site in Tonami City, which was surveyed in 2005. This artificial canal was approximately 7m wide and the surveyed section was about 2km long. It is thought that water was led from the old river channel near the Senbo River course (the main channel of the Sho River at that time). Ishiawa Manor in the Todaiji domain, depicted on a map dated 759 (Nara National Museum collection), has a piece of another map of

the same year (Tenri Library collection). It shows a "large ditch" and a separate three-branch irrigation canal. The ditch at the Hisaizumi site is thought to be such a ditch.

Up to this point, the Sho River was not embanked by levees and had several channels. Like the Senbo River course, it is thought that there was a central river channel for each period, but it was not fixed. Moreover, it is thought that during floods, the muddy and sandy flow surged into several river channels and deposited sediments. This is how the Sho River fan was created.

Channels on the Sho River fan

The Sho River channel now runs roughly northward from the top of the alluvial fan, but as shown in Figure 1, old river channels extend radially from the top of the fan. The main old river channels are called Nojiri River Course, Nakamura River Course, Aramata River Course, and Senbo River Course, in order from west to north. Each was once the main channel of the Sho River and was involved in the formation of alluvial fan. Along these former river channels, there are a number of slight rises caused by flood deposition in an elongated form in the direction of the river channel. These are advantageous to live because of offering rather safe parts against slightly high water level, although they might be submerged during large floods,

Since alluvial fan is basically composed of sands and slightly larger gravels, the water flowing over the surface is usually scarce, and while groundwater is abundant, it is not suitable for paddy cultivation. However, in the case of the Sho River fan, a large fan with a gentle slope and small streams such as the old river channel course made it possible to use



Figure 1. River courses, muddy soils and farmhouses on and around Sho River fan in 1617 (quoted and partially modified from *Historico Geographical Study of the Jori Plan and the Rural Settlement*, p. 475)

the water for daily life and irrigation.

In addition to these slight rises, there were slightly lower areas away from the old river channel where muddy soil was deposited during floods, making the river water easily accessible and suitable for rice cultivation.

On the east side of the Sho River fan, there was

another river from the Shoto Mountains. This river had several diverges depicted on a map as shown in Figure 2.

At this time, a land system called “Jori Plan” implemented for each county, which indicates the location of land piece on a grid pattern. It shows that Iyama Manor was almost in the vicinity of the former Hannya Village (administrative unit,

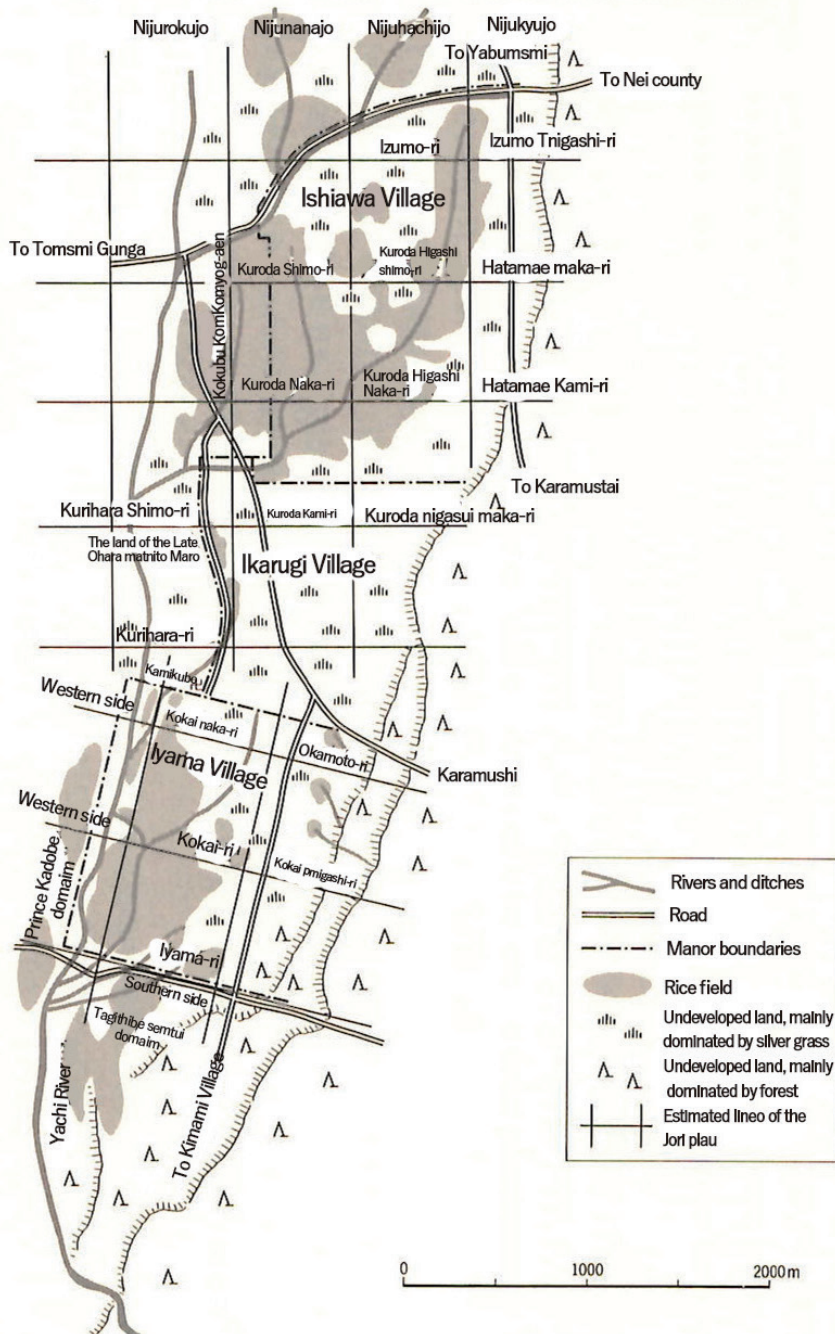


Figure 2. Rivers and ditches on the east side of Sho River fan in the 8th century (Ancient Manor Maps and Landscapes, p. 152)

Hannya, Tonami City). The 8th century maps show that Ikarugi Manor and Ishiawa Manor, also in the Todaiji domain, continue to the north of Iyama Manor. To the south and north of the area of Hannya Village, there were irrigation canals similar to the flow depicted in Figure 2. It is estimated that the original water course was the Yachi River, which flows out from the vicinity of Mitani at the foot of the Shoto Mountains.

On the other hand, there was also Kinahiru Manor

belonging to Todaiji in the northern area of Toide town (in former Tonami County), Takaoka City, near the end of the Sho River fan. The three rivers "Kinahiru River, Hayakawa River and Ishiguro River" are drawn on the map dating from the year 767. There is also another manor map drawn in the year 759, Imizu County, in the north of Tonami County, which is to the north of Kinahiru Manor, showing two rivers flowing almost south to north. As shown in Fig. 3, the Kinahiru River and the Hayakawa River are thought to have connected

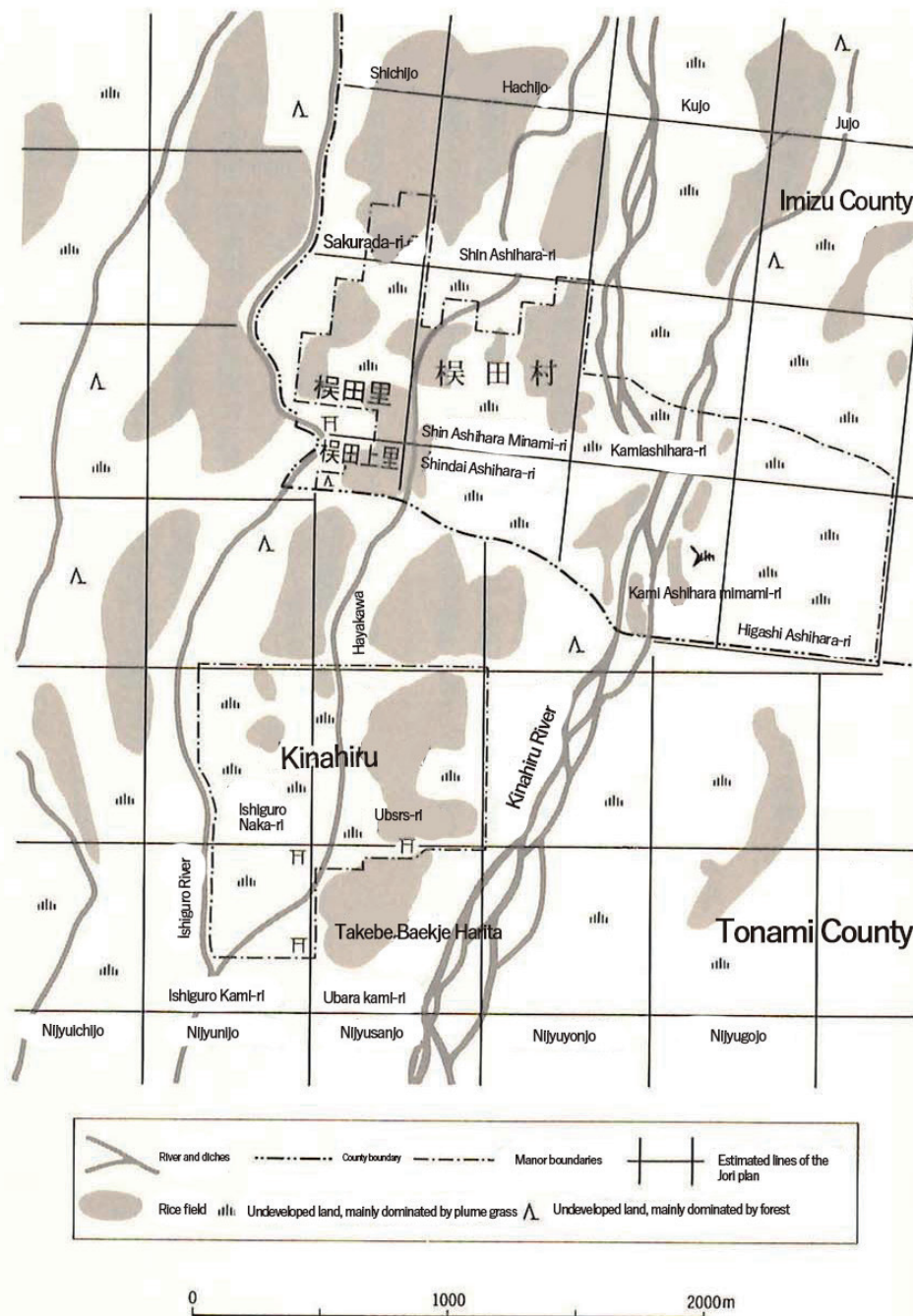


Figure 3. Villages and rivers near the end of Sho River fan (Ancient Manor Maps and Landscapes, p. 155, partially modified.)

to these two rivers. The rivers are represented as merging with one another, which may represent the situation of the rivers in the alluvial fan area. It seems to indicate the situation when the Sho River was flowing through the Senbo River Course.

Fixing the Sho River Channel and cultivation of old riverbeds in the Early Modern Period

It was mentioned earlier that the present river channel of the Sho River was created after the

great flood caused by the earthquake in 1585. This present river channel follows the course of the Yachi River. This channel has been added as the main channel in addition to the existing four courses on the fan, including the Senbo River Course.

The Kaga Domain spent 44 years from 1670 to 1714 for building a levee called "Matsu-kawayoke" to keep the channel in the new course. This project was also designed to prevent from overflowing into

the old river courses.

In 1726, after the Sho River was fixed to the present river channel, rice paddies expecting the harvest of 4500 'koku'(675 t) were planned to be cultivated at the old riverbed of Senbo River course. However, little progress was made in cultivating the riverbed itself, and cultivation along the diversion or fringes of the riverbed took precedence. The riverbed of the Senbo River course was still stony or sandy, and it is thought that the river had not yet accumulated the necessary mud to be used for rice paddies. The full-scale development of the main river proceeded after about 100 years when the new channel had been fixed.

The Senbo River course made it difficult to settle at one time, and the villagers along the river cultivated little by little. It is known that the policy of the Kaga Domain also did not allow the establishment of new settlement. Even today, the Senbo River course is a strip of land where the distribution of farmhouses are almost nonexistent.



Photo 1. Old photo of Matsu-kawayoke (offered by Tonami City)

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Establishment of Tonami dispersed settlement

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KINDA Akihiro

Ancient and medieval settlements

Iyama Manor in Tonami County in the Todaiji domain was originally private rice paddies cultivated by Shirushi Tonami-no-omi, a prominent local figure. A map (Shosoin Treasure) drawn in 767 shows rivers, 56 ha of rice paddies, and 87 ha of undeveloped land. Although there are no direct descriptions of houses or settlements on this map, Takuji Ogawa, Professor of Geography at Kyoto Imperial University in the 1920s, once pointed out a description of Todaiji Temple manor map as the origin of "isolated manor house" in the Tonami Plain. It is due to the fact that "Mononobe-no-Ishishiki zaike" was shown on the map of Shikata Manor in Imizu County (Shosoin Treasure). On that map, the "zaike (influential farm house)" is surrounded on three sides by rice paddies in the Todaiji domain, and the area of the house is more than 2 tan (2376m²).

At Hisaizumi site in Tonami City, where an irrigation ditch called as the "Great Ditch" was found. Near the side of the ditch the remains of four buildings with "hottate-bashira(dugout pillars)" were also found, and one of which was dating from the late 8th or early 9th century. However, these buildings are thought to be some facilities related to the management of this irrigation canal (ditch) and not a normal farm house. Aforesaid map of Iyama Manor shows the location of rice paddies cultivated by a certain landlord of Ohno Go (local unit), but again, there is no description of the settlement.

The Manyoshu (a famous anthology of poems in 8th century) records that Ohtomo-no-Yakamochi, Governor of Etchu Province at that time, investigated cultivating land and lodged at the

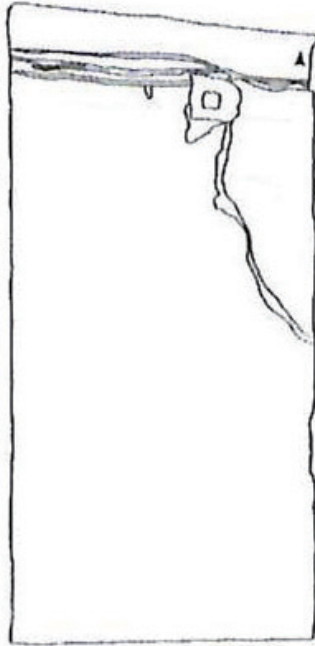
House of Tajihibe-no-Hokuri, Undersecretary of Tonami County, and composed a poem meaning "I am staying in a house at Yabunami, and like to tell to my darling that I hide in the spring rain." It is known that one of the undersecretaries of the county had a "house" in Yabunami, but the type of residence is still unknown.

Although the general form of the settlement is not clearly known from ancient materials and ruins, a group of medieval buildings detected at the Tajiri site in Nanto City in the southwestern part of the Tonami Plain indicates that there were scattered groups of residences. As shown in Fig. 1, there was a mound on which a pagoda was erected before the second half of the 12th century (Period I), but it is believed that there were no buildings at that time.

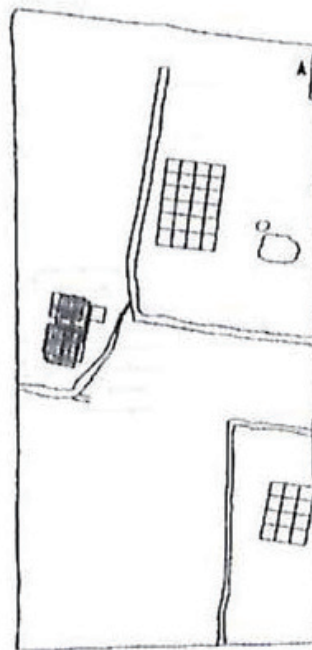
From the second half of the 12th century to the first half of the 13th century (Period II), three compartments surrounded by ditches were formed, and the northeastern plot had evidences of 7 pillars (north-south), 5 pillars (east-west) house. It was confirmed that there was a large hottate-bashira (dugout pillar) building and a well, suggesting that there was some kind of workshop in the vicinity, was found in the plot. A smaller building is known to have existed on the west plot, but it is believed to have been rebuilt 6 times during this period, and the building ruins overlapped each other. The 4 pillars × 3 pillars building was found in the southeast plot.

In the late 13th-14th century (Period III), the ditches of the previous plots disappeared, and smaller plots than the previous ones appeared in the northeastern and southeastern areas. The

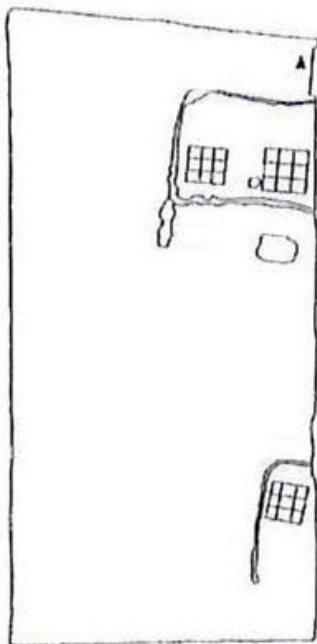
Period I
Before late 12th century



Period II
Late 12th- early 13th century



Period III
Late 13th - 14th century



Period IV
First half of the 15th century

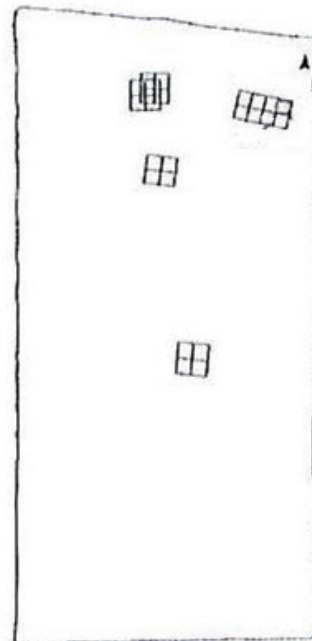


Figure 1. Remains of moated pillar buildings at the Tajiri site (Report on the Survey of Buried Cultural Properties, Vol. 8, partially modified)

northeastern plot contained the remains of two buildings, and the southeastern plot contained one building, both with different column spacing, and the large northeastern building was accompanied by the remains of a well.

In the first half of the 15th century (Period IV), the remains of six small buildings of 2×2 pillars were found, but there were no ditches surrounding these

buildings.

All of these building remains were hottatebashira buildings. In most cases, these buildings with many pillars were heavy buildings with tiled roofs or buildings that housed heavy objects such as warehouses, and the pillars were erected on foundation stones in that case rather than dugout pillars.

In the case of the Tajiri site, however, there are no tiles among the excavated artifacts, suggesting that the roof was probably thatched. The building appears to have been a full-post building, except for the pillars on the outside, which were probably bundle pillars supporting the floor, suggesting that it was a building with a floor covering to cope with the snow accumulation in the winter of Hokuriku region.

To the south of this survey area of the Tajiri Site, there is another survey area by former Fukunotown (now a part of Nanto City), which is also known as consisting of 5 or 6 groups of hottatebashira buildings with all pillars. Among these, just north of the Nanto Super Farm Road, there was a large building of 5 pillars × 4 pillars, and it is thought that it had a cloister on the north side. If we consider this large building as the main building of this area and measure the distance from the large building of the latter half of the 12th century to the first half of the 13th century (Period II) as mentioned above, the distance between the two buildings is close to 100 m. Assuming that these were the main residences of the influential class, this means that the residences of the influential peasants were located far apart at this time. This situation is reminiscent of the later distribution of farmhouses in Tonami dispersed settlement.

Since the nature of the small dugout buildings is unknown, it is difficult to immediately determine whether the settlement form was scattered, as seen in later periods. However, it is at least certain that the settlement was not clustered together and was sparsely distributed, called "dispersed settlement" or "Einzelhof".

Hirose-go in Ishiguro-sho, Ensoji temple domain, was located in the southwestern corner of the Tonami Plain at the foot of Mt. Ioh (near present-day Tachi and Kosaka, Nanto City). The "Shigematsu-myo" of this Hirose-go managed 3.3 ha rice paddies in 1278, and consisted of one house for a main family (leading farmers) and nineteen

houses for side families (attached farmers) in 1262. It is thought that 19 attached households worked for the main family. We may consider the large building at the Tajiri site to be such "main farmer" and the smaller buildings to be "side farmers".

This document indicates the location of the "Odeino Hatake" and "Adono-uchi Hatake", both dry fields in Hirose-go, by their surroundings. In the case of "Adono-uchi Hatake," there was a moat of a mansion (a magnificent house) to the northeast, a shrine to the east, and a house to the north. In both cases, the houses are not densely packed together, and the distribution of residences appears to have been scattered.

Shin-nosuke Makino, an eminent historian, published a paper pointing out that those dispersed settlement derived from those settlements in the end of Middle Ages and the policies of the Kaga Domain. These realities can be explained by the medieval building sites we have seen here and the distribution of houses in Hirose-go.

Distribution of the farm house and topsoil in the early modern period

Takanosu Village (former administrative unit, present day Takanosu, Tonami City), located in the middle of the Nakamura River and Nojiri River courses, was surveyed by the Kaga Domain in 1651. Thirty-one "mochi-yabus (farmers own bamboo groves)" were exempted from taxation as "oyabu (designated grove)" for arrow bamboo. Such groves were located within premises forests("'kainyo'") around farm houses. These farm houses were located on the land with thick surface soil (muddy), as shown in Figure 2. Such muddy soil area was also slightly accumulated land that could be cultivated using topsoil and water from upstream. It is thought that farmers lived in such muddy areas and cultivated surrounding areas in the early modern period.

In a document titled " New Account Book of Households in Tonami County " (Kawai

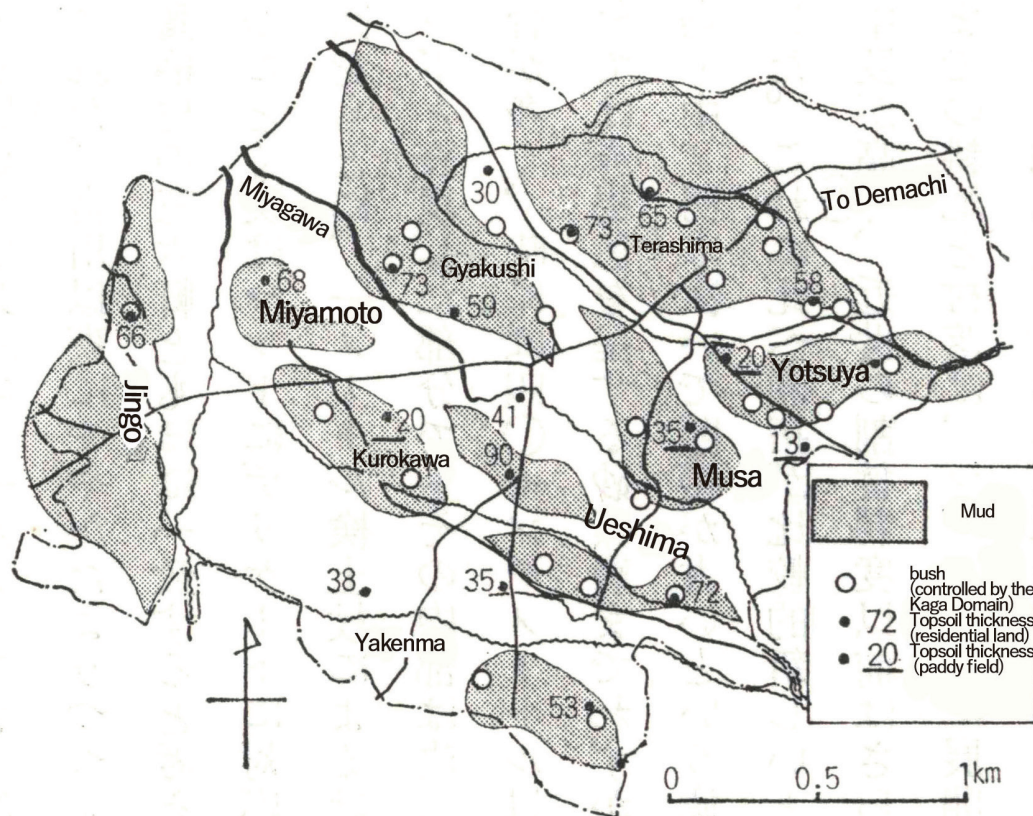


Figure 2. "Oyabu" and "Mud" in the former Takanosu Village (KINDA Akihiro, *Historico Geographical Study of the Jori Plain and Rural Settlement*, p.473)

Documents, University of Toyama) dated 1619, there are 36 houses in Takanosu. These family with the "recognized yield" were large farmland owners with rice production output of several tons to 100 t or more. In most cases, the "oyabu" and those houses seem to have coincided with each other. The landscape of dispersed settlements has emerged on the Sho River fan. At this stage, however, there were still not many settlements on the old riverbeds.

In 1867, at the end of the early modern era, there were 700 administrative villages in total in Tonami County. Since the number of those villages in 1619 was 429, and no change in the 70 villages of Gokayama mountainous region during this period, which means that 201 new villages were established in the Tonami Plain. At the same time, the 'kokudaka' (the yield of crop. In case of rice, 1 koku \approx 140~150 kg) of Tonami County increased by 35 %. As shown in Figure 3, these new villages are mostly located on the old riverbeds on the alluvial fan and on the Pleistocene plateau at the eastern and southern ends of the plain. The development

of the old riverbeds required the deposition of soil on the surface of the stony and sandy lands. The expression, such as "Take the mud of Sho River into stony lands" or "I want, little by little, to make paddies among stony lands" appears in the historical records of that time.

With the establishment of these new rice paddies in the early modern era, the dispersed settlement has spread throughout the plain. The Kaga Domain also directed the establishment of such settlements. As mentioned earlier, Makino pointed to such historical documents as "a new house should be scattered away from other houses" and "a new house should be located about 90 m apart from other house". He also noted some descriptions of these documents indicating that the domestic sewage was to feed the rice paddies, or that a house was to be closed to paddies. In addition, the Kaga Domain also permitted a privilege to gather managing the paddies around their homes (called "Hikiti"), along with a system called "Denjiwari (allotment of rice paddies)".

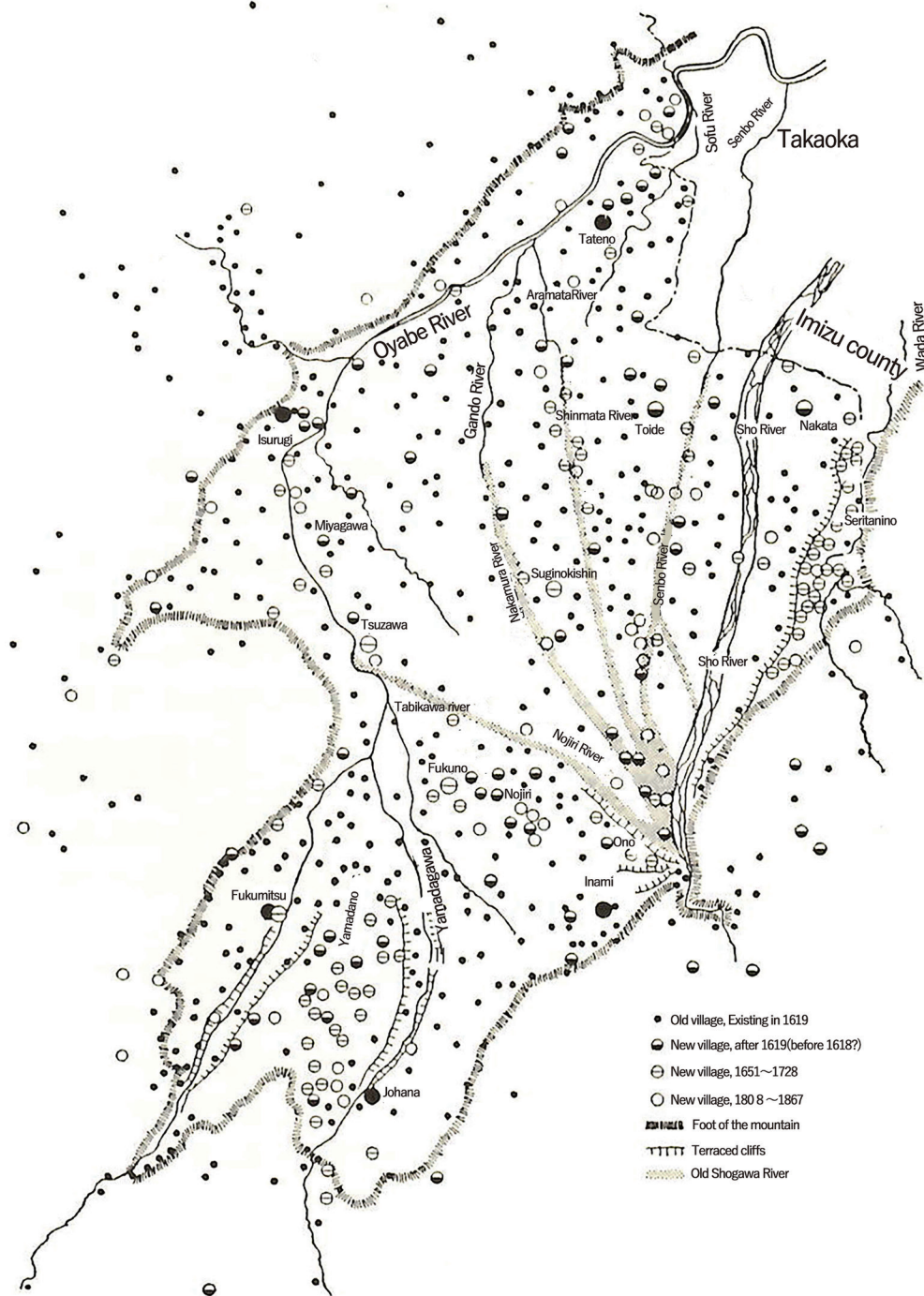


Figure 3. Old river courses of the Sho River and distribution of new villages in the early modern period (SAEKI Yasukazu and SHINDO Masao, Establishment of new villages in the early modern period in Tonami County, (Etchu-shidan, Vol.26, p.8, partially modified)

Thus, in the Tonami Plain, flood control projects of large rivers were carried out by the end of the early modern period, and the dispersed settlement where farmers cultivated land around their houses developed extensively across the plain. Each farmer furthermore owns bushes and forests around his dwelling, and obtained timber like cedar and zelkova for building and fuel, and fruits such as plums,

persimmons, and chestnuts from the forests. In other words, farmers lived a highly self-sufficient lifestyle, not only farming in the rice paddies around their houses but also subsisting on a variety of goods from their own bushes and forests.

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Reading the topography of the Tonami Plain using a drone

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SENDA Masako



Photo 1. View of the fan top from Ushidake (June 6, 2020, Photo: Eco-DRR Project)



Photo 2. Matsu-kawayoke (September 14, 2020, Photo: Eco-DRR Project)

It is well known that the Tonami Plain is a compound alluvial fan of the Oyabe and Sho Rivers. The abundant precipitation supported by the heavy snowfall characteristic of the Hokuriku region brought enormous amounts of sand and gravel from the Hida Mountains through the Oyabe and Sho Rivers to form the fan-shaped area. At the same time, the abundant water became a blessing to enrich the vast rice paddy field area. In recent years, however, the amount of snowfall in winter has been decreasing.

Here we will mainly use drone photos to look at the topography, following the water flow from upstream to downstream.

Let's start by looking at the top of the fan, where the fan begins.



Photo 3. Tonami Plain in the snow (February 13, 2021, Photo: Eco-DRR Project)



Photo 4. Four directions from Goromaru, Tonami (June 7, 2020, August 1, 2020 Photo: Eco-DRR Project)

Photo 1 shows the western view of Ushidake. From the front to the back of the photo, you can see the fan-shaped topography, as the name suggests, and you can see how the land is well-used along with the topography, including roads and rice paddies. The Hodatsu Hills can also be seen in the distance.

Next, Photo 2 shows the Sho River down from the top of the fan. In the center of the image, you can see a series of Matsu-kawayoke. The Sho River on

the right of the image meanders northward and empties into Toyama Bay.

Now let us look back from the plain in the direction of Ushidake, contrary to Photos 1 and 2. Photo 3 shows the southeast view from the riverbed near Tonami Sports Park. The Sho River flows on the right of the screen and the Ota Bridge can be seen behind it.

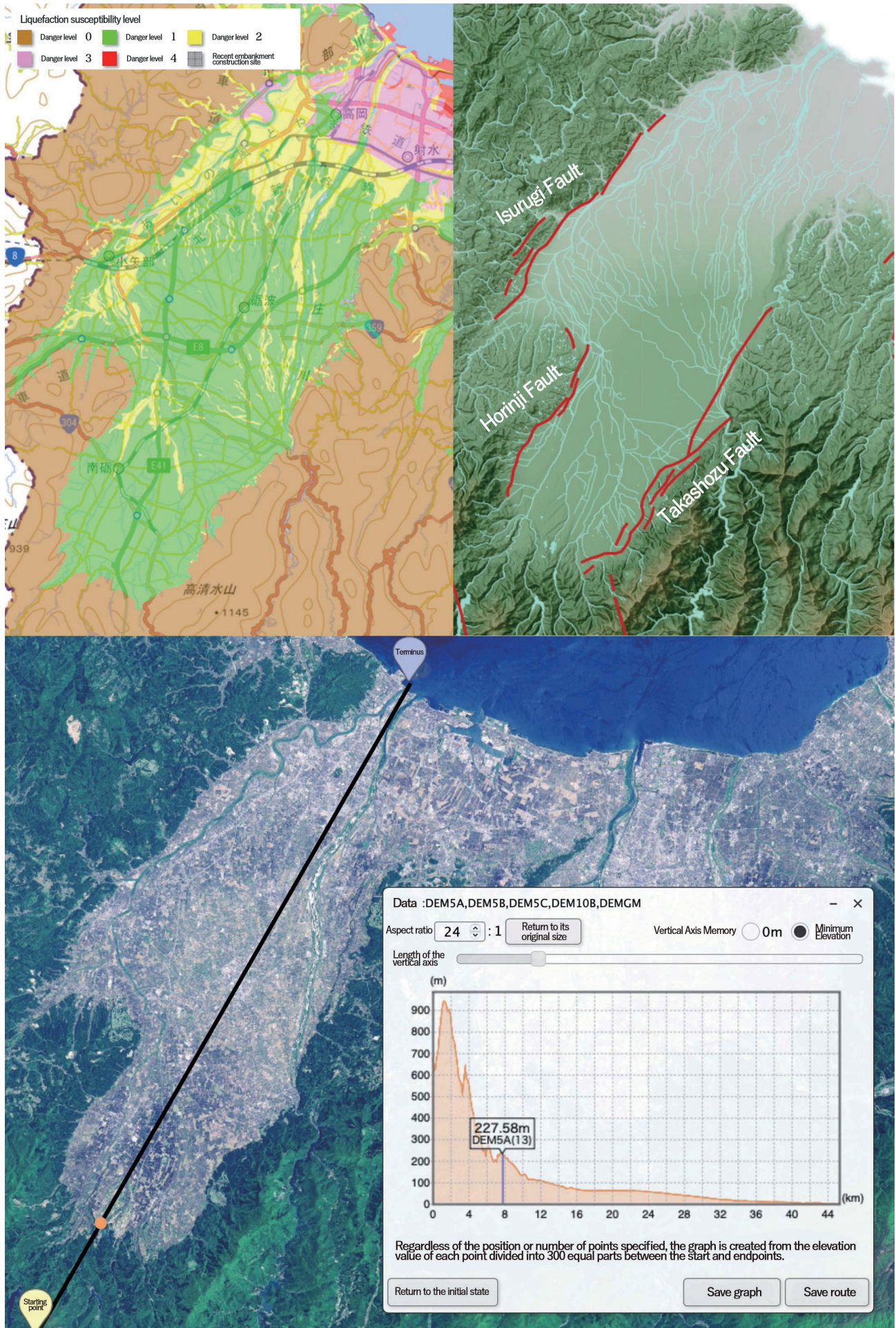


Figure 1. Tonami Plain seen from various maps, (Upper left) Ease of liquefaction map, (Upper right) Active fault database, (Bottom) Landsat mosaic image

Finally, let's look at the center of the fan. Photo 4 shows a view from the center of the fan, looking north, south, east, and west. You can see beautiful dispersed villages spread out on a spacious plain with almost no undulations or slopes. The paddy fields have been developed right up to the foot of the mountains, from where hills rise up. This foot line also coincides with the eastern part of the Tonami Plain Fault Zone and the western part of the Tonami Plain Fault Zone, respectively.

Figure 1 on the previous page shows three maps of the Tonami Plain. The upper left is a liquefaction susceptibility map. The degree of danger is affected by the height of the groundwater table. There are almost overlaps between Danger 0 (■) and a mountainous area, between Danger 1 (■) and a fan-shaped area of Sho and Oyabe Rivers, between Danger 2 (■) and the coastal plain at the end of the fan-shaped area, between Danger 3 and 4 (■ and ■) and sedimentary plains on the coast. The upper right is a database of active faults. You can see how the hills that flank the Tonami Plain from the east and west rise from the fault. The map below is a national Landsat mosaic image. The elevation of the straight sections in the figure is shown in the graph (height is emphasized 24 times). You can see the contrast between the steep slopes of the mountains and the gentle slopes of the plains.

The sand and gravel deposited on the fan shape of the Sho River was once sediment from the Ryohaku Mountains in the upper reaches of the river. The topography of the Tonami Plain, which gently descends for more than 30 km to Toyama Bay, remembers the mudslides and floods that were repeated many times. Thus, while the fan-shaped area is highly permeable due to its composition of sand and gravel, and the risk of liquefaction is low, the low groundwater table is disadvantageous for water utilization. However, the Tonami Plain has developed rice paddies by taking water from the Sho River, an abundant water resource supported by heavy snowfall in winter. This book introduces the history of how people overcame the conflicting

difficulties of using rice paddies while avoiding floods. We will be very happy if this book will be of help to your study.

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A Bird's-eye view of dispersed villages in the Meiji Period

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Cohabited landscape

The Tonami Plain is a fan-shaped area with an expanse of about 220 km², and many homes are still dispersed among the rice paddies. The reason why

these dispersed villages were created is because each farmer cultivated the land around his/her house to grow rice. Each house also has its own characteristics. The forests surrounding the houses

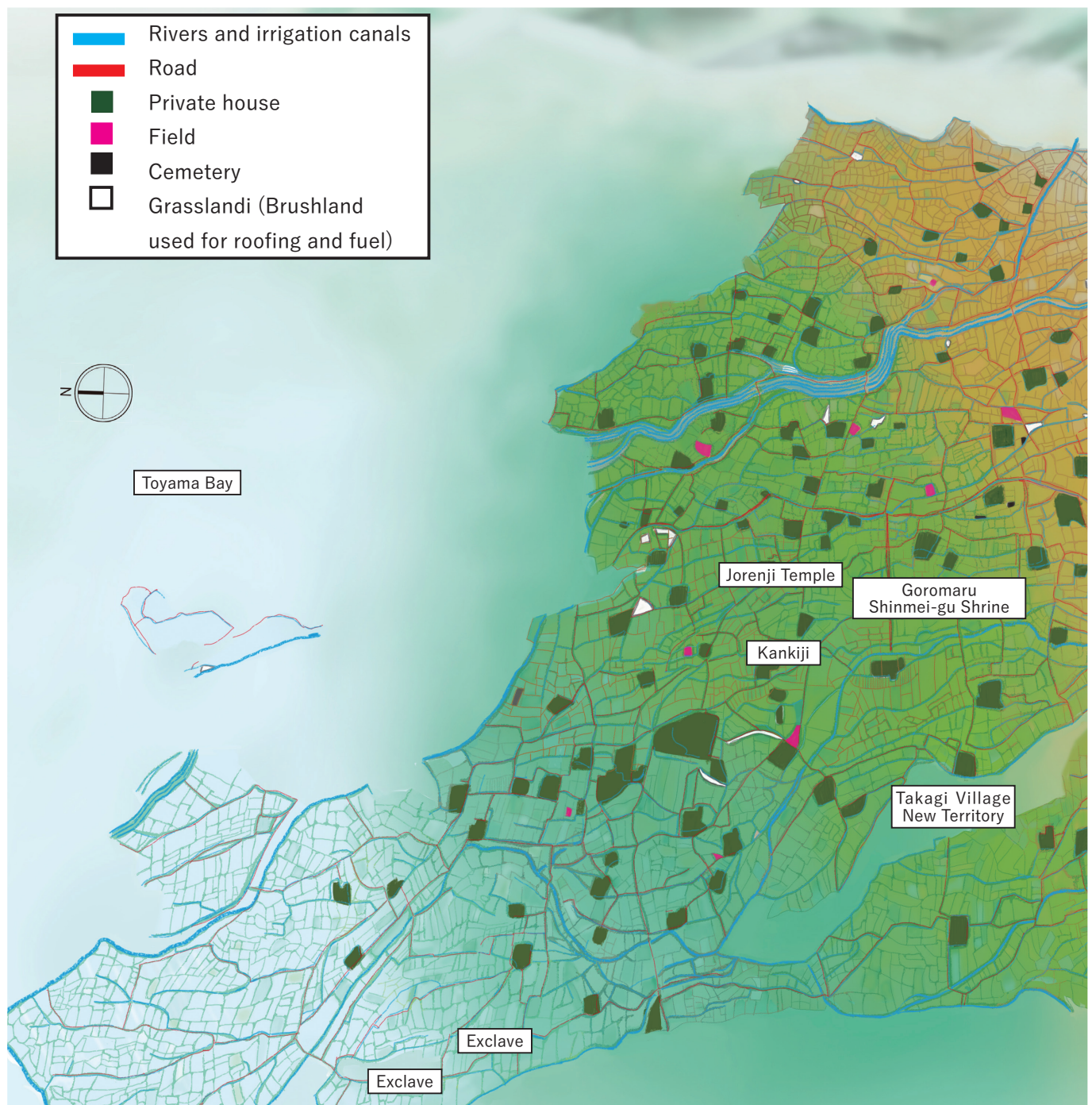


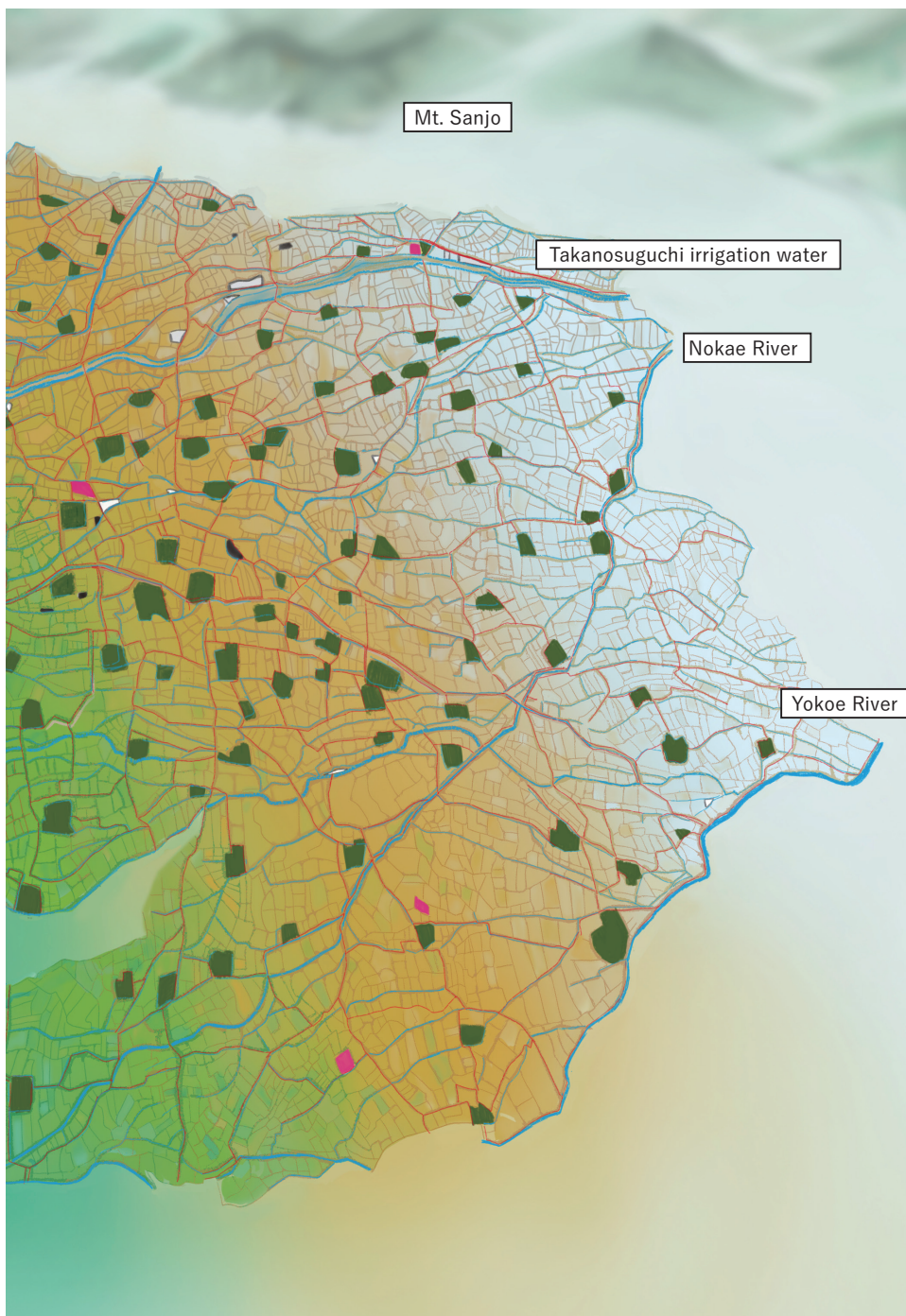
Fig 1. Bird's eye view of the whole area of Goromaru, Tonami City

are called "kainyo". These forests protect the mansions/houses from strong winds and the hot summer sun. This can be said to be one of the landscapes representative of the Tonami Plain.

Four seasons

The Tonami Plain offers a variety of original Japanese landscapes depending on the four seasons.

In spring, the rice paddies stretched all over the area resemble a mirror made from water, complementing the forests of the homes. At dusk, the entire area turns orange, creating a magical scene as if floating in a large ocean.



In summer, you can see the original landscape of a farming village surrounded by green all over. The view from the hilltop is a sight to behold, and the green color of the entire area makes it worth the trip.

In summer and fall, the scene changes from bright green to a carpet of golden colors. Tonami also undergoes a complete change in winter, when a pure white snowy landscape appears. The forests and houses are covered with snow, and the rice paddies are also tinged with white, creating a space of serenity.

As you can see, you can enjoy different tastes and scenery in each of the four seasons, and all of them offer spectacular scenery that you will want to visit at least once in every season.

Bird's eye view of the whole area of Goromaru, Tonami City

The bird's eye view of the whole area of Goromaru in Tonami City shown in Figure 1 is based on the "Land Registry Map of Goromaru Village" (Figure 2), with the image of the four seasons changing from left to right, with the color of paddy fields changing from white to pale green, yellowish green and yellow. The "Land Registry

Map of Goromaru Village" was created in 1875 (Meiji year 8) and depicts the land registry of Terashima, Kitajima, Oshima, and Nishitajima, which make up Goromaru Village (present-day Goromaru, Gokaya district, Tonami City). The cadastral maps of the four areas were merged using Adobe Photoshop CC 2021. Figure 3 shows an enlarged view of the area around Goromaru Shinmei-gu Shrine, which is a part of the four areas. Goromaru Shinmyongu Shrine is located near the center of the village, with Jorenji Temple and Kankiji Temple in the vicinity. According to the "History of Tonami City," the land registry was established in 1868 (the first year of Meiji era) at 165.19 cho ('cho' is a unit of the area of land used in Japan. 1 cho \approx 0.991736ha), fields 0.13 cho, residential land 10.59 cho, mountain forest 0.19 cho, and wilderness 0.44 cho. In 1872, Goromaru Village had 170 households and a population of 949 people.

In the Meiji period, Goromaru Village was dotted with residences ("Private house" in the map legend) along a network of aguaducts ("Rivers and irrigation canal" in the map legend). Rice paddies ("Paddy field" in the map legend) accounted for nearly 95 % of the total land, with many narrow winding roads ("Road" in the map legend) and small, irregularly shaped rice paddies, indicating that the size and shape of the rice paddies were not even. Regularly subdivided paddy fields existed in the area adjacent to Shinmeigu. The fields were small and

dispersed adjacent to the farmer's property, and were also found in dense aguaducts. Irrigation canals drawn from the Sho River extended throughout the area, suggesting that water could be easily drawn from anywhere. In addition, after creating the bird's eye view map, we noticed that many of the houses were surrounded by canals, and some of them had canals running through their houses. The total length of roads and aguaducts depicted in the "Land Registry Map of Goromaru Village" is 54.65 km and 93.6 km, respectively. In addition, small "shiba-kaya" areas are scattered throughout the district along aguaducts such as

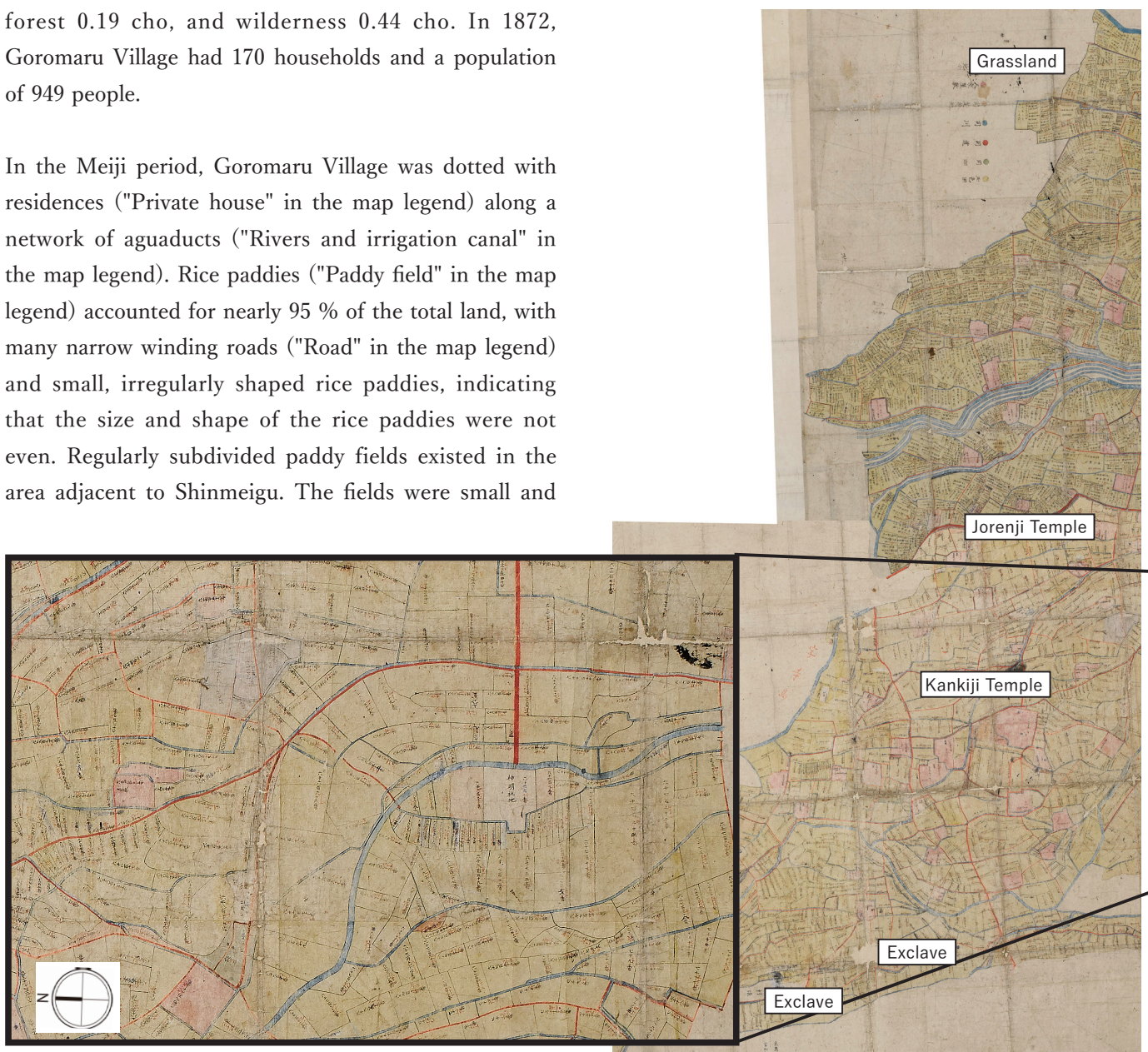


Figure 3. The area around Goromaru Shinmei-gu Shrine

"Takanosuguchi irrigation water" and "Noka River" in the district. In these areas, herbaceous plants such as silver grass were collected for use as roofing materials and fertilizers. There were also several cemeteries located from the center of the village to the east. To the west of Goromaru Shinmeigu, there was a large area of "Takagi Village New Territory" (land owned by Takagi Village, not Goromaru Village), and two small enclaves of "Takagi Village New Territory" were located in the northwest part of Terashima.

Summary

This time, we have introduced the features of the

Tonami Plain and the landscape that still remains by comparing old maps and bird's eye view maps of the Meiji period. We would be happy if this bird's eye view map could interest you in the Tonami Plain.

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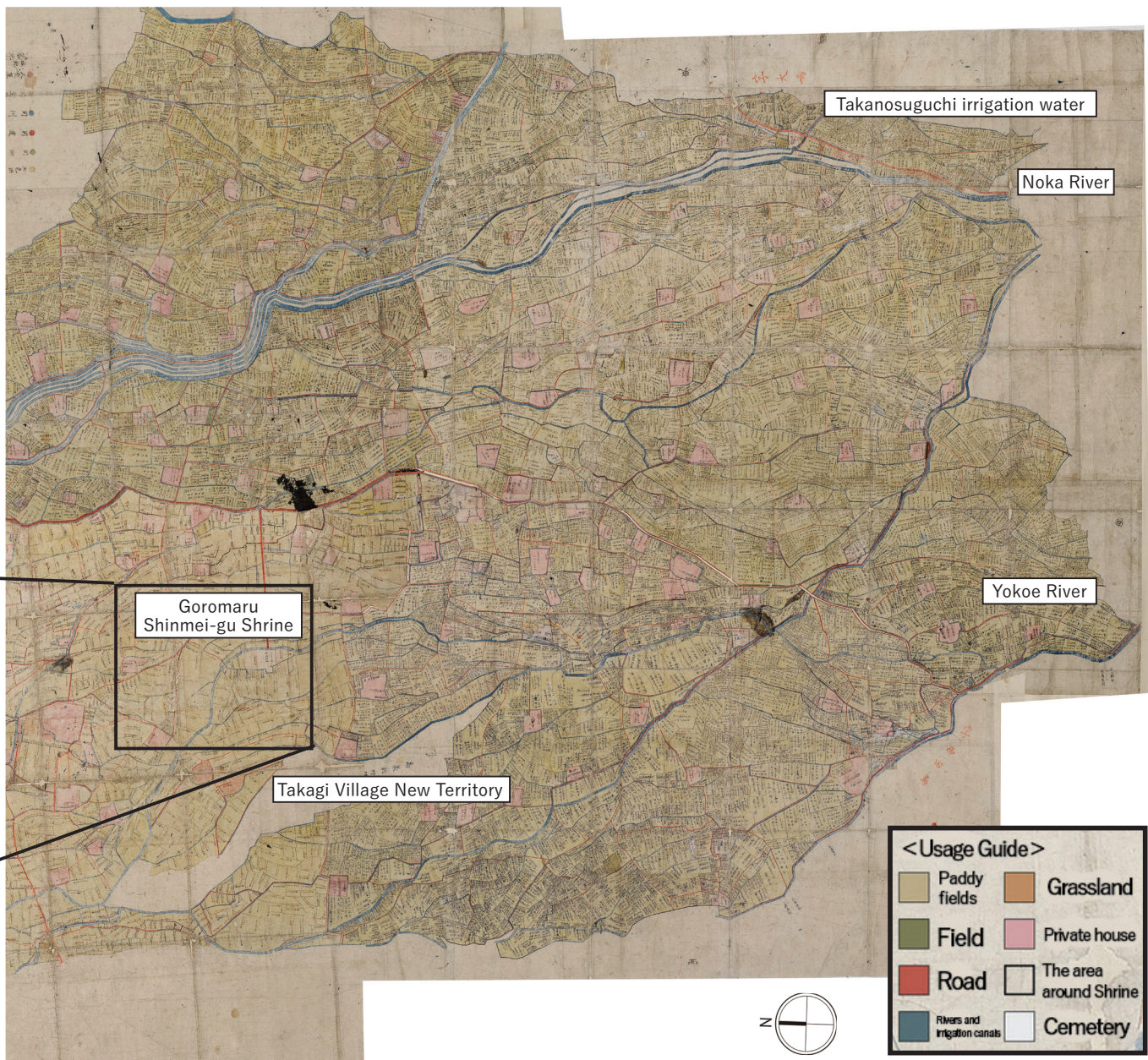


Figure 2. Land registry map of Goromaru Village (1875)

【Flood control and water utilization in the Sho River basin】





Photo courtesy of Eco-DRR Project

Shogawa "storm" and seed rice production

Dispersed Village Regional Research Institute

YASUKAGAWA Keiko

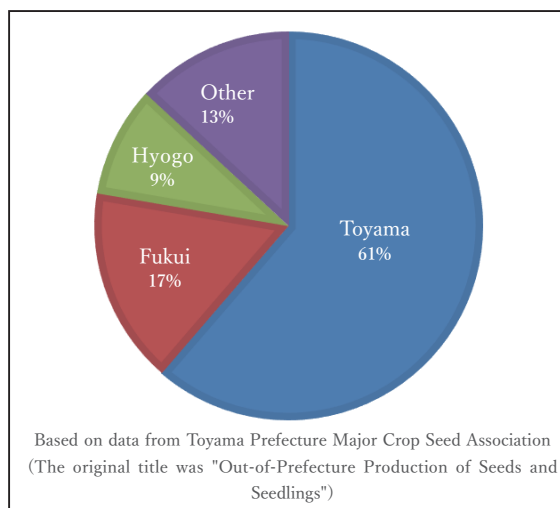


Figure 1. Seed rice shipments to outside of the prefecture (2020)

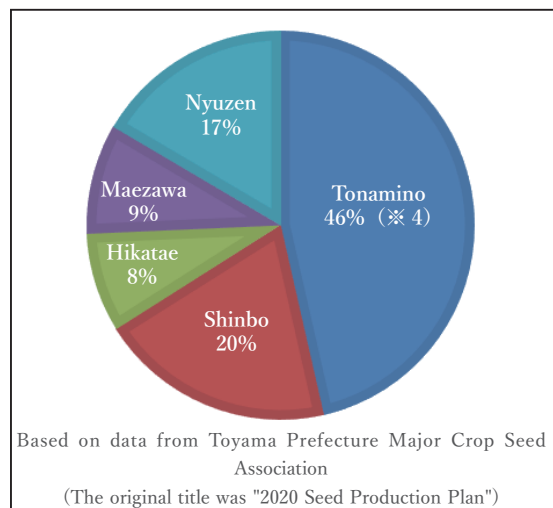


Figure 2. Production volume by seed site in Toyama Prefecture (planned for 2020)

Introduction

Seed rice is a type of rice that is selected and saved for the following year for the purpose of sowing as seed. In the old days, farmers used to take the ears of rice that were strong and productive among the rice harvested that year, save them as unhulled rice, and use them as seed rice for the next year. However, if this process was repeated every year, the quality of the rice would deteriorate and the yield would decrease. Therefore, it is necessary to introduce new high-quality seed rice once every few years. In response to this demand, seed rice production centers called "seed fields" have been established throughout Japan.

Tonami production area and the "Shogawa Storm"

There are a number of seed farms throughout Japan, but there are currently five in Toyama Prefecture, including Tonami City, Shinbo in Toyama City, and Nyuzen. Toyama Prefecture accounts for approximately 60 % of the total amount of seed rice shipped out of the prefecture, the highest in Japan

(Figure 1). Tonami City also accounts for about 50 % of the total amount of seed rice produced in Toyama Prefecture (Figure 2).

Seed rice is produced in Tonami in the area shown in Figure 3, which is centered on the Taneda, Aoshima, and Nakano areas. Seed rice is produced here because the natural environment of this area is suitable for seed rice cultivation. The Sho River flows from the mountains to the plains at the top of the fan-shaped Sho River, and there is always abundant water from the Sho River.

This "Shogawa storm" is one of Japan's local winds and is introduced in "Winds of the World and Japan" by Masatoshi Yoshino. It is a strong wind that blows from the Sho River starting from around 10 p.m. to the next morning, during the fall when the ears of rice are ripening. It is said that thanks to the Shogawa storm, no matter where rice is planted in Japan, it grows seeds that can adapt to each region.

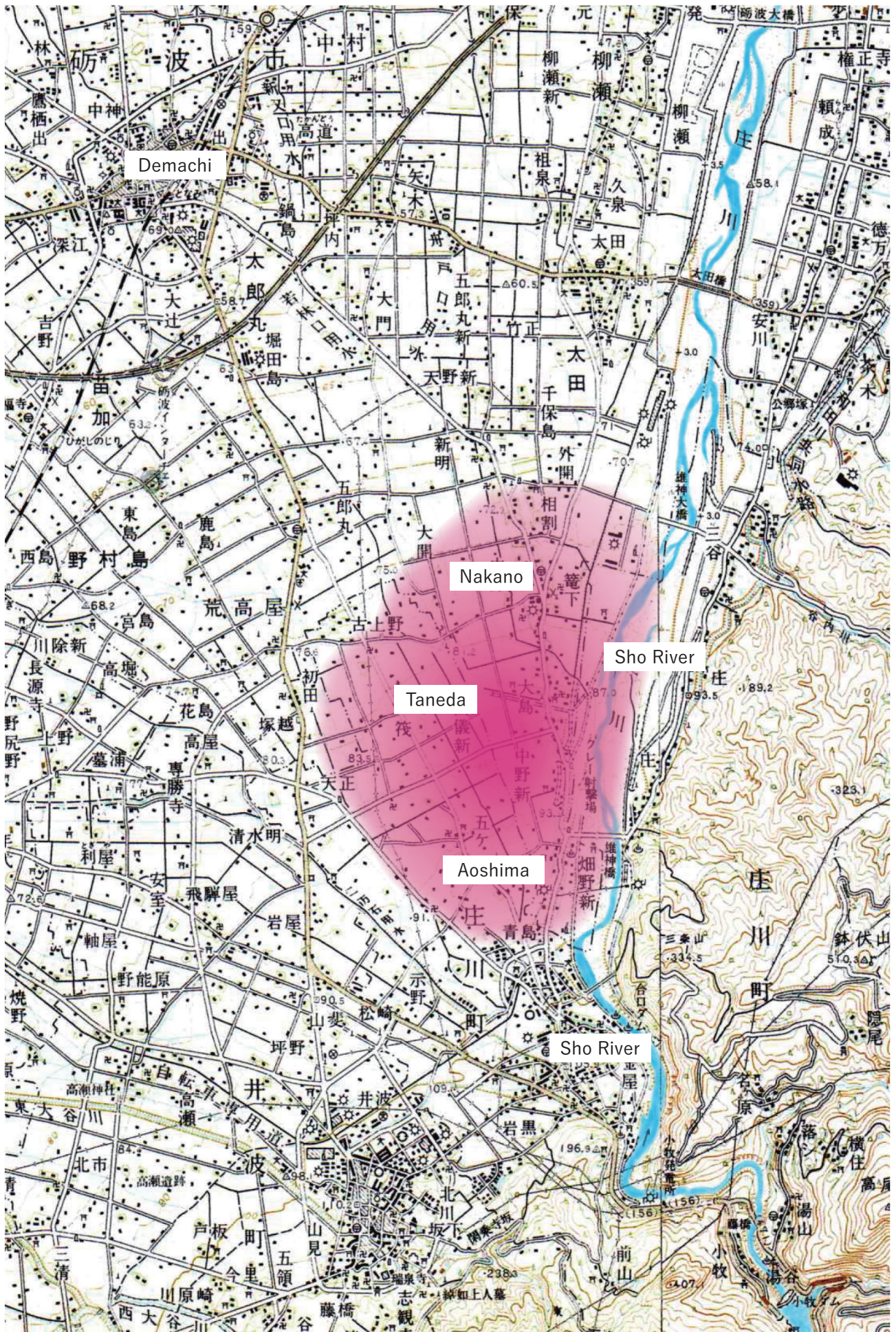
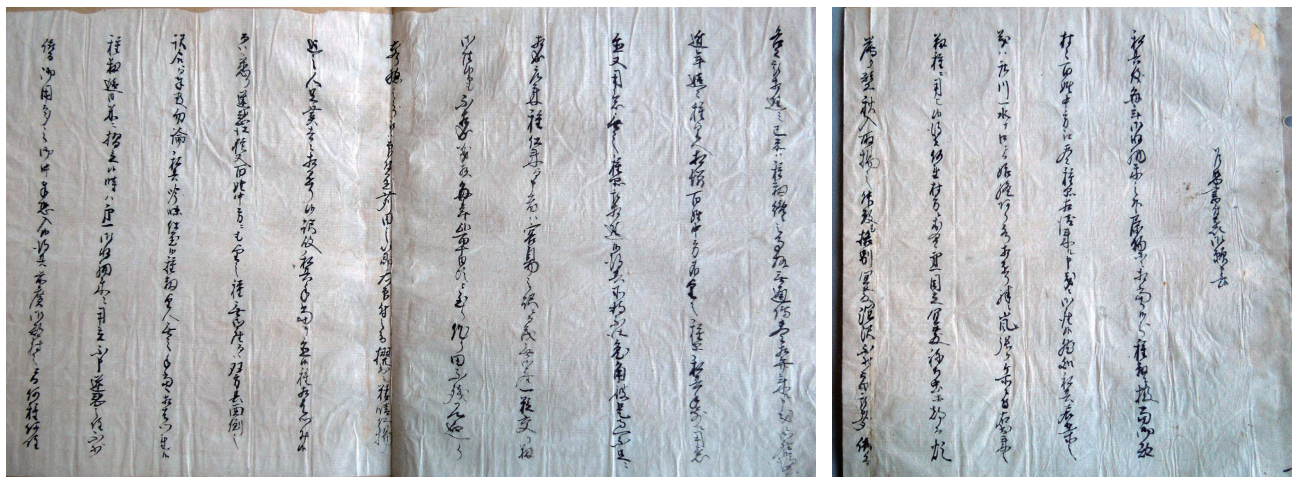


Fig 3. Seed rice cultivation area in Tonami City ("Johana" and "Yao" from GSI 1/50,000)



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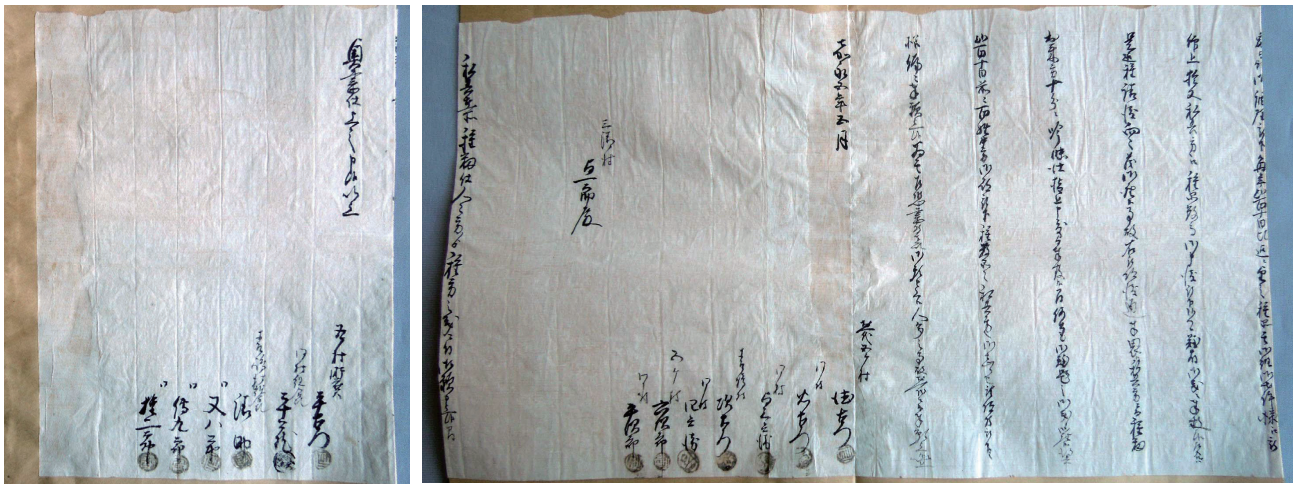
Fig 4. Application for seed rice and Notice 210 Days Before in May 1852 (the 5th year of Kaei)(Terai family document, Tonami Sho Library collection)

The area where the seed rice shown in Figure 3 is grown almost overlaps the area where the "Shogawa Storm" blows.

History of seed rice production in the Tonami area

As for the origin of the production of seed rice in this area, there is a theory that during the Horeki era (1751-1763) in the middle of the Edo period, an ancestor of Hoshoji Temple in Gokamura (present

Goka, Shogawa Town, Tonami City) brought seed rice to an area with poor harvest when he was a missionary. There is a theory that during the Meiwa and Amei Eras (1764-1780), Tokuemon, a Kimoiri (*1) of Gokamura, gave seed rice to Kuroemon, a giver of Taya Village, for trial production at Yosanosuke's house in Sankyo Village of Tomura (*2). In any case, it has been known as "Gokatane" (The seed of Goka) since the Edo period.



乍恐書付を以御願申上候

私共儀、毎年御收納米之外、屎物等^二相当り候分種粃^三拵、当御郡村々百姓中方^江夫々種品相渡来ル申義^二御座候、然処私共居在所之義^ハ、庄川一水^ナ口^ニ而、始終あら水打懸り、殊^ニ嵐強クケ所^ニ付、右出来之粃種^ニ用ヒ候得^者、何れ村方^ニおめて第一目立宜敷、ねち虫等都^而煩薄ク、暨秋入取揚之升数も格別宜敷、潤沢不少旨被申聞、依^而各々被相進之、已前^ハ種粃纏之事故無通伝、夫々相弁来ル申義^ニ御座候得共、近年追々種望人相増、百姓中方不望之種品私共手前^ニ用意、又用意無之種品被相進候得共、所持不仕、兎角彼是過不足^ニ相成、元来種仕来^与申者^ハ容易之訳^ニ而茂、無御座、一粒交り粃御座候^而も不相成義故、毎年式百十日頃^ニ至り作り田不残見廻り、交り穂之分^江印付置、苧田之節右印付之分撰出シ、精晴仕揚迄之人足莫太^ニ相懸り候訳故、私共手当^テ置候種相はづみ候^而ハ、悉ク迷惑仕、猶又百姓中方^ニも望之種無御座^而ハ、双方共面倒之訳合^与奉存、勿論私共吟味仕置候種粃望人無之、手当^ニ相はつれ候種粃追日米^ニ摺立候時^ハ、第一御收納米^ニ用立不申、迷惑之程不少、依^而御用多之御中奉恐入候得共、前廣御郡村々^ニ而何種何程望^与歟御調理被下、毎年式百十日頃迄^ニ望之種品、其御組御才許様^江被仰上、猶又私共方^江種品数高御申渡被下候^ハ、難有御義^ニ奉存候、左スル^ハ、是迄種請渡向々茂御座候事故、右被仰渡通奉畏候、私共方^ニ種粃出来方十分^ニ吟味仕指上申度^与奉存候間、何とも御難題之御義^ニ御座候得共、式百十日前^ニ百姓中方御尋被下、種数品々私共方^へ御しらせ被仰付被下候様偏^ニ奉願上候、為其乍恐書付を以御願申上候、人多之事故惣代^ニ奉願上候以上

嘉永五年五月

惣代五ヶ村

徳右衛門 (印)

Figure 4 is a photograph of an old document from the Edo period. It is an application submitted to the clan in May 1852, with five people from five villages growing seed rice and two people from Aoshima Village (currently Aoshima, Shogawa Town, Tonami City) as general representatives.

In 1852, it seems that these villages had already grown seed rice and given it to other villages, but in recent years in particular, there has been a tendency

to oversupply, either because there are no varieties desired (by people in other villages) or because they have prepared many varieties that are not desired. "We would like you to find out which villages want which varieties and in what quantities before the first day of spring (which would be around September 1 if the fourth day of the second lunar month is the first day of spring), and let us know. If you do so, we will be able to provide each village with well-selected seed rice." In this document, it

was already written, "We are located at the mouth of the Sho River, where there is fresh water all the time and storms are particularly strong. I have heard that the autumn harvest is exceptionally good and plentiful. The villagers themselves were fully aware that their village was in a natural environment suitable for rice cultivation."

He also said that the cultivation of seed rice is much more time-consuming than the cultivation of ordinary rice: "Originally, it was not easy to cultivate seed rice, and even a single grain (of different kinds of seeds) must not be mixed in. When the rice paddies are harvested, the marked portions are picked out, and so on."

In the Meiji Era, the previous "clan" boundaries were removed and sales channels were expanded to a wider range of areas. Along with this, some rough and tumble producers began to appear, and in order to improve the quality of the seeds and organize them as a specialty, comrades from Goka Village, Aoshima Village, and Kaminakano Village (present Nakano, Tonami City) joined forces and established a company called "Kakushusha" (expanding seed company). It is recorded that in 1884, its sales amounted to 1853 koku (*3).

The name of today's district, "Taneda," is the name of a village called "Taneda-mura," which was created through the merger of towns and villages in 1889. This village name reflects the villagers' intention to expand seed rice as a future specialty.

Later, the company was dissolved, but the farmers organized themselves into associations according to the times, leading to today's "Japan Agriculture Tonamino Rice Seed Department".

How the JA Tonamino (Tonamino agricultural cooperative) rice seed center works

Currently, farmers who produce seed rice do not just make any variety they like and sell it on their own. An organization called JA Tonamino Rice Seed Center (*4) plays a major role in the production of seed rice.

Each year, the Rice Seed Center prepares planting plans in response to requests from all over Japan and outsources cultivation to contract farmers. Thanks to this plan, we are able to supply varieties that meet the demand of each region of Japan without excess or shortage.

In 2019 (the first year of Reiwa), 449 ha of fields were planted with 41 varieties of seed rice (*5). The rice varieties included early, medium, and late rice for glutinous rice, sake rice, and early, medium, and late glutinous rice for glutinous rice.

Looking at the percentage of the planted area by variety, Koshihikari accounts for about 50 % of the total, but the remaining 40 varieties are extremely small in quantity. Surprisingly, all of them are under 10 %, and there are 25 varieties that account for less than 1 % of the total.

The "small-quantity, multi-product response" is the major feature of JA Tonamino, and by extension, also a characteristic of Toyama Prefecture's seed rice. Cultivating a large number of different varieties of seed rice is a very difficult task, as described below.

Farmers' difficulties

What is important for seed rice is the absence of heterogeneous varieties and miscellaneous mixtures, and that the seeds germinate reliably, i.e., a high germination rate. In addition, the occurrence of contagious diseases is also important. In order to produce such high quality seed rice, farmers spend many times more time and effort than ordinary rice growers. From planting to harvesting, farmers enter the fields many times to inspect the rice plants with the utmost care, looking for plants of different varieties, disease, uniform height, different leaf colors, and unusually early ears. If any plant is found to be abnormal, we repeatedly pull it out from the root base.

When growing different varieties, rice transplanters and combines are thoroughly cleaned to prevent

contamination of other varieties. Not even a single grain of rice can be left in the machinery. From planting to harvesting, the rice is subject to repeated guidance and examination by Toyama Prefecture seed inspectors, agricultural advisors from agricultural cooperatives, and district rice seed committee members, and even after shipment, the rice must undergo a germination test and strict examination at the Rice Seed Center regarding contamination of different varieties.

Today, despite the systematization of cultivation techniques developed through the latest research and the mechanization and efficiency of operations, there are still many things that require reliance on the human hand and eye. Currently, the JA Tonamino Rice Seed Department has 232 members and five management entities (joint-stock companies, limited liability companies, and agricultural corporation management entities)(*6) cultivating seed rice.

Conclusion

As Japan's population ages throughout the country, the trend is even more severe in the agricultural sector. Despite this, the production of seed rice, which requires even more labor than ordinary rice cultivation, continues and is shipped to all parts of the country. When I asked him what the reason is for this sustainability, Mr. Kiyonobu Sato, director of the JA Tonamino Rice Seed Center, replied, "It is the farmers' high cultivation techniques, high-performance plant facilities, and above all, the farmers themselves are proud of their own work". Perhaps, in the hearts of the farmers, there is a strong sense of pride in the cultivation of seed rice that their parents, grandparents, and even earlier ancestors had so diligently cultivated. Even though we have a strong natural ally in the clear waters of the Sho River, we cannot make the most of nature if we do not have the will to do so. If we date the beginning of rice seed production to the Horeki period (1751-1763), it has now been 260 years. The spirit of rice cultivation cultivated during this period is still alive and well today.

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cooperation

JA Tonamino Rice Seed Center

glossary

- 1 Kimoiri: A representative of village officials in the Kaga domain. The equivalent of a village headman in other clans.
- 2 Tomura: The highest position for farmers in the Kaga clan's township and village governance structure. It is the equivalent of the headman of another clan.
- 3 "*History of Shogawa town*," Vol. 2, p. 180, figures for both the expanded company and private sales.
- 4 JA Tonamino Rice Seed Center Tonamino Agricultural Cooperative Association spans Tonami City (former Tonami City and former Shogawa Town) and Nanto City (former Fukuno Town, former Inami Town and former Toga Village). Within this organization, there is a Rice Seed Committee for those who produce seed rice, and the Rice Seed Center is in charge of production, coordination, and sales. Although the scope of JA Tonamino is wide, only some people in Shogawa town and Nakano area of Tonami City belong to the Rice Seed Subcommittee.
- 5 JA Tonamino Rice Seed Department, 2020 data
- 6 Same as above.

Famine and food for the hungry in old documents -The case of former Inokuchi village

Dispersed Village Regional Research Institute

YASUKAGAWA Keiko



Fig 1. Account book of various matters concerning the bad harvest in the 7th year of Tenpo from the spring of the same year to the 8th year of Tenpo

The Edo period was hit by famine many times. The most severe famines were those of the Tenmei era (1781-1788) and the Tenpo era (1830-1843). The Tenpo famine was particularly devastating in Etchu-no-kuni (Etchu Province) (present-day Toyama Prefecture). This is because it did not last for a single year, but for many years. The summer of 1833 was a cool summer, resulting in a poor harvest, which pushed up the price of rice. The following year (1834) was a good harvest, but the price of rice did not fall, and an epidemic broke out. Two years later (1836) there was a normal crop, but the following year (1837) was a cool summer again, resulting in an unprecedentedly poor harvest.

A booklet recording this time has been left in a certain family in Inokuchi Village, Tonami County, Etchu-no-kuni (present Inokuchi, Nanto City, Toyama Prefecture). It is a 34-page booklet titled

一、悪作ニ付五ヶ山并山方村々ニクサヤ与申草之実多ク取申候
右クサヤ与申八草山并里方ニ而八川原ニ少々生ヒ申ものニ候
から
むしの柴^⑧ニ能ク似タルものニテ秋実をムスヒ申候、右之実
壱人シテ一日二三升程も取申由ニ候、尤右実いり候而粉并
米を交テいり粉ニ仕たへ申候、又チポイノ根多ク堀取申候、
右根一寸程充二切、流レ水ニウタセアクヲ取、夫ながらかみ
くたき、其味ヲ吞込、口ニタマリ候かすハはき出シ申候、
又アクヲ取、細力ニキサミ能ク干候而いり米并ゆるごニ交テ
団子ニ仕たへ申候^④

一、正月雪之内方山方村々葛之根堀申候、二月末まで二大
方堀尽シ申由、右粉ノゆるごニ交テたへ申候、かすハ細力ニ切、
鍋ニテ
能ク□□煎粉之中へ交テたへ申候^⑤

一、当年八山之アザミ并又マヨモギ、チヨウ柴^⑧、ギビキ之
類、列年之倍生立申由、大キニ飢饉食用之足シニ相成
申候、ケ様之年柄ニハケ様之事モ可有之義与存候、さつき
前後毎日五十人・七十人充打連レ、チヨウ柴^⑧等取に
山江参り申候、我等モ家来并下女取ニ遣被申候、井波・福野杯
ニ而又マヨモギ十貫目ニテ二百三四十文方三百文迄仕候、チヨ
ウ柴^⑧

"Memorandum of various matters from the spring of 1836 (the 7th year of the Tenpo era) to the following year" due to a bad harvest in the same year. It was written by Ittoku Nakayabu, who was the deputy of the Takebe family of Tomura (*1). It contains a detailed record of ninety-four items, including weather conditions, crop yields, rice prices, famine conditions, clan movements, and rumors from around the country. The following are specific descriptions of the climate and famine of the time, and how people managed to endure hunger and survive amidst food shortages.

First, let's look at the reality of climate and famine (the following in double quotation mark is the original translation).

"In Tenpo 7, it did not rain that much during the seedling planting season, but the seedlings were not doing well, and it began to rain around the time the rice was about to be planted. During April (*2), there were only three days without rain. In May, there were two rainless days of two days each, and in June, there were three days without rain, and only one time when the weather was good for four or five days. In July, there were only two good weather days of three days each, four or

five good weather days during August, and finally in September, the weather finally improved, but as just mentioned, the rain continued and the growth of the rice plants was very poor. (①)"

"In addition, from the end of August to September, it hailed from time to time. At seven o'clock in the afternoon (around four o'clock in the afternoon) on September 1, hail the size of walnuts fell in four or five villages around Nishigawara Village, north of Tsuzawa. I put them in a bract (a wrapper made of straw), and on the evening of the second day, I was shown them. They were as big as ginkgo nuts, very hard, stringy, and like crystals. The next day, on the third day, he took it to the arithmetician's office (*3), but it had not yet melted. (②)"

"During the last year, many people in Takaoka died of starvation or from illnesses. The poor couldn't even prepare firewood to burn the corpses, so they were left in the crematorium. The local government provided each person with three gou of oil, which was then used to burn a corpse. The bodies that could not be burned even in the castle sites were simply buried in samadai (cemetery), and dogs and foxes dug them up,

一、天保七丙申ノ年、苗代時分ハさのみ雨降申二而も無之候得共、苗出来不宜候而三十八・九日ニテ田植かゝり申候、夫よりそろそろ雨降出、四月中ニ三日降不申日有之、五月中ニ二日充二度雨落不申日有之、六月中ニ三日降不申日一度、四五日宜敷日一度、七月三日充二度宜敷天氣有之、八月中ニ四日五日程宜敷天氣有之候、九月ノ余程天氣宜敷相成申候得共、右之通り降続キ候故立毛悪敷候 (①)

一、八月末・九月へ懸テアラレ時々降申候、其内九月朔日之昼七つ時津沢之下モ西川原村辺四五ヶ村くるミ之大□程之氷降申候、夫を翌二日晚つと二いたし作分見受候ニ、イテウ之実程之分有之、至テカタキモノニ而筋有之スイシャウノ様ナルモノニ□候、翌三日御算用場江上り申節いまた消不申聞ニ候 (②)

一、去年中、高岡ニ飢人并ヤク病ニ而死人多ク有之、軽キ者共やきくさも調得不申事故、やき場ニ打捨置申様ニ相成候ニ付、役所方志人に油三合充相渡り、夫ニテ漸クやき申由ニ候、城端杯ニ而もやき草調得不申故

三味ニ一寸埋置候躰ニ而犬狐等掘出シ、ウデ・アタマ等三味辺之田畠畔ニ有之、誠ニ目モアテラレン物之由ニ候、飢饉ハラソロシキものト承り居候得共、ケ様之ものと不思寄候 (③)

十目ニテ二百四五拾文余モ仕候、町方ノ身元相応ナル
衆すらチヨウ柴式十貫目・三十貫目充買入飯之
上置二仕たへ申候、又マヨモギモ十目廿貫目充買入団
子ニ交テたへ申候 (⑥)

一、チヨウ柴飯并ヨモギ団子ト申事、兼々間居候得共、拵方
存不申候所、チヨウ柴をゆで干、或ハ生ニテ干モミ、粉之様ニ致シ
置、ゆで不申分ハ其時々ゆで候而しぼり、其内江塩を入テ
後大方焚上リ候上ニ置アタ、メ鉢ニあける時交セ申候事、扱又
ヨモギ団子ハ又マヨモギゆで干、或ハ生ニテ干置、尤ゆで不申分
ハ其時々ゆで夫ヲ鍋ニ入水少々入テジクくと煮、扱ゆるこ
之粉ヲ別ニ湯ニテシトね其ヨモギノ上ニ置、右ヨモギノ
汁ニテむせ上ル迄むし候而鍋ヲ下シ、暫クタチテする木
ニテツキ交候而団子ニ仕候、右ニ品ニテ飯米并ゆるこ
大ニ喰延シ申候 (⑦)

一、飢饉ハ極メテ五六七十年ノ間ニハ一度有之ものニ候得ハ
前之飢饉三四十年後方ハ食用ニ相成候品を貯置
申度ものニ候、百姓・町人米糶ハ逆も貯申事も出来
不申様ニ候得ハ、稗ヲ年々貯置申候得ハ宜敷候、稗ハ
何年貯置候而も損シ不申物之由ニ候、尤凶作之年ハ野菜
ノ類も不出来之物ニ候間、芋からを年々貯置
可申事ニ候、今度城端ニ先祖方代々云伝候由ニ而手
からを多く貯候者有之、大ニ難をふせき申由ニ候 (⑧)

scattering arms and heads everywhere. I had heard that famine is horrifying, but I had never imagined anything like this. (③)"

In response to this devastation, the clan and the Tomura (*1) gave rice and money to the starving people, but this was a drop in the bucket. With no public support from the clan or government officials, the villagers had to secure food on their own. What did they do? Let's take a look at some descriptions of what plants they ate and how they ate them.

"In the villages of Gokayama and Yamakata, we gathered a lot of fruit of a grass called kusaya. They grow on the grassy hillsides and riverbanks in the villages, and resemble the leaves of the Japanese lamb's head, and bear fruit in the fall. One person could pick up to three bushels of kusaya a day, which were then roasted and mixed with kuzu rice and eaten as iriko.

The roots of the chiboi are dug, cut into one inch (about three centim), and dunked in running water to remove the yolk, which is then chewed to swallow the sweetness and spit out the debris. The dried tood is then mixed with roasted rice or

yurugo and eaten as dumplings. (④)"

"While there was still snow on New Year's Day, the villagers in the mountains dug up arrowroot roots, and by the end of February, most of the roots had been dug up. They eat it mixed with powdered yurugo, or even the dregs of it, cut into small pieces, boiled well in a pot, and mixed into the iriko. (⑤)"

"In a year like this, thistles, wormwood, jouba, and gibbons in the mountains grew more than twice as many as in previous years, providing a great deal of food for the people. Before and after rice planting, fifty or seventy people would go to the mountains to get jowls. I even sent my family's servants to fetch them. In Inami and Fukuno town, the price for ten kilograms of numa-yomogi (*4) ranged from 203.40 to 300 mon. A ten-kan piece of jouba also cost 204.50 mon. Even people of respectable status in the town would buy 20 or 30 *kan* of jouba and eat it on top of their rice. They also bought ten or twenty kilograms of Numayomogi and ate it mixed with dumplings. (⑥)"

"Jouba is boiled, dried, and rubbed into a powder,

or it is dried raw, rubbed into a powder, boiled, and salted, then placed on top of cooked rice to warm, and mixed into a bowl when the rice is ready to be served.

Wormwood dumplings are made by boiling and drying big sagebush, or fresh and dried, and then boiling them in a pot with a little water to make them jiggle. Separately, knead the yurugo powder in hot water, place it on top of the wormwood, and steam it in the wormwood juice. Put the pot down, and after a while, pound it with a mortar and pestle and mix them together to make dumplings. With these two dishes, the rice and yurugo could be consumed in a short period of time. (⑦)"

Thus, people were able to survive and stave off hunger by using plants that grew in the mountains, such as kusaya, chiboi, arrowroot, thistle, wormwood, jyoba, and gibiki. Even in years without a particularly bad harvest, these plants may have been used by households that lacked daily meals.

And finally, he concludes with the following sentence:

"Since famines occur once every 50 to 70 years, we would like to store up more food than we did during the famine of three or four hundred years ago, but it is unlikely that peasants and townspeople will be able to store up enough rice and unhulled rice. Therefore, it is better to store millet. Millet never gets old, even after many years. In a bad harvest year, vegetables do not do well either, so it is better to store up potato scraps. On this occasion, a person who had stored potato husks, which had been handed down from generation to generation in Johana, prevented a great deal of trouble. (⑧)"

The "potato husks" here is probably a dried and preserved taro's stem. This is called imoji in Tonami. It is still eaten as a preserved food in winter. It is not "stem" but "leaf" though. After the taro harvest is over, the leaves are chopped and spread

out on a mat to dry and store, and when there are no vegetables in winter, they are boiled in boiling water, roasted with miso, and eaten on top of rice. This is called "imoji no yogoshi". Yogoshi is boiled and crushed vegetables chopped into small pieces, placed in a pot and stir-fried over a flame with miso until dry. In addition to imoji, any vegetable can be used as an ingredient, such as daikon radish leaves, carrot leaves, eggplant, etc. Fifty years ago, when I rarely shopped at supermarkets, it was a "side dish" for everyday meals.

I myself have never eaten kusaya or thistle, but I did eat chiboi for fun as a child. It is a common roadside grass, but when I ate the young, cotton-like shoots, they were slightly sweet. When cooked, gibiki (giboushi) tastes like a wild vegetable, albeit a little bitter. It used to be eaten as yogoshi. Yomogi (wormwood) is used to make wormwood rice cakes, and kuzu (arrowroot) is still enjoyed as kuzu *mochi* (kuzu rice cakes).

When did Japan become known as the age of boredom? It has been a long time since the term "local production for local consumption" was coined and "local foods," which have been handed down from generation to generation in farming, mountain, and fishing villages throughout Japan, came into the spotlight. Yet, Japan's food self-sufficiency rate continues to decline.

Is today the time when you can eat what you want as much as you want as long as you pay for it? May the days when people used as much as possible of what they could find in nature to sustain their lives, to quench their hunger, be handed down only as a distant memory of a bygone era.



Photo 1. Thistle



Photo 2. Gibbiki (Gibboushi)



Photo 3. Wormwood

References

Inokuchi Village History Compiled by *Inokuchi Village History Compilation Committee*, vol. 1, A Compilation of General History, Inokuchi Village, 1995.

Photos 1-3 Plants growing wild in Masuyama, Tonami City (15 km northeast of the former Inokuchi Village), where the author lives.

Glossary

1 Tomura The highest position in the Kaga clan's local village ruling structure for peasants. The highest position in the Kaga clan's local village governance system.

The calendar of those days was a lunar calendar (based on the phases of the moon), so there is a discrepancy of one to one and a half months from the solar calendar (based on the annual operation of the sun) in use today.

3 Arithmetic office: The government office of the clan.

4 KAN A unit of weight. Consistency is 3.75 kg.

Addendum: Famine Rescue Plants in the Former Iguchi Village

In the "Memorandum of various matters during spring of 1836 to the 1837 of Tempo due to the bad harvest" in the collection of a family in Iguchi Village, Tonami County, Ecchu-no-Kuni (present-day Iguchi, Nanto City, Toyama Prefecture), the situation of the bad harvest and famine relief food are described by Keiko in detail. Among the many famine relief plants, I would like to add a few more about *Numayomogi* and *Imogara*.

The dialect name *Numa-yomogi* is the Japanese name of *O-yomogi*, which grows in the mountains deep in the Tonami region. Its leaves and stems are larger than those of ordinary mugwort, and it is soft and tasty. It is collected, boiled, dried and preserved. It was commonly eaten in mountain villages until the 1960s, when the number of generations that ate *Numa-yomogi* began to decrease, and it is now rare to collect it separately from mugwort.

Imogara is thought to be dried taro stems of red taro or eight-headed stem, which are peeled and torn into thin strips, woven with straw, and called *kanpyo kawatori* in the Tonami region. It is rehydrated in hot water, and used as a soup ingredient, simmered dish, tofu paste, or as a substitute for *kanpyo* in *nori maki* (seaweed rolls). To prevent insects from attaching to it, it is dried again in summer and stored for a long time.



Numayomogi (photo)
Both of these ingredients were eaten until the 1960s to increase the amount of available food.

KATO Kyoko

Flood control and water utilization in the Sho River basin

SHINDO Masao

Flood control of the Sho River during the Kaga Domain era

1, The Great Flood of Tensho 13 (1585)

The year Tensho 13, about 400 years ago, was a landmark year in the history of the Tonami Plain.

The first point is that in this year, Toshiie and Toshinaga Maeda were given the three counties of Tonami, Imizu and Nei by Hideyoshi Toyotomi as their fiefdom, and then during Maeda's repatriation in 1871 for about 300 years it was ruled as the Kaga domain.

Secondly, the Sho River, which had previously flowed westward from Aoshima at the mouth of the valley, shifted its course eastward due to a major flood caused by the great earthquake during the same year, and due in part to the flood control policy of the Kaga Clan, the river became almost fixed in its present course and flowed eastward across the Tonami Plain.

2. Sho River channel shifts to the east.

In November of Tensho 13, a major earthquake caused a landslide in the Iwakuro area of Kanaya Village on the left bank of the Sho River. A large amount of earth and rocks reached Snake Island on the right bank, damming up the Sho River and creating a large lake. After 20 days of flooding, the weir collapsed in one fell swoop, causing a massive flood that flowed down as a mudslide, depositing huge amounts of rocks and sediment on the riverbanks of the Nojiri, Nakamura, and Senbo Rivers, which had previously flowed to the west. The muddy stream, dammed by the deposits, turned to the east and flowed downstream, some of it returning to the Senbo River downstream, and

some of it overflowing the lowlands in the precincts of Ogami Shrine that continued from the foot of the mountains to the east, became a new stream that entered the Nakada River (present-day Sho River), and this flood seems to have divided the Sho into two streams, the Senbo River and the Nakada River. In the flood of 1630, another river entered the Nakada River from the west of Benzaiten, and the Nakada River became the mainstream of the Sho River, which widened and became a large river flowing northward on the east side of the fan-shaped land.

The basin of the Nakada River was one of the earliest open areas in the Tonami Plain, and the river's expansion caused tremendous damage as human houses and arable land were washed away, leaving most of the villages as riverbanks. Flooding of the Sho River continued, and the riverbed of the Sho River near the valley mouth rose year by year. In the flood of 1655, most of the flow of the Sho River returned to the Senbo River again, and the villages downstream of the Senbo River were heavily flooded. The city was hit hard by this disaster.

3. Nakada River and Yanaze Fushin

After this flood, MAEDA Toshitsune, the lord of the Kaga domain, ordered local residents such as Tomura Matabei to lower the bottom of the Nakada River in June 1653. This was to transfer the flow of the Senbo River to the Nakada River and fix the Nakada River as the main stream of the Sho River.

In June of the same year, the clan began a large-scale flood control project called "Yanaze Fushin," which involved building a dike from Soizumi to the west of Yanaze in the Yanaze area on the right bank



Photo 1. Pine River removal (September 14, 2020, Photo: Eco-DRR Project)



Photo 2. Pine River removal (May 23, 2021)

of the lower reaches of the Senbo River. A total of more than 34,000 farmers from Tonami, Imizu, and Himi counties were mobilized to complete the work in mid-August, with the revision magistrate, Ito Naizen, personally inspecting the work.

There was a reason why Toshitsune made such a river survey of the Nakada River, shifting the mainstream eastward and insisting on the Yanaze Fushin. If the Senbo River overflowed at the point of the Yanaze Fushin, the floodwaters would flow down the Zouni River from Akimoto, Kanaya village in the west side, and Kokudai west of Yanaze and enter the Takaoka area from Futatsuka.

Construction of Zuiryuji Temple began in 1645 by Toshitsune as a family temple for his brother Maeda Toshinaga. The construction was scheduled to be completed in 1656, and 1653 was just before the completion of the project.

4. Built levee to prevent flooding of the Matsu-kawayoke

It is no exaggeration to say that rice was the financial foundation of the early days of the feudal domain, and that the domain was governed by the annual rice tribute paid by the farmers for cultivating their land. How the feudal lord secured the land to produce the annual rice tribute, how the farmers were allowed to cultivate the rice, and how the annual rice tribute was paid were the cornerstones of agricultural policy, which determined the rise and fall of the domain government. The Kaga Domain's agricultural policy was based on a new cultivation law devised by Toshitsune, which was implemented in the first year of the Meireki era (1655) and continued until the end of the Edo period.

The Sho River flood control project was deemed important by the clan to prevent flooding in Takaoka Town downstream of the Sho River, and

construction of the Matsu-kawayoke was initiated to protect the villages in the Tonami Plain from flood damage. The construction of the large embankment, 850 ken (1,530 m) in length, was a difficult undertaking that was subject to frequent flooding, and after being built and swept away, the embankment was built again and again. It was finally completed in 1714.

Even after the Matsu-kawayoke was cleared, parts of the embankment, especially the intake for irrigation water, often collapsed, and repair and reinforcement work continued until the end of the Edo period. In 1807, pine trees were planted to strengthen the embankment, and in 1842-1844 The local people called it "Matsu-kawayoke" because a pine tree was planted on the front side of the river. (Photos 1 and 2)

5. The Great Flood of 1772

In the spring of 1772, about sixty years after the Matsu-kawayoke was constructed, the Sho River swelled with melting snow and overflowed its front weir. On March 27 th, the Benzaiten-mae Matsu-kawayoke collapsed and 70 to 80 % of the muddy water flowed into the former Senbo River site and overflowed through an irrigation channel built on the old river site and reached the Oyabe River, causing extensive damage to many villages. Hundreds of houses were inundated, 4 were totally destroyed and 52 were half destroyed, and the roads between Toide and Johana, Toide and Isurugi, and Tateno and Takaoka were Temporarily impassable due to the loss of bridges and flooding, making it the largest flood in the Tonami Plain during the domain period. Restoration work was delayed due to the financial situation of the clan at the time, and in December, 2,070 koku of rice was finally lent to the flooded villages in Tonami County. It was also at the end of December that the emergency cutoff work for the broken part of the Matsu-kawayoke was completed.

This flooding made them realize the importance of levees (Matsu-kawayoke) at the top of the fan, and

they made efforts to reinforce the Matsu-kawayoke by collecting underwater silver from the villages on the fan until the end of the feudal government.

The front-weir was a levee built along the river to protect the Matsu-kawayoke, which started as a Temporary levee and was gradually reinforced to become a continuous levee reinforced with pine trees, and the arrangement of the front-weir and Matsu-kawayoke made it into a levee that enhanced flood prevention. Later, the clan planned to build new levees along the coast of the new Sho River in villages where land had been washed away due to the widening of the river, but construction did not proceed smoothly. Since the purpose of the riverbank protection was to protect arable land and people's homes from flood damage, the burden was supposed to be borne by the coastal villages. However, since the flooding of the Sho River was beyond the financial means of coastal villages, it was decided to cover the cost with the clan's silver reserves, the county's silver reserves, and the silver from the basin, and each coastal village was assigned a post to maintain the riverbanks and perform general construction work.

Floods and flood control projects since the Meiji Era

1. Great flood of 1896

Flooding of the Sho River occurred frequently from the end of the Edo period to the beginning of the Meiji period. The riverbed rose in the lower reaches of the Matsu-kawayoke causing frequent damage to fields and homes as levees burst not only in the villages of Nakano, Ota, Yanaze, and Higashikaihotsu, but also in the downstream villages of Asai and Daimon in Imizu county, where fields and homes were washed away. One such event was the flood of 1896. During the rainy season, heavy rains occurred from July 17 th to 21 st, and the levees broke in Nakano and four places in Ota-mae, and also in Kasuga and Futatsuka downstream, which then flowed into the Senbo River, washing away the tracks of the Chuetsu Railway (now the Johana Line) that was nearing completion.



Figure 1. Flood record of the Sho River fan, partially modified

2. Separation of the mouths of the Oyabe and Sho Rivers

At that time, the Sho River joined the Oyabe River and flowed into Fushiki Port. The river was narrow from Daimon Town downstream, and the large amount of sediment flowing from upstream caused the riverbed to rise, resulting in flooding every time the river overflowed. As a countermeasure, the Ministry of Home Affairs' Public Works Bureau began to reinforce the levees in 1883, but this was not enough, and in 1894 and 1898, the river flooded. In 1899, the area was hit by a series of major floods. As a result, a

major renovation plan to prevent flooding in the lower reaches of the Sho River was considered, and work began in 1900 under the direct control of the Minister of Home Affairs, and continued until the first year of the Taisho Era (1912).

The main contents of the project were: 1) excavation of a 4.1 km stretch of the new Sho River to separate the mouths of

the Sho and Oyabe Rivers, 2) widening of the river, by 450 m, between Fusumae in Futakuchi Village and Shimoishize in Nomura, 3) During this period, a new 9.6-km-long levee was built on the left bank and a 6-km-long levee on the right bank was repaired, which was a major construction project. Although Shinminato Town was bisected by the new Sho River, flooding in the lower reaches of the Sho River was drastically reduced, and Fushiki Port, no longer damaged by quicksand from the Sho River, was able to expand its wharves and accommodate large 7,000-ton ships that had been newly dredged. Fushiki Port developed as a trading port.

3. Kasumi Dike

Since the clan made efforts not only to prevent flooding at the front weir but also to prevent the back flowing of the river, Kasumi dikes were constructed in various places as part of the flood control measures. In the Meiji period, the Sho River was planned to be repaired, and the strengthening of levees was promoted. Figure 2 shows the location of the levees along the Sho River in the late Meiji period. In the case of the first levee, the second levee receives it and returns it to the mainstream, and in the case of the second levee, the third levee receives it and returns it. When the water level in the mainstream rises, turbid water flows back upstream from the No. 2 and No. 3 levees and floods these levees, thereby reducing flooding in the downstream area. The muddy water flowed into the embankments No. 2 and No. 3, flooding the rice paddies and allowing it to percolate underground, where clay and silt would settle and accumulate as topsoil. Construction of Kasumi levees gradually expanded to downstream areas.

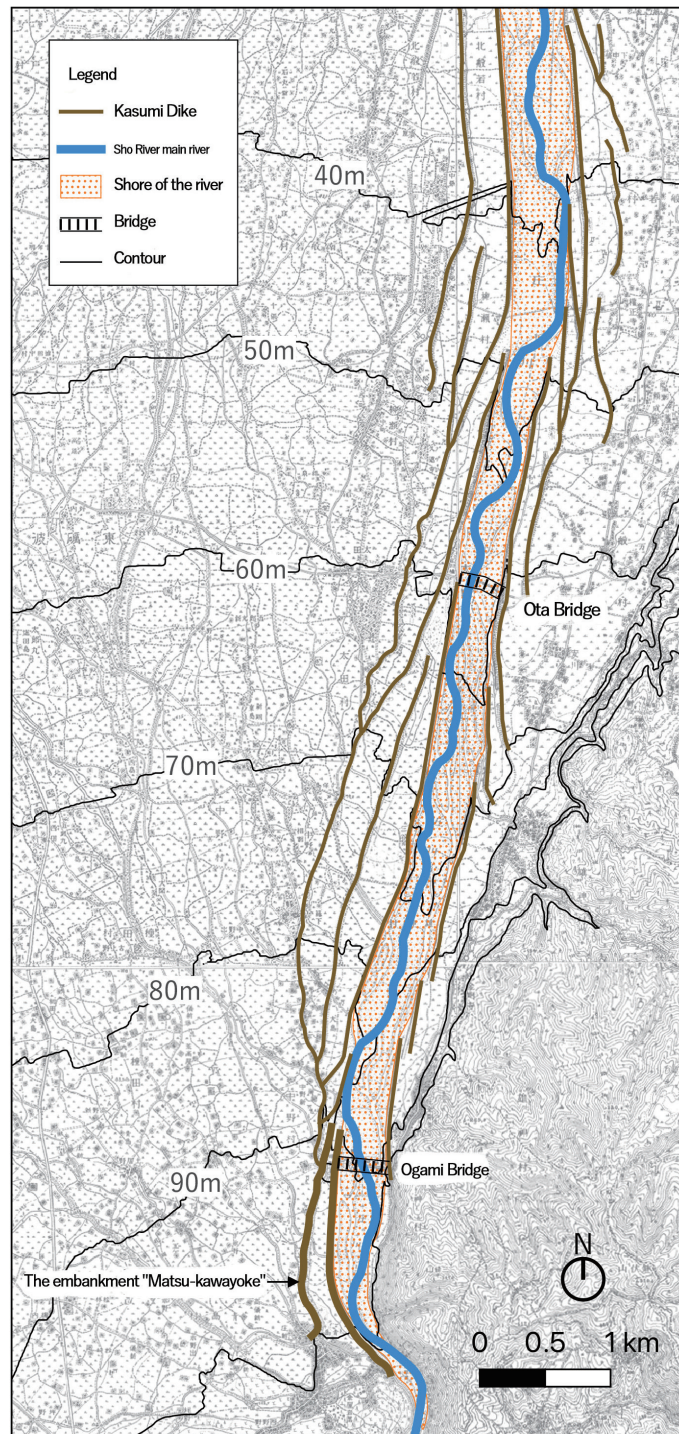


Figure2. Figure Location of Kasumi Dike in the Sho River in the late Meiji Period (Created by WANG Wen)

Development of hydropower projects on the Sho River

The headwaters of the Sho River are located on the southeastern slope of Mt. Yamanaka (elevation 1,634 m), near the divide in the Hida Mountains that separates the Sea of Japan and Pacific Ocean sides of Gifu Prefecture. The elevation of the water source on the gentle slope near the summit is approximately 1,520 m. The river has a total length of 114 km and a basin area of 1,189 km², which flows northward while deeply eroding the Hida Plateau and

forming a gorge, as well as forming the Tonami Plain downstream and eventually flowing into the Sea of Japan. The basin experiences high rainfall with annual precipitation exceeding 2,500 mm, and the mountainous area upstream receives some of the heaviest snowfall in Japan. During the spring snowmelt season, when the rainy season front is stagnant and when typhoons hit the area, the swift-flowing river overflows, causing frequent flooding damage in the area.

The first hydroelectric power plant built in the Sho River basin was the Hirase Power Plant in Shirakawa Village, Gifu Prefecture. Instead of using the water from the main stream of the Sho River, Nohi Electric Co., Ltd. installed a weir in the valley of the tributary of the Oshira River to take in water and draw it to the hillside on the left bank of the Sho River, and construct power generation facilities at the western foot of the Hirase village.

The Sho River basin's power development began with an initial output of 11,000 kw on October 30, 1926.

1. Construction of Komaki Dam

At the same time that large-scale river channel improvement work was underway in the Sho River estuary area, the Sho River began to develop a power generation project, known as the Komaki Dam, in the upstream canyon area that would utilize the flow of the Sho River.

Souichiro Asano, a businessman from Yabuta Village, Himi County, who moved to Tokyo at a young age to manage a cement company, reclaimed Tokyo Bay to create a coastal industrial zone, and built a power plant in the Tone River basin, became concerned with the Sho River. Due to heavy floods from the Sho River occurring in the plain, he wondered if it could be used for hydroelectric power generation, and in 1917, he visited the site for a field survey. It is said that he stood on the bank of the Sho River in the canyon and looked at the torrential flow of the Sho River, and exclaimed,

"Oh, golden water flows!" In 1919, he established Shogawa Hydroelectric Co., Ltd. and drew up plans for the construction of Komaki Dam and a power plant. The project was then taken over by Nippon Denryoku K.K., and construction of the Komaki Dam and Power Plant began on April 1, 1925, with the construction of a large dam at Komaki in the gorge to dam the Sho River and generate power downstream of the dam.

The dam was a large, arched gravity concrete dam with a water storage capacity of 38,000 t, 79 m high and 300 m long. The construction of the dam required a large amount of aggregate (gravel and sand). The Sho riverbanks are rich in rhyolite and granite gravel suitable for concrete, so it was decided to use this gravel for construction. This aggregate was then transported by light rail, and concreting of the dam began in July 1926 and was completed at the end of 1929. Power generation began in November 1930. After 6:35 p.m. on September 21, the Temporary drainage gate was closed and waterlogging began, stopping the natural flow of the Sho River, which carried large amounts of sand and gravel from the Hida Mountains to form the Tonami Plain. The Komaki Power Plant, built downstream, began operation on November 12, generating a maximum output of 72,000 kw, making it the largest dam and hydroelectric power plant in the East at that time.

There was strong opposition to the construction of this dam from the local community as well as residents of the downstream and upstream areas. The main ones were:

- (1) Construction of dams and waterlogging will submerge fields, forests, roads, bridges, and houses.
- (2) Downstream of the dam, the riverbed will drop, making it difficult to take in water for irrigation, which will have a serious impact on rice paddy farming in the Sho River fan area.
- (3) The Sho River has long been used to transport

Table 1. Power generation facilities in the Sho River system

As of April 2007

Power Plant Name	River Name	belong to	Location	Permitted maximum output (kw)	Water consumption (m ³ /s)	Effective drop (m)	*Start of power generation Year, month, day	intake dam form (something takes)	Effective capacity (thousand m ³)	Top length (m)	Height (m)			
Ogami Township	Ogamigoukawa	power development	alpine	20,000	12.10	198.50	November 4, 1971	large canyon	rockfill	20,000	140.00	34.000		
Miboro No. 2	(village) river			215,000	130.00	192.10	January 14, 1961	Miboro No. 2	rockfill	330,000	405.00	131.000		
Gomogi No. 2	White Rice river				59,200	15.00	460.10	December 19, 1963	white rice river	rockfill	11,000	390.00	95.000	
Shiramizu Chikara	//	Shirakawa Village		150	2.30	8.08	April 26, 2005	(Hirase) (Water discharge)						
flatboat	//	white river		11,000	6.96	201.21	Oct. 1, 2003							
wasteland	Arakawa River			11,200	5.00	273.60	October 30, 1998							
dovecote valley	(village) river			40,300	57.50	81.20	November 24, 1956	dovecote valley	gravity	4,051	331.50	63.200		
new Camellia japonica 'Shin-Tsubakihara' (cultivar of common camellia)	//			63,100	120.00	62.00	March 27, 1975	father	gravity	5,768	201.73	68.200		
father	//			38,700	70.00	65.30	January 8, 1954							
newly emerged	//			58,200	130.00	52.95	March 20, 1975	departure	gravity	2,671	190.00	53.200		
departure	//			35,000	79.60	53.00	November 17, 1951							
river in Shizuoka Prefecture	river in Shizuoka Prefecture		Kansai Electric Power Co.	Nanto Kamitaira	24,200	13.00	216.70	Nov. 1, 1993	Sakai River (Pref.)	gravity	55,968	297.50	115.000	
end	(village) river					32,500	220.00	17.40	October 26, 1978	end	gravity	759	153.40	29.200
small field	//					45,700	140.40	39.20	December 2, 1942	small field	gravity	3,751	158.20	52.000
The New Small Wastes	//				45,000	100.00	52.60	April 4, 1980						
Rikaga River first	Rikaga River				Nanto Riga	15,400	7.00	260.07	December 15, 1973	Riga River (Pref.)	gravity	934	142.50	37.000
Rikaga River second	//				Nanto Island (in Japanese mythology, the island formed by drops of water falling from the heavenly jeweled spear)	31,700	11.00	338.73	December 8, 1973	1000 ryou (an old Japanese coin)	gravity	138	143.00	23.500
mountain stronghold	(village) river					54,300	93.70	67.20	December 10, 1930					
name of a haiku poetess	//					68,000	120.00	65.70	February 25, 1967	mountain stronghold	gravity	7,051	132.00	73.200
pasture land	Rikaga River				Nanto Riga	15,600	9.70	194.23	May 18, 1944	congratulatory greetings	gravity	346	70.00	31.000
pasture	(village) river				Tonami Shogawa	85,600	138.74	68.46	Sho 5.11.12	pasture	gravity	15,907	300.84	79.248
Nakano	//		tonami (traditional Okinawan currency, esp. used for ceremonies)	6,700	44.52	17.66	Dec. 13, 2002	pal	gravity	510	103.33	18.485		
male god	//		Tonami Shogawa	14,000	90.00	18.22	March 24, 1967							
river in Shizuoka Prefecture	//	Toyama prefecture (Hokuriku area)	Nanto Kamitaira	300	0.40	97.37	June 2, 2005	Sakai River (Pref.)	gravity	5,610	297.50	115.000		
Shoto Daiichi	//				24,000	70.00	42.05	November 29, 1968						
Shoto 2nd	Wada River			tonami	7,400	50.00	18.15	December 14, 1968	Wada	gravity	3,070	137.00	21.000	
cheap river	(village) river	earth form of "change of season" solar term (approx. Oct. 22)	tonami	580	4.00	19.10	January 14, 1963							
(Edo period) ministry	//		Tonami Shogawa	550	8.63	8.29	January 25, 2011		gravity	200	103.33	18.500		

Compiled by Shogawa Power System Center, Kansai Electric Power Company; Miboro, Power Development Corporation; Toga Dam, Hokuriku Regional Construction Bureau, Ministry of Land, Infrastructure, Transport and Tourism; and Jishino Power Station, Shogawa Upper Stream Water Improvement District Association.

timber from the upstream villages of Shokawa, Shirakawa, and the Gokayama region, but when this was no longer possible, transport companies and the forestry industry were no longer viable.

(4) The Sho River had many trout, sweetfish, and other river fish that used to migrate upstream, but with their disappearance, the fishing industry in

the upstream areas declined, and the diet of the mountain villages were severely impacted.

(5) If the large levee fails, there is a risk of major flooding in the downstream areas.

There were many other problems, such as flooding of the dam for power generation and the volume

of water discharged downstream during drought, opening and closing of the drainage discharge gates during flooding, and the low water temperature of irrigation water.

One of the most problematic issues was the driftwood rights issue. The dispute with Hishu Lumber Co., Ltd. which was at the center of the opposition movement and had continued to discharge lumber, developed into an administrative lawsuit, which involved Toyama Prefecture, the Ministry of Home Affairs, and the Ministry of Agriculture and Forestry, was challenged in court as the "Sho driftwood rights issue," and was also taken up in the Imperial Diet.

Amid opposition, construction progressed steadily, and by the end of 1929, the dam construction work was almost complete, with power generation beginning in 1930. The dispute over the driftwood issue continued, and ended in August 1933, after the Komaki Power Station began generating power.

During the floods from July 8th to 11th, 1934, rainfall in the upstream area of the Sho River at Hirase reached 360 mm in three days and exceeded 400 mm in some places, causing the volume of water in the Sho River to rise. The Komaki Dam also received 150 mm of precipitation on the 11th, and the water level of the dam rose sharply, causing the 17 flood discharge gates to fully open to release water downstream. The downstream portion of the Sho River experienced heavy flooding, and the Ota Bridge, built in 1900, was washed away. Levees collapsed in various places, and the levees in Shimoaso, Nakada town and Hirokami, Asai village on the downstream right bank burst, filling Kushida and Asai villages with muddy water. The flooded area expanded downstream, covering the villages of Futakuchi, Daimon town, Shimo, Tsukahara, Tukorimichi, Nanami, Katakuchi and Shinminato, as well as Nomura, Makino and Futatsuka village on the left bank and the western part of the Imizu Plain with muddy water. The entire area became lake water. In the Sho River basin, 38 towns and

villages were affected, with 20 people killed, 240 injured, and 43 houses destroyed or swept away.

2. Construction of Nakano Power Plant

The Sho coastal water joint project, which had been a concern since the feudal era, was planned as a prefectural project in 1918, as the construction of the Komaki Dam was predicted to lower the riverbed downstream.

Construction of the Sho (Gokuchi) Dam began in 1934 and was planned as a prefectural project in 1926. The construction work began in 1934 to collect the water intakes from 27,000 stones, Funato-guchi, Takanosu-guchi, Wakabayashi-guchi, Aramata-guchi and Senbo Yanaze-guchi on the left bank and Seridanino-guchi, Rokke-guchi, Hariyamaguchi and Nakada-guchi on the right bank in one location and collect the water in a common location was completed in 1941. The Gokuchi Dam, a.k.a. the Sho River water diversion dam, built at the mouth of the Sho River valley, is 103 m long and 18.5 m high, with a fish passage and a water intake structure that takes into account water rights prior to its construction. The Nakano Power Plant (maximum output: 67,000 kw) was constructed using water taken from the left bank of the Gokuchi Dam, and began operation in December 1939.

3. Construction of the Soyama Power Plant

The Soyama Power Plant started generating power in December 1930, one month later than the Komaki Power Plant, with a maximum output of 73,200 kw. Daido Electric Power Co., Ltd. acquired the water rights in 1925, and the plant was later constructed by Shogawa Electric Power Co. It was a large dam with an embankment length of 132 m, a height of 73 m, and a water level of 10.3 km upstream when full. As with the construction of the Komaki Dam, a great deal of money and time was spent in the dispute with Hishu Lumber over the right to drift timber, and outside land brokers were involved in the local submergence compensation.

4. Construction of Ohara Power Plant

Showa Denryoku K.K. acquired the water rights in 1927 and started construction the same year, with plans to build a dam and power plant in Ohara, Kamitaira Village. The Japan Power Company was established in October of the same year under the Electricity Control Ordinance. Ltd. and completed in December of 1942 (Showa period 17), with a maximum output of 45,700 kw. Since the construction of this dam submerged the village of Mugarashima, it was relocated to the terrace on the left bank, and rice paddies were created in the village of Ohara on the terrace on the right bank.

5. Construction of Narude Power Plant

Similar to the Ohara Dam, this power plant was acquired by Showa Electric Power Co., Ltd. in October 1943, and after the Ohara Power Plant, Japan Electric Generation and Transmission Co., Ltd. started construction of a dam near the prefectural border with Gifu Prefecture. However due to the difficulty in obtaining construction materials at the end of the war and the shortage of engineers and field workers, in the spring of 1945, only part of the foundation work for the dam was undertaken.

After the war, as industry recovered, demand for power development increased and Nippon Hatsuden resumed construction in February 1950. The Sho River basin power generation business was taken over by the Kansai Electric Power Company, Inc. under the Electricity Business Reorganization Order of May 1, 1951. Construction was completed in November 1955, and power was generated with a maximum output of 35,000 kw and transmitted to the Kansai region.

6. Construction of Tsubakihara Power

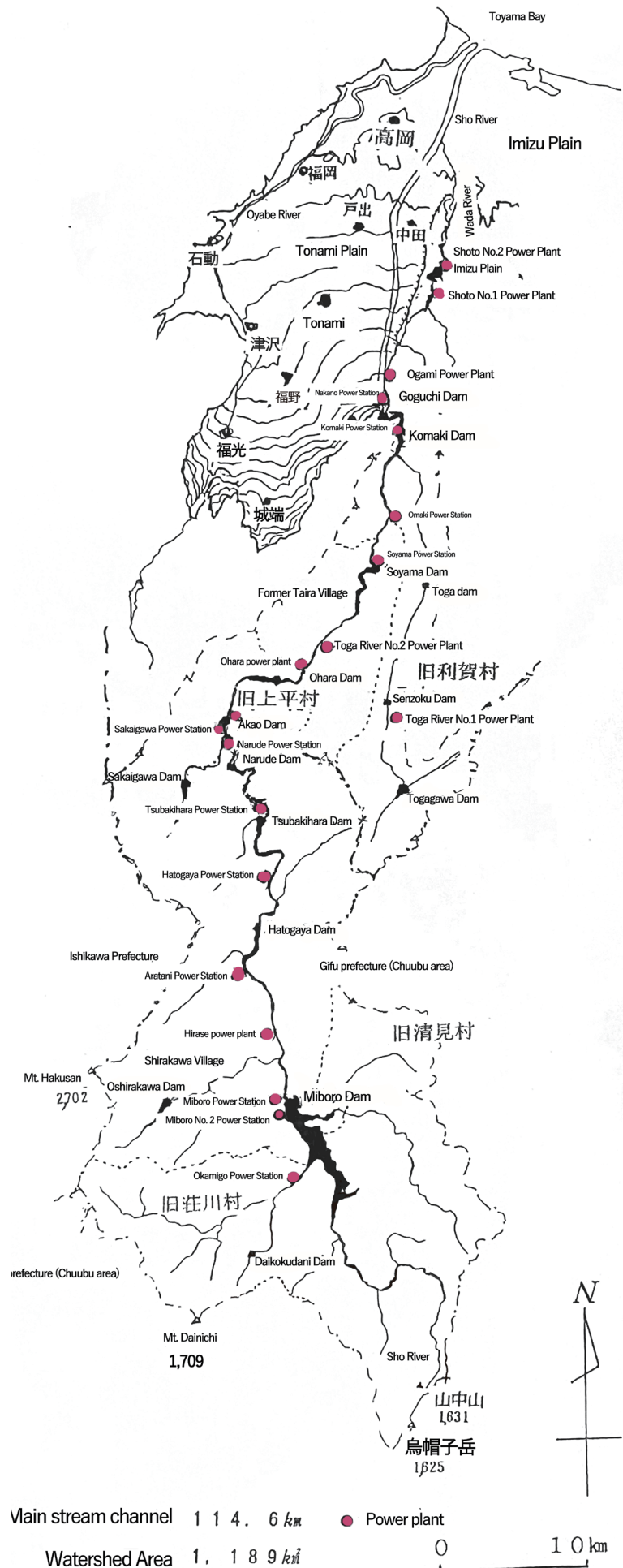


Figure 3. Dams and power plants in the Sho River basin

Plant

The development plans for the Narude, Tsubakihara, and Hatogaya power plants were drafted by Showa Denryoku Co. The company had obtained permission to use water in July 1927, and had acquired land for construction in various locations from around 1934, and had already reached an agreement on the construction of the power plants. On January 27, 1952, a contract for the construction of the dam and power plant was signed and construction began. Flooding of the dam began in November 1953, and construction began in 1954. The Tsubakihara Power Station began generating electricity in January (April) with a maximum output of 38,700 kw.

7. Construction of Hatogaya Power Plant

In 1952, the Kansai Electric Power Co., Inc. announced plans to construct the Hatogaya Power Plant upstream from the Tsubakihara Power Plant, which was under construction. The outline of the plan was to build a large dam with a bank length of 331 m and a height of 63 m in the Hatogaya area in the southern part of Shirakawa Village upstream to intake water, dig a long tunnel 4,351 m underground to draw water, and construct a semi-underground power station downstream in Yamashita in the Iijima area to generate electricity. However, when the dam was built, twenty-three houses in the Omaki district and six houses in the Noda district were to be submerged. For the residents, their homes where they were born and raised and their ancestral fields and forests were all submerged under the lake, depriving them of their livelihood, which was unbearable even though they understood that power development was an important measure for national reconstruction. During a period of about a year from 1953, compensation for the submergence of the Omaki and Noda areas and the village's demands were resolved, and the residents relocated in search of a safe place to live in the vicinity of Kanazawa City, Takaoka City in the north, and Gifu City and its vicinity in the south. In October 1954, construction of a dam and excavation of a Aquaduct began, and in November 1956, the

Hatogaya Power Plant was completed and began generating electricity with a maximum output of 43,000 kw.

8. Construction of Miboro Dam

The dams from Komaki to Hatogaya were all built in the gorges formed by the Sho River eroding the steep mountains leading to the Hida Plateau. All the dams had low water storage capacity for their height, and were unable to store the large amounts of snowmelt water in the spring or flood water during the rainy season and during typhoons to be fully utilized for power generation. Therefore, there was an early movement to construct a large dam upstream to control flooding and improve power generation efficiency. Showa Denryoku K.K., which built the Soyama Dam in the downstream area mentioned above, was already planning to build a large dam upstream near Miboro, Shirakawa Village, in 1926. However, this plan was not realized due to opposition to the project, which would have submerged many villages in the southern part of Shirakawa Village and the northern part of Shokawa Village, and would have prevented the flow of Hida timber. However, the project was continued and was transferred to Nippon Hatsuden, and then to the Kansai Electric Power Co.

In May 1951, Kansai Electric Power Co., Inc. established a survey station in Makido, Shokawa Village, clearly marked the dam construction site, and began surveying and geological investigations. At the time, comprehensive national land development was a fundamental policy for the development of Japan, and the Power Source Development Promotion Act was promulgated and enforced to utilize water resources. In response, the local community held a local assembly and expressed their opposition to the dam construction. In order to promote the construction of the Miboro Dam, the government, which considered the Sho River system's power development situation important, changed the construction and power generation business of the Miboro Dam from Kansai Electric Power Company to J-Power Development

Corporation by Notification No. 237 of the Prime Minister's Office on October 8th, 1952.

The opposition movement lasted for a long period of time, but the Power Development Corporation was sincere in its desire to resolve the issues, including compensation for the residents of the submerged areas caused by the dam construction and requests for the continuation of Shirakawa and Shokawa villages. Five years later, on June 6th, 1957, construction of the Miboro Dam and power plant began upstream of the Sho River at a total cost of 35.5 billion yen. The Miboro Dam was a large rock-fell dam with an embankment length of 405 m, a height of 131 m, a lake elevation of 776 m, and an effective storage capacity of 330 million tons. Three years later, in October 1960, the dam was flooded with water and filled with melted snow the following spring, and two generators installed 90 m underground on the left bank of the dam generated electricity with a maximum output of 215,000 kw. The plant is now in operation.

Changes in downstream water use due to the construction of the Miboro Dam

1. Expansion of power plants

Taking advantage of the stable flow of the Sho River made possible by the construction of the Miboro Dam, KEPCO constructed four new power plants along the main stream at Shin-soyama, Shin-Ohara, Shin-Narude, and Shin-Tsubakihara, and two low drop power plants at Akao and Ogami, in conjunction with existing power plants. The total power generation capacity of the newly built power plants was 280,800 kw, which was 65,800 kw more than that of the Miboro power plant.

2. Progress of the Wada River Comprehensive Development Project

The Wadagawa Comprehensive Development Project was planned by Toyama Prefecture as the core project for the construction of Toyama-Takaoka New Industrial City. The Wada River is fed by a large amount of water, 70 t per second, discharged by the Ogami Power Plant constructed in 1967 by

Kansai Electric Power Co. on the right bank of the Sho River. A new 7.3 km-long irrigation channel was then built to direct the water over the Seridanino terrace, and into the Wada River to be used for power generation. This makes it possible to generate 24 kw at the Shoto No. 1 Power Plant and 7,400 kw at the No. 2 Power Plant. The discharged water is used to supply water for the dry rice paddies of the Imizu Plain and for water supply and industrial use in the Takaoka and Imizu areas.

3. Progress of the Nanto Sanroku Water Supply Project

In the southern part of the Tonami Plain, including Shougawa town, the alluvial fan at the foot of the mountain that is connected to the fault stretches from Inami to Johana. This was an area where paddy fields were opened early on, but irrigation depended on streams and small reservoirs from the local mountains, and it was always troubled by a shortage of water. Various attempts were made to fix this, including the construction of Akasotu Reservoir, which was completed in 1944, but the problem remained unresolved. In June 1957, when the construction of the Miboro Dam began, it was reported that the amount of water in the Sho River would increase downstream, and a proposal to divert water from the Sho River at the Komaki Dam and construct a new irrigation system at the foot of the mountain to supply water to Johana was proposed. Toyama Prefecture supported this idea, and on April 15, 1960, the Nanto Sanroku Water Supply Project Regulation Promotion Committee was promptly formed, and repeated negotiations were held with the Kansai Electric Power Company, the Sho River Water Improvement District Association, the Ministry of Agriculture and Forestry, the Ministry of Construction, and the relevant organizations in Toyama Prefecture. In December 1965, the prefectural Nanto Sanroku Water Supply Project was completed at a total project cost of 820 million yen. The 13 km long three-sided open concrete culvert canal was constructed with three-way tunnels, culverts, siphons, canals, and Aqueducts, and was completed in December 1965. It took nine

months to complete the project in 1974. The villages at the foot of the mountain were supplied with 2 ton of water per second from the Komaki Dam, which facilitated irrigation of large paddy fields that had already been prepared, and new agricultural activities began to be observed.

4. Progress of waterworks projects in the wide area of Tonami City

The origin of Tonami's waterworks business dates back to September 7, 1920 (Taisho 9), when Tonami City was granted permission to establish a waterworks business in Demachi (formerly Suginokishin Town), the central district of Tonami, by "Tomie No.1, Home Affairs Office". The water was taken from the Wakabayashiguchi water supply, where the Sho River intake is located, and a retention pond was set up in the Nakano district to allow sand and mud to settle and remove debris, and water pipes were buried along the Wakabayashiguchi canal to allow the water to flow naturally. A water distribution facility was established in Taromaru, Demachi, and water was supplied to each household beginning on September 1, 1937, making it the earliest waterworks service in the three prefectures of Hokuriku. After that, Demachi passed through Tonami Town due to the merger of towns and villages after the war, and in 1954 it became Tonami City which expanded into a dispersed village area. At that time, river water was noticeably polluted by the spraying of agricultural chemicals and waste water from factories during the period of high economic growth. The groundwater level dropped due to land improvement projects and excessive pumping of groundwater for factories, resulting in the shallow wells of farmers drying up during the drought. As an emergency measure, Tonami City dug a deep well in Demachi for their water supply, and all water supply was switched from surface water to groundwater. Additional deep wells were drilled on the right bank of the Sho River at the top of the fan to find a water source, and the water supply system was extended to the mountain villages of Sendanyama and Sendanno in the Shoto mountain range. Since then, the amount

of water distributed increased year by year, so a new water source was sought. This trend was similar in the surrounding towns and villages, which were responding with the installation of simple water systems. In March 1973, Tonami City, Shogawa town, Inami Town, Johana Town, Fukumitsu Town, Fukuno Town and Inokuchi Village got together to secure a water source and applied to the governor for the establishment of the Tonami Wide-area Waterworks Company to conduct waterworks business. The application was filed and the water rights of 0.146 ton were transferred from the water rights held by the Shogawa Water Supply Land Improvement District Association. Water was taken from the Goguchi Dam, and on November 1, 1976, water supply was started to Matsushima in Inami Town. This project was established because the flow of the Sho River was changed by the construction of the Miboro Dam along with the aforementioned Wada River Comprehensive Development Project and the Nanto Sanroku Water Supply Project.

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Sho River water supply joint project

Dispersed Village Regional Research Institute

SUGIMORI Mitsugu

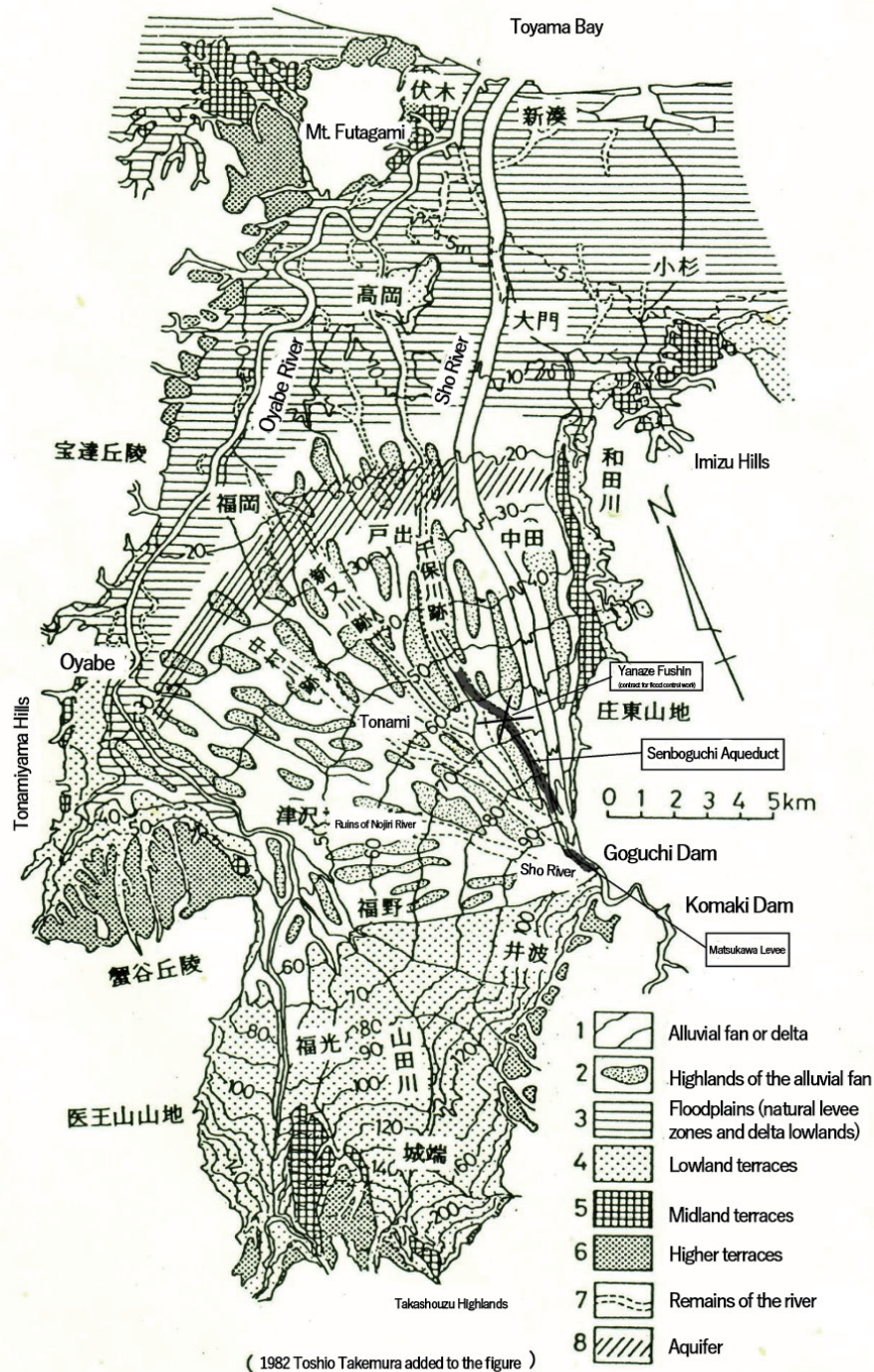


Fig 1. Topographic classification map of Tonami Plain (added to Toshio Takemura's map in 1982)

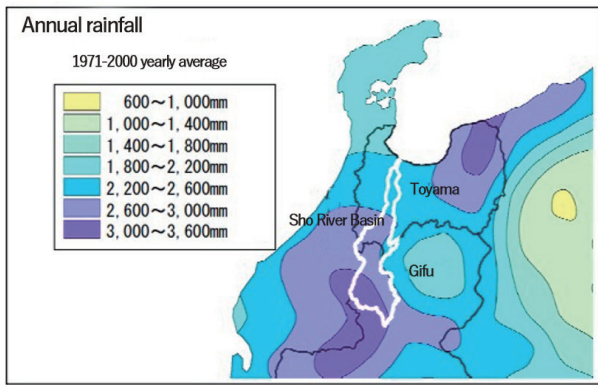


Figure 2. Annual rainfall distribution in the Sho River catchment area (data from the Hokuriku Regional Development Bureau, MLIT)

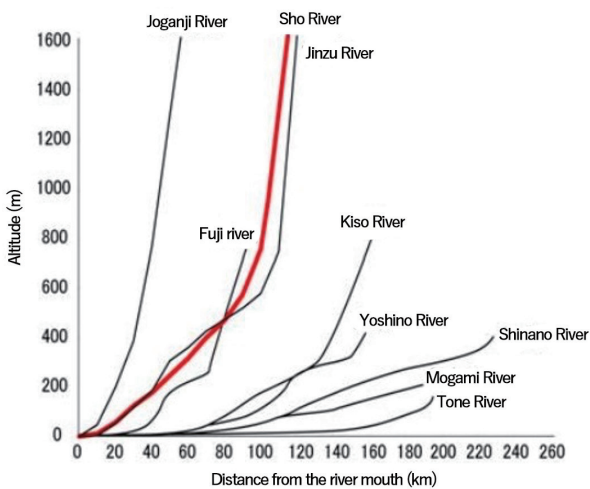


Figure 3. Slope of major rivers (data from Hokuriku Regional Development Bureau, MLIT)

Introduction

The Sho River is one of the fastest rivers in Japan. It originates in the middle of Mt. Yamanaka at an elevation of 1631.3 m and flows down for about 115 km at a stretch before emptying into Toyama Bay. Most of its length is carved into steep valleys, and only about 25 km of the river opens at the mouth of the valley and flows through the plains. Because it emerges from the mountains and the gradient suddenly slows, the Sho River deposits a large amount of earth and sand carried from upstream, and forms one of the largest alluvial fan-shaped areas in the country with Aoshima in Shogawa town, Tonami City being located near the top of the fan. The Sho River alluvial fan is shown in Figure 1. Generally, alluvial fans are composed of sand and gravel and are often not suitable for rice paddies due to the large amount of water infiltrating underground. However, the Sho River's catchment area receives a

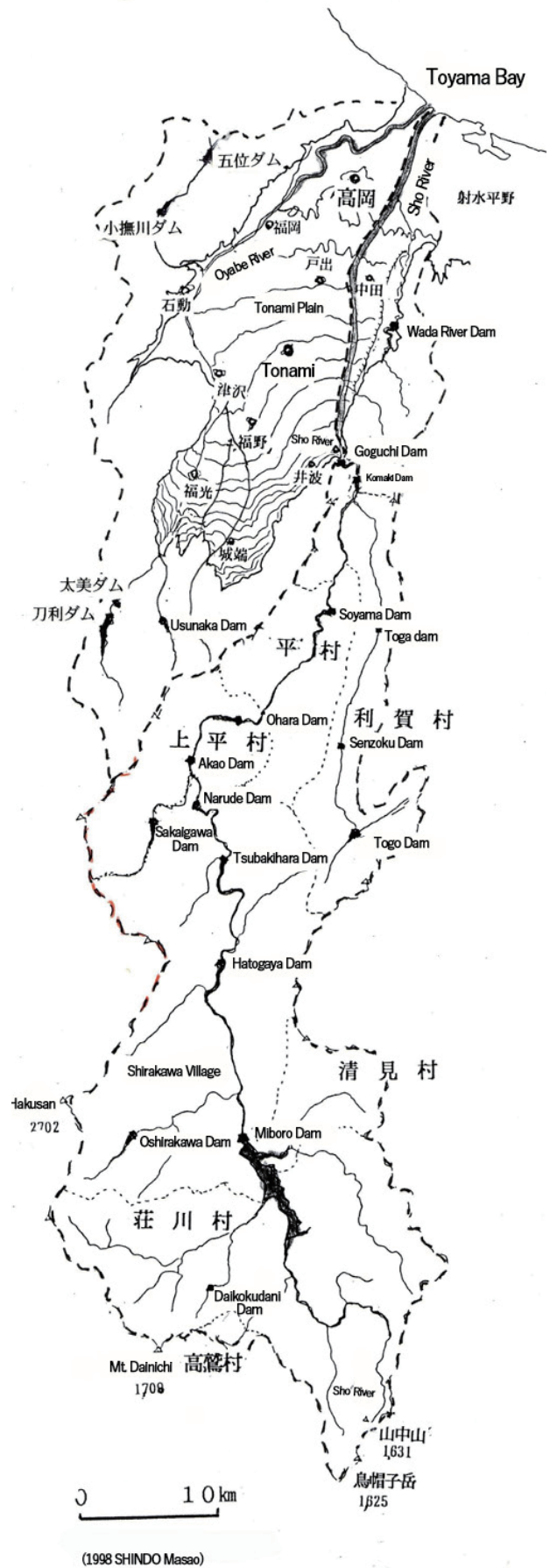


Figure 4. Watersheds of the Sho and Oyabe Rivers (1998, SHINDO Masao)

large amount of precipitation throughout the year, making it easy to obtain water relatively anywhere in the area (Figure 2). In addition, it was easy to obtain water from small and medium-sized rivers flowing from the surrounding mountains.

Repeated flooding and water withdrawal

On the other hand, high precipitation in the catchment area means that the area is vulnerable to flood damage. The history of human activities in the Sho River alluvial fan is indeed a history of struggle against water. For example, the Sho River was damaged by floods 139 times during the Edo period alone, and 30 times during the Meiji period.

The floods caused great damage to houses and fields and loss of life, but another problem was the destruction of the water intake and the water itself. There were years when the floodwaters receded and the fields could not be cultivated, resulting in crops that could not be harvested at all.

The water intake at this time was (Fig. 6) made of lumber up to ten m high, lined with tree branches and bales to stop the momentum of the water, and gaps were filled with straw matting. The water was channeled through a slanting weir that stretched over a distance of 1.5 m.

These weirs were washed away by floods. In addition, when flooding occurred, the river channel would change, and it was often necessary to change the location of the water intake. The hardships involved in doing this were immense.

In 1935, before the construction of the Sho River Goguchi Weir, there were six water intakes for the Sho River: the "27,000 stone" channel, Funato-guchi, Takanosu-guchi, Wakabayashi-guchi, Aramata-guchi, and Senbo Yanaze-guchi

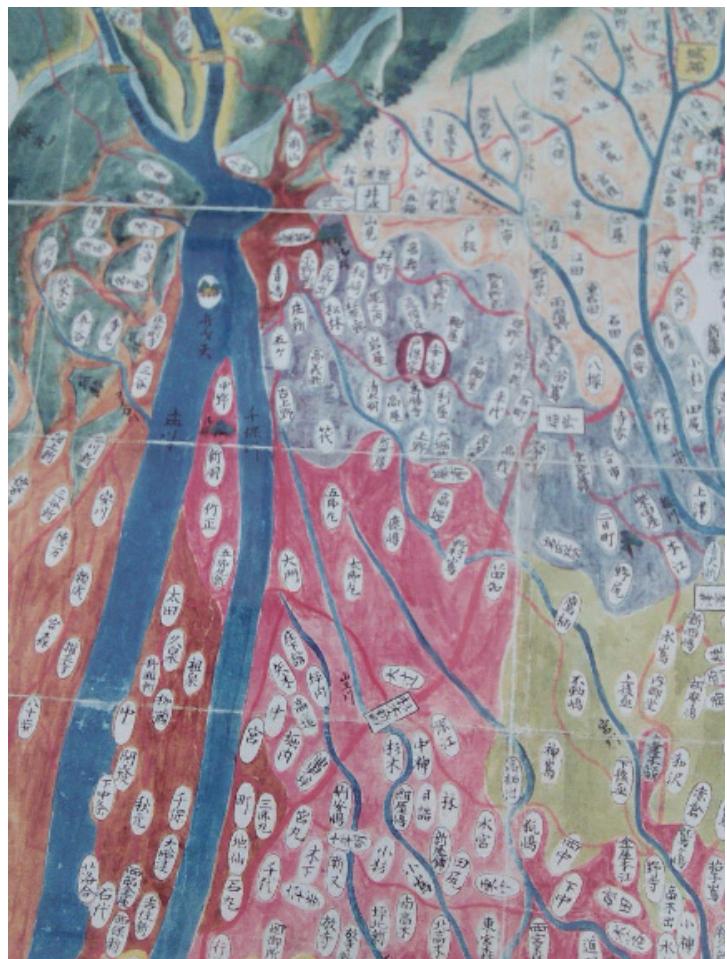


Fig. 5. Old map of Tonami County in the Kan'ei era (Shogawa town History, upper volume)

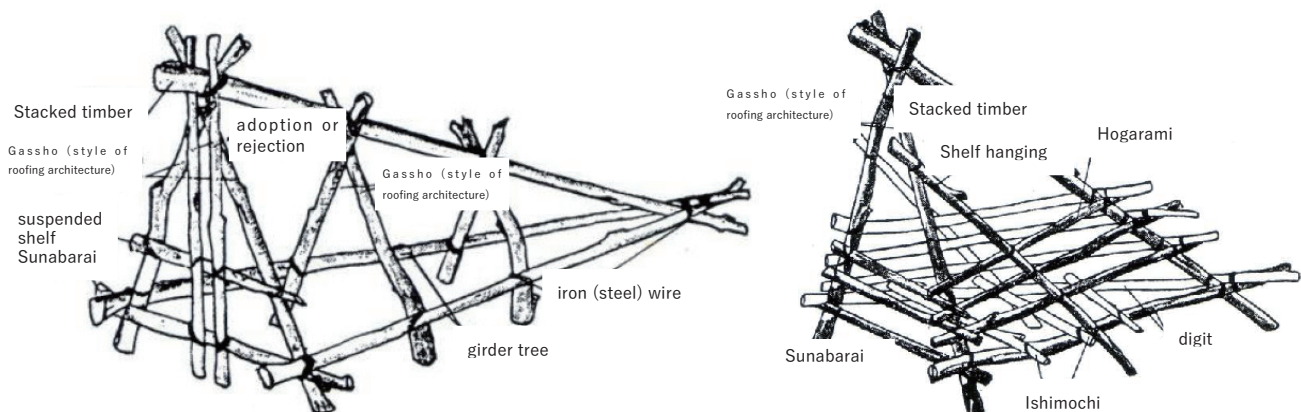


Fig. 6. Higiriushi (left) and Toriashi (right) (History of Shogawa town, vol. 1, p. 314)

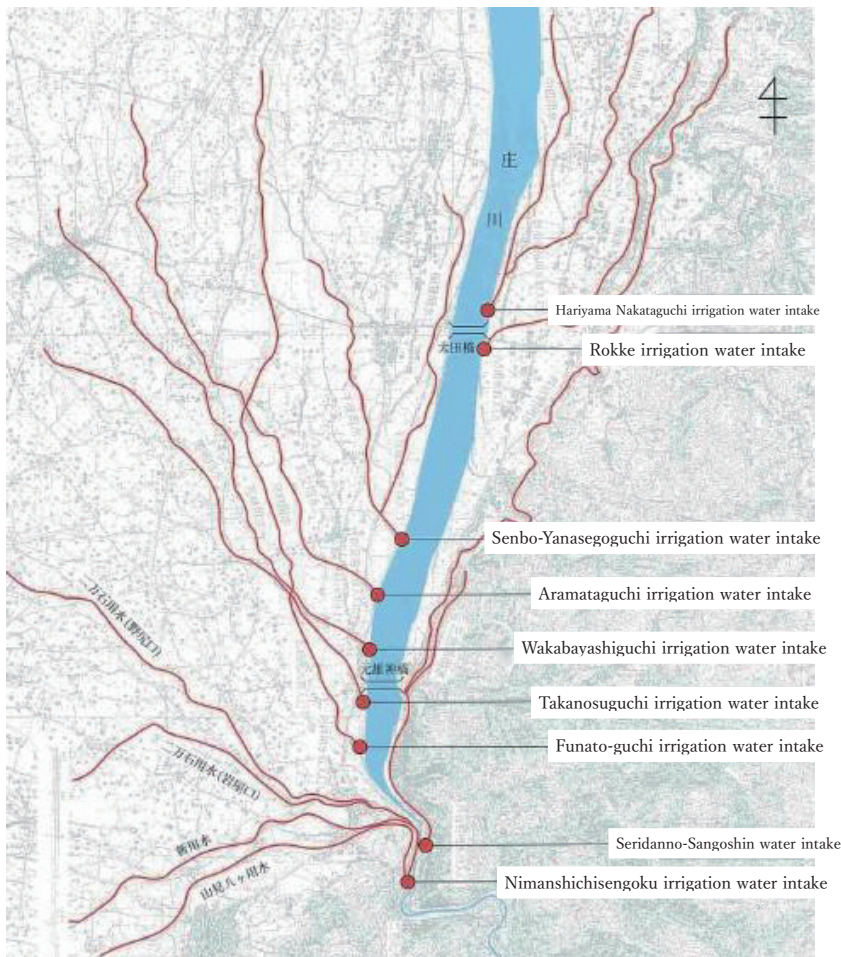


Fig. 7. Water intake before the dock entrance "From Sho Coastal Water" Sho Coastal Water Land Improvement District Association



Photo 1. Wakabayashi water intake (1936) "from Sho coastal water".

on the left bank, and three on the right bank: Seridanno, Rokke, and Hariyamaguchi (Figure 7). They individually irrigated the fields by conducting water from the natural flow of the Sho River. The Sho River is abundant in water and there was usually not much shortage of water, but sometimes the flow of water became scarce due to prolonged periods of sunshine. The lowest intakes, such as the Senbo-Yanazeguchi irrigation channel and the Rokke-Hariyamaguchi irrigation channel, were not able to take in as much water as expected, sometimes resulting in significant drought damage. There

was no fixed limit to the amount of water each intake could take in from the Sho River, with the upstream intakes having the advantage of more water meaning the downstream intakes had a disadvantage. Villages in the lower reaches of the river would sometimes ask the upper reaches to share their water for a certain period of time if they were short of water.

In each water supply, water tended to become scarce as it was diverted downstream. Even though it is irrigation water, the flow is similar to the natural flow of a river. Due to leakage and seepage into the riverbed, the amount of water is reduced as one goes downstream. Villages downstream took turns standing watch day and night to ensure that the agreed amount of water was distributed. For farmers, water was the most important thing, next to life. It was essential not only as water for agriculture, but also for drinking, washing, and other daily needs. Because of this, water conflicts occurred every year upstream and downstream of the water intake and at the diversion outlets for irrigation water.

Movement to the construction of joint intakes

A lot of manpower and money were required to repair water intakes when intake weirs were washed out due to floods or when water could no longer be taken due to a drop in the riverbed or

inflow of sediment. In addition, the fact that there were many intakes scattered across the river was a problem from the viewpoint of the strength of the levees, and the clan considered the construction of joint intakes as a basic measure for flood control of the Sho River and water for agricultural use.

However, no matter how many times the clan proposed the farmers to join their farms, things did not go easily. This is because the interests of upstream and downstream water users were completely conflicting. Even when downstream water users wanted to secure their water supply, the upstream water users were always reluctant to do so, fearing a decrease in their water supply and the loss of their vested rights. However, when either side became dissatisfied due to floods, droughts, or other problems, the joint entrance was sometimes dissolved once again.

In 1891, the head of Higashi-tonami County expressed his intention to join all water supplies near Akaiwa, so each water supply would have an intake in the Sho River. This was the year when there were major floods in many parts of the prefecture, resulting in the loss of many houses and lives. The county mayor tried to persuade each village by explaining that a larger and stronger weir could be constructed if the various water intakes were combined, that the construction cost for each village would be much less than if they were constructed independently, and that the amount of water could be distributed more appropriately at the sluice gates by establishing a joint weir.

However, the upstream water users such as Shin water and Nojiri-Iwayaguchi water users strongly opposed the project, claiming that they would only suffer disadvantages, and the project was not realized.

Momentum at the construction of joint intakes

In the Taisho era (1912-1926), there was an event that necessitated the merging of various water intakes. In 1916, Souichiro Asano submitted a plan

to the prefectural government to close the Sho River and construct a high weir in the Komaki area of Higashiyamami Village for hydraulic power generation. If the entire river is closed, sediment will no longer flow down from upstream, and the riverbed may drop, making it difficult to extract water. Furthermore, if the high weir were to break, it could cause extensive damage downstream. The people involved in the water supply were very upset. However, it was clear that once the decision was made to build the Komaki weir, all the Aguducts would have no choice but to join together.

In 1917, in response to an application by the county head, the prefectural government prepared a general outline of the "Sho River Agricultural Water Intake and Inlet Combination Plan," which was approved by the prefectural assembly the following year and a field survey began. Based on this, the "Shoriver Water Inlet and Outlet Plan Outline" was published. There were some twists and turns along the way, including disagreements between the upstream and downstream water supply companies and the Great Kanto Earthquake, but the upstream water supply company, which had opposed the project, moved in favor of it after seeing the Komaki weir construction progressing steadily, and the prefectural assembly decided to implement the project in 1926. In 1927, the first phase of the project was approved for government subsidies, and land acquisition began the following year.

As can be seen in the following "Memorandum of Understanding on the Left Bank Water Supply Gap" concluded in 1927, the settlement was a significant concession to the upstream water supply side.

Memorandum of Understanding (excerpt)

(i) The required amount of water for Nimanshichisengoku Irrigation Water after the water supply is combined shall be taken in priority according to the old custom.

(ii) Nimanshichisengoku Irrigation Water shall not bear any of the cost of the construction of joint

intakes.

(iii) The annual maintenance cost of the Nimanshichisengoku Irrigation Water shall be no more than one-sixth of the total amount of the water, and shall not exceed the five-year average amount required for the maintenance of the Nimanshichisengoku Irrigation Water to date. However, this shall not apply to disaster restoration expenses due to natural disasters.
(Omitted below.)

Start of Sho River water supply joint project

In the summer of 1935, work finally began on the weir and left bank main channel. The weir was to be constructed 100 m upstream of the Fujikake Bridge in Kanaya, Shogawa town. This was five years after the groundbreaking ceremony for the Sho River Water Supply Joint Project. The reason for this was that it took time and effort to coordinate the upstream and downstream sections of the intake and to negotiate the timing and volume of water to be released from the Komaki weir.

A new construction method developed by Nippon Takugyo company using iron wire cages was used to close the entire river. Hundreds of workers worked day and night, with construction equipment buzzing at all hours of the day. The sound of dynamite crushing rocks echoed through the valley, and the concreting of the weir continued uninterrupted.

In 1939, a large part of the water supply joint weir was completed, and the weir was flooded and water began to flow into the irrigation canal. The Nakano Power Plant, which was constructed in the middle of the left bank main canal, was also completed and put into operation.

In the same year, work began on the right bank canal. This was the year Japan entered World War II. The construction work was carried out under unfavorable conditions due to wartime material shortages, budget cuts, and worker shortages. However, under the supreme order of the government to increase food production,

construction continued, and finally the Sho River Water Supply Joint Project was completed in 1943. This was 26 years after the prefectural government had drawn up the "Sho River Agricultural Water Inlet and Outlet Project" in 1917.

The share of these projects was 24.25 % for the national government, 10.04 % for the prefectural government, 16.25 % for the local government, and 49.46 % for the electric power company. In other words, about half of the project costs were borne by the electric power company.

The water from the Sho River confluence weir is used for irrigation and power generation, and is also utilized for water supply and industrial water supply to enrich people's lives.

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Photo 2. Current Sho river confluence weir (October 24, 2021, Photo: Eco-DRR project)

Villages and stone walls in the Sho River alluvial fan

Dispersed Village Regional Research Institute

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Figure 1. Distribution of Jomon Period sites (red dots indicate each site) (How to choose a Jomon residence: Takao Uno), partially modified.

Introduction

The Sho River is a raging river under the heavens, and has caused record floods since the beginning of the Showa period.

The flood disaster that occurred on July 11, 1934 (Showa 9) left a particularly large mark in the form of extensive damage. (Photo 1)



Photo 1. Flooding in Asai Village in 1934 (from tonamino.jp)



Photo 2. Excavation view of the large ditch at the Hisaizumi site (from "Tonami Shouso")

The rain that had been falling since July 9 gradually intensified, and by 10:00 a.m. on July 11, the first levee in the Nishi-Hirokami area of Asai Village on the right bank of the Sho River collapsed, followed by the collapse of the second levee. The levee in Shimoasouarea, Nakada Town, a short distance upstream, also broke, and most of the villages in Imizu county downstream, including Nakada, Asai, Daimon, Oshima, Kushida, Fotakuchi, Tsukahara, Tukorimichi, Kataguchi, and Shinminato, were

swallowed up by the muddy waters. As a result, 20 people were killed, 240 injured, 94 houses washed away, 4009 houses flooded, 5418 houses damaged, and 4168 ha of fields flooded.

In Asai Village and other areas affected by the disaster, a "Flood Reconstruction Monument" and a "Flood Level Marker" have been erected to commemorate the recovery from this disaster and to leave the lessons learned from the flood for future generations. According to the record, the floodwaters were as deep as 16.17 m near Hirokami Shrine.

Since ancient times, the water of the Sho River has been both a blessing and an object of fear for the people living in the Sho River basin. In particular, when people built houses in the fan-shaped area, it was natural to choose a place where water for agriculture and daily life could be easily obtained and where there was soil suitable for farming.

Location of villages in the Sho River fan area

(1) Establishment of villages

The Sho River flowed freely and frequently changed its course, forcing people to live side by side with the danger of flooding, making it a difficult place for people to live in peace.

Based on the distribution of Paleolithic and Jomon Period sites, it is thought that the Sho River basin was first inhabited by people on the Pleistocene plateau and old river terraces around the Sho River fan. (Figure 1)

People gradually settled on the plains from around the beginning of the Yayoi period, presumably for rice cultivation. Remains of rice paddies have been found in the present Toide and Fukuoka areas, in the wetlands of the spring area at the fan end of the Sho River fan, and in the foothills of the mountains around the fan. There, the wetlands were relatively unaffected by flooding from the Sho River and were suitable for rice cultivation. As time went by, people gradually spread out across the plains, but it seems that preparation for floods was taken into



Photo 3. House with dirt mound and cedar hedge (sungoshiwa)



Photo 4. Stone wall (hadori) of Nakano Hachiman Shrine in Tonami City (July 31st, 2021. Photo: Eco-DRR Project)

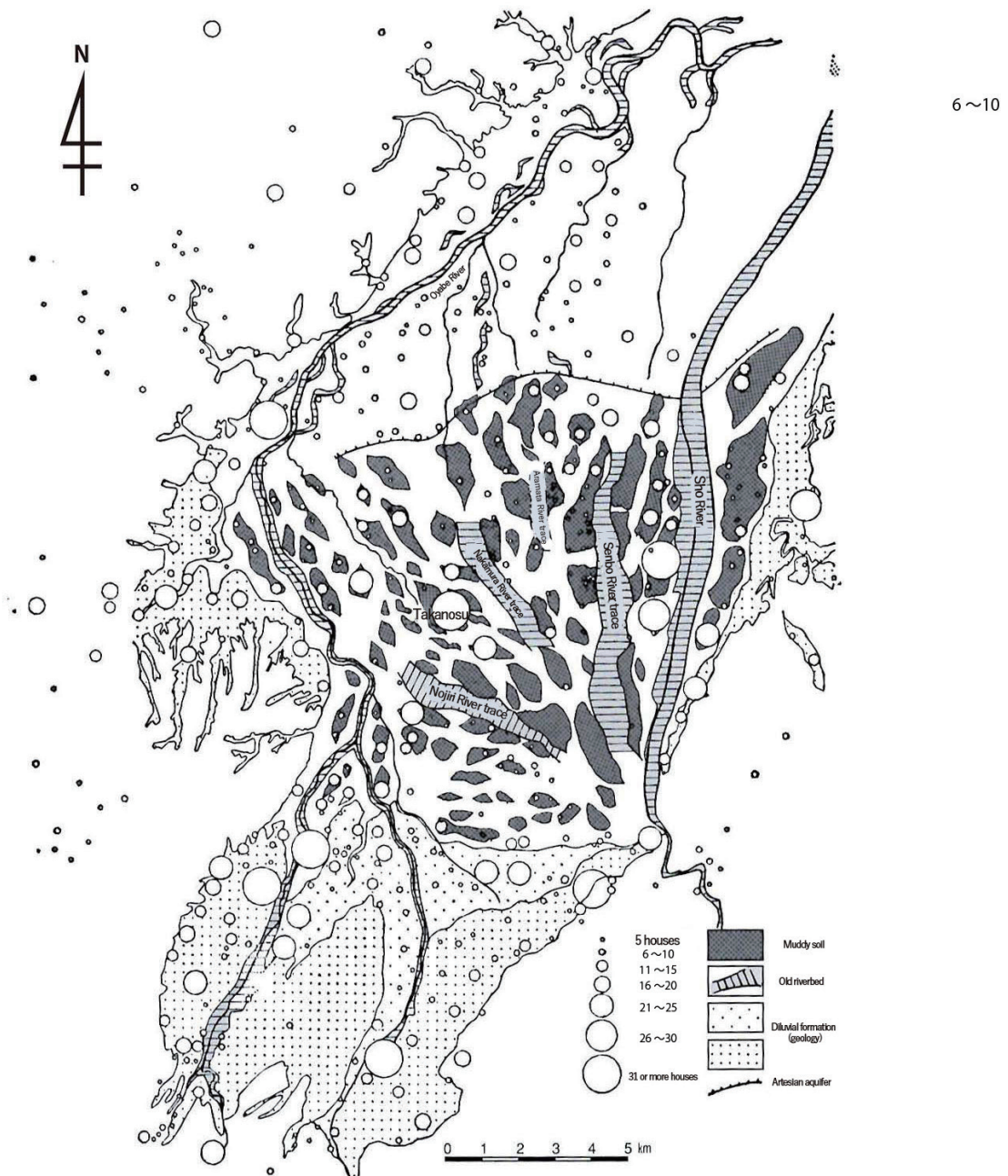


Figure 2. Distribution of house in genna year 5 and Muddy Area (KINDA 1970), partially modified

consideration, and it was mostly in the "muddy" areas, the fine highlands with thick topsoil, where the remains of settlements from that period can be found. Of course, it is easy to imagine that this would have been an environment conducive to agriculture.

Act for the Privatization of Reclaimed Land in Perpetuity of 743 led to the spread of manors throughout the country. According to the map of rice field development in Todaiji Temple territory in Etchu-no-kuni, Todaiji Temple manors were also spread out in the eastern part of the Sho River fan in Tonami County. They are Ishiawa-sho, Ikarugi-sho (Ikaryubisho), Iyama-sho, and Kinahiru-sho. It can be seen that rice cultivation was actively conducted here and there along the Sho River fan. From ancient times, this area seems to have been known as one of the most important granaries in Japan.

Rice cultivation in the 4 manors of Todaiji Temple was mainly done with water from the short and relatively low flowing Yachi River, which flows out of the foothills of the Shoto Mountains. At that time, the mainstream of the Sho River is thought to have been considerably west of the fan-shaped area, and the eastern part of the fan-shaped area, where Todaiji Temple's manor were located, must have been a place of relatively calm life with few major floods. However, the Senbo River was an offshoot of the Senbo River, and at the Hisaizumi site excavated in 2003, a large ditch was found that seems to have been excavated to draw water from the Senbo River to Ikarugi-sho. (Photo 2) It seems to have been a rather large ditch, approximately 2 km long, 10 m wide at its widest point, and 1.55 m deep at its deepest point.

In addition, a group of buildings consisting of a dug-out pillar building and a pit building were also discovered during the excavation. Located on the west side of the large ditch, the remains of four dug-out pillar buildings and 14 pit buildings were confirmed. The Hisaizumi site demonstrated

the authenticity of what is written in historical documents such as the Kanta map mentioned above, and also proved that people lived there for a long period of time from the Jomon Period to the Middle Ages.

(2) Development of new villages

The relatively thick topsoil deposits on the muddy areas were developed early on due to their suitability for agriculture and safety from flooding. The distribution of house at the end of the Middle Ages shows that villages of various sizes were formed on most of the muddy areas from the center of the fan to the edge of the fan. (Figure 2)

The development of new rice paddies in the early modern period was strongly promoted under the Kaga clan, and the existence of cultivable topsoil was essential to this development process. It is believed that the second and third sons and daughters of the Kaga clan, when they branched out, cultivated the land by searching for shallow deposits of topsoil on old flood plains and riverbeds. In doing so, they probably avoided setting up their houses on the flood plains of large rivers that were in danger of frequent flooding. Looking at the distribution of houses in 1619, there were still few houses along the Nakamura and Nojiri river races, as well as along the Senbo River races, which would have been the main stream until 1585.

I would like to start by looking at the development of Nomurajima Village. Nomurajima was originally part of Kanoshima Village, and it is reported that the Kawai family of the same village made efforts to develop the area.

The following sentence is found in a Kawai family document.

"We will fill the land of stones with mud from the Sho River, and newly open 100 bales of rice next year and 50 bales the year before..."

"Bring mud to Ishihara, Nomurajima, Tonami County, we can see that from the painting in Keicho

era..."

The southern part of Nomurajima Village was the flood plain of the Nojiri River lrace. The area that was once the floodplain of the Nojiri River has become a large abandoned riverbed due to mainstream migration, and we can see how they cultivated the mud puddles one hoe by one. The development of new villages in the Sho River fan area seems to have been carried out in this way, even if there were some differences in age.

Flood Preparedness

What has emerged in the process of forming these villages are the dispersed villages of the Tonami Plain, which is a rare rural landscape in Japan and is also known as the "original landscape of a farming village. I would like to skip the explanation of this formation process here, but among the house structures in these dispersed villages, there is one that may have originally been used as a flood control measure. They are "Cedar hedges" (Photo 3) and "Stone wall" (Photo 4).

As for "Sungoshiwa", they can be found in most of the dispersed village residences. The word "Sungoshiwa" means "small cedar hedge". In the dispersed villages of the Tonami Plain, there are now hedges made of Chinese juniper, *sazanka*, azalea, etc., but in the past, cedar hedges were the norm. Although hedges themselves do not have the power to dam floodwaters, they probably did enough to reduce the force of the onrushing muddy water. In many cases, these hedges are planted around the entire perimeter of the house, but in some areas, they are planted in the direction of the water, for example, to the south or east on the left bank of the Sho River. Also, in some cases, earth fill is placed under the hedges. This is a more obvious indication of the intention to prevent water intrusion. It is thought that the hedges as plantings also played a role as a rooting structure for the earth fill. (Photo 5)

Stone walls as housing protection

Protecting houses with stone walls has been widely



Photo 5. House with stone walls on top of earthen mound



Photo 6. Big stone wall house



Photo 7. Flood level marker (in Doai area, Imizu City) (20211026date photo provided by Eco-DRR Project)



Photo 8. Flood Damage Reconstruction Monument (October 26th, 2021. Photo: Eco-DRR Project)



Figure 3. Distribution of houses with stone walls made of Shogawa Boulders near the top of the Sho fan

practiced throughout Japan.

Here are some typical examples:

First is the Takada district of Oita City, located in the Ono River basin in Oita Prefecture. This district has a "Waju" landscape, represented by levees used to protect agricultural fields from floods. It has long been plagued by flooding, and has been devising ways to reduce the damage caused by flooding. Flood prevention in this district is characterized by the use of stone walls to fill in the earth, and houses are built on higher ground. The first floor of the house is left open to reduce damage from flash floods. Another well-known example of a similar style is the "mizuya" architecture in Waju, located along the Kiso Three Rivers.

Mizuya town, Tosu City, located in the Chikugo River basin in Saga Prefecture, has also suffered constant flood damage since long ago. As in the Takata area, it is said that when people built houses, they piled up a stone wall on the foundation and raised it 1 to 2 m higher than the road, called "Yachimori". The first time the building was built, it was in the middle of a mountainous area.

The above are examples of how stone walls were used to protect houses from flooding and raising them above the surrounding ground.

A case similar to this in the Sho River fan area is found in the former Asai Village introduced at the beginning of this article. Today, it is difficult to see what it was like

in those days due to infrastructure development and road construction, but if you look at the houses of the people who have lived there for a long time, you will see that the method of enclosing the area with stone walls, etc. and raising it with earth was partially used there as well. (Photo 5) However, it required large round stones, which were difficult to obtain in the downstream area, and it seems that this method was limited to only a few households with sufficient financial resources.

In the Sho fan area, there are houses with stone walls in other areas, but many of them seem to be built to enclose the house like a fence rather than to fill the soil. Some of the more grandiose ones even look like the stone walls of a castle. (Photo 6) However, they are not found everywhere in the Sho River alluvial fan and are particularly noticeable in the eastern part of the fan, from the top to the center. On the left bank of the Sho River, the areas are Nakano, Ota, Yanaze, Goka, Ikada, and Furuueno, and on the right bank of the Sho River, the areas are Yasukawa, Ranjo, and Gonshoji. As one moves north, i.e., downstream, there are no houses with stone walls, but the density of such houses becomes much lower. The same is true toward the western part of the alluvial fan. What is interesting is that houses with stone walls are concentrated in rows on both banks of the old Senbo River. (Fig. 3) It seems to indicate that the Senbo and Nakata Rivers flowed between them.

So why is it found predominantly in such a few areas?

In my opinion, this may have something to do with the fact that Boulders of appropriate sizes, which were used as materials, were readily available. When building a weir with stones around a house as a means of protecting it from flooding, many heavy stones had to be brought to the house from the riverbank. This was a time when heavy stones could only be carried by human power. It would have been difficult for ordinary people to carry a large number of stones far from the river, unless they had

wealth or power and could use many people to do the labor.

One more thing about the stone walls becoming less visible the further downstream you go. It may have something to do with the size of the stones on the nearby riverbanks. If the stones on the riverbank near your house are the size of your fist, or even smaller, the idea of building a stone wall using them would never occur to you. As a means of flood control, they must have thought of another method. In Asai Village, a village in the lower reaches of the Sho River, as mentioned earlier, the first step was to select a small elevated piece of land on which to build a house. Furthermore, in some places, they probably raised the foundations of their houses to minimize damage.

The great flood of 1934 caused great damage, as if to mock the wisdom of such predecessors. The floodwaters rushed in far beyond what was thought possible. The people of the former Asai Village have erected "flood level markers" throughout the community to pass on the lessons learned from the flood to future generations, and to encourage people to be prepared for disasters. (Photos 7 and 8)

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【The premises forest in dispersed villages】





Photo courtesy of Eco-DRR Project

Living with premises forest

SHINDO Masao



Photo 1. Taken from the southwest (August 1, 2021)

My family are farmers living in a dispersed village in a rice paddy field area in the middle of the Sho River alluvial fan, nearly at the center of the Tonami Plain. We split off from a neighboring village about 200 m upstream, built a house and settled here in 1754 (Horeki period 4) in the middle of the Edo era. Since then, they have lived by cultivating the surrounding rice paddies and growing a forest around their house. Although there are no records of the forests in the Edo era, it seems that they were not often cut down for use when the houses were remodeled. Houses built in the 20's of the Meiji era seem to have been constructed using lumber purchased from other villages and old timber. When the entrance was reconstructed in the early Showa era, a large cedar round girder was used, but this cedar was bought from a neighbor's forest and used, and it seems that the cedar from the premises forest was not cut down but rather carefully preserved.

In the dispersed village areas where the premises forest are located, there is a saying that has been handed down: "Sell your 'taka', don't sell your 'kainyo'". "Taka" refers to the land (rice fields), and "kainyo" refers to the premises forest. "kainyo" are

an indispensable part of village life, and every family has been attached to and cherished them.

It was not until the beginning of World War II that the landscape of the dispersed villages changed drastically as the forests were cut down. The "supply campaign" was a result of the escalation from the Second Sino-Japanese War to the Pacific War. It was decided to use lumber to make up for the shortage of steel, which was indispensable for the war effort, and the government set a target volume of lumber production for each prefecture to expand lumber production. Toyama Prefecture was already one of the leading rice-producing prefectures in Japan at the time, but despite its mountainous terrain, its forestry industry was underdeveloped and forest roads were not well maintained, so it was unable to respond to the urgent needs of the war effort.

The beginning of the campaign for the provision of trees in the premises forest was announced by the governor at a meeting of mayors of cities, towns, and villages on March 20, 1942. The gist of the letter is as follows: 'kainyo' (premises forests) have developed in farming villages throughout the prefecture, and a large amount of useful timber has been accumulated. However, if these forests are left unregulated, there will be many adverse effects on the health of the people of the prefecture and on the growth of agricultural crops. Therefore, in view of the increasing demand for military timber, if the forests in the prefecture are cleared and cut down, it will contribute to the construction of a national defense state and the completion of the Greater East Asia War, and it will also help to improve the health of the people of the prefecture. The agreement stated, "We hope you will cooperate fully

with us. However, the clearing of the forests did not proceed easily. The governor issued a "Governor's Announcement on the Promotion of the Premises forest Offering Campaign" on November 11, and it was not until the spring of 1943 that the felling of trees finally began in earnest. The target trees were cedar, cypress, Japanese cypress, Spanish oak, pine, fir, Japanese boxwood, zelkova, and celtis trees with a diameter of approximately 2.5" or more. The offerings continued until the spring of the 1944 and 1945 years, and later, even trees over one foot in diameter were cut down.

Since my grandfather was the village head at the time, he took the initiative to offer the trees of his house at the end of 1943, and eleven cedars were cut down and offered on the south and west sides of the house. No crooked cedars or *asunaro* were cut down. Only the long, good timber was offered up, and the knotty treetop wood and a large number of branches and leaves were left behind, which were collected and dried in piles, then carried on their backs up to the ama (second floor) and used as fuel for hearths and cooking stoves for more than ten years. The cedar seedlings that were distributed to us were planted in the area where the trees had been cut down, and they have now grown to a circumference of 150 cm at breast height.

The remaining premises forest are even smaller because they were cut down due to fallen trees caused by strong winds. During Typhoon Isewan on September 25, 1959, many cedars that had grown up after the offering of trees fell over in the strong winds from the west, causing severe damage to the roofs. At that time, we cut down many cedars, *asunaro*, *nemunoki*, *konara* oak, and other miscellaneous trees that had returned to their roots, so much so that the inside of the house was brightened. However, the occurrence of fallen trees caused by Isewan Typhoon seems to be related to the thinning of the western side of the premises forest at the end of the previous year. The forest was so overgrown that its branches reached above the rice paddies and provided shade, so we cut

down a number of mountain ash, oak, and *asunaro* trees. This may have been one of the reasons why many of the trees were uprooted by the strong typhoon winds. On the site, we have grown eurya and sawtooth oak, zelkova trees on the outside and a bamboo thicket made of *hachiku* bamboo.

During the 2nd Muroto Typhoon (Typhoon No. 15) on September 25, 1961, the wind suddenly became stronger in the evening and the house shook. The whole family gathered in the hall and waited for the typhoon to pass. The next morning, when we looked at the garden, we saw that the persimmon and cedars were broken, the zelkova, cedar, persimmon, and bamboo trees were filled with fresh green fallen leaves, the cedar on the north side was almost completely tilted over, it had fallen on the roof of the bathroom and chicken coop, and the moso bamboo had turned over and was completely destroyed. Next, in 1963, there was a heavy snowfall, and the premises forest was also damaged by the rapid growth of cedar trees that broke their trunks and turned over their roots. The fallen cedar trees were milled into posts, boards, and stakes at a lumber mill in Demachi, which was hired by a contractor for use as lumber, and were then dried in the shade of the forest and used for house remodeling and repairs. A large amount of branches and leaves were, of course, brought up to the 2nd floor of main house for use as fuel.

Cooking and heating in my house were replaced by electricity, oil, and gas in the late 1960s, and the hearth was lost in 1970. Baths were partially converted to electric in 1963 and all to oil in 1977. Until then, all the fuel for my house came from the thinning of the trees in the forest and the fallen leaves of the cedar trees, which were sufficient. Of course, for ease of use, they were bundled as bushes, processed into firewood, and stored for use. Hearths made of Isolite are still available and in use today because they can steam *sekihan* (red rice) and *mochi* rice with only a little firewood.

Typhoon No. 23 that hit the Tonami area from

the evening to midnight of October 20, 2004 was an unusual typhoon in the Tonami area, causing damage from fallen trees in many premises forests. I was on a trip to Kyoto on that day, so I hurried home by bus on the expressway the next day. When I entered the Tonami Plain, I was surprised to see the whole area covered with smoke. It was smoke from burning the branches and leaves of fallen trees. This typhoon blew for a long time with northeast to northerly winds of more than 10 m/s and heavy rain. This caused water to accumulate in the house and the trees were shaken for so long that the soil at the base of the trees liquefied, making it impossible to support the trees and causing them to turn on their roots. When we looked at the fallen cedar stumps, we found that the thin roots were still attached to the stumps in the form of planks. Many of the fallen cedars were over 60 years old, planted on the site of wartime offerings, and many of them were "Boka cedars," which grow quickly and have many branches and leaves, making them vulnerable to wind.

In my house, this typhoon brought down four cedars, two cypresses, one Himalaya cedar, and several small trees. Only a few thick trunks were left behind, and all the remains were carried to the rice field and incinerated. With the help of relatives, the whole family worked together, and we finished burning the trees when it was dark underfoot, and we almost tripped over the rice stubble. This typhoon was an opportunity for me to have many discussions with my family about the forests around our house.

My grandmother would get up early in the fall to pick chestnuts from the back door, and when I was young, I would go to the garden to pick up chestnuts. My father is good at making long bamboo ladders, climbing trees, pruning cedar branches, and tying up bamboo. My wife looks forward to picking and eating the bamboo shoots of the *Hachiku* bamboo plant on our back porch, but the leaves of the *Hachiku* fall throughout the year and the wind blows them all over the garden.

The three old persimmon trees in the front yard that drop many dead leaves and ripe persimmons every day in late autumn, the cherry tree that never blooms, the large celtis and zelkova trees that shade the rice paddies with their overgrowth, and the large amount of sumba (fallen cedar leaves) that remain in the yard after typhoons and spring thaws, all of which are difficult to deal with, were discussed. Some suggested increasing the number of trees, leaving the trees that are memorable or necessary, and cutting down or pruning the trees that are in the way.

There were both planted trees and naturally grown trees, with cedar being the most abundant (14 trees) among tall trees, and other trees including celtis, *asunaro*, zelkova, fir, and chestnut (17 trees); cedar, persimmon, pine, and other trees (53 trees) among medium trees; camellia, eurya, cedar, witch hazel, and other trees (116 trees) among low trees; hydrangea, rhododendron, Japanese holly, and other small shrubs (many of them are small shrubs); and there were also one hundred and forty-five *hachiku* and four hundred and eighty-eight yadake bamboo. All of these trees were important and none were in the way.

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Premises forest in the Tonami Plain

SHINDO Masao



Photo 1. Heavy snowfall from the night of January 9, 2021

Tonami Plain premises forest

The Tonami Plain is characterized by a dispersed village landscape of farmhouses surrounded by premises forests scattered all over the plain. The scenery in early May, when the rice paddies are flooded, is particularly beautiful, resembling the sight of many small green islands floating in the ocean.

The Tonami Plain is a fan-shaped plain formed by the accumulation of earth and sand carried from the mountains by the Sho and Oyabe Rivers and their tributaries. It slopes gently and is blessed with abundant water and fertile soil. Rice cultivation

was already practiced in some areas during the Yayoi Period, and in the Nara Period, the area was designated as the domain of Nara Todaiji Temple and a jori settlement was established. (See KINDA Akihiro, p. 14.)

Subsequently, development proceeded rapidly in the central part of the plain from the Muromachi period to the beginning of the modern era. In the newly developed villages, it seems that many irrigation canals were opened by taking advantage of the slope of the fan-shaped land, and by creating housing lots for farmers dispersed throughout the village, isolated dispersed villages in rice paddy fields convenient for

rice cultivation, gradually spread.

It was in the late medieval and early modern periods that rice paddies spread across the plains, and houses surrounded by the greenery of premises forest began to be seen dotted throughout the landscape. The origin of the premises forest can be traced back to the time of the ancient settlement of the plain, when people descended from the surrounding mountains to the wooded plain to open rice paddies, leaving useful trees such as cedar, pine, and zelkova around the houses to serve as windbreaks.

Tonami's nature that nurtured premises forest

The Tonami Plain is a basin-like plain surrounded by mountains on three sides, with only the northeastern part opening to Toyama Bay, and has a climate with large differences in temperature. In August, the highest temperature exceeds 30 °C, and in winter it is cold and snowy, with many days in January and February when the lowest temperature is below minus 5 °C, and in rare cases minus 10° C is recorded. The city has a long winter from the end of November to March, the winter monsoon blows, and the area has heavy snowfall along the Sea of Japan coast. In 1963, a strong monsoon blew and snow fell from mid-January, resulting in a record snowfall of 238 cm in Tonami City, located in the center of the plain. The central city as well as dispersed villages were buried under snow, transportation was halted, houses and residential forests were damaged, and snow remained in the fields until early April, affecting agriculture.

In the Tonami Plain, strong south winds blow down over the Hida Mountains in early spring, strong south and west winds are blown by typhoons that pass over the Sea of Japan in autumn, and monsoon winds carry cold and snow in long winters, although wind directions vary from place to place.

In this way, it was a rice farming village that was created by cultivating the wild nature of Tonami. Villages were often not clustered, but rather

scattered, with farmhouses scattered one by one throughout the rice paddy fields. Dispersed villages have continued for hundreds of years because every farmhouse can cultivate the rice paddies around its house, and the proximity of the paddies means less time is needed for watering and field management, and the transportation of rice and fertilizers is more efficient. Farmers in dispersed villages isolated in rice paddy fields had to cope with the harsh natural conditions mentioned above, especially wind, in order to maintain their livelihoods.

(1) Beginning of the premises forest

The establishment of premises forest in the Tonami Plain dates back to the time of pioneers, when houses were built in the wilderness and some of the trees that grew around the houses were left as windbreaks. These trees were increased by devising the type of trees suitable for windbreaks in each place, their arrangement within the house, management such as pruning and thinning, and the method of growing saplings. Zelkova, chestnut, and other trees began to be planted as well. In addition, willow branches, which grow near the water, were used to make rugs and wickerwork, witch hazel was used to tie wood together, and cherry and Japanese pagoda trees were used for their beautiful flowers as well as for lumber. In addition to trees, wildflowers such as thatch, butterbur, wormwood, violets, and Japanese knotweed, flowering Fuji and kuzu vines, and yam for food grow in the forests, and small animals such as small birds and rabbits lived there.

(2) Trees in premises forest

The forests in the Tonami Plain are mainly cedar trees that prefer water, and the tall tree layer (over 10 m) includes cedar, Japanese red cypress, zelkova, pine, celtis, fir, etc. The mid tree layer (5 to 10 m) includes cedar, oak, oyster, chestnut, maple, camellia, and Japanese linden, while the low tree layer (1 to 5 m) includes mulberry, Japanese red cypress, and Japanese knotweed. The small shrubs (less than 1 m) consist of various horticultural species and young trees, such as Japanese cedar, Japanese cypress, Japanese apricot, Japanese apricot,

Table 1. Planting status of premises forest in the central fan of the Tonami Plain (trees with diameter of 10 cm or more)

46 units in Kanoshima district (March-November 198)

Tree name	Number	Remarks	Tree name	Number	Remarks	Tree name	Number	Remarks
Japanese cedar (Cryptomeria japonica)	735	48% 73%	Chinese nettle tree	5	45	Japanese privet (Ligustrum japonicum)	1	
Pine tree (Pinus spp.)	131	8 30	Oriental arborvitae	5	71	Japanese white pine	1	
Persimmon	111	7 64	Umbrella pine	4	29	Chinese crabapple (Malus prunifolia)	1	
Cypress (Thujaopsis dolabrata)	58	4 38	Crape myrtle (Lagerstroemia indica)	4	31	Yew plum pine (Podocarpus macrophyllus)	1	
Evergreen oak	43	3 43	Sweet viburnum	4	31	Common hibiscus (Hibiscus syriacus)	1	
Chusan palm	41	3 88	Veitch's silver fir (Abies veitchii)	4	4	Juniperus rigida	1	
Japanese maple (Acer palmatum)	29	2 25	Japanese spindle tree (Euonymus japonicus)	4	27	Japanese ternstroemia	1	
Camellia	20	1 9	Willow (any tree of genus Salix)	4	44	Momi fir	1	
Cherry tree	20	1 45	Japanese laurel	3	3	Ilex crenata var. paludosa	1	
Maple (tree) (Acer spp.)	19	1 38	Gambelia innovans (species of deciduous tree)	3	50	Podocarpus macrophyllus var. maks (variety of yew plum pine)	1	
Japanese wax tree (Rhus succedanea)	18	1 37	Azalea	3	1	Himalayan cedar	1	
Japanese apricot (Prunus mume)	18	1 26	Persian Silk Tree	3	50	Celtis sinensis	1	
Japanese zelkova (species of elm-like tree, Zelkova serrata)	17	1 57	Nomura Maple	3	9	Magnolia kobus	1	
Himalayan cedar	15	1 88	Peach	3	23	Chinese fringe tree (Chionanthus retusus)	1	
Japanese yew	14	1 10	Cypress	2	66	Prunus armeniaca (plum)	1	
Japanese photinia	14	1 13	Asteraceae flowering plant (Parasenecio delphinifolius)	2	4	Castanopsis	1	
Daphniphyllum macropodium	13	1 32	Japanese pepper (species of Sichuan pepper, Zanthoxylum piperitum)	2	25	Japanese white birch (Betula platyphylla var. japonica)	1	
Vitex cannabifolia	12	1 12	Holly (Ilex latifolia)	2	67			
Charmaecyparis pisifera	12	1 21	Cephalotaxus harringtonia	2	25			
Mochi tree (Ilex integra)	11	1 31	Southern Japanese pine (species of conifer native to Japan, Tsuga sieboldii)	2	20			
Loquat (Eriobotrya japonica)	10	56	Magnolia (Magnolia obovata)	2	50			
Japanese pagoda tree (Sophora japonica)	10	83	Lily magnolia (Magnolia quinqueapeta, Magnolia liliiflora)	2	7			
Japanese chestnut (Castanea crenata)	10	48	Dawn redwood (Metasequoia)	2	50			
Sasanqua (Camellia sasanqua)	9	11	Japanese oak silkmoth (Antheraea yamamai)	2	20			
Lyophyllum shimeji (species of edible mushroom)	7	14	Lettuce	2	100			
Chinese parasol-tree (Firmiana simplex)	7	100	Chinese catalpa	1				
Empress tree (Paulownia tomentosa)	6	75	southern Japanese pine (species of conifer native to Japan, Tsuga sieboldii)	1				
Red cedar (Thuja plicata)	6	12	Chinese fir	1				
Evergreen magnolia	6	38	Longleaf pine (Pinus palustris)	1				
Holly tree	6	14	Japanese horse-chestnut	1				
Fig tree	5	21	Pear tree (Pyrus pyrifolia, esp. var. culta)	1				
Ginkgo (Ginkgo biloba)	5	63	Chinese date	1				
Japanese star anise (Illicium anisatum)	5	29	Japanese white birch (Betula platyphylla var. japonica)	1				
						Total	1,542	

*The numbers on the left side of the remarks are the ratios of the total, and the numbers on the right side are the ratios of the tree.



Photo 2. Kanoshima, Tonami City Cedar-dominated premises forest

Japanese winterberry, and Japanese knotweed, etc. The small shrubs (less than 1 m) consist of various horticultural species and young trees, such as *rhododendron*.

As shown in Table 1, in 1986, the Tonami Kanoshima community (46 households) located in the center of the fan had 1,542 trees of 83 species with a diameter of 10 cm or more. Of these, 735 were cedar trees, accounting for 48 % of the total.

Benefits of the Premises Forest

(1) Premises forest as windbreaks

The purpose of growing forests was to protect homes and livelihoods from strong winds. In the old days, houses had thatched roofs, and when typhoons or strong spring southerly winds blew, the roofs would be blown off, so ropes were sometimes hung on the roofs to prevent this. Even today, with tiled roofs, tiles can still be blown off. Tall trees



Photo 3. Fallen cedar leaves (sumba) in early winter, an important fuel source until about 1970 (December 11, 2020)



Photo 4. Yamato persimmon, a 200-year-old tree, turns sweet in November (November 6, 2020)

such as cedar, zelkova, and celtis prevent this from happening. In addition, the forests block the wind and snow in winter and reduce the accumulation of snow in the house, thereby mitigating damage to the roof and the house.

Premises forest reduce wind speed and regulate temperature drops. It is said that the wind protection effect of standing trees is six times the height of the trees on the windward side and 30 times the height of the trees on the leeward side. The forests of isolated farmhouses in dispersed villages protect not only their own houses but also the houses of their neighbors, and they also weaken the winds of the entire plain.

(2) Mitigation of weather conditions

On a hot summer day, when one escapes from the blazing sun on the paved road into a forest to avoid the sun's rays, one feels grateful for the coolness of the premises forest. Not only do the trees block the sun's rays, but the green leaves also reduce the temperature of the surroundings as the transpiration of water removes heat as vaporization heat. This is the reason why it feels cooler in the forest. In winter, the opposite is true: the many trees act as a blanket around the house, protecting it from the cold winds and preventing it from losing heat. This effect also affects the temperature of the entire plain.

(3) Air purification

Living trees have the power to purify and improve the environment. The leaves of many trees in a forest absorb carbon dioxide (CO₂), a factor in global warming, and release oxygen (O₂). The forests are truly functioning as oxygen supply factories. They also absorb and filter pollutants such as sulfur dioxide (SO₂) and other atmospheric debris to clean the air and prevent noise pollution.

(4) Premises forests that supported people's daily lives

Sugi (Japanese cedar), cypress, and zelkova trees were cut down as building materials when new

houses were built or renovated, and saplings were always planted in their place. The remaining twigs, after being processed into lumber for posts and boards, were bundled and carried up to the back of the house to be used as fuel for hearths and cooking stoves. The same was done when a large tree fell in a typhoon. Fallen cedar leaves and twigs were called *sumba*, and were a valuable fuel because they burned easily and generated a lot of heat. (Photo 3).

In addition to tall cedar, ash, and zelkova trees, many premises forest have bamboo thickets where *moso*, *karatake* (*madake*), *hachiku*, and *yadake* grow. Bamboo thickets are effective as windbreaks, and because bamboo absorbs water and dries the soil, it dries the damp, shaded land on the west and north sides of the house. It grows quickly and can be cut down and used every year because it grows fully in one year and becomes strong after three years. Because of its strength, bamboo has been used as a material for roofing, snow fencing, snow hanging, and bamboo fences. Bamboo bark was widely used for wrapping *onigiri* (rice balls) and sweets, and as material for sandals. Every farmer used thin bamboo such as *yadake* and *madake* for supporting vegetables and flowers in the field, and bamboo had

a wide variety of uses and was a necessity for the daily life and production of the farmers.

Persimmon trees were always planted in the front yards of farmhouses in dispersed villages (Photo 4). It is said that in the old days, when a family split off and built a new house, the head family gave them seedlings of persimmon trees, chestnut trees, and plum trees. These persimmon trees were carefully nurtured for generations.

A number of persimmon trees, including sweet and astringent persimmons, were planted in the compound. Persimmons were not only a snack for children, but also an important fruit for adults. In November, astringent persimmons were peeled and hung from the eaves, and when it snowed, they were taken in and dried on the hearth to make dried persimmons, which were needed to be placed on top of the *Kagamimochi* (rice cakes) for New Year's decorations. In late August, after the O-Bon Festival, astringent persimmons were squeezed to make astringent persimmon juice, which was widely used for painting posts, wall panels, joists, and other building materials, as well as for making antiseptic paint for fishing nets and astringent paper. When



Photo 5. West side of the premises forest (June 28, 2021)

the rainy season began, plums were pickled in salt, and when the rainy season ended, shiso leaves were added, dried in the sun for several days, and then left out in the dew overnight to become red pickled plums. Fruits such as yamaboshi, saku, mulberry, and jujube were also enjoyed by children during playtime.

Although few in number, trees useful for daily life were also planted, such as Japanese sumac, linden, goby, and sawtooth oak. Shuro was used to peel the bark to make rope and brooms, and sawtooth oak was used to make the teeth of a chafing mortar. The sawtooth oak was used to make the teeth of the rice hulling mud mortar, the yamaboshi and chestnut were used for hoes, sickles, axes, and other handles, the Japanese pagoda tree was used for wedges, and the oak was used for plane bases.

Many houses had a princess tree on the north side of the compound. When a girl was born, a princess tree seedling was planted to commemorate her birth. Since princess trees grow quickly, they were planted in anticipation of building a wardrobe from the tree and sending the daughter off as a bride when she came of age.

The premises forest blocks people's line of sight and serves as a blindfold. Although you can see what is going on outside from your house, it blocks people's line of sight from the outside, allowing you to live at ease with your family.

Many houses had bamboo fences or *sugikoshiwa* (hedges) around their forests. The hedges shelter the house from strong winds, allow moderate breezes to pass through, and protect the house from moisture by allowing breezes to enter the subfloor (Photo 5).

Many plants that were used for medicinal purposes and food were grown in the undergrowth of the premises forest. Geranium was used for diarrhea, Chinese juniper was used for stomach aches, and to suck out boils. There were many other medicinal herbs such as dokudami, wormwood, saxifrage, horsetail, plantain, peony, and horsetail, as well as medicinal trees such as yellow cedar and Japanese pepper.

Butterbur, Japanese parsley, Japanese honeysuckle, wormwood, yomena, and itadori (Japanese knotweed) decorated the seasonal meals, and the



Photo 6. View of a premises forest after rice planting (May 5, 2017)

entire forest was connected to daily life.

(5) Home to wild birds and insects

The trees that make up the forest include tall cedar and zelkova trees as well as shrubs such as Japanese cypress, evergreen conifers, evergreen broad-leaved trees, and deciduous broad-leaved trees, which spread their leaves, bloom, bear fruit, and nurture a variety of insects. In spring, cormorants visit from the surrounding mountains. When rice planting begins, cuckoos nesting and singing in the nearby premises forest can be heard, and as summer approaches, the green of the rice paddies deepens, prompted by the calls of the city bird of Tonami, the *hiyodori*, singing in the treetops of the zelkova trees (Photo 6). As autumn turns, many migratory birds such as thrushes, avocets, and wrens from the north fly south to rest their wings in the premises forest, and many birds such as sparrows, pheasants, and wood pigeons avoid the cold and overwinter in the forests.

(6) Daily forest bathing

Early in the morning, when one enters a premises forest, which is dominated by cedars and cypress, one is enveloped by the subtle aroma of tree resin, which refreshes and invigorates one. This is believed to be due to the presence of a terrific substance called "phytoncides" which is emitted not only from coniferous trees but also from broad-leaved trees. "Phyton" means plant and "cide" means to kill. Trees emit substances that kill microorganisms in order to protect themselves, and the fact that these substances have a positive effect on human organisms was researched by biophotonist Keizo Kamiyama, and has become the focus of attention as "an unknown vital element emanating from forests". Forest bathing in which people are exposed to this vital element is the basis of good health, and this has led to the development of walking trails and forest parks in the satoyama area. In Tonami's dispersed villages, people lived in residential forests mainly made of cedar trees, but they were not so much aware of the benefits of forest bathing, and were sometimes encouraged to

cut down the trees because the thickly overgrown forests did not allow light to enter the house, which was considered bad for the living environment and hygiene. However, there were many legends in daily life about the benefits of forest bathing, such as that cedar, Japanese white ash, and nanten leaves placed on top of red rice that would prevent the rice from going bad, or that branches and leaves of *Abies sachalinensis* would prevent mold from growing in the room.

The future of premises forest

Here is a summary of what combination of trees would be appropriate for a dispersed village premises forest. It depends on the size of the house, area to be planted, location, soil type, wind conditions, etc., but we hope you will find it useful.

(1) Trees growing over 20 m

The trees are planted mainly from Japanese cedar, red pine, black pine, *asunaro*, Japanese cypress, *sawara*, fir, zelkova, celtis, alder, camphor, and other species.

(2) Medium-sized shrubs that grow to around 10 m and have a crown of 3 to 4 m

Japanese white oak, *egonoki*, Japanese knotweed, Japanese maple, *ubamegashi*, *yuzuriha*, *akamegashi*, *yamaboshi*, *mizuki*, *enju*, *yabutsubaki*, *sangojumochi*, *nemunoki*, *itohiba*, witch hazel, ash, *clevera japonica*, boxwood, *kobushi*, *sazanka*, and others.

(3) Shrubs less than 4 m, small shrubs that stabilize the shire

Yabukouji, *manryo*, *senryo*, *sasa*, etc.

(4) Flowers and fruit trees that emit aroma

Cherry, *sanshu*, *fragrant olive*, gardenia, hyssop, oyster, chestnut, plum, apricot, Japanese apricot, Japanese winterberry, loquat, pomegranate, *gumi*, fig, rose, etc. (Photo 7).

(5) Trees that prefer moist soil

Willow, walnut, *yachidamo*, alder, etc.



Photo 7. Fragrant olive (October 10, 2020)



Photo 8. Preparing the front yard for winter, snow fence made of bamboo screen at the entrance (December 11, 2020)



Photo 9. *Sanshuyu* (*Comus officinalis*) adorn the forests of mansions at the beginning of spring

(6) Semi-shade trees and semi-sunlight trees that can grow even without strong direct sunlight
Japanese cypress, camphor tree, Japanese white birch, Japanese sumac, Japanese knotweed, Japanese white birch, white Japanese ash, hydrangea, kobus, and *Sawara cypress*.

(7) Shade trees that do not like direct sunlight, trees that grow as the understory of a forest

Yew, carabok, *Japanese holly*, *yuzuriha*, *mochi*, *nandina*, *senryo*, *aoki*, *yatsudo*, *yabukouji*, *yabutsubaki*, and others.

(8) Bamboo species can also be added to create a stable premises forest.

Bamboo species grow fast and absorb a lot of water by evapotranspiration, drying out the damp, shady land on the north side of the compound. Bamboo forests also provide wind protection, and mousou bamboo and *hachiku* are valuable as bamboo shoots for cooking, and can be widely used for bamboo screens, bamboo baskets, and other bamboo crafts, as well as construction materials (Photo 8). However, cleaning is difficult because bamboo is defoliates throughout the year.

(9) In selecting tree species, we should refer to the combination of trees that have been grown in each region for centuries, and add flowering and fruiting trees, garden trees, and commemorative trees for family celebrations. (Photo 9)

(10) Living in a sparsely populated area with flowers and greenery around the house is probably the highest luxury in terms of living environment.

As a new type of forest, each village or district could select the same type of flowering trees, and a series of landscapes could be created in which the flowers can be seen somewhere in the forest.

In any case, we would like to start by selecting land and planting trees within the compound, and grow it into a premises forest with dreams and enjoyment.

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The premises forest in the Edo Period - Oyabu in Takanosu village

SHINDO Masao

In Takanosu Village in Tonami City, located in the center of the Sho River fan, there was a forest called "Oyabu" designated by the Kaga clan that ruled the village in the Edo period. The designation of "Oyabu" was made in 1651, the year when the law of reorganization was enforced in Takanosu Village. It seems that the government designated these magnificent forests as "oyabu" (thickets) in order to preserve them for use as lumber.

Takanosu Village was developed in the early modern period. It was a large village with 61 households in 1670, and its seal value was 3,500 koku. Although there are no documents available regarding the individual oyabus at the time of the designation, according to the "Takanosu Village Oyabu Custody People Memorandum" written by the village to the county office in 1782, there were 31 oyabus, covering an area of 35,000 sq. m. The total area of 3,908.2 *bu* (approximately 13,000 m²) remained unchanged from the initial designation to the end. The land in the area designated as "oyabu" was under the direct control of the clan, and the village was exempted from paying annual tribute. The responsibility for the management of the hedges was borne not only by the farmers who had been entrusted with the land, but also by the village head and the head of the cooperative.



Photo 1. Oyabu in Takanosu Village (as it looks today) (August 1, 2021)

Table 1 shows people who in charge, the area, and the status of trees and bamboos for each of the oyabu in the write-up book. The area for each oyabu does not represent the total area of the depositor's residence, but rather the area where the trees and bamboo were actually growing. In 1837, one hundred and eighty-six years after the designation in 1651, there were 17 oyabus containing Chinese bamboo, 15 oyabus with light bamboo, and some with no bamboo listed.

The most common tree species is cedar, with 272 trees found in the hedges and an average of 77 trees in total, while there are 507 cypress trees, 107 Zelkova trees, and only 8 pine trees. The trend for lumber demand can be seen from these statistics.

In 1616, the Kaga Clan prohibited the felling of cedar, pine, cypress, chestnut, zelkova, nourushi, and Japanese apricot trees in order to secure the timber needed to restore the castle, build the castle town, build bridges, flood control, and for daily life under the "seven-tree rule." The "Peasant Fence Seven-tree" were prohibited the unauthorized cutting of pine, cedar, zelkova, *Japanese cypress*, tsuga, oak, and Chinese bamboo in the premises forests by the clan. The species of trees varied from region to region, and in 1725 the seven trees in Tonami and Imizu counties were pine, cedar, cypress, zelkova, oak, princess tree, and chestnut.

The clan placed a peasant officer under the county magistrate's office to enforce the seven-tree rule. The officials patrolled the villages twice a year, once in spring and once in fall, and called for the head of the association to enforce the seven-tree system. However, as shown in Table 1, the thickets in Takanosu Village were not only made up of seven trees, but also a wide variety of trees, mainly cedar, and were composed of tall trees, medium-sized

Table 1. The area and trees of oyabus in Takanosu Village in 1836

Person's name	The area of oyabu	Trees and shrubs											The number of trees	Bamboo			
		Japanese cedar (Cryptomeria japonica)	Cypress	Juniperus rigida	Hiba-like arborvitae (Species of cypress, Thuja-like arborvitae)	Pine trees (Pinus spp.)	Sugi-like Japanese cedar (Species of cypress, Thuja-like arborvitae)	Japanese zelkova (Species of elm-like tree, Zelkova serrata)	Evergreen oak	Japanese chestnut (Castanea crenata)	Empress tree (Paulownia tomentosa)	assorted trees		Shrub-like bamboo (Miscanthus)	Heaven bamboo (Phyllostachys puberula var. tenax)	Heaven bamboo and Shrub-like bamboo	Daimai
1 栄次郎	100	48	18	2			1	2				6	77			231	
2 与右衛門	48.2	54	7		3	1	1					18	84	51			
3 作助	200	119						17				17	153		643		
4 新左衛門	50	56						12				8	76		280		
5 六郎左衛門	230	11							2			141	154	299			
6 彦右衛門	140	79	11					5	2	1		23	121		8		
7 六藏	200	7	2		1							19	29	No description			
8 六兵衛	90	104	3		1			6				55	169			215	
9 甚五	170	32	1		7			11				15	66			1185	
10 兵左衛門	100	6	0					2				9	17		14		
11 作右衛門	170	138	2					2				140	282	546			
12 孫市	150	133	0	3								249	385		261		
13 六右衛門	150	24	4		1	1	1		1	2		42	76		497		
14 弥右衛門	170	38	0							1		49	88	207			
15 孫七	100	89	29		3							259	380	560			
16 与九郎	150	138	6					1				69	214		99		
17 津右衛門北古屋敷跡	180	217	173		3							110	503	No description			
18 五郎兵衛	130	88	12	17		3					2	33	155			435	
19 才右衛門	170	115										116	231	135			
20 宗右衛門	50	108	24					5				6	143	270			
21 助兵衛	30	9	3									2	14	203			
22 与五郎東古屋敷	140	272	4	5	2	2		10				147	442				26
23 五右衛門北古屋敷	50	10						22				372	404	No description			
24 藤左衛門	140	50	5							1		174	230		292		
25 岩松	50	93	27					3				19	142	218			
26 与兵衛	170	130	120	2	4	1	1					59	317			450	
27 伝四郎西古屋敷	80	66										124	190			71	
28 平三郎古屋敷	250	14	1									527	542	43			
29 三郎左衛門古屋敷	170	67	5					7				291	370		160		
30 長太郎	50	76	2									194	272	5			
31 四郎兵衛	30	10	48	2	4			2		3		6	75		43		
Takasu Village Total	3908.2	2401	507	31	29	8	4	107	5	8	2	3299	6401	2537	2297	2587	26

Created according to "Tonami County Gorin Gorin Yabu Takeyabu Hyakusei Mochiyama Gorin Kizoku etc. Sho Sho Uesincho (Tonami County Yamamawari), May 7th year of Tenpo.

Table 2. Trees and Bamboo in Takanosu Village in 1836

Tree ring fractures	Japanese cedar (Cryptomeria japonica)	Cypress	Juniperus rigida	Hiba-like arborvitae (Species of cypress, Thuja-like arborvitae)	Pine trees (Pinus spp.)	Sugi-like Japanese cedar (Species of cypress, Thuja-like arborvitae)	Japanese zelkova (Species of elm-like tree, Zelkova serrata)	Evergreen oak	Japanese chestnut (Castanea crenata)	Empress tree (Paulownia tomentosa)	assorted trees	Total
3 尺以上	21	1	3	0	3	1	8	4	0	0	6	47
1 ~2.9	850	151	28	16	1	3	72	1	7	2	607	1738
9 寸以下	1530	355	0	13	4	0	27	0	1	0	2686	4616
Total	2401	507	31	29	8	4	107	5	8	2	3299	6401

Created according to "Tonami County Gorin Gorin Yabu Takeyabu Hyakusei Mochiyama Gorin Kizoku etc. Sho Sho Uesincho (Tonami County Yamamawari), May 7th year of Tenpo.

trees, and shrubs, like a stable forest surrounding bamboo. Although the farmers who were entrusted with the property had to manage it by pruning branches and thinning trees, they were able to protect it from the harsh winter winds and snow, alleviate the summer heat, and provide enough fuel for cooking and heating with sumba (fallen cedar leaves and branches) and branches and leaves from thinning the miscellaneous trees. The forest was rich in nature, with seasonal flowers in bloom, small birds and hares, and served as a premises forest.

However, this forest was the domain's thicket, therefore they distributed saplings of trees that were needed, and the farmers who received them grew them. When the domain needed them, they were cut down and removed, leaving only branches and leaves and stumps in their wake, and the farmers were unable to cut them down for use.

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Types and distribution of premises forest

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FUKAMACHI Katsue

Introduction

The Tonami Plain has one of the best dispersed village landscapes in Japan. The premises forest, called "kainyo" in this area, are the main component of the dispersed village landscape and have various functions such as disaster prevention, microclimate improvement, resource use for housing materials, fuel, and food, and health and recreation, forming a unique forest space and residential culture.

A typical premises forest in the Tonami Plain consists of a tall tree layer such as cedar and zelkova and a medium shrub layer such as plum and *sazanka*. Then, to cope with the influence of seasonal winds, cedar trees are mainly placed from the south to the west, centering on the houses, while zelkova and other tall trees are placed in the rest of the forest. A few bamboo trees such as madake are planted on the west to north sides, and fruit trees and flowering trees are planted on the east side. Around 1944, at the end of World War



Fig. 1-1. KD family's premises forest, a conventional type with mainly cedar trees



Fig. 1-2. NJ family's premises forest, a conventional type with mainly zelkova trees

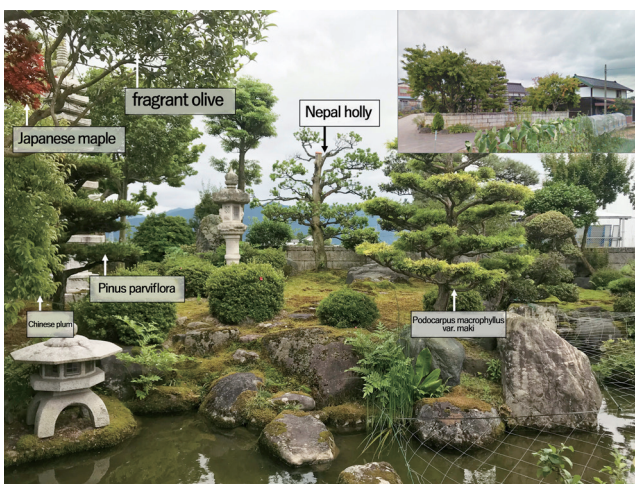


Fig. 1-3. NO family's premises forest, a garden type



Fig. 1-4. The NM family's premises forest, an intermediate type

II, the forests in the Tonami Plain were needed for timber supply and were cut down in large quantities, decreasing the number of trees significantly.

Since then, many farmers have planted new cedar saplings, and cedar trees now make up the majority of the trees in the premises forests.

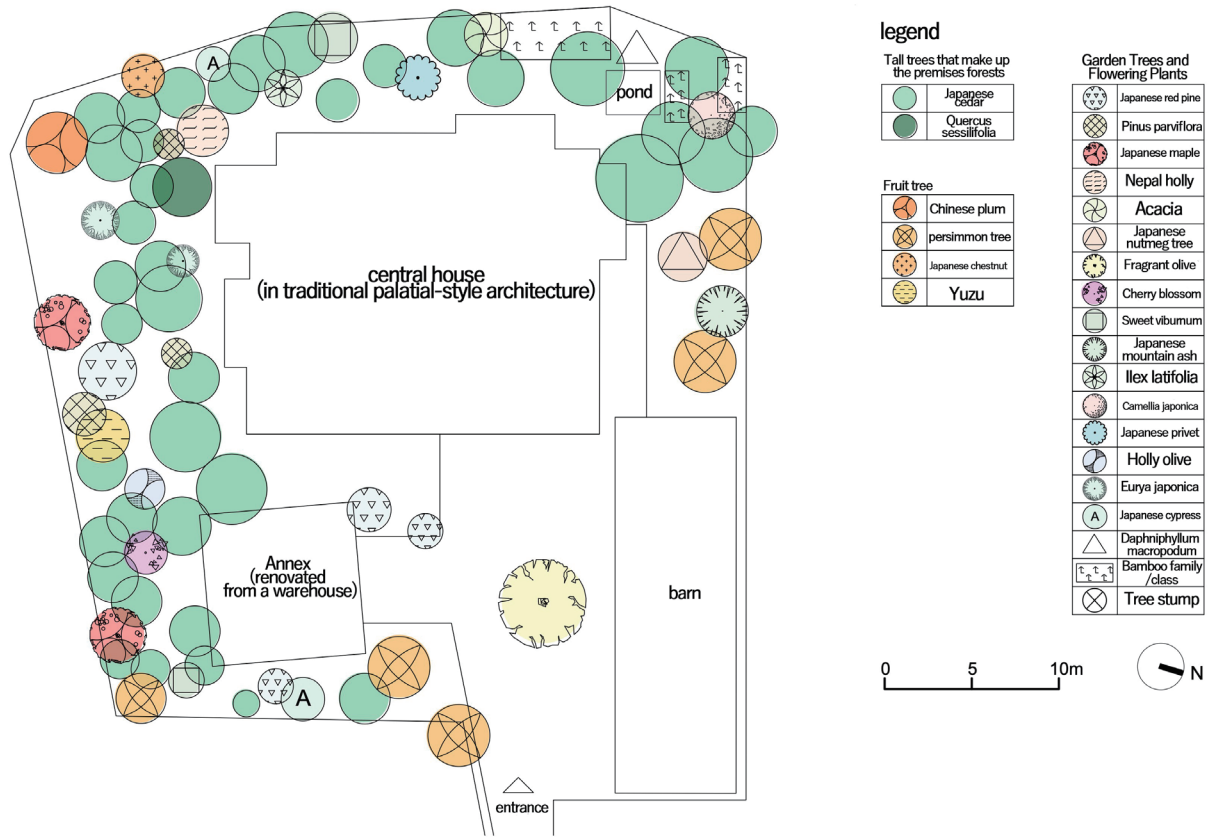


Figure 2-1. Layout of the KD family's premises forest with conventional cedar as the main tree species

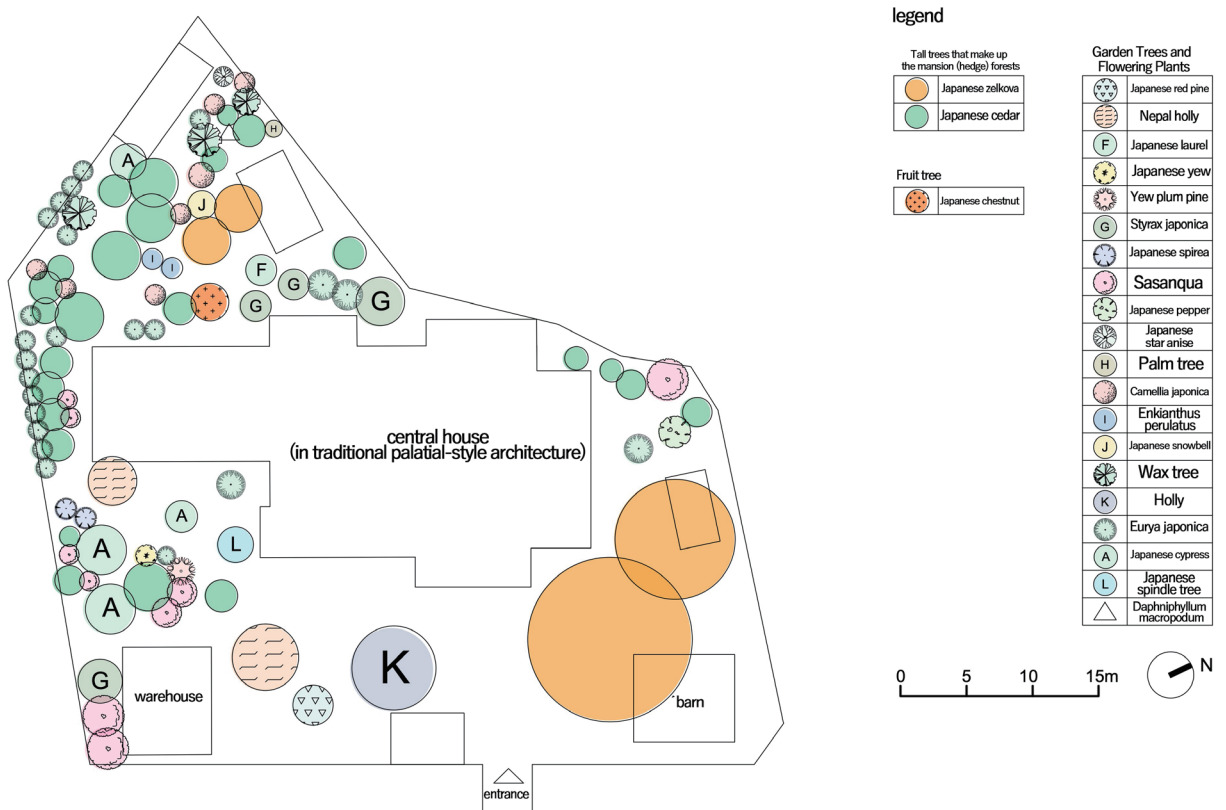


Figure 2-2. Layout of the NJ family's premises forest, with the conventional zelkova tree as the main tree species

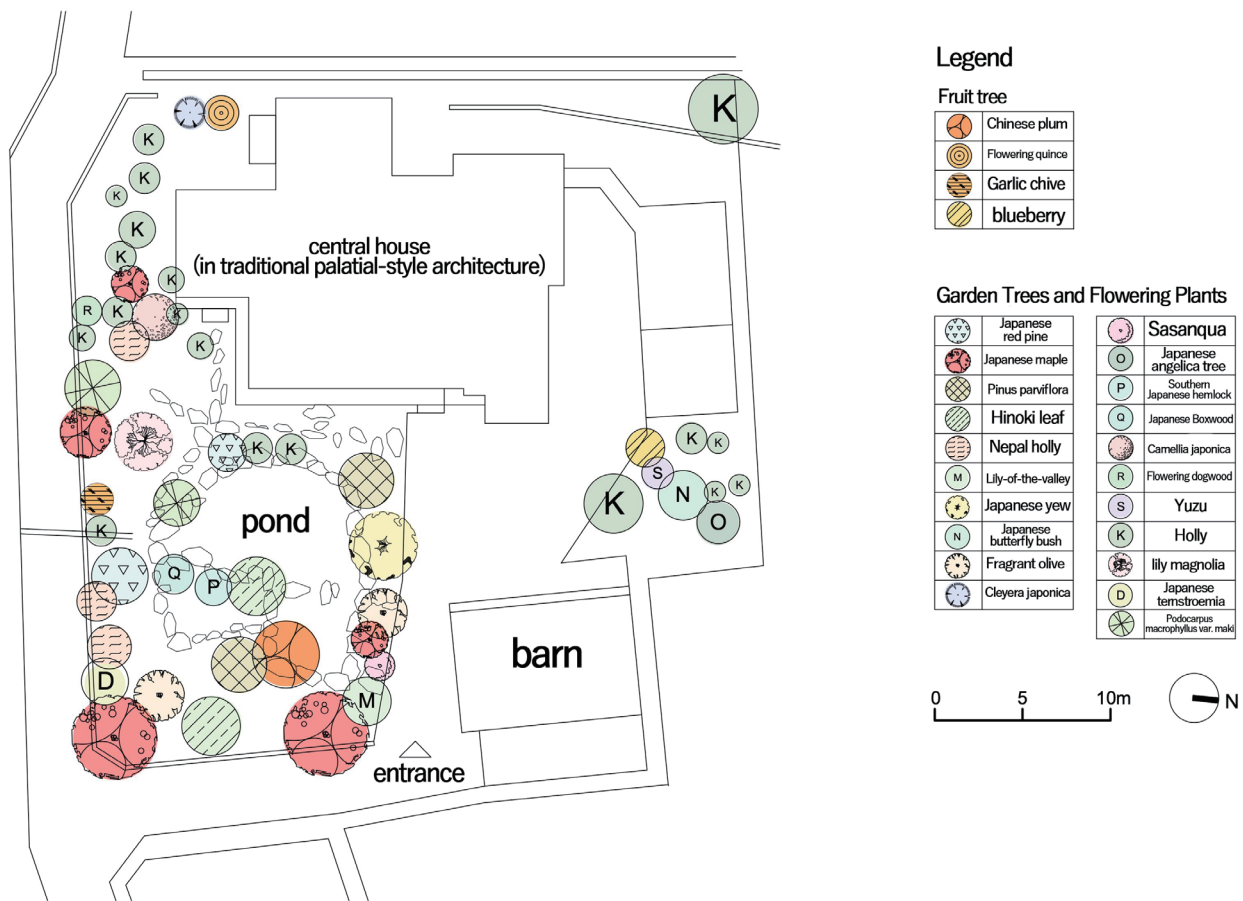


Figure 2-3. Layout of the NO family's premises forest, which is a garden type

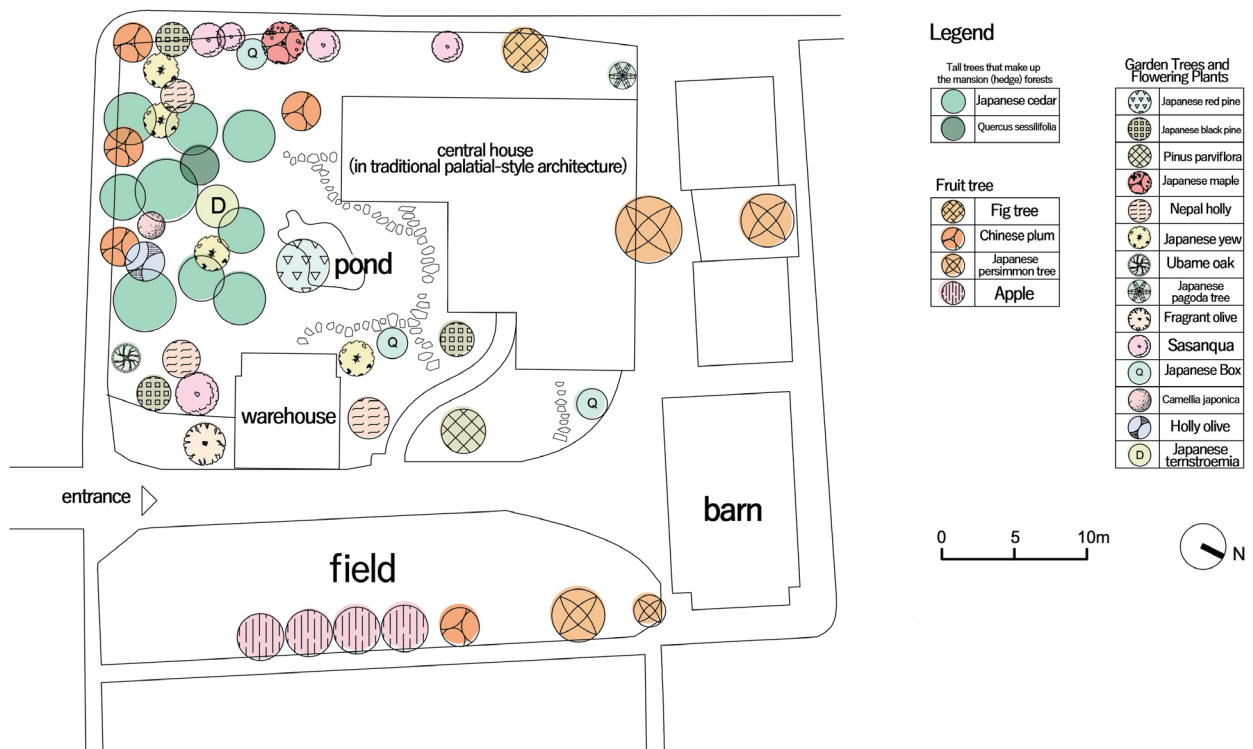


Figure 2-4. Layout of the NM family's premises forest., which is an intermediate type

Types of premises forest

Since the 1960-1964, the natural environment surrounding the premises forest and the

socioeconomic changes in the dispersed villages have changed the form of today's premises forest drastically. The causes of these changes include

(1) the impact of the development of industrial technology and the energy revolution, (2) the impact of farm land consolidation and large-scale public works projects, (3) the impact of the declining birthrate, aging population, and urbanization, and (4) typhoons and other strong wind related disasters.

At present, there are three types of premises forest in Tonami: the "conventional type" consisting of cedar, zelkova, bamboo, etc.; the "garden type" consisting mainly of pine, yellow maple, and Japanese linden; and the "intermediate type" having characteristics of both "conventional type" and "garden type". The following is a detailed look at four examples. Fig. 1-1 shows a conventional-type forest of the KD family which having traditional Japanese cedar forest, and Fig. 1-2 shows a conventional-type forest of the NJ family which having traditional Japanese zelkova forest. Fig. 1-3 shows a garden-type forest of the NO family, and Fig. 1-4 shows an intermediate-type of forest belonging to the NM family.

Layout of premises forest

The common feature of the building layout in the four cases was that the main house was located in the center, with a storehouse on the southeast corner where the wind exposure was weak, and a barn on the northeast corner. Figure 2-1 shows the layout of the KD family's premises forest, which consists mainly of conventional cedar trees. Cedar trees were mostly distributed on the west and south sides of the main house. Bamboos were concentrated on the northwest side of the main house, and there was a pond in a small bamboo grove. Figure 2-2 shows the layout of the NJ family's premises forest, which is dominated by conventional zelkova trees. The zelkova tree is the most representative tree species in the premises forest, with two large trees planted on the northeast side of the main house and one on the west side. Cedar trees were mostly found on the west side of the premises forest, with some on the north and south sides. Figure 2-3 shows the layout of the garden-type premises forest of NO family. A garden-style pond was built near the

entrance on the east side of the main house, and the pond was enclosed by stones. There was no tall cedar or zelkova trees in the NO family's premises forest. Tall trees used to be distributed on the south side of the main house, but in 2004, Typhoon No. 23 caused many cedar and other tall trees to fall. Figure 2-4 shows the layout of the premises forest of NM family, which is an intermediate type. On the east side of the main house, a garden-style pond was constructed between the main house and the warehouse. Cedar trees were mostly concentrated on the southeast side of the main house. Fruit trees were planted in a strip along the eastern edge of the field on the east side of the property.

In the KD and NM families, there was one Japanese white oak on the south side of the main house, which is common in natural forests. In these four cases, fruit trees such as plum, persimmon, and chestnut were dispersed around the main house and along the hedges. Garden trees such as red pine, camellia, and yellow maple were abundant within the forests in the four cases and were distributed mainly on the south and east sides of the houses. In the NJ family, the garden tree, the honeysuckle, was placed in a strip along the hedge from the west side to the south side. In the NO family, holly trees, Japanese white pine, Japanese cypress, and Chinese juniper were distributed around the pond. In the NM family, there were no garden trees or flowering trees on the north face.

Types of trees that make up the premises forest

Table 1 shows the species composition of the forests in the four cases, with the largest number of medium-tall trees per square meter in the conventional type (KD and NJ), followed by the garden type (NO). The total number of tree species was 23 to 24 in the conventional (KD and NJ) forests, followed by the garden (NO) forests. The forests of the intermediate type (NM family) had 20 species. The forests in all four cases consisted of evergreen trees (including tall trees, small trees and shrubs), and deciduous trees (including tall trees, small trees, and shrubs). And evergreen tall trees are

Table1 Tree species composition of 3 types (4 cases) of premises forest

The type of premises forests	Overall site area (m ²)	Number of medium-high trees (Number of trees per square meter)	Total number of tree species	Evergreen trees (number of species)			Deciduous trees (number of species)		
				tall tree	small tree	shrub	tall tree	small tree	shrub
Conventional (KD family)	1,911	75 (0.039)	24	13	5	1	3	2	0
Conventional (NJ family)	2,133	88 (0.041)	23	9	3	3	4	2	2
Garden type (NO family)	1,469	37 (0.025)	25	8	6	2	2	4	3
Intermediate type (NM family)	2,309	51 (0.022)	20	7	7	0	4	2	0

abundant in all four cases. The NJ and NM family had a higher number of deciduous tall tree species than the other two cases.

The tall evergreen trees included evergreen broadleaf trees and evergreen conifers. The evergreen broad-leaved trees identified in two or more premises forests were Japanese white oak, camellia, Japanese linden, and daphniphyllum macropodum, while the evergreen coniferous trees were red pine, yew, Japanese white pine, cedar, and cypress. The small evergreen trees were mainly evergreen broad-leaved trees, and the species found in two or more premises forests were *fragrant olive*, *cleyera japonica*, holly, and *sazanka*.

Deciduous tall trees were mainly broadleaf trees, and the species identified in two or more premises forests were yellow maple, persimmon, and chestnut. In the conventional premises forest of NJ family, the deciduous broad-leaved tall trees were mostly zelkova.

No deciduous shrubs were found in the KD family and no shrubs were found in the NM family. Although the number of species of deciduous small trees and shrubs were low, plum, a deciduous broadleaf small tree, was found in three of the four premises forests, and hyssop, an evergreen broadleaf shrub, were found in two premises forests. There are also various species of evergreen shrubs such as Japanese andromeda and Japanese star anise,

and deciduous shrubs such as hawthorn, Japanese pepper, and rose of Sharon, which have formed a rich forest environment in the premises forest.

In these premises forests, there were also many plum trees, cherry trees, azaleas, and royal azaleas, all of which are enjoyed for their flowers in spring. Flowering trees in summer such as Persian silk trees. In autumn, there are zelkova and yellow maple trees with beautiful red leaves, and spindle trees and persimmon trees that bear fruit. In winter, there were ornamental trees such as the *sazanka*, which flowers, and the Japanese laurel, which bears fruit.

Conclusion

Although there were no major differences in the number of tree species in the four case study premises forests, there were significant differences in the layout and species composition. The layout within the premises forest of each type were unique, with the traditional characteristic of placing tall trees on the south and west sides of the premises forest being inherited. On the other hand, in the garden and intermediate types, many trees were arranged around a pond near the front of the building, and the arrangement of trees in each direction was different. The ratio of the number of trees per square meter of site area was the highest in the conventional type among the three types. Despite the different types of premises forests, trees typical of premises forests were commonly present,

such as Japanese cedar, red pine, persimmon, yellow maple, camellia, and Japanese apricot. They also included a variety of horticultural species and fruit trees, many of which were planted based on each family's lifestyle and preferences and characterized the landscape from season to season. These forests are often made up of tall evergreen and deciduous trees, and although the types of forests differ, they have a unified landscape. Commonly found as small trees and hedgerows are evergreen trees such as *sazanka* and *fragrant olives*. In light of recent natural disasters, it will be important to accumulate knowledge from various perspectives on the disaster prevention and mitigation functions of the forests, and to relate this knowledge to future disaster response and the conservation and management of forests in the area.

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Windbreak effects of the layout of the Premises forest

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Introduction

There is no disputing the fact that premises forests have a windbreak effect. However, why did the people who have lived in the Tonami Plain choose the method of scattering these forests among the many windbreak measures? Also, how were the height of the forests and the distance between them determined? The answers to these questions can never be obtained from a single point of view. In fact, they must have been changed to their current forms through trial and error under the constraints of various external factors. However, this paper dares to consider not only the forests but also the wind-breaking effects of the forests and their layout from the viewpoint of environmental engineering. Even if the engineering study finds a certain rationality in the form of premises forests and dispersed villages, it may be that they are rational from the viewpoint of wind engineering. Even if they are deemed as irrational from the viewpoint of wind engineering, it may be that they are so for other reasons. Therefore, although wind engineering considerations cannot lead to an answer to the above question, I believe that by describing my own considerations in this paper, I can encourage the involvement of considerations from other perspectives.

Wind speed inside and outside the premises forest

At the beginning of this article, I mentioned that premises forest have wind-breaking effects, but to what extent do they reduce wind speed? Aizawa et al. (1980) observed wind speed inside and outside of a premises forest in a dispersed village in the Tonami Plain, and attempted to evaluate the effect of wind speed reduction. They conducted a study

from August 31st to September 2nd, 1979, including wind speed observations in the premises forest located in Goromaru, Yatakamachi, and Ota in Tonami City, respectively. According to the results of this survey, the ratio of wind speed inside the forest to that outside the forest was about 0.2 to 1.3. However, the wind speed outside the forest at the time of the survey was weak (1 m/s to 3 m/s), and the main house was located upstream of the wind observation point in the forest. Unfortunately, it is difficult to evaluate the windbreak effect of the premises forest.

The author's research group has been working on the following research projects from September 19, 2019 to April 6, 2021. Wind speed inside and outside the premises forest using POTEKA (Very High Density Weather Observation and Information Service, Meisei Electric Co. (2.5 m above the ground) were continuously observed. The locations observed are shown in Figure 1. Strong winds blew on March 28, 2021, just before the end of the installation period, and we were able to acquire wind speed data (*1). The wind speed



Figure 1. Location of anemometer

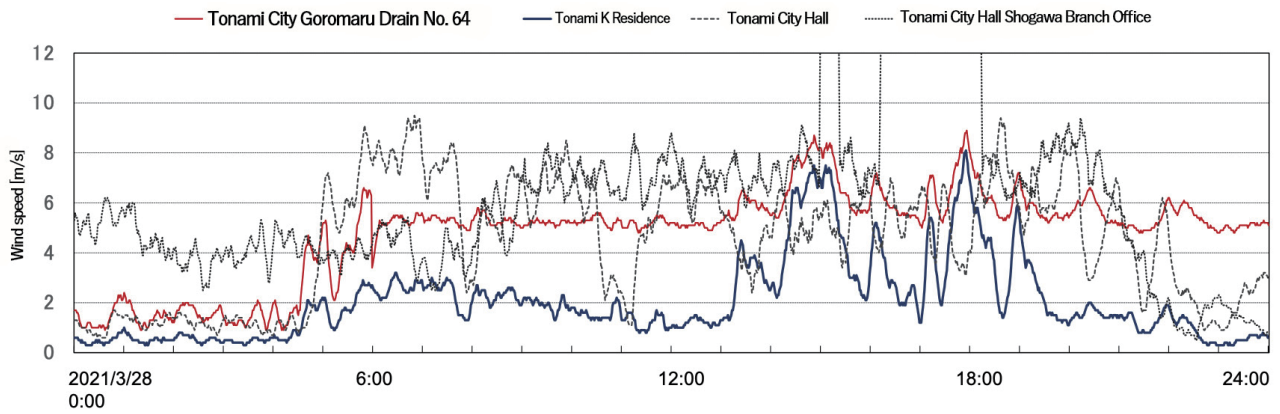


Figure 2. Wind velocity time history for March, 28th 2021

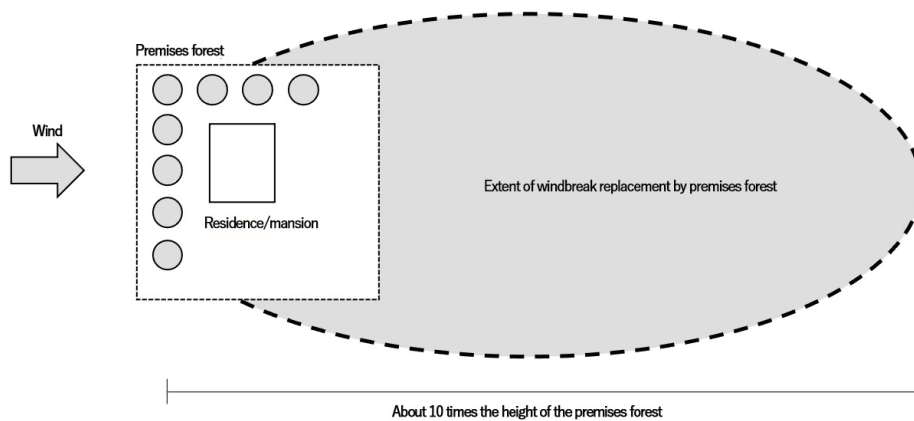


Figure 3. Windbreak effect of premises forest

record at that time is shown in Figure 2. In the figure, "Tonami City Goromaru Drain No. 64" is the wind speed outside the premises forest, and "K Residence" is the wind speed inside the premises forest. The other two wind speeds are the wind speeds observed by POTEKA installed in Tonami City Hall and the Shogawa Branch Office. Strong southerly winds began to blow around 5:00 am. The wind speed outside the forest is about 5 m/s, and inside the forest is about 2 m/s. The ratio of wind speeds inside and outside the forest is about 0.4 at this time of day, indicating that the forest has a significant wind-breaking effect. (Wind speeds inside and outside the forest are close to each other around 15:00 and 18:00, see *1. On other days when strong winds were observed, the wind speed ratios inside and outside the forest were sometimes around 0.25).) In this wind speed observation, since the main house is located right next to the anemometer installed in the forest, the observed wind speed was affected by the main house, and does not indicate

the pure wind-blocking effect of the forest.

Layout of premises forest

The wind-blocking effect of premises forest is not limited to the premises. Studies on the wind speed reduction effect of windbreaks have shown that the wind speed at a point downstream, 10 times the distance from the height of the windbreak, is approximately 60 % to 70 % (for example, reference Kondo (2012)). Figure 3 shows a schematic diagram. According to a series of surveys conducted by Wang and FUKAMACHI in 2020, the height of the forest in Goromaru in the late Meiji period was about 11m. In other words, if we consider the area shown on the right as the range of windbreak effect, it would mean that windbreak effect extends to a distance of about 110 m downwind of the forest. On the other hand, the same survey estimated that the spatial density of the number of houses in the late Meiji period was about one per 9,600 m². In other words, the separation distance between the premises

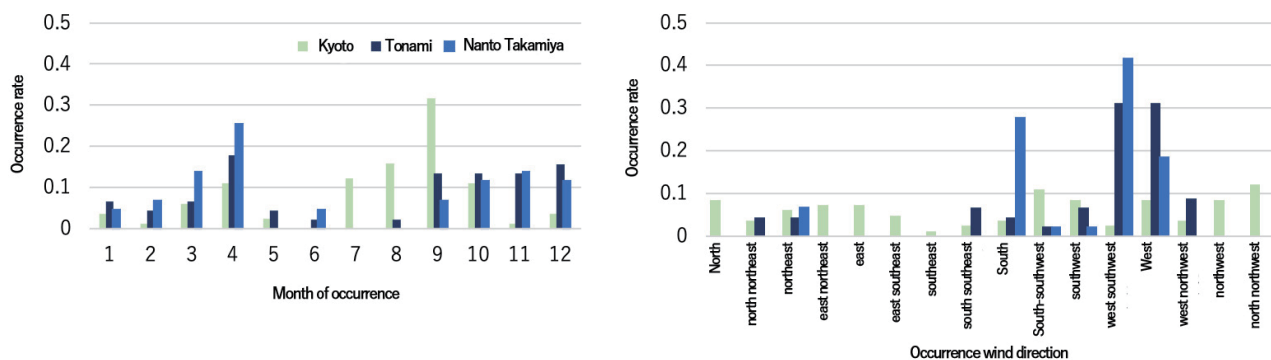


Figure 4. Month of occurrence of annual maximum wind speed and wind direction

forest was approximately $\sqrt{9,600} \doteq 98$ m, which roughly corresponds to the extent of the windbreak effect. This means that in Goromaru in the late Meiji period, the windbreak effect was maintained at a maximum distance between the houses. It is interesting to note such a coincidence. As of 2020, the spatial density of the number of residences had not changed, and the average height of the forests was approximately 6 m.

Statistical characteristics of strong wind occurrence

While a premises forest provides excellent wind protection for the house and its surroundings, it is not an easy task to create and maintain a premises forest. It is thought that the people living in the Tonami Plain have adopted windbreak measures with premises forest because there was a price to pay for the labor, namely, a reasonable reduction in damage from strong winds. To confirm this, the annual maximum wind speed and direction observed at the AMeDAS (Tonami and Nanto Takamiya) located in the southwestern part of Toyama Prefecture was analyzed in comparison with the annual maximum wind speed and direction observed at the Kyoto District Meteorological Observatory as a comparison object. For the analysis, we referred to the historical weather database of the Japan Meteorological Agency.

First, we examined whether strong winds blow every year, in other words, whether the same level of annual maximum wind speed is observed every year. The coefficient of variation (standard deviation

divided by the mean) of the annual maximum wind speed was used as an indicator for comparison (*2). As a result, the coefficient of variation was 18 % in Tonami and 16 % in Nanto Takamiya. On the other hand, in Kyoto, the coefficient of variation was 25 %. Since the coefficient of variation in Tonami and Nanto Takamiya was even smaller than that in Kyoto, where the impact from typhoons is relatively small, it can be inferred that these areas have the same level of strong winds blowing consistently every year compared to other areas in Japan.

Next, Figure 4 shows the results of a comparison of the month in which the annual maximum wind speed was observed and the wind direction at the time the annual maximum wind speed occurred. First, comparing the month of occurrence (Figure 4 (left)), in Tonami and Nanto Takamiya, a high percentage of the annual maximum wind speed is observed around spring. However, the percentage of annual maximum wind speeds observed from autumn to winter is also equally high, meaning winds blowing in early spring are not totally dominant. Next, Figure 4 (right) shows the results of examining the wind direction when the annual maximum wind speed occurs. From this graph, it can be seen that in Tonami and Nanto Takamiya, most of the annual maximum wind speeds are generated by winds from the west to the south. The extremity is obvious when compared to the case of Kyoto shown for comparison. From these facts, it is not surprising that strong winds blowing from the direction from the west to the south have made a strong impression on the memory of people living

in the Tonami Plain and probably caused a lot of damage from strong winds, and as a result, people living there chose to build and maintain their premises forest.

Conclusion

In this paper, we confirm the windbreak effect of the premises forest by observation. As a result, it was confirmed that the wind speed reduction effect was about 60 % to 75 % immediately downwind of the premises forest. Next, comparing the range of the windbreak effect revealed from the existing studies on the windbreak effect of windbreak forests and the spacing of the Meiji era premises forest in Goromaru, Tonami Plain, the results showed that they were generally in agreement. It is a very interesting finding if people before the Meiji era, who did not have anemom, optimized the separation distance based on their own experiences. However, it is also quite possible that the separation distance was determined for completely different reasons, and we hope that specialists in other fields will consider this point. Finally, we have shown with statistical data the fact that in the Tonami Plain, the same level of strong winds blow from the same direction (from west to south) every year. If the people who have lived in the Tonami Plain felt the strong winds blowing from the same direction every year, and as a result, created the premises forest and dispersed villages that remain today, the landscape in the Tonami Plain is evidence to us today that the wind has been blowing as it does today since long before modern observation was made. It is nothing more than a way of life.

Acknowledgements

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- 1 Wind speed of POTEKA installed in Goromaru Drain No. 64 in Tonami City was recalculated manually by removing only the error value because the wind speed value calculation result by the standard algorithm was showing an error after 6:00 a.m. Wind speed values.
 - 2 Data from AMeDAS and weather stations are not necessarily homogeneous throughout the data recording organization due to relocation of observation sites, changes in observation equipment, and changes in observation time intervals. Therefore, for the examination using wind speed values, data after 1976 for AMeDAS Tonami, 1976 for AMeDAS Nanto Takamiya, 1976 for AMeDAS Nanto Takamiya, and 1976 for AMeDAS Nanto Takamiya are used. For the Kyoto District Meteorological Observatory, we used data from 1975 onward. For wind direction, all data for the period of record were used in the analysis.

Thermal environment of the residence and the premises forest

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IBA Chiemi

Introduction

"The form of a vernacular house often reflects its climate", Kenichi Kimura once said. Kimura believed that the form of a vernacular house is mainly determined by the conditions of its thermal environment, and he drew a map of the world based on Bowen's definition of the relationship between form of private houses and its climate, dividing the regions into categories of vegetation based on their thermal climate. The characteristics of private houses in each climate category are shown, and the effects of architectural elements on the thermal environment of private houses are analyzed.

Regarding the thermal environment of farmhouses, which are private houses in the Tonami Plain of Toyama Prefecture, Hoyano et al. have focused on the microclimate control function around the houses in the premises forest, and have studied the effect of solar radiation shielding in summer outdoors. The indoor thermal environment (temperature, humidity, air flow, etc. perceived by residents) has not been fully clarified.

In this paper, we measured the indoor thermal environment of houses with and without premises forests in order to clarify the differences in indoor thermal environment between houses with and without premises forests and their effects on the livelihood of people living there. The results obtained so far are described below.

Surveyed residences and survey method

The survey was conducted in Goromaru, located in the center of the alluvial fan. Surveyed Residence A (Photo 1), which has a premises forest ("kainyo"), and Residence B (Photo 2), where the premises

forest has been mostly cleared. Residence A retains the appearance of a traditional premises forest, and has not undergone any particular insulation renovation, and is a two-story building with no air conditioning facilities. On the other hand, Residence B has been partially insulated and is a two-story building with an air-conditioning system. Since there are almost no tall trees, Residence B is treated below as a house without a forest.

To study the differences in weather conditions inside and outside the premises forest, weather stations were set up at two locations, one inside the premises of Residence A and the other along the



Photo 1. Exterior of Residence A taken from the south



Photo 2. Exterior of Residence B taken from the southwest

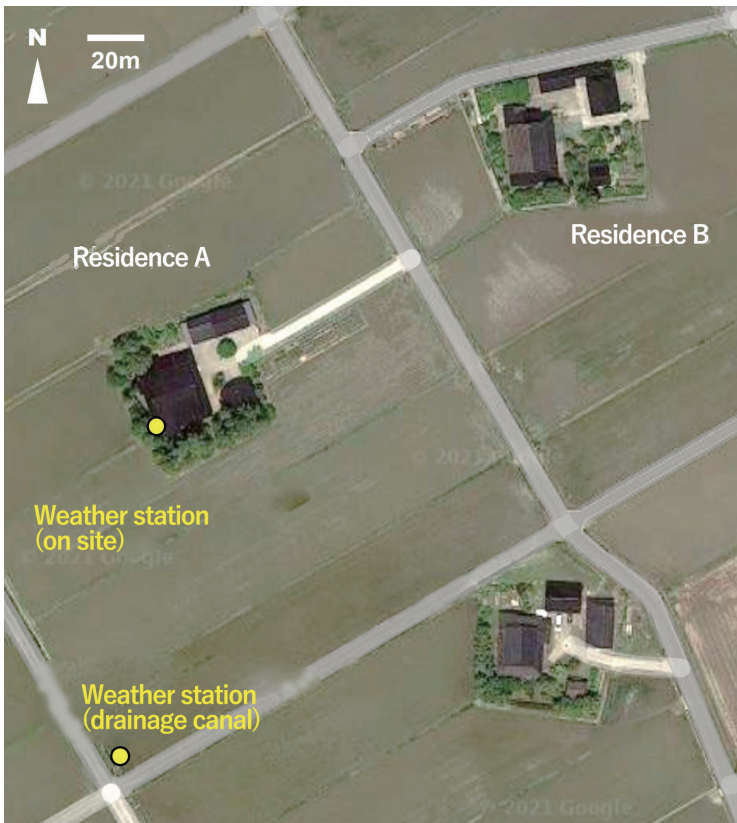


Figure 1. Location of the surveyed residences and the conditions of the premises forest (from Google map)

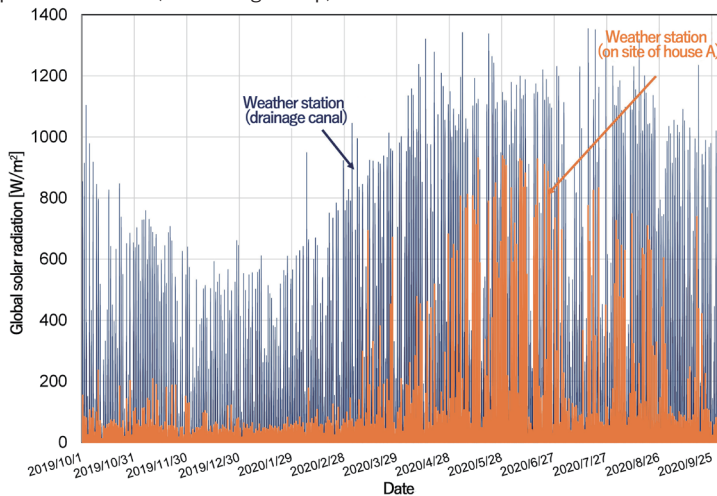


Figure 2. The amount of solar radiation on site of Residence A and along drainage canal (instantaneous values every 15 minutes)

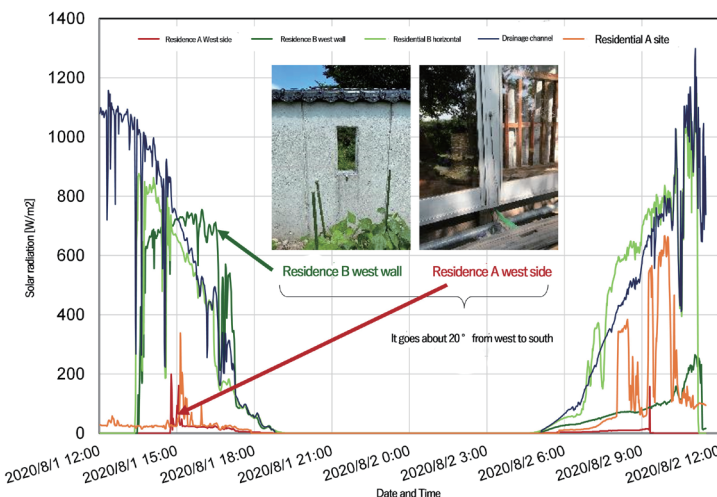


Figure 3. The amount of solar radiation around Residences A and B during the summer survey

offsite drainage canal that runs along the southwest side of Residence A, as shown in Figure 1. The outdoor air temperature, humidity, precipitation, wind direction and speed, and solar radiation were measured. In addition, in order to clarify the differences in the thermal environment of houses with and without forests, temperature and humidity data loggers were installed in 5 to 6 indoor locations in each house (hall, main living room, upstairs room, etc.), and the data was collected for one and a half years (from the end of August 2019 to the end of March 2021). In addition, to gain a more detailed understanding of the seasonal thermal environment, measurements were taken on August 1st and 2nd, 2020 for the summer season, and on February 19th, 2020 for the winter season. When we visited the site we used a thermal imaging camera to examine the temperature distribution on the surface of the house in both summer and winter, and an anemometer and streamer for summer only to determine wind speed and direction in the residence and to determine cross ventilation conditions.

Outdoor microclimate measurements and discussion

This report focuses on the results of the summer survey.

(1) Solar radiation around houses

Figure 2 shows a comparison of the annual variation in solar radiation (horizontal surface) measured on the Residence A site and along the offsite drainage canal, and Figure 3 shows a comparison of solar radiation around Residences A and B during the summer survey. Figure 2 shows that the amount of solar radiation on the site was about

a quarter of that along the drainage canal where solar radiation was unobstructed, from October to March. This is due to the fact that the premises forest in Residence A is thicker on the southwest and southeast sides, and the solar altitude is lower during this period. On the other hand, in June and July, the amount of solar radiation on the site was also high, especially in the morning, and sometimes exceeded 80 % of the amount of solar radiation along the drainage canal. This can be attributed

to the higher solar altitude, which facilitated the exposure of the premises forest to solar radiation.

Next, we compare the solar radiation measurements around residences A and B at the vertical walls facing west of residence A and the west wall of residence B during the summer survey. Note that the walls of both houses are shifted by approximately 20 degrees from due west to south. Figure 3 shows that the amount of solar radiation

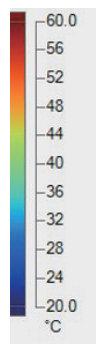
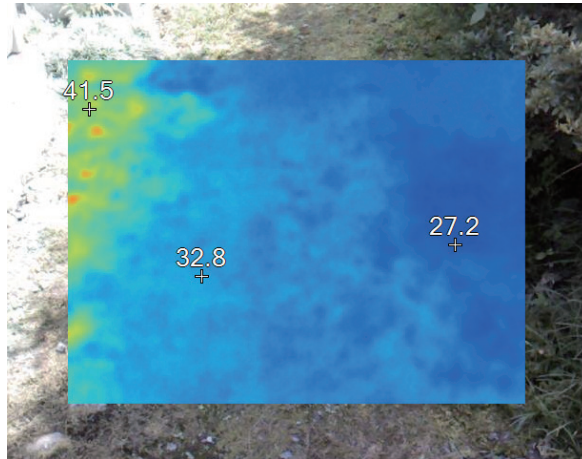
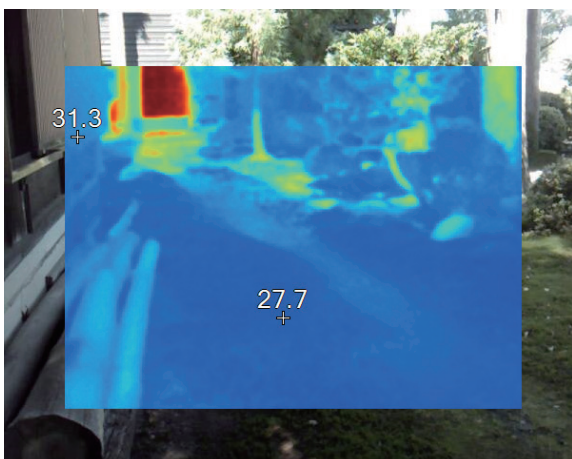
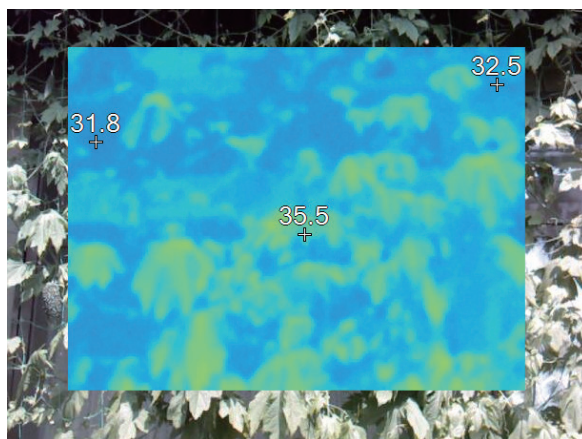
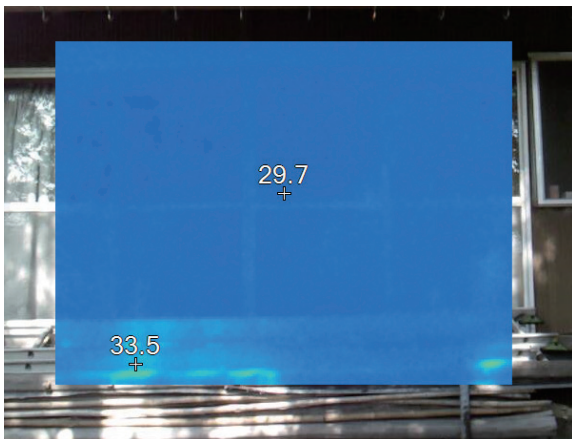
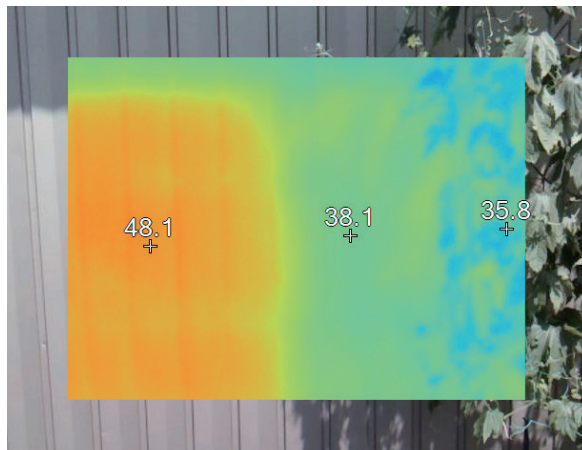
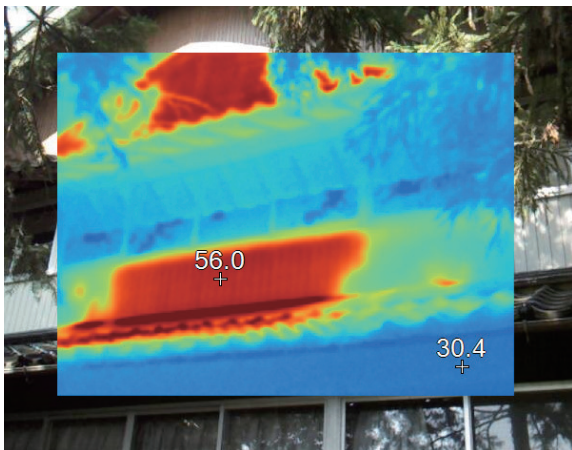


Figure 4. Thermal image of the west exterior wall and ground of Residence A during the summer survey (August 1, 2020, around 15:00)

Figure 5. Thermal image of the west exterior wall and ground of Residence B during the summer survey (August 1, 2020, around 14:00)

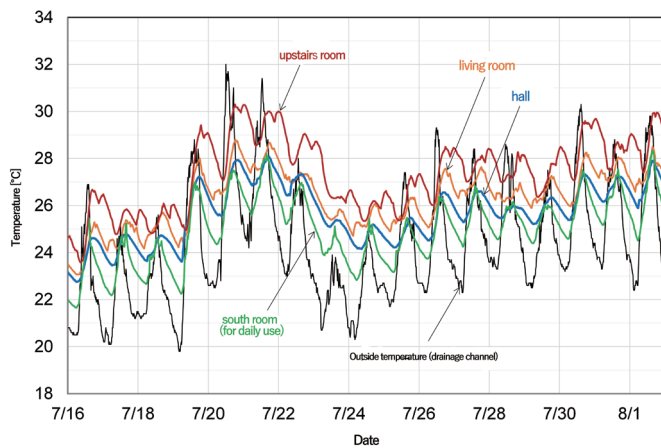


Figure 6. Indoor temperature of Residence A in summer

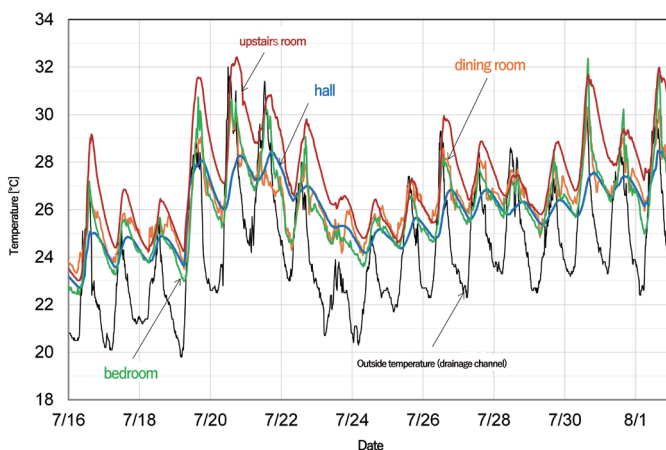


Figure 7. Indoor temperature of Residence B in summer

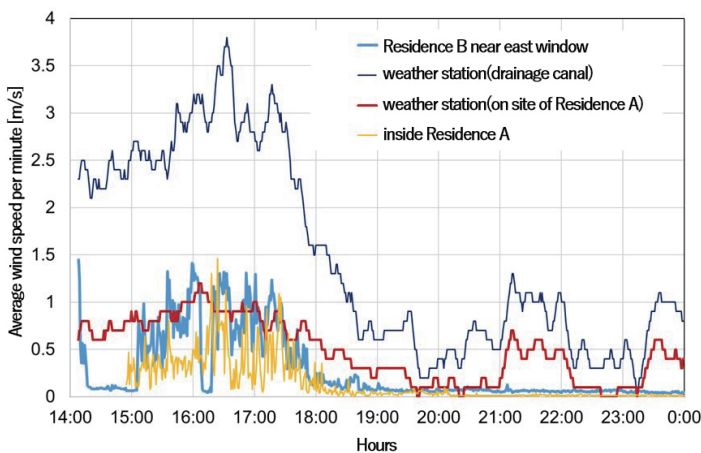


Figure 8. Indoor and outdoor wind speeds in Residences A and B during the summer survey

is higher on the west wall of Residence B in the afternoon, and Temporarily higher on the west wall of Residence A after 3:00 p.m., but very low at other times of the day. This is thought to be because the southwest side of Residence A is surrounded by tall trees, making it difficult for the house to receive western solar radiation, and the Temporary increase is thought to be due to exposure through gaps in the trees. Residence B has no tall trees outside

the measurement point on the exterior of the site, indicating that it is more easily exposed to the western solar radiation.

(2) Thermal image around the house

Figures 4 and 5 show thermal images of the west exterior wall and ground of Residences A and B, respectively, during the summer survey. The outside temperature for both was approximately 29 °C . Figure 4 shows that the temperatures on the exterior wall of the second floor and the top of the first floor shed roof of Residence A, which are exposed to solar radiation, are high, but the temperature on the west side exterior wall surface of the first floor is about the same as the outside air temperature, and the ground surface, which is not exposed to solar radiation, is lower than the outside air temperature. Figure 5 shows that the surface of the exterior wall of Residence B, which is exposed to solar radiation on the first floor, rose to about 48 °C . However, the window surfaces were covered with plants and other measures were taken to prevent heat from flowing into the interior. The ground surface, where it is exposed to solar radiation, reached more than 40 °C , but in the shade it maintained a slightly lower temperature than the outdoor air.

Measurement results and discussion of indoor thermal environment in summer

(1) Indoor temperature

Figures 6 and 7 show the indoor temperature fluctuations of Residences A and B, respectively, during the summer months. Figure 6 shows that in Residence A, the daily temperature change in the hall, which is not directly contact with the outside air, is the smallest, and the temperature in each room does not rise excessively during the day. This is due to the fact that the forest around the house

suppresses the western solar radiation, especially in the afternoon. The south room (room for daily use) facing the outside air has the largest temperature drop at night, and the upstairs room is always hotter than the first floor, but the maximum temperature is about the same as the outside air.

Figure 7 shows that because Residence B is more exposed to solar radiation, room temperatures are higher on both the first and second floors than Residence A, and the temperature drop is smaller at night as well. The dining room and bedroom tend to be warmer during the daytime, although the daytime temperatures are less likely to rise in the halls that are not exposed to the outside air. The reason for the higher temperatures during the day is thought to be due to the direct exposure of the walls to solar radiation. On the other hand, the reason for the difficulty in lowering the temperature at night can be attributed to the fact that the partial insulation renovation prevents heat from dissipating to the outside. For this reason, it was observed that the air conditioner was sometimes running in the dining room.

(2) Ventilation properties

During the summer, both Residences A and B had their windows open during the day for ventilation, but at night, Residence A had its windows closed and Residence B had Japanese transoms which are the upper openings between rooms open.

Figure 8 shows the measured indoor and outdoor wind speeds in Residences A and B during the summer survey. Both Residences A and B showed that when the windows were open in the evening, there was the same level of airflow indoors as on the premises. In Residence B, airflow entered primarily through the windows on the west side during the day and exited through the windows on the north and east sides. In Residence A, where the windows were also open at night, temperatures close to the outdoor temperature were observed in the vicinity of the windows, but because the external wind velocity was small, the indoor airflow was also kept

small. In the dining room, there was not much of a temperature drop.

Summary

The measurement results showed that the amount of incident solar radiation on the exterior walls, etc. of Residence A, which has a premises forest, was greatly suppressed compared to Residence B, which does not have a premises forest. However, even the house with a forest did not provide much shielding from solar radiation on the second floor. The difference in the amount of solar radiation received by the exterior walls of the house with a forest may be the reason why the house within a premises forest is more comfortable in summer than that without a premises forest, as they suppress the daytime temperature rise inside the house. The house without the forest also showed a room temperature that dropped at night, which may be due to the fact that the house was partially insulated.

On the other hand, in the premises forest of Residence A, the difference in temperature and humidity between the inside and outside of the premises forest was found to be small. It seems to be due to sufficient airflow from the outside to the inside of the forest. In addition, there was no significant difference in wind speed during daytime ventilation inside the house when the windows were open, depending on whether the house was surrounded by a forest or not. The house without a forest had transom windows to ventilate during the night, but the external wind speed was low during the survey, confirming that ventilation has little effect on lowering the room temperature at night.

Although the results of the thermal environment in winter are not shown in this report, we experienced that the room temperature in the house with the premises forest is quite low, partly due to the lack of insulation structure, and the thermal environment is not favorable from the viewpoint of health and comfort. It can be said that in houses with premises forests, appropriate insulation renovation of the house will improve the living environment and

make it healthier and more comfortable throughout the year.

The results of this study do not allow for a quantitative evaluation of the impact of partial insulation retrofits on houses that do not have a premises forest. For more detailed verification of this and other factors, we believe that simulation of the indoor thermal environment and numerical fluid dynamics simulation would be useful.

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Trends in policies for the conservation and utilization of premises forest

Dispersed Village Regional Research Institute

KAWAHARA Kuniaki

Dispersed villages in the Tonami Plain

As for the history of these dispersed villages, it is said that the mainstream area of the Sho River, which formed the Tonami Plain, gradually moved eastward and dispersed village-shaped settlements developed in the center of the fan from the end of the Middle Ages to the beginning of the Early Modern Period. Two thirds of the village names that remain today can be found in old documents from the early Edo Period.

Dispersed villages are characterized by two main features. One is, needless to say, the scattering of houses, and the other is the existence of characteristic premises forest that protect the isolated houses. From these two perspectives, we will examine the recent situation, preservation trends, and utilization measures for these important elements of the precious landscape that remain today.

Dispersed village forms: Past and present

Within the village areas, rice cultivation is the basic method of farming due to the abundance and variety of surface water and flow paths utilizing the Sho River's remains, and the advantage of having farmland around the house is preferred.

Dispersed villages on the Tonami Plain, centered around Tonami City and extending into the surrounding area, once numbered 12,000 households according to some records, but now, based on visual inspection on aerial photographs, the number is estimated to be in excess of 7,000 households.

This decrease in the number of households has directly led to a decrease in the number of premises

forest.

In particular, the high economic growth after the war had a great impact on the dispersed villages and landscape of the Tonami Plain.

First of all, it was the land improvement (field development) projects that transformed the visual situation of the Tonami Plain. The wave of mechanization that pushed agricultural work, which was largely done by hand, began in 1962 (Showa year 37), ahead of the rest of the country. Irregularly shaped rice paddies were enlarged to rectangular



Photo 1. Before field preparation (1955-1964) (from GSI aerial photograph)

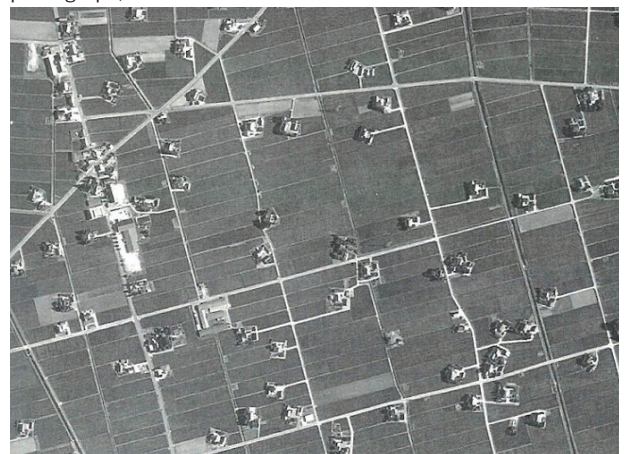


Photo 2. After field preparation (1977) (from GSI aerial photograph)



Photo 3. View of Tonami City (1955-1964)



Photo 4. View of Tonami City (2008-2017)



Photo 5. Factories and residential complexes in dispersed villages (2019)

fields of 30 to 40 ares, and farm roads and irrigation/drainage channels were straightened and improved. The winding, unexcavated aguaducts where river fish lived in abundance and the shores where chestnut trees and other bushes grew disappeared, but the dispersed village form itself remained. The main farm road was replaced by a residential road, and large rice paddies were built around the houses as often as possible. (Photos 1 and 2)

On the other hand, the impact of economic trends on the decline of dispersed villages can be seen in the relationship between dispersed villages and towns. Demachi, in the central part of the alluvial fan, was founded in the early modern period as a result of the maturation of dispersed villages. However, even at the end of the Edo period, Demachi was a small town with an industrial base of only about 200 households. Later, taking advantage of its location, it gradually became the center of the road transportation network, and government offices, business offices, and in recent years, suburban-type stores have been concentrated, reducing the number of dispersed villages in the surrounding area. (Photos 3 and 4)

After the development of the plots, a situation known as the "integration of agriculture and industry" emerged in the dispersed village areas. With the introduction of power tillers and other agricultural machinery, and the trend toward dual employment, a surplus labor force emerged in the dispersed villages, attracting factories and other enterprises. In recent years, with the overseas relocation of the manufacturing industry and the conversion of farmland without

successors, a mixture of business and residential complexes have developed in Demachi, especially in the urban periphery.

This has led to the reduction and transformation of new dispersed village landscapes. (Photo 5)

Premises forest past and present

The situation for the premises forest within and around the dispersed villages is severe. Since the Edo period (1603-1868), there has been a saying, "Sell your land but do not sell your "kainyo"(premises forest)". They were an integral part of daily life, providing shelter from the wind, snow, and sun, as well as valuable timber, fuel, and nuts.

However, most of the roles that were considered important in modern life have become unnecessary, and housing renovations since the period of rapid economic growth have accelerated the decline of the mansion premises forest.

In addition, recent natural disasters, such as Typhoon No. 23 in 2004, which recorded a maximum wind speed of 40.6 m per hour and blew in a northeasterly direction, which is not the usual direction, have caused a great deal of damage and loss of life. In the Tonami Plain, about 20,000 cedars and other large trees fell or tilted. Nowadays, residents' sense of value toward the premises forest of their mansions is becoming increasingly strained thanks to various challenges, such as the aging and decreasing number of household members and the burden of maintenance costs.



Photo 6. Appearance level 4 of a premise forest (almost the entire surface is planted with a series of tall trees that exceed the roof)

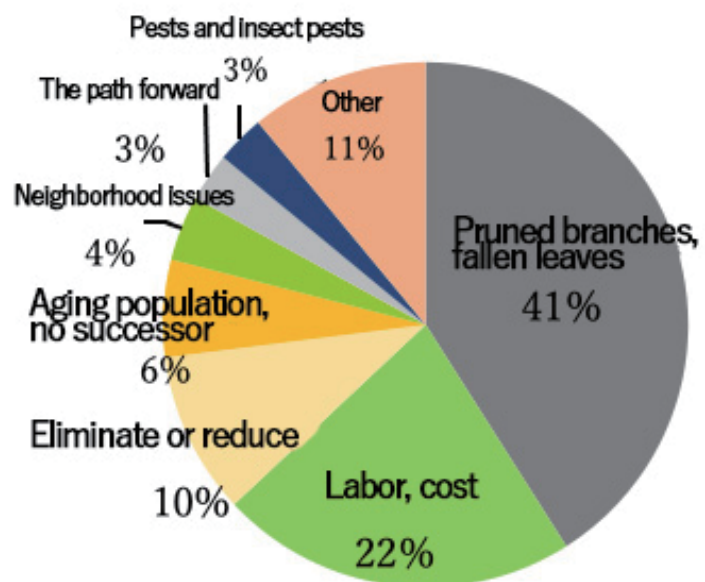


Figure 1. Survey on attitudes toward premises forest (2020)

Tonami City conducted a survey of premises forest in 2020 and a survey of premises forest over 3 m in height. It was the first survey in 17 years since the last survey was conducted in 2003, just before the merger. The number of trees decreased by 10,632 (15.1 %) from 70,543 to 59,911, and the number of households owning trees slightly decreased from 1,900 to 1,802. By species, the number of cedar, zelkova, and ash trees decreased, with cedar decreasing significantly. The number of trees in the respondent households was 123,647, or about 26 trees per household. The decline of cedar trees is particularly



Photo 7. Preferred pruning example (prior)



Photo 8. Preferred pruning example (finished)

significant, and the fact that only 6 % of the households self-identified with the level 4 shape (Photo 6), which used to be the shape of the villagers' premises forest, symbolizes the severity of the conservation of the premises forest in the village.

The survey asked for awareness and opinions about premises forest, and the results are shown in Figure 1. The survey listed a wide range of concerns and difficulties, and we believe that this is where we can find hints for concrete measures for preservation.

Despite this situation, citizens share a historically cultivated awareness of the need for coexistence between people and green spaces including premises forest.

Next, we will introduce the efforts being made in recent years by the government, local communities, and residents to protect scattered living spaces, in addition to environmental aspects.

Conservation measures for the landscape

Tonami City has formulated a landscape community development ordinance and action plan based on the Landscape Law from 2014 to protect, nurture, and pass on to the next generation a favorable environment, including the scattered landscape. Japan, has been a leader in the development of the city's tourism industry.

First, from the owner's perspective, we will discuss the Scattered Landscape Preservation Project. This project is designed to reduce the cost of pruning and pruning of tall trees that require specialized skills, with support from the prefectural government. Taking place in areas (the last 130 areas) where community associations and other local units have concluded "community development



Photo 9. Nyudo Family Residence and the premises forest (before)



Photo 10. Nyudo Family Residence and the premises forest (as it is now)

agreements that make the best use of the scattered landscape".

On the other hand, many residents, fearing falling trees due to recent catastrophes, want to prune trees using special techniques. So training sessions are held for professionals who are responsible for the work to teach each other proper methods for pruning (Photos 7 and 8).

While there is such a support system in place, the current situation is changing mainly for elderly households because of the regularly occurring expenses such as the need for aerial work platforms.

The current state of the forest surrounding the "Azumadachi" house, a prefectural-designated cultural property of the modern traditional house of a dispersed village that has become an elderly



Photo 11. Collection of pruning branches, etc



Photo 12. Chipping pruning branches, etc

household, provides a glimpse of the philosophy and reality of conservation. (Photos 9 and 10)

Next, we begin by discussing the city's efforts as a basic municipality responsible for landscape administration.

In addition to the rural landscape of dispersed villages, there are rich natural landscapes of the Sho River and hill mountainous areas, as well as urban landscapes where commercial and residential facilities have been rapidly concentrated in recent years, and it is desirable to preserve them in harmony with each other. It also states that citizens (including property owners), businesses, and the government should work together to protect and nurture the landscape, which is the pride of the community, with community ties as the nucleus.

We will cover landscape community development projects from the perspective of mutual support in that community.

This is a system to support local community activities such as tree pruning, pest control, and fallen leaves disposal in areas where agreements have been concluded, based on the same regulatory requirements as the aforementioned projects. As villages have shifted from being "places of agricultural production and residence" to "places of residence-centered activities," and as human relations have grown weaker due to the aging of

the population, we feel the need for a concept that allows personal property to be shared as a community asset. Hopefully the circle of support in the community will expand.

Maintenance measures for premises forests

Next, there is an issue that has become a major challenge. Article 16-2 of the so-called "Waste Disposal and Public Cleaning Act" prohibits open burning in principle and adds penalties. Of course, it is understood that there is a risk of infringing on the health of unspecified residents and causing physical nuisances in the neighborhood. Although it is considered unavoidable to light fires with broken branches and fallen leaves from the premises forest in the villages, in recent years there have been some cases of violations of the law that have been reported to the authorities. This is no longer an internal problem of the village, and measures to deal with this issue are urgently needed. For this reason, the refuse incineration facilities operated on a wide scale are accepting pruned branches and grass clippings. Since elderly single-person households may not have the means to carry them out, the city outsources the collection work to the Silver Human Resource Center, which covers part of the cost, and other measures are being implemented throughout the city. (Photo 11)

A movement from the community has also begun to chip pruning branches and other materials using a tree grinder. The chips will be used within the

community for compost for fertilizer and mulch for weed control. (Photo 12)

Next, a "Month of Strengthening" has been set aside since 2021 in order to pass on the premises forest to the next generation. This is a project from the viewpoint of mutual community support for the disposal of pruned branches from the premises forest. The city accepts prunings collected by neighborhood associations free of charge, and the prunings are recycled by a disposal company. A wide range of uses may be expected in the future, such as composting by chipping. Although the cost of bringing in these facilities is high at present, the future of these community premises forest relies on the establishment of this recycling system.

On the other hand, fallen leaves from yard cleanups, which in the past would have conjured up a heartwarming scene as a household bonfire, are no longer so. Even in dispersed villages, people are required to dispose of them in combustible garbage bags and take them to the "garbage collection point". The introduction of special tear-resistant bags (commonly known as "green bags") may be a practical solution. (Photo 13)



Photo 13. Garbage bag for fallen leaves



Photo 14. Activities of the premises forest caring support team

A third initiative is the presence of volunteers. The "'kainyo" Care Support Team," as it is called, assists elderly residents who are having difficulty pruning or cutting down trees around their houses. We would like to keep the circle of "protecting the premises forest of elderly households in need of assistance through volunteer activities" alive. (Photo 14)

Utilization of landscape resources

Dispersed villages are one of the cultural landscapes in Japan that show the way of life and livelihood that has been rooted in the local climate, and are an asset to the region. In order to promote conservation in the midst of change, external evaluation through external information dissemination is also important.

Some information dissemination projects are introduced below. First, there is a photo contest for the scattered landscape, which was held for the 20th time in 2020. Entries are received from outside the prefecture, and the best works are widely used. (Photo 15)

Many people also believe that the charm of the Dispersed Village landscape is worth seeing from a distance. Observation platforms have been established in Tonami City and Nanto City where you can see the seasonal expressions such as sunset, morning glow, in the mist, spring greenery, rice field maintenance, rice planting, and rice harvesting. (Photo 16)



Photo 15. Grand Prize of the contest (2020)



Photo 16. Dispersed village view from the observation platform

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【Life in a dispersed village and its changes: A case study of Goromaru, Tonami City】





Photo courtesy of Eco-DRR Project

Land use changes in Goromaru, Tonami City since the Meiji Period

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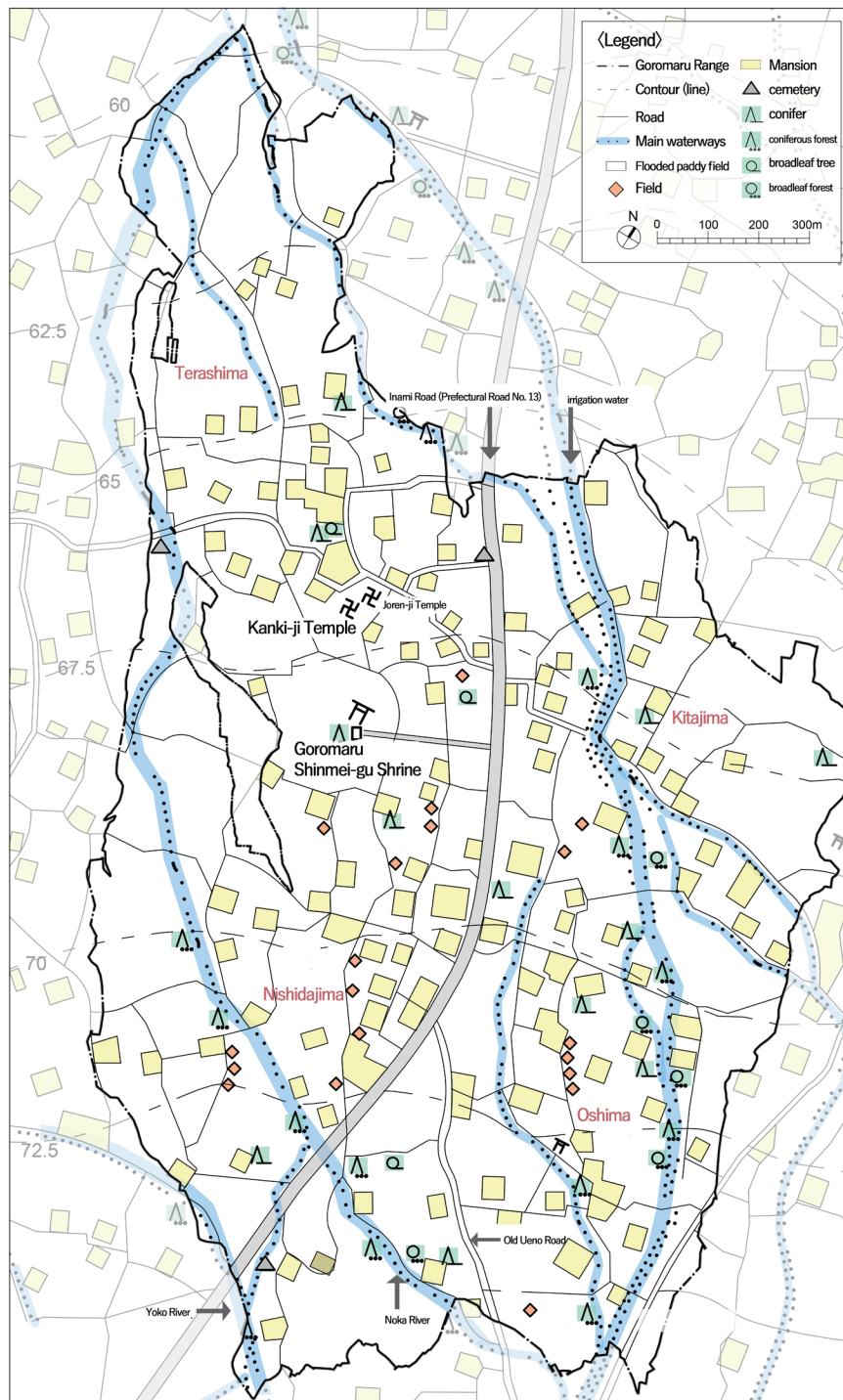


Figure 1. Land use map of Goromaru in 1910

Goromaru's location and social environment

Goromaru, Gokaya district of Tonami City is a dispersed village with an area of about 233 hectares located on a slight elevation in the center of the Sho River fan (the elevation of the center is about 70 m), where new rice fields have been developed since the Edo period. To the north is the Tonami Interchange on the Hokuriku Expressway, located approximately 1.5 km southeast of Tonami Station, with National Route 156 running through the center. Goromaru consists of four neighborhood associations, Oshima (located in the southeast), Nishitajima (in the southwest), Kitajima (in the northeast), and Terashima (in the northwest). Local organizations also include the Public Works Committee, Production Association, Ujiko (parishioner), Children's Group, Hoonko, and Senior Citizens Club.

Looking at the history of administrative divisions, first, in 1871, after the abolition of the feudal clan system, it became Goromaru Village, Tonami County, Kanazawa Prefecture. Then in 1884, it became Goromaru community, Tonami County, Toyama Prefecture. In 1889, it merged with Kanoshima and Aratakaya to become Gokaya Village. In 1952, it became Tonami Town along with other villages due to the merger of town and villages, and in 1954 it became a part of Tonami City, as it's still known as today. As for the number of households and the population of Goromaru, in 1619, there were 10 households, in 1872, there

were increased to 170 households with a population of 949. Then in 1990, there were 149 households with a population of 860. The number of farmers in 1954 was 157 (58 for full-time), but in 1990 the number of farmers decreased to 99 (2 for full-time). According to the 2015 national census, the number of households was 372, with a population of 1237, and the number of workers in the main industries was 186 in the manufacturing industry, 109 in the wholesale / retail industry, 75 in the medical / welfare industry, 62 in the construction industry, and 31 in agriculture. Since the late Showa period (1951 ~), the number of farmers and workers has been decreasing, while the population has been increasing due to the construction of housing complexes.

Land use in the late Meiji period

Figure 1 is a land use map of Goromaru in the latter half of the Meiji period, based on a provisional topographic map from 1910. Goromaru is a slightly elevated area (60-75 m in elevation) that rises from north to south, with a total of 134 houses comprising an area of 22.88 ha. Many residences were clustered around the south side of Goromaru Shinmei-gu Shrine in the center and the north side of Joren-ji Temple and Kanki-ji Temple. The majority of the land was rice paddies, but in addition to the forests, small areas of coniferous and broadleaf forests were distributed mainly along the aguaducts and scattered in the rice paddies near the residences. The wooded areas along the irrigation



Photo 1-1. Toyama Prefectural Road No. 25 Tonami Hosoiri Line before construction (in 1950s) (Photo is provided by Tatsuya Matoike)



Photo 1-2. Toyama Prefectural Road No. 25 Tonami Hosoiri Line after construction (April, 2021)

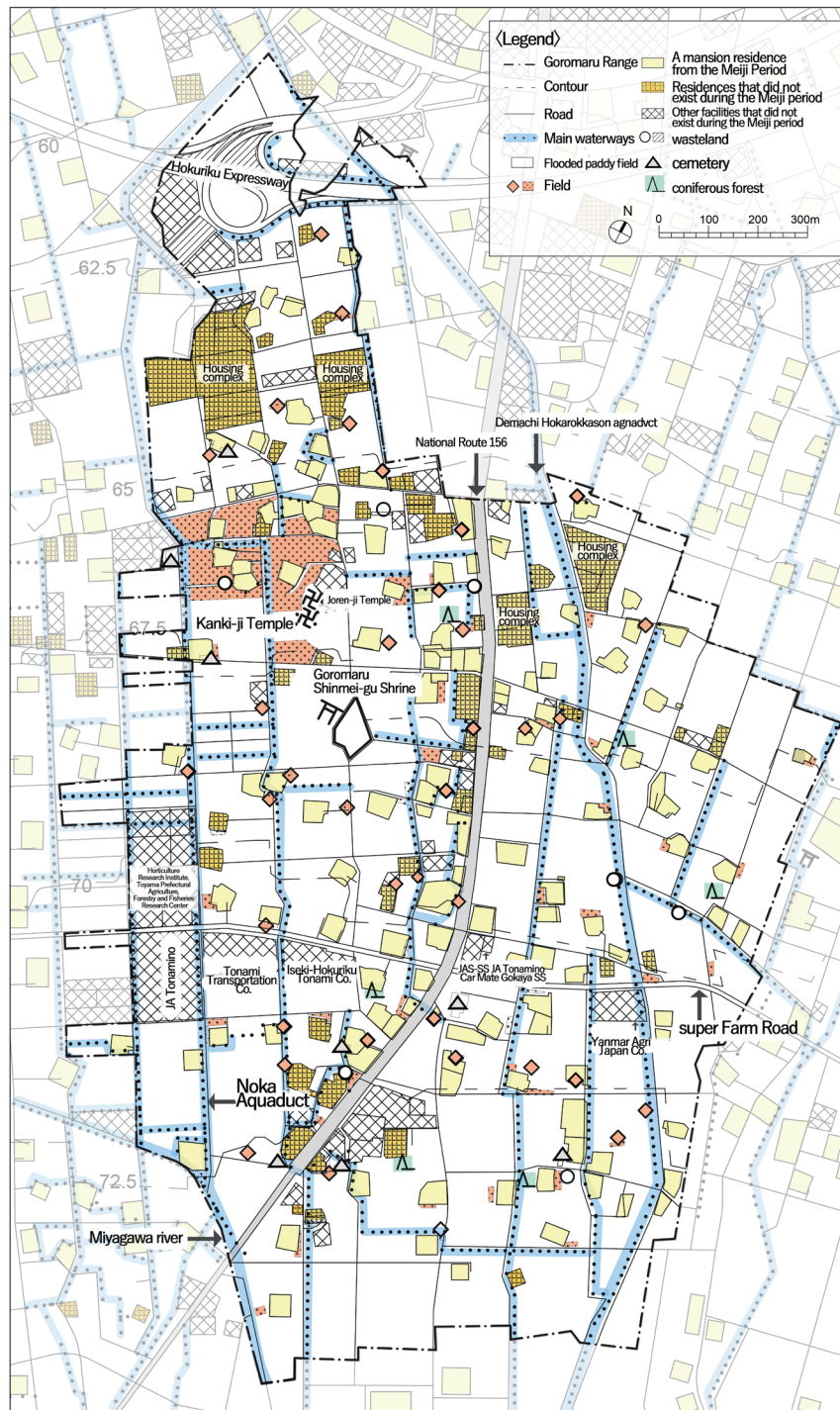


Figure 2. Land use map of Goromaru around 2015~2016

revetments were called Noguro. Fields were small and scattered around the houses.

The main irrigation canals were “Takanosuguchi irrigation water”, “Nokae River” and “Yokoe River”, and in particular, many irrigation canals gathered along the “Takanosuguchi irrigation water” and flowed in a winding



Photo 2. Newly developed housing complex (March, 2020)



Photo 3-1. Farmland before field preparation (1950s, Photo is provided by Tatsuya Matoike)



Photo 3-2. Farmland after field preparation (April, 2021)

manner. The aguaducts that cover the entire area while supplying and draining water to each paddy field approached as it flowed from south to north, and the flow was close to each other at an altitude of around 60 m. The irrigation water was also used as water for daily life in the mansion and as power for the water wheel. The main road was the Inami Road (prefectural road No. 13), which runs north-south through the center, and the old Ueno Road and other roads passed from east to west.

Land use change from Meiji period to Heisei period

In Goromaru, Inami Road (now National Route 156) was opened in 1891. In 1905, the old Ueno Road was repaired, and in the Taisho Period, electric lights were installed. The first time the company's products were introduced to the market was in 1949. In the Showa period (1926-1989), mechanization of agriculture gradually progressed, and in 1936, passenger cars (hired cars) began to be driven. In 1945, the Gokaya Agricultural Cooperative Association was established, and a community center was founded. In 1955, waterworks and village roads around Shinmei-gu Shrine were constructed. Later, the Gokaya Land Improvement District was organized and power tillers and tractors were introduced, further promoting the mechanization of agriculture and the shift to dual employment by farmers.

From 1970, the prefectural field maintenance was

carried out, and the landscape of the dispersed village changed drastically with the expansion of the paddy fields shaped into one area of about 30 to 45 acres, after which the aguaducts and road networks were maintained in a straight line. After the field development, the small subdivisions were abolished, some of the enclaves disappeared, and the boundary regulations for the entire district were readjusted. In the 1970s, road improvements such as the Hokuriku Expressway and Super Farm Road Toyama Prefectural Road No. 25 greatly improved convenience (Photo 1-1, 1-2). From 1985 onward, factories, commercial facilities, and other large scale facilities began to expand near major roads. In the Heisei period, the four-lane expansion of National Route 156 changed the form and layout of houses along the road, and large-scale facilities began to be seen. In addition, new residential complexes were built one after another along the Tonami Interchange on the Hokuriku Expressway. In addition, the area under cultivation of horticultural crops such as onions increased, and the utilization accumulation ratio of farmland to bearers of agriculture increased to more than 80 %.

Land use in the Heisei period

Figure 2 shows the land use map of Goromaru in the Heisei period, which was created by integrating the topographic map of 2016 and the residential map of 2015. Of the 134 mansions in the late Meiji period, 128 were confirmed, and the total area was 20.5 ha. Large-scale housing estates were distributed

mainly in the northern part of the area (Photo 2), and new residences were scattered throughout the area, totaling 12.4 ha in area. Along the Super Farm Road and the Hokuriku Expressway, facilities such as the Toyama Horticultural Research Institute, Tonami Transportation, and Yanmar, as well as hot spring facilities were gathered, with a total area of 17.1 ha. Some of these facilities, covering several hectares, were converted from paddy fields, residences, and woodlands during the Meiji period.

In addition, large areas of rice paddies have been developed (Photos 3-1 and 3-2), along with straight roads and the "Demachi Hokaokkason Aquaduct" and "Noka Aquaduct" are regularly found out throughout the district (Photo 4). The paddy fields were small and scattered near residences, and there were large areas of fields near temples and shrine. The wooded areas along the aquaduct had almost disappeared, and only five coniferous forests were observed near residences. On the other hand, wasteland was scattered near the Hokuriku Expressway and along the houses, roads, and aquaducts, and the location of the cemetery had partially changed since the Meiji period.

Conclusion

In Goromaru in the late Meiji period (1868-1912), the land use pattern was based on rice cultivation, which was common in dispersed villages, as well as the procurement of food, fuel, and other natural resources for food, clothing, and housing from the surrounding environment. The land use patterns have changed drastically since the mid-Showa period (since 1946), as water from the Sho River was efficiently utilized for farmland and other purposes, and land use improvements were devised to cope with natural disasters, but the relationship between people and nature in their daily lives has been diminished.

Since the Heisei period (since 1989), farmland has decreased in Goromaru, and new residential spaces, logistics centers, and commerce have been developed for people moving from outside the



Photo 4. Well-maintained Aquaduct (February, 2020)



Photo 5. Joint work at Goromaru Shinmei-gu Shrine (June, 2020)



Photo 6. Autumn Festival Yomiya Festival in Shrine (2020)

area. Although the population, including young people, has increased, there is a tendency for different generations to have different attitudes toward agriculture including the maintenance and management of residential forests, and opportunities to use and manage the surrounding environment have also decreased significantly. Despite this situation, the main elements that make up the landscape of the dispersed villages and the

cooperative work (Photo 5) and festivals (Photo 6) of the organizations that support local people and livelihoods have continued to this day. A major challenge is how to share the relationship between people and nature and its significance. Mainly including the perceptions and memories of the land from the people living in Goromaru, and how to connect them to the future.

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Construction of houses and communal labor in the Meiji Period

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Introduction

Traditional architecture (風土建築), which has been cultivated in the local climate and culture, can be created using local resources and materials (natural resources), community labor (human resources), and indigenous technology (intellectual resources) as architecture unique to the region (*1).

"Azumadachi and Maenagare", traditional dwellings found in the dispersed villages of the Tonami Plain, are examples of endemic architecture that has been developed and passed down in this region. However, the process of procuring materials from the surrounding area, having the villagers help, and having each craftsmen involved in the construction to complete a single dwelling is not done today, and the details of this process have been lost. In this paper, we attempt to understand the entire construction process of the *Azumadachi* Minka (private house), which was built approximately 110 years ago, by reading the construction-related materials from that time and organizing each task in chronological order. The process of building a traditional dwelling leads to an understanding of architectural culture within a broad framework that

includes not only the building itself, but also the community, indigenous technology, and local materials unique to the area.

Azumadachi dwelling construction documents

In Tonami on July 14, 2017 Mr. KATADA Isao of Goromaru showed us the documents (photos, diaries, account books, etc.) of his family's daily life kept at his home, mainly from the late Meiji period onward (Photo 1). Among them, this paper will focus on the construction of the KATADA Residence in 1912 (the first year of Taisho period) and 1913, the year of preparation and



Photo1. Viewing various documents at the 1 KATADA Residence

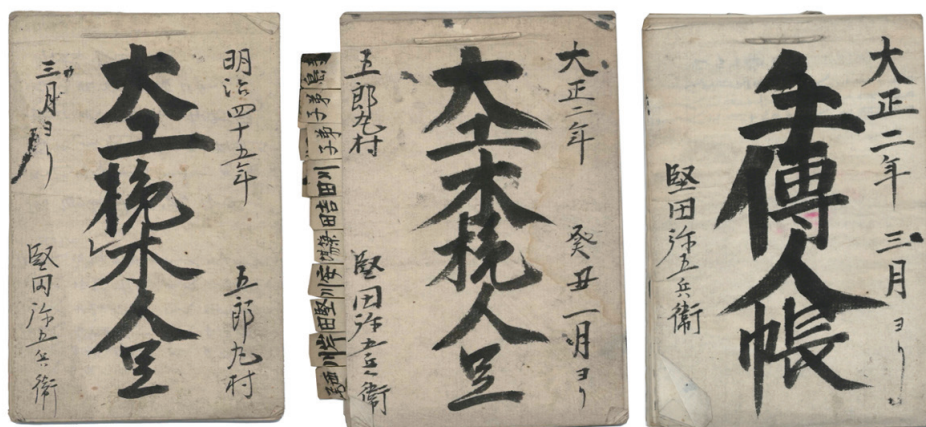


Fig. 1. Some of the construction-related documents

construction of the house. Based on construction-related documents from 1913 (Fig. 1), we will analyze the process by which the *Azumadachi Dwelling* was constructed. In particular, we will attempt to understand the involvement of craftsmen and residents in the construction process, based on records of payments to craftsmen and records of residents' assistance. The names of the villagers mentioned in the documents are written in initials in this report, as they are still used as trade names.

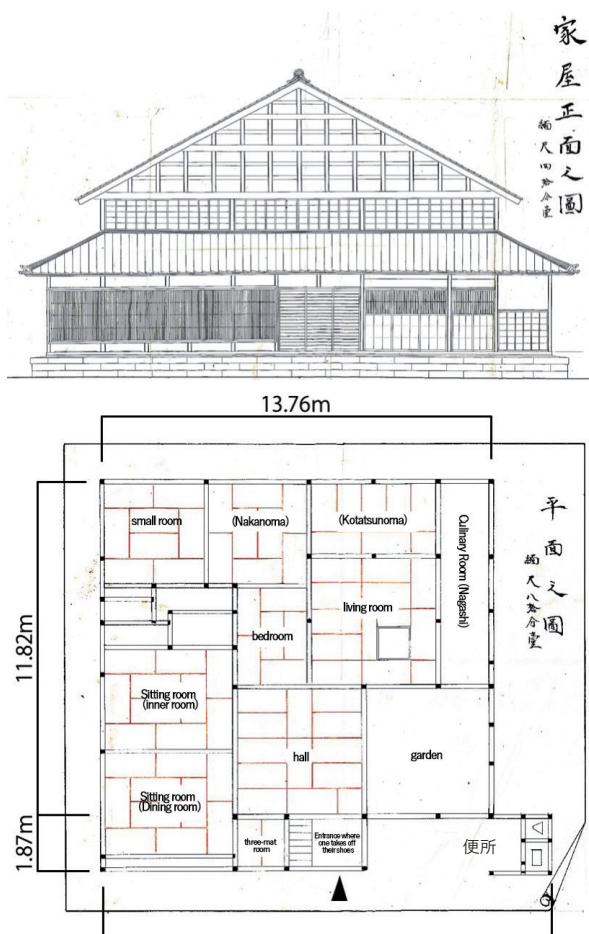


Fig. 2. Front elevation and floor plan (Author's addition to original document)

The construction-related materials are (1) design documents and (2) craftsmen/assistance documents, which are outlined below.

(1) Design documents

The design documents include (1) front view of the house, scaled to 1/40, (2) planar map, scaled to 1/80, (3) Untitled materials (axonometric drawings and beam sub-surface drawings) were available.

Although each drawing is not dated, the envelope containing the set of drawings is dated March, 1912, which indicates the construction preparation period (March to December, 1912) during which the site preparation and material procurement described below took place. It is believed that the drawings were made during the period from March to December.

The main drawings are the "front elevation" and the "floor plan" (Fig. 2). *Azumadachi Dwelling* is a gable-roofed dwelling with the entrance on the east side to avoid the seasonal typhoons of the Tonami Plain, and the front view is drawn on a scale of 1/40. The present dwelling was extended by one room to the south in later years, but the document already depicts such a figure. The floor plan drawn at 1/80 scale shows a typical *azumadachi* dwelling layout, but with the account and back rooms. The hall is not built in a *Wakunouchi* style but in a *chanoma* (tea room) (*2). The main building (main house) is relatively large, with a beam length of 45 *shaku 4 sun 2 bu* (13.76 m), 39' 0" 1" (11.82m) long.

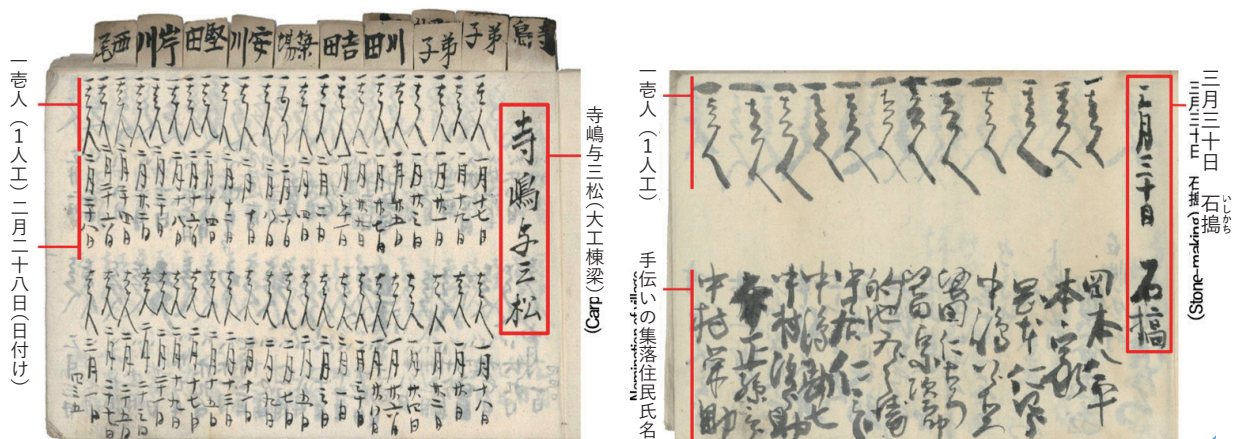


Fig. 3. Examples of entries 3 "Carpenter's Woodsman's Work" (left) and the "assistant work" (right)

The main entrance has a beam length of 51 *shaku* 6 *sun* 2 *bu* (15.64 m). The length of the building is 15.64m and the length of the girder is 6' 2" (1.87 m). The total floor space is 58.1 tsubo (192 m²).

(2) Craftsmen and assistance materials

The artisans and helpers' materials are as follows:

- (1) Carpenter's woodcutter's footprints: from March 1912,
- (2) Carpenter's woodcutter's footprints: from January 1913,
- (3) Handbook: from March 1913.

Mr. Yagobei KATADA, whose name is written on the cover, is KATADA Isao's great-grandfather, and was the landlord of the new house when it was built. Yagobei kept a record of manpower (a unit for the amount of work a person does in a day, which is almost the same as a man-day) for the purpose of paying wages to various craftsmen and understanding the assistance of the villagers. The "Carpenter and Wood Grinder Manpower (from March 1912)" is 39 pages long (including 11 pages of blank pages and the front cover). The following activities are described: wood sawing and carting (transporting lumber), procurement of bamboo and straw, carpentry, and assistance by villagers in wood sawing and hut building (building a carpenter's work shed).

"Carpenters and Woodworkers (from January 1913)" has 71 pages (front cover). The "assistant" is a 45-page book (including the front cover and 3 blank pages) of construction work by carpenters, masons, woodcutters, wall-makers, roofers, and

other craftsmen. There are records of assistance by residents in groundwork, stone pounding (*4), erection, lacquering, and other tasks. Figure 3 shows an example of one of the records. The left side is an artificial record (*5) by a master carpenter, TY1 (Terashima Yosomatsu), and the right side is a record of assistance by villagers in pounding stones, with the residents involved listed by date. Names and artifacts are listed.

Construction process 1: Preparation by craftsmen and assistants for construction

"Carpenter and Wood Grinder Manpower (March 1912-)" records the work of procuring lumber and other preparations for construction. The first page describes the cleanup of the construction site by the villagers: "On March 6, in the house, in front of and behind the house, kogi (yonknnts of woodcutter's cedar), paying ten yen and one square kiro of sake, burnt ash, one place, in the Nakamura River, paying one yen and one square kiro of sake, Kichitaro Yaniba, will do it. The "Kibori Kogi (*6)" is thought to have been the process of removing trees and other materials remaining on the construction site, which were burned to ashes and then discharged into the Nakamura River that flowed nearby. If you look at a map of the area before the Showa period (1926-1989), you will surely see the Nakamura River, a branch of the Sho River, next to the KATADA Residence. The villagers cooperated in the work, paying 10 yen and one square kiro of sake for the root prying work and one yen fifty sen and one square kiro of sake for the disposal work. The company received a sum of money for the project.

Table 1 summarizes the work items, the people involved, their

Table 1. Distribution of work items, total workload, and workdays related to construction preparation

Work item	Worker/Employee	Total manpower	February	March	April	May	June	July	August	September	October	November	December
Sawyer	Mr. KS (village resident)	3.5											
	Mr. NS1 (village resident)	57.9											
	Mr. IF (village resident)	32											
	Mr. NH (village resident)	38.2											
	Mr. KH1 (village resident)	38.8											
	Second son of Mr. KS (village resident)	3											
carpenter	Mr. TY1 (building manager, village resident)	2											
Hoop maker	Mr. SG (village resident)	3											
Cart equipment	Majority population	9.5											
Bamboo Straw Procurement	Majority population	7											
Work item	Employee (Work)	Total manpower	February	March	April	May	June	July	August	September	October	November	December
Assistant	Numerous inhabitants (woodchuck cogging)	29											
	Numerous inhabitants (wood grinders, shed hangers, lumber procurement)	54.5											

total manpower (total workload), and the distribution of work days during the construction preparation phase. The black, gray, and white stripes in the distribution of workdays indicate the days that a large number of villagers were engaged in the work. The bottom row of the table shows a record of villagers helping on February 26, but full-scale construction preparations began on March 6, when the aforementioned root-pulling work began. Work on the wood grinders also began around the same time, on March 9. The work continues from March to December, but since the villagers, who are originally farmers, are engaged in the work as artisans and helpers, they are not allowed to work during the rice planting season in May and the harvesting season from September to December.

First, let's look at the status of the work of the craftsmen involved in the construction preparations. Work related to the wood grinders began on March 9. The six people engaged in woodcutting are all residents of the village, but the name of Mr. KS is written next to that of "Sandanshi" (*7), which indicates that they are engaged in the work from procurement of lumber at the lumberyard in Kanaya (Kanaya, Shogawa town, Tonami City) to material transportation and the construction of the house. The record of his involvement in the construction of the building (carts), the sawing of wood, and even the erection of the building itself suggests that he was in charge of these operations. The actual woodcutting work was done by Mr. NS1, Mr. IF, Mr. NH, Mr. K Mr. H1 was in charge of the project from March 6 to April 27, and The work was done mainly from June 3 to September 3, with a total of 6 people, including Mr. KS's second son, working a total of 173.4 man-hours.

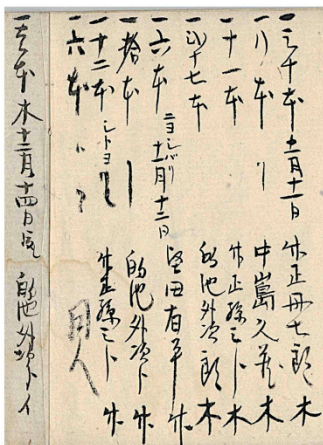


Fig 4. Procurement of wood and bamboo from village residents

Mr. TY1, a master carpenter (a resident of the village), was engaged only for two days on March 9 and 10. It is believed that meetings were held on these two days to discuss the procurement of necessary lumber for the construction. Mr. SG for making tubs

(a resident of the village) reported the following dates in April: unknown (for one day), 17 th, and 28 th. In total, the "tubtn foot-washing" was made in three days.

The carts are 9.5 man-made in total, and four residents from inside and outside of the village are involved in the work. Mr. KS (village resident), plus two others, Mr. YM and Mr. NK1 (village unknown). On July 24 th, one Mr. NK1 went to "Kanaya-no Zaimoku Gen-ni Gyo", which means "to the lumber store in Kanaya". The lumber was transported from the lumber yard in a half-day operation (3.5 man-hours in total). In addition, on July 1 and August 11, NK1 made a half-day trip as you can see, the wall soil material was transported from Yassui Village (Yassui, Nanto City) (*8) (2 man-made in total). Other destinations are not listed, but the following two trips were made on August 19, 29, and September 5 (a total of 2.5 man-hours). (village resident) on December 1 and 2 (total of 1.5 man-hours), and Mr. TM (village resident) on December 1 and 2 (total of 1.5 man-hours). Mr. NK1 was engaged in the transportation of the cargo.

Bamboo and straw materials were purchased on September 4 from Mr. NK2 for 6.3 kan (6 kan 300 me (1kan = 3.75 kg, 1 moku = 3.75g)), Mr. OM gave a weight of 6.1 kan (6 kan 100 me), and Mr. NH1 gave a weight of 8.8 kan (8 kan 800 me). On September 5, YY1 sent an 8.8 kan (8 kan 800 moku) weight. On November 16, 82 bamboo materials were purchased(*9) from Mr. MT of Higashi Bessho Village (Higashi Bessho, Tonami City) . 200 bundles of straw material were purchased from Mr. DJ on September 6, and on November 12, 280 bundles from Mr. TM were purchased.

Next, let's look at the assistance of the village residents in preparing for construction. "Kibori Kogi" was constructed on March 6 (total of 11 man-hours), March 9 (total of 10 man-hours), and March 10th (total of 8 man-hours), ,resulting in a total of 29 man-hours being recorded. The work of woodcutting, shedding, and lumber procurement began in earnest on March 6, and a total of 54.5 man-hours were recorded. From March to April, the residents help with the wood grinding, and from June to August, they help with lumber procurement at the lumberyard in Kanaya. From September to December, the carpenters built their work huts, as described in the "Koyagake" section.

Table 2. Distribution of total workload and workdays of carpenters, carpentry helpers, and hired carpenters

Work item	Worker/Employee	Total manpower	January	February	March	April	May	June	July	August	September	October	November
Sawyer	Mr. TY1 (building owner, village resident)	154											
	Mr. C (apprentice)	142.5											
	Mr. K (apprentice, Horuchi Village)	129.5											
Carpenter's assistant	Mr. KH2	12											
	Mr. IS2 (Sugiki village)	11.5											
	Mr. YY2	3											
	Second son of Mr. KJ (village resident)	27											
	Mr. YS (village resident)	17.5											
	Mr. YK (village resident)	19											
	Mr. KE (village resident)	33.5											
	Mr. KJ (village resident)	15.5											
	Mr. NK3 (village resident)	21.5											
	Mr. NS2	7											
	Mr. NC1 (YS disciple, eldest son of Mr. NT)	23											
	Mr. NH (village resident)	55											
	Mr. NS1 (village resident)	41											
	Mr. I (Demachi)	18											
	Mr. O (YS disciple, Demachi)	23											
Hired carpenter	Mr. OK	11											
	Mr. TY1	16											
	Mr. MC	20											
	Mr. TY2	23											
	Mr. SC	21											
	Mr. OK	10											
Mr. TF	11												

Table 3. Distribution of total workload and workdays for masonry, wood milling, and roofing

Work item	Worker/Employee	Total manpower	January	February	March	April	May	June	July	August	September	October	November
Mason	Mr. IS2 (Nishinakano Village)	7.5											
	Mr. IK (Nishinakano Village)	4.5											
	Mr. NS3	4											
Sawyer	Mr. IF (village resident)	3											
	Mr. UH	7											
	Mr. TS (Noto)	8											
Wall shop	Mr. NR (Otsuji Village)	23											
	Mr. YY3	13.8											
	Mr. OS (Old Ueno Village)	1											
	Mr. OT (Old Ueno Village)	2											
	Mr. SY (Old Ueno Village)	12											
	Mr. MG	5											
Roof	Mr. NC2	8											
	(No names listed, 2 persons)	7.5											
	(Name not shown)	3											

Table 4. Distribution of total workload and working days of village residents' help.

Work item	Overseers (Work Contents)	Total manpower	January	February	March	April	May	June	July	August	September	October	November
Assistant	Majority of residents (ground)	50											
	Many inhabitants (stone making)	46											
	Majority of residents (construction)	78.5											
	Many residents (lacquer painting, other help)	32											

As shown in Fig. 4, the final page of "Carpenter Kobiki document(March 1912-)" has a description that eight villagers (near KATADA's residence) provide wood and bamboo. The contents are as stated below.

- I 30 timbers, November 11, Mr. TT Wood.
- I 8 timbers Mr. NK Wood
- I 11 timbers Mr. TM Wood
- I 27 timbers Mr. MS Wood
- I 6 trees November 12, Mr. KY bamboo
- I 10 trees Mr. MS Bamboo
- I 12 trees Mr. TM Bamboo
- I 6 trees Mr. TM Bamboo

I 1 timbers, delivered on December 14, Mr. MS Wood"

There is no mention of payment here, and it could be that the materials were provided by a neighbor's premises forest.

Construction process 2: Construction work by craftsmen and helpers

The "Carpenters' Woodworkers' manpower (from January 1913)" and "Assistance (from March 1913)" show how the houses were built through detailed records of the craftsmen and village residents at each step of the process. The construction period was about eight and a half months from mid-

January to early October, and on January 17th, they started carving wood such as pillars and beams as the "beginning of chonna".

First, we will look at the details of artisanal construction work. Table 2 shows the work items and persons engaged, as well as their total manpower (total workload) and distribution of workdays for carpenters, carpenter assistants, and hired carpenters; Table 3 shows the work items and persons engaged, as well as their total manpower (total workload) and distribution of workdays for masons, wood grinders, wallers, and roofers. The black workdays are 1 manpower and the gray are 0.5 manpower. The carpenters are Mr. TY1, the master carpenter, and Mr. C and Mr. K, who are described as "TY1 apprentices". Two apprentices were employed for the entire construction period from January 17 to October 4 (261 days), especially from the start of construction to July 9 (176 days). Mr. TY1's total manpower was 154 days, and Mr. C and Mr. K's workdays were 142.5 days and 129.5 days respectively, roughly the same amount of work. The three professional carpenters were assisted by 15 carpenters, at least eight of whom were village residents, according to an interview with KATADA Isao. Most of the carpentry assistants finished their work on April 7-8 after the erection, but Mr. NH and Mr. NS1 have been engaged throughout the entire construction period. Mr. I and Mr. O of Demachi town (Demachi, Tonami City) worked only from January to February before the construction. In addition to the "yatoi" after the name in the data, are seven hired carpenters who were engaged in the finishing work from early September to early October, during the final stage of the construction.

The first work of the stonemasons was done by Mr. NS3 from April 1 and it is thought that the foundation stones for the construction of the stone site were laid in preparation for the erection of the building, which began on April 4. In addition, two masons from Nishinakano Village (Nakano, Tonami City) worked for several days each in early and late June and mid-September, and this is thought to be

work around the retaining wall of the fill where the stones are finished.

As for the Kobiki (sawyer), two people (one of them a resident of the village) worked on the erection from March 30 to April 5. In addition, one Noto sawyer is engaged from the end of August to mid-September, as indicated by "sawyer Noto" instead of his name, but the nature of his work is unknown.

There are as many as seven people working on the mud walls, including one from Otsuji Village (Otsuji, Tonami City) and three from Furuueno Village (Furuueno, Shokawa town, Tonami City), with craftsmen from outside the village listed. All seven workers were engaged in the main work periods from April 11th-18th and April 28th-May 12th. Considering that it is the work immediately after the construction, it seems that it is the work of shaving the wood under the wall and painting the rough wall. In addition, the two are engaged in finishing coating from June 30th to July 10th, and are doing additional work during the few days from August to October.

Although the roofer's name is not listed, there is a description of "noshi thatching (bark thatching)" on the "main building" on April 10-13, after the erection of the roof, which indicates that the roofing was done with bark instead of tiles as originally planned. The roof was changed to a thatched roof. In addition, the roofing of the entrance area was done from June 22 to 24.

The daily wages paid to these craftsmen were: carpenter: 0.55 yen/day, roofer: 0.55 yen/day, wood grinder 0.55 yen/day, wall-maker 0.58 yen/day, and stonemason 0.65 yen/day. The daily wage varies slightly depending on the type of work.

Next, let's look at the records of the village residents' assistance. Table 4 shows the number of people assisted by the villagers (50 in all, 8 days from March 22 to 29), stone pounding (46 in all, 5 days from March 30 to April 3), construction (78.5

Table 5. Detailed status of help in procurement of materials and house construction (main help)

Year of implementation		1912年(Meiji 45)		1913年(Taisho 2)																Total population by assistant	
Date of implementation		3/6	2/26	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6		4/7
		3/10	4/13																		
Work item		canal cogl	sawyer Hut Timber Procurement	Settlement								Stone-making				Construction					
1	Same village	2	7				1	1		0.5	1	1					1	1	1		16.5
2	Same village	3															1	1			5
3	Same village	3	3				1	1			1	1					1	1	1		13
4	Same village	3	2				1	1			0.5	1	1				1	1	1		12.5
5	Relatives	1	1.5						1	1		1					1				6.5
6	Same village	3																			3
7	Same village	3															0.5				3.5
8	Same village	3																			3
9	Same village	3	0.5																		3.5
10	Same village	3																			3
11	Relatives	2	9		0.5	1	1		1			1	1		0.5		1	1	1		20
12	Relatives		8	1		1	1	1	1												13
13	Same village		0.5		0.5																1
14	Relatives (other villages)		1.5									1	1		1	1	1	1			7.5
15	other villages		2																		2
16	Same village		1								0.5	1					1				3.5
17	—		0.5			1			1												2.5
18	Same village		1.5					1	1			1					1	1			6.5
19	Relatives		2.5			1	1			1		1					1	1			8.5
20	Relatives		0.5															1			1.5
21	Relatives		0.5							1	1	1			1	0.5	1	1	1		8
22	Same village		0.5																		0.5
23	Same village		3.5				1	1				1					1	1	1		9.5
24	—		2										1								3
25	—		1																		1
26	Same village		1.5				1	1				1					1	1	1		7.5
27	Same village		1															1			2
28	Same village		1.5														1	1	0.5		4
29	—		2																		2
30	Same village			1					1												2
31	Same village							1				1					1	1			4
32	Same village							1													1
33	Relatives								1			1					1	1			4
34	Same village								1			1					1				3
35	Same village							1	1			1					1	1	1		6
36	Same village							1	1			1					1	1			5
37	Same village								1	1		1					1	1	1		6
38	Same village								1	0.5		1					1	1	1		5.5
39	Same village										1	1					1				3
40	Same village								1												1
41	Same village									1		1					1				3
42	Relatives											1					1	1			3
43	other villages											1					1				2
44	Relatives (other villages)											1					1				2
45	other villages											1	1				1				3
46	Relatives											1					0.5				1.5
47	Relatives											1					0.5				1.5
48	Relatives											1	1				1				3
49	Same village											1									1
50	Relatives (other villages)											1	1				1				3
51	other villages											1									1
52	Same village											1									1
53	Same village											1									1
54	—												1				1				2
55	—																1				1
56	Same village																1	1			2
57	Same village																1	1	1		3
58	Relatives											1					1				2
59	Same village																1				1
60	Same village																1				1
61	other villages																1				1
62	—																				1
63	—																	0.5			0.5
64	Relatives																1				1
65	Same village																			1	1
66	Same village																		1		1
67	—																				1
Total population by work		29	54.5	2	1	4	8	9	10	9.5	6.5	34	8	0	2.5	1.5	39.5	24.5	13.5	1	258
				50								46				78.5					

man-hours, 4 days from April 4 to 7), lacquering and other work (32 manpower in total, March to September). The following tables (5 and 6) show the total manpower (total amount of work) and distribution of work days for each village resident.

The first day (March 22) was for "digging up drainage ditches" and the second day (March 23) was for "digging up water intake ditches". On March 22 and 23, two and one man-hours, respectively, were used for "soil removal" (removal of waste soil), a pre-filling operation. The six days from March 24 to 29 were for groundwork, with 4 to 10 people working each day. On March 30th, 34 residents were engaged in "Ishikachi," which is ground tamping work, and the next day, March 31 st, as described in the description of "atomatai" (*10) t, the cleanup work had already begun, indicating that the main work of stone pounding was completed in a single day.

The "construction" process, in which the main structural materials are assembled, was completed over three days from April 4 to 6 with the involvement of many village residents (April 4th: 39.5 man-hours; April 5th: 24.5 man-hours) The description on the first day of construction on April 4th states that 13 carpenters and 4 wood grinders worked with their helpers. On April 7th, "Tachimai" was written, which indicates that the building was completed, followed by "Yane No Komai Uchi", which is the foundation of the earthen wall in the structure.

Construction process 3: Details regarding villagers assistance

The following section will identify the residents of the village who helped out in Tables 5 and 6, and how they were divided between inside and outside the village, and how the joint labor was carried out. The total number of people involved in helping out was 67, and based on interviews (*11), 50 of them were residents of the same village (including 13 relatives), while there were 8 residents of other villages (including 3 relatives), and 9 residents

whose whereabouts could not be ascertained. These results indicate that 75 % of the residents of the village assisted in the construction of the houses, indicating that many of the neighbors cooperated in the construction of the houses. In addition, seven female residents whose names were followed by "wife" or "mother" (45, 46, 48, 49, 50, 51, and 54) were basically helping out with meal preparation..

The names of surrounding villages were also noted, as they came to help with the stone pounding, construction, and other tasks that required a large number of hands. In Table 5, 43 is Mizushima Village (Mizushima, Oyabe City), 44 is Shimogoze Village (Shimogoze, Oyabe City), 50 is Furujikuya Village (Inami, Nanto City), 15, 45, 61 is Takanosu Village (Takanosu, Tonami City), 14 and 51 are Tsubono Village (Tsubono, Tonami City). According to interviews with Mr. KATADA Isao, three of Shimogoze and Furujikuya relatives.

The whereabouts of 42 of the 50 residents of the community were ascertained and illustrated in Figures 5 and 6. Goromaru consists of four subdivisions: Nishidashima area, where the KATADA Residence is located, as well as Oshima, Terashima, and Kitajima, with Nishidashima and Oshima together referred to as Kamimura, and Terashima and Kitajima as Shimomura. Figure 5 shows the residential distribution of the population of villagers who were engaged in helping out: 22 (52 %) on Nishidashima, 11 (26 %) on Oshima, 6 (14 %) on Terashima, and 3 (7 %) on Kitajima. More than half of the helpers were from Nishidashima, where the KATADA Residence is located. The majority of the respondents, 79 %, came from Oshima and the Kamimura area. The number in Fig. 6 shows the number of residents helping out, and the number of village residents with the highest number of helpers (4 or more) is 19, of which 13 (68 %) are from Oshima and the rest are from Kamimura. 68 % are residents of Nishidashima and 16 (84 %) of them are residents of Kamimura, indicating that residents of the vicinity of the KATADA Residence make up the majority of the workers who were involved. The

Table 6. Detailed status of help in house construction (other help)

Year of implementation	1913年(Taisho 2)																			Total population by assistant													
	Date of implementation (Excluding 18 days)	4/13	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/22	7/18	7/19	4/8	4/10	4/12	4/13	4/11		4/13	4/24	6/23	9/13	9/24	9/25							
Work item	Lacquering	Other help																			Total population by assistant												
		No item description	Carpenter's smashed hut	Wall shop assistance	Method for stable construction	Zashiki Canina Clean up trash	Nagashibu construction and roofing																										
—	6																									6							
1	Same village																				0.5						0.5						
4	Same village															1											1						
11	Relatives													0.5					1		0.5						2						
21	Relatives		1	1	1	0.5	0.5	1	1	1	1	1	0.5	1	1	1	1	1	1			1	1	1	1	1	18.5						
68	Same village														1	1		1									3						
69	Same village																				1						1						
Total population by work		6	1	1	1	0.5	0.5	1	1	1	1	1	0.5	1	1	2.5	1	2	1								32						
		17.5													6.5						2	1	1	1	1	1	1	1	1	1	1	1	3

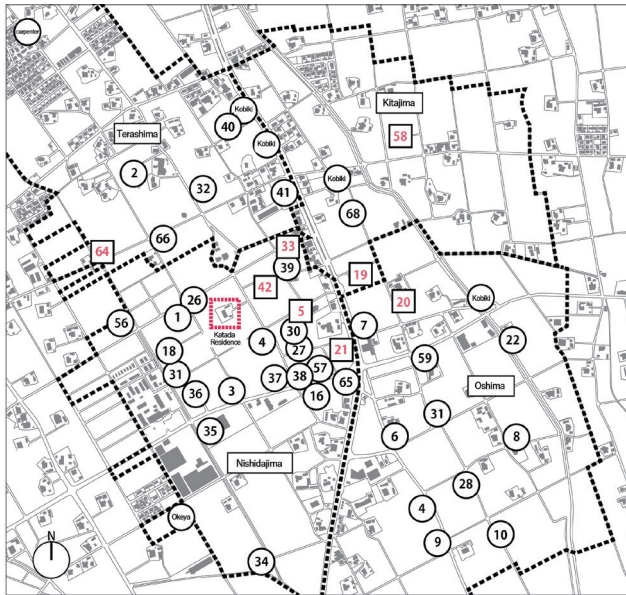


Fig 5. Residential distribution of village residents engaged in helping (numbers in the figure correspond to those in tables 5 and 6, □ indicates relatives in the village, ○ indicates residents of the village)

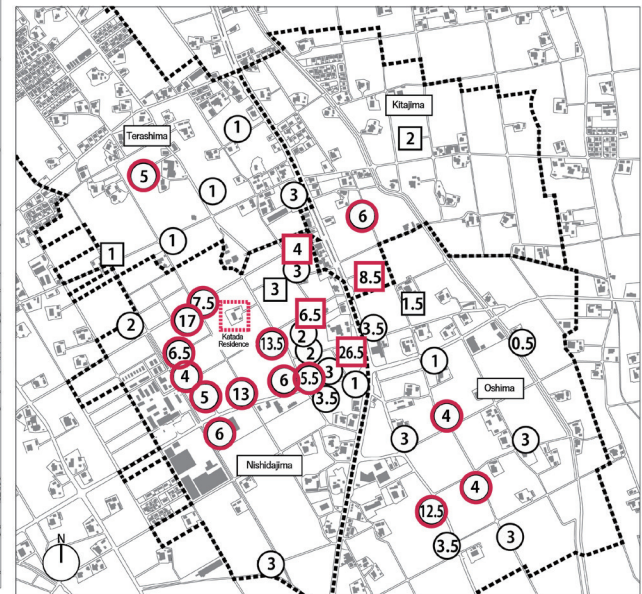


Fig 6. Distribution of village residents and the number of people assisting them (numbers in the figure are assistants, □ and ○ in bold represent village residents with more than 4 assistants)

following is a brief overview of the project.

Major artisans were also involved from the village, and the carpenter's notation on Terashima in Figure 5 indicates the master carpenter, Mr.TY1. IF and NS1, the wood turners, are located in Terashima, Mr.NH is located in Kitajima, Mr. H1 lives in Oshima, and Mr. KS (No. 28 in Fig. 5), an arithmetician, lives in Oshima. Mr.SG, the cooperage, resides on Nishidashima. The above details the involvement of many of the village residents in helping out and the involvement of the farmers and craftsmen in the village.

Summary

The construction work involved carpenters, masons, wallers, and roofers. In addition, the villagers were involved in the preparation of the construction

work, such as root plowing (kobiki) on the site, assisting in the procurement of lumber and wood grinding, and building a hut for carpentry work. In particular, it was confirmed that many villagers living in the vicinity of the KATADA Residence assisted in the construction work. The details of the work processes and artifacts of these craftsmen and villagers are described in the main text.

The communal labor of village residents in community-based construction plays a major role in the construction of *Azumadachi*, the traditional dwellings of the Tonami village. In the work done by the craftsmen, there was also a great deal of involvement from those village residents who were farmers and craftsmen. All six people who were engaged in the construction preparation were village residents, and one of them led the wood-related work, from wood procurement to construction, as

a master planner. In addition, one of the craftsmen who worked on the pails and two of the four men who transported materials (carts) were also residents of the village. At least eight of the 15 carpenters who assisted in the construction were village residents. Construction work was suspended in May (rice planting season) and September to October (harvest season), showing the seasonal nature of construction. The materials also include descriptions of wood and bamboo supplied by the villagers from their forests.

Thus, we were able to systematically understand the diverse involvement of local resources in the village, including assistance from village residents, artisans who also work as farmers, and materials provided by the premises forest.

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Annotation

- 1 The author's experience with endemic architecture reconstruction projects in Vietnam, Fiji, and Thailand has led him to focus on three local resources related to endemic architecture.
- 2 Based on an interview with Mr. SHINDO Masao, Director Emeritus of Tonami Institute of Tonami Dispersed Village Area Studies.
- 3 The Chinese zodiac sign 癸丑 is the 50th of the 60-year cycle that combines the 10 signs of the zodiac and the 12 signs of the Chinese zodiac. This indicates that the year 1913 is the 2nd year of the Taisho era.
- 4 *Ishikachi* (pounding stones) is a process in which residents work together to secure the foundation stones and harden the foundation with stones and logs.
- 5 The full-day work is described as "one man (1 man)" and the half-day work as "five minutes (0.5 man)". In Fig. 3, the entry for February 6 shows "one and a half".
- 6 Trees were pulled out by their roots as part of site preparation. The word "kogi" has the meaning of pulling out trees and plants with their roots still attached. A similar word is "nekogi".
- 7 "Sandanshi" is a profession that generally involves transporting heavy objects. In Carpenter Wood Grinder Hitotsuki (March 1913-), descriptions include "KATADA san-suke sandanshi" and "KATADA san-suke tachimai sandanshi" are listed as "KATADA san-suke sandanshi" and "KATADA san-suke tachimai sandanshi".
- 8 According to an interview with Mr. SHINDO Masao, honorary director of Tonami Institute of Tonami Dispersed Village Area Studies, Yasui Village had good soil at that time and tile production was prosperous. Therefore, it is thought that the wall clay material for the KATADA Residence was also secured here.
- 9 According to an interview with Mr. SHINDO Masao, honorary director of Tonami Institute of Tonami Dispersed Village Area Studies, Mr. Shindo is from Higashi Bessho Village and remembers that there were many easily obtainable madake bamboo in the village. Therefore, it is believed that a lot of bamboo material was purchased from Mr. MT in the same village for the construction of wall base material in the KATADA Residence.
- 10 In the Toyama dialect, *mataisuru* means "to put away," and *atomatai* indicates the cleanup work after pounding stones.
- 11 The names of the villagers are still carried on as house names, and it is possible to distinguish between the inside and outside of the village and to identify their whereabouts to some extent from the names recorded in the *Tetsudaininchou* through interview surveys.

Construction of mansions and use of local materials in the Meiji period

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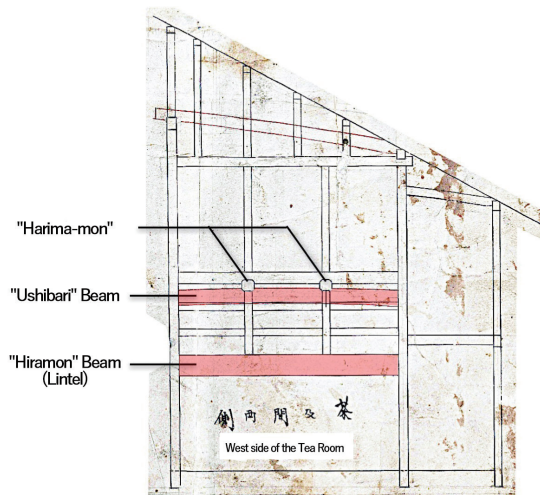


Figure 1. Axis diagram of Wakunouchi construction (author's addition to original document)

Introduction

This paper continues from the previous article by analyzing the construction-related materials of the KATADA Residence. Based on the material purchase documents, we will clarify the composition and diversity of wooden materials used in the

dwelling space by sorting out what kind of wood was used in the construction of the residence, and by comparing the wood cutting and purchase lists with the design drawings and actual on-site measurements.

Construction materials 1: Procurement of wood materials for construction

The design documents described in the previous paper include (1) an elevational diagram of the front of the house, (2) a shaft assembly drawing showing the cross-sectional configuration of the structural members, (3) a master landscape plan, (4) a sub-foundation drawing showing the shape of the foundation, and (5) a cross-sectional drawing in the east-west direction. From the front elevation (Figure 2 in the previous paper), the roof shape and the location of the front doors and windows could be read, and the location of the main structural members inside were also illustrated with red lines.

新	河	午	千	千	間	土	釣	名
物	物	物	物	草	草	草	柱	稱
杉	杉	杉	杉	杉	杉	杉	杉	杉
拾八尺	拾八尺	拾八尺	拾八尺	拾八尺	拾八尺	拾八尺	拾八尺	拾八尺
四六寸	四六寸	四六寸	四六寸	四六寸	四六寸	四六寸	四六寸	四六寸
三爪	三爪	三爪	三爪	三爪	三爪	三爪	三爪	三爪
下	下	下	下	下	下	下	下	下
右同所側桁	右同所側桁	右同所側桁	右同所側桁	右同所側桁	右同所側桁	右同所側桁	右同所側桁	右同所側桁

桁	梁物	牛物	片面平物	平物	間草	土基	釣束柱	名称
杉	杉	杉	杉	杉	杉	杉	杉	杉
16尺	15尺6寸	15尺9寸	15尺6寸	9尺6寸	15尺5寸	6尺6寸	9尺6寸	長
6寸	6寸	押木	1尺4寸	1尺4寸	1尺4寸	1尺2寸	5寸2分	厚
4寸	9寸角	1尺角	3寸	3寸	4寸	4寸	3寸	口
3本	2本	1本	1本	3本	1本	1本	4本	数
右同所側桁	右同所梁物	右同所牛物	右同所片面平物	右同所平物	茶ノ間見付及右左トウ	右同所下トウ	庭入口上トウ	摘要

Figure 2. Examples of wood listings (left: original diagram, right: its translation)

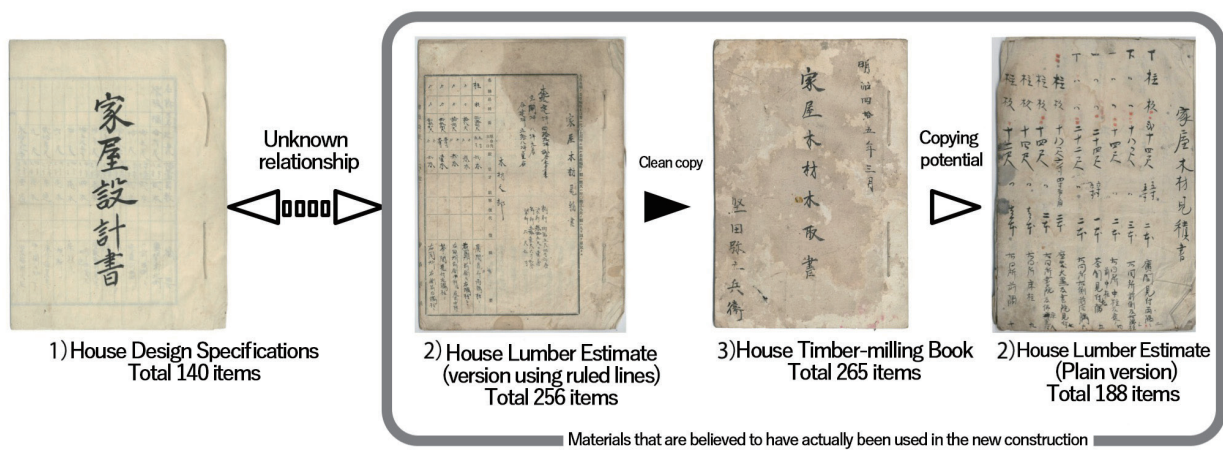


Figure 3. Relationship between each wood purchase material

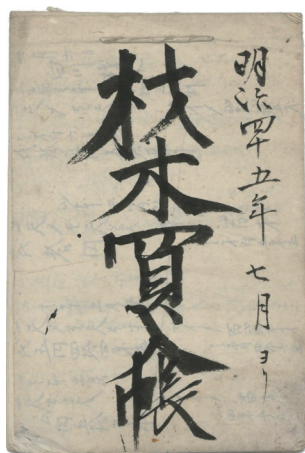


Figure 4. Cover of Lumber Purchase Ledger

The axial drawing depicts the Wakunouchi-zukuri columns and beams of the tea room, as shown in Figure 1, indicating that it was structurally important in its position. The axial assembly drawing also shows beam materials (such as Ushibari) in orthogonal directions, indicated by red lines, which penetrate the center of the roof.

The overall floor plan (Figure 2 in the previous paper) is a typical *Azumadachi* floor plan, with the main entrance facing east, a lavatory on the right side of the entrance, a earthen floor space called a "Niwa" visible as you enter from the front, and 12.5-mat (1 mat $\approx 1.62\text{m}^2$) room is located in the center of the building. As mentioned in the previous article, only the tea room, not the hall, is Wakunouchi style. A Shinto altar is enshrined in the southwest corner of the hall, and there is an entrance for visitors and a small room on the east side. On the south side of the hall (Hiroma), there is an 11.5-mat room (Kuchi-Zashiki) and a 10-mat

room (Oku-Zashiki).

Next, we will decipher the details of the wood used to construct the dwelling (Figure 2) from the material purchase documents. The four documents related to wood purchases are as follows:

- "House Design Specifications" 1copy
- "House Lumber Estimate". 2copies
- "House Timber-milling Book: March 1912, KATADA Yagohei" 1copy

In considering the relationship of each copy, the two "House Lumber Estimate" and the "House Timber-milling Book" were almost identical in their descriptions. One of the two "House Wood Estimate" sheets contained 256 items in total, and the "House Timber-milling Book" was probably created based on this estimate. The other estimate contains 188 items in total, and the names of parts and abstracts are listed one column later than on the "House Timber-milling Book," suggesting that the "House Timber-milling Book" was a transcription of the wood cutting sheet. On the other hand, only the "House Design Specifications" was different from the other three. Although the names of the main components (columns, beams, etc.) are listed in the same manner as the other documents, their dimensions and quantities are different, so it is better to regard it as a reference document at the design stage (Fig. 3).

Next, we will take a detailed look at the "House Timber-milling Book," which has the largest number

of parts among the four documents. First, the front cover of the document states "March 1912 (Taisho first year)," which means that it was created at the same time as the architectural design. It consists of three parts as follows:

- Lumber section : Wooden materials such as pillars and beams, used for purposes other than entrancehall.
- Entrancehall (Genkan) section: Wooden materials such as pillars and beams used in the entranceway area.
- Finishing materials used in rooms other than the entrance halls, such as thresholds, head lintel, and ceiling battens.

In addition to common structural materials such as pillars, beams, and girders, there are also materials unique to Wakunouchi-zukuri, such as Ushi-bari and Harima-mon. In addition, there were also descriptions of the finishing materials such as ceiling battens, head jambs, and thresholds, as well as the paneling materials such as rafters and cornerstones (materials that complement the structural materials and provide a base for the building). Of the 265 materials used, 216 were cedar (including, Straight grain cedar, and top-grain cedar). Pine (including Hime-komatsu) was next with 26 items, followed by *ate* (*1), *Zelkova*, and Japanese cypress.

The following two lists of construction materials purchased, including lumber, from the materials purchase documents will then be examined in detail to see where each was obtained.

- Untitled material: Various materials purchase lists
- "Lumber Purchase Ledger": July 1912 (Fig. 4)

A total of 129 items were recorded in the untitled materials, and a total of 125 items were recorded in the "Lumber Purchase Ledger", of which 101 items were duplicates. Since the "Lumber Purchase Ledger" contains multiple purchases from the same person, with closing amounts and payment dates, it is believed that the "Lumber Purchase Ledger"

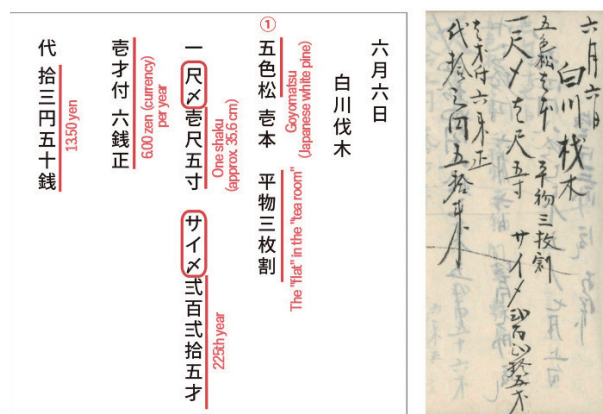


Figure 5. Example of "Lumber Purchase Ledger" Contents

is a final compilation of various material purchase documents that were transcribed with additions and corrections.

Of the materials purchased, 30 out of 125 items are related to wood materials, and 5 out of 125 items are related to finishing materials such as fixtures. Of the 30 wood materials purchased, pine was the most common species, cedar was the second most common, and only one other species, *zelkova*, was found.

Next, we read the contents of the "Lumber Purchase Ledgers" one by one to determine where these wood materials were purchased. For example, on page 1, the date of purchase is June 6, 1912, the species purchased was Japanese white pine (Hime komatsu), the quantity was 1 piece, and the description is "Hiramon Sanmai-wari" (a flat three pieces split). (Fig. 5). "Hiramono" refers to a component used in the Wakunouchi style of building. The dimensions of the material are 1 *Shaku* and 5 *Sun*, 225 Sai (*2). This lumber is a lumber with a scale of 1 *shaku* 5 *sun* square = 15 *sun* square, and since there is a description of 3 pieces, one lumber can be divided into 3 pieces of 5 *sun* × 15 *sun* square. It was supposed.

The unit price of lumber is described as 6 sen per 1 sai, and since this material is 15 *sun* × 15 *sun* = 225 sai, the price of one lumber is 225 sai × 6 sen = 1,350 sen = It will be 13.50 yen.



Photo 1. Lumberyard (Kanaya) (Courtesy of Tonami Board of Education)

A total of 7 pieces of lumber were purchased on the same day, June 6, for a closing price of 44,835 yen. Of that amount, 30 yen was paid on the day of purchase, followed by 14,835 yen in early July. The description of the handover to Mr. KS, the master of the house, is given below. The "Tetsudainincho" also mentions that on June 5 and 6, three

people, including KS, went to "Kanaya Kimoto ni Iku" as cart bearers (material transporters), and the following is a description of the "Tetsudainincho". This schedule is consistent with the dates that lumber was purchased and transported from the lumberyard in Kanaya.

In Kanaya, where the lumber was purchased, there was a large lumber storage facility (Photo 1). This lumberyard was the location where the lumber industry developed before the development of railroads, etc., utilizing the water transportation of the Sho River to transport lumber from the upper reaches of the river, generally called Hida lumber (Figure 6). About 50 km upstream is the Shirakawa area, one of the production areas. The fact that Figure 5 shows that the house was purchased from "Shirakawa Lumber" suggests that the KATADA Residence also used wood from this area. Other wooden materials include one 2-ken and one 9-*shaku* door sills from the nearby village

of Aratakaya (Aratakaya, Tonami City), and 406 komaikan from a lumber store in Takaoka City.

Construction materials 2: Composition of wood material arrangement

The "House Timber-milling Book" shows which parts of the house were used for which wood materials. Here, we will examine the structure of the tea-room of the KATADA Residence, using the "House Timber-milling Book," plan drawings from design documents, survey data, and a 3D model to confirm the component structure of the Wakunouchi style,

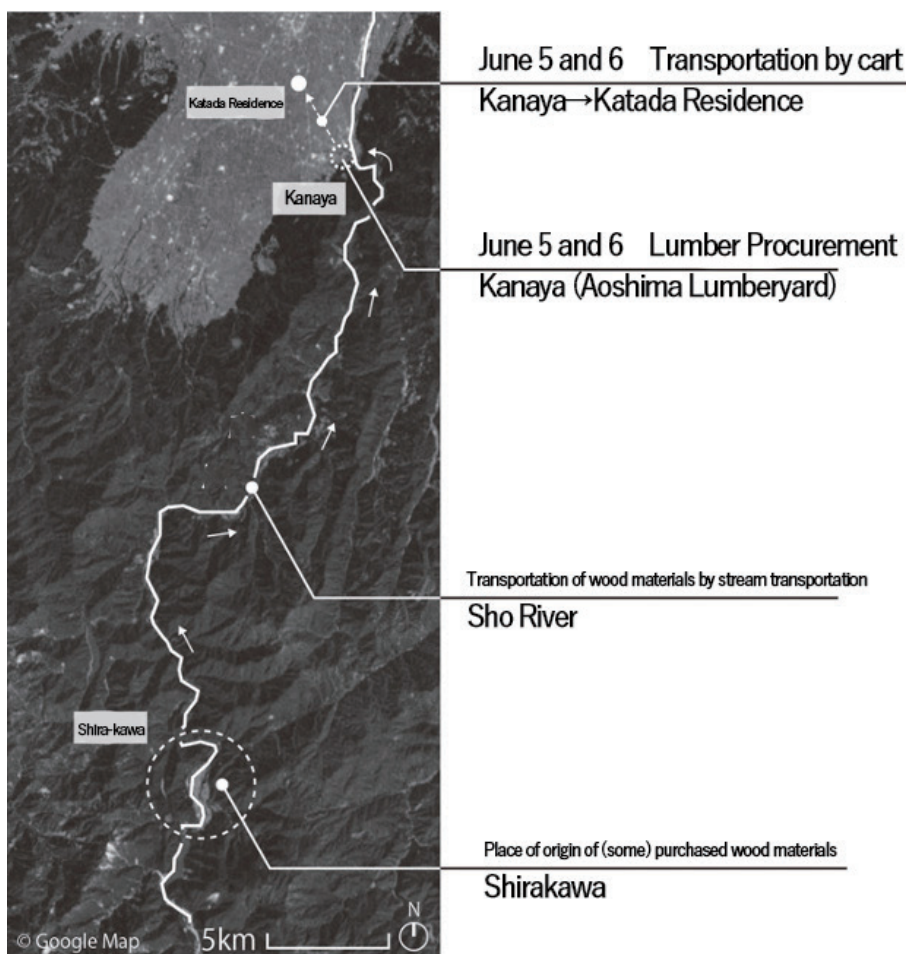


Figure 6. Producing areas and procurement routes of wood materials

13	12	11	10	9	8	7	6	5	4	3	2	1
敷居	飾り檼	桁	梁物	牛物	平物	片面束柱	束柱	下立柱	柱	名称		
松	杉	杉	杉	杉	杉	杉	杉	杉	杉	杉	杉	杉
7尺5寸	7尺5寸	16尺	15尺6寸	15尺9寸	15尺5寸	5尺6寸	5尺6寸	8尺	22尺	24尺	長さ	
6寸	4寸4分	6寸	押末	1尺4寸	4寸2分	5寸	5寸	4寸6分	6寸	厚巾角		
1寸8分	8分	4寸	9寸角	1尺角	4寸2分	2寸5分	4寸	4寸	6寸	末口		
6本	8枚	3本	2本	1本	3枚	4本	5本	3本	2本	1本	数量	
茶ノ間敷居二	茶ノ間右左全部二	右同所側桁二	右同所梁間物二	右同所牛物二	茶ノ間見付及右左トウラ二	右同所右左二	茶ノ間平物上ニテ束木二	茶ノ間平物下二	右同所右側前後ウラ二隅柱二	茶ノ間見付左隅柱二	摘要	
258	257	110	109	43	42	41	38	29	28	15	6	5

Figure 7. Chanoma-related items in the "House Timber-milling Book" (excerpts)

a characteristic of the *Azumadachi* Dwelling. The wood materials related to the tea room are described in the "House Timber-milling Book," including structural materials such as pillars, bundles, beams, and girders; finishing materials such as decorative rafters, decorative stiles, and door sills; and panelling materials such as large pillars and floor levellers (joists) (Figure 7). The following is an overview of the species, dimensions, and sections of each wood material, focusing on the structural and finishing materials that make up the living room.

First, the pillars that make up the tea room are made of 6 *sun* square (approximately 180 mm square) timbers in each of the three corners of the room. One 24 *shaku* long pillar is described as "For tea room front left corner pillar (southwest corner) " and two 22 *shaku* long pillars are described as "For right same place (tea room) right front and back (northeast and northwest corners) " respectively. Instead, a corner pillar (5 *sun* square (approx. 150 mm square)) on the border between the hall and the Niwa (Entrance hall) was placed

in the middle of the east face of the tea room to support the upper timbers. The dimensions of these corner pillars were also confirmed in the survey. In addition, there is a pillar called "lower pillars" in the middle between the three corner pillars, each of which is 8 *shaku* (approx. 2,400 mm) long and 4 *sun* 6 *bu* (approx. 140 mm) wide × 4 *sun* (approx. 120 mm) long. The species of wood used for both the corner pillars and the lower standing pillars was cedar. The "House Timber-milling Book" lists 13 items and 26 pieces of wood for the pillars alone (excluding the pillars listed in the "Entrance Hall Section"), the largest being the three pillars in the tea room. It was a 6 *sun* square pillar used in the corner. This indicates that the tea room, which was built in the Wakunouchi style, was a room of high importance in the house (Fig. 8).

Next, we will look at the materials that characterize the Wakunouchi style: Hirammon, Ushimon, and Harimamon. According to the "House Timber-milling Book," Hirammon is 15 *shaku* 5 *sun* (about 4,650 mm) in length and 1 *shaku* 4 inches (about 420 mm in height) and 4 *shaku* 2 *bu* (about 120 mm) wide. They are placed on the west (front) and north and south sides of the tea room. There are two types of Wakunouchi-zukuri Hirammon: those placed on three sides, and those placed on all four sides after the Meiji period (1868-1912). As mentioned above, the presence of a pillar in the middle of the east facade of the tea room and the fact that the upper part of the pillar on the east facade is not a Hirammon but a beam material for the hall and Niwa suggest that the structural materials for the front entrance, Niwa, and hall were built first, followed by the

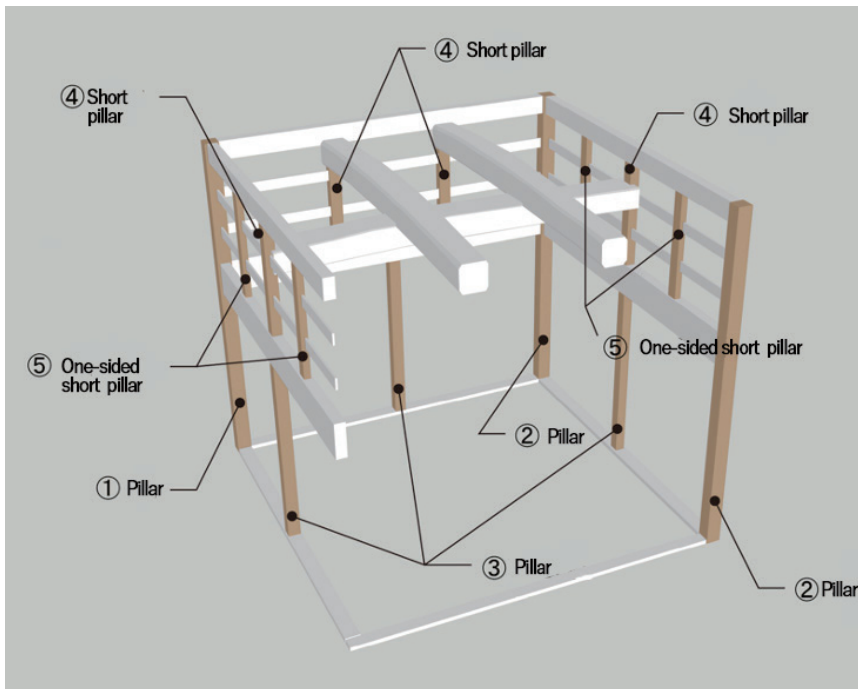


Figure 8. 3D model of tea room (post and bundle materials)

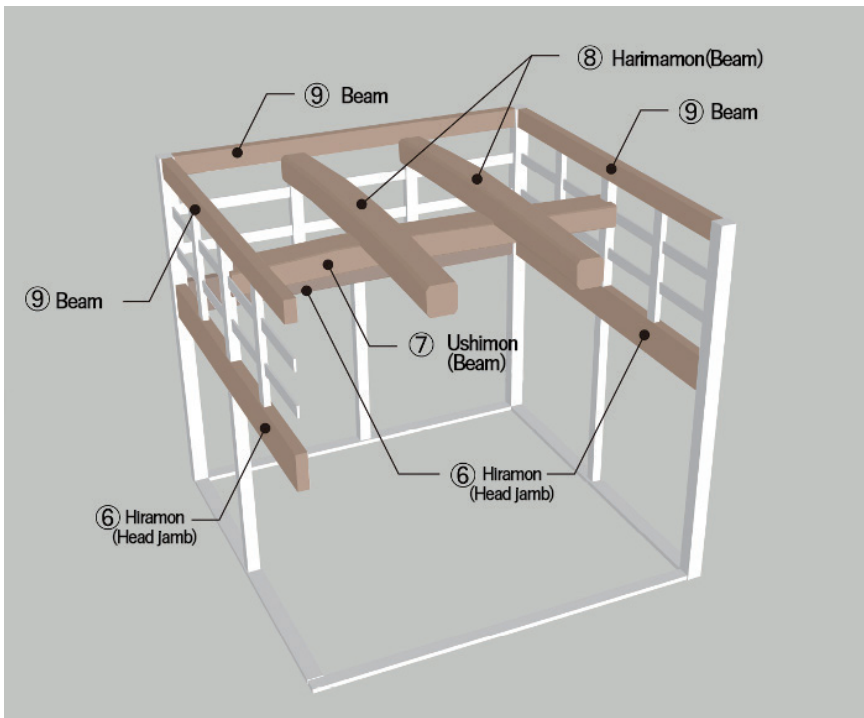


Figure 9. 3D model of tea room (transverse timber)

west side structural materials for the tea room and other rooms.

"Ushimon" is a transverse timber that penetrates the upper beams and is 15 *shaku* 9 *sun* (about 4,770 mm) long. One piece of 1 square *shaku* (about 300 mm square) lumber is used. The word "oshimatsu" indicates that the wood is "oshi-matsu" (square wood with bark remaining at the four corners), and that the thinnest part, the end, is 1 *shaku* square. The arrangement of the "ushimon" was confirmed to be north-south based on a planar map, a cross-sectional drawing of the tea room, and a field

survey. In the Wakunouchi-zukuri style, the Ushimons are often placed above the Kami-daikokubashira (central pillar) standing at the center of the south facade and the Shimo-daikokubashira standing at the center of the north facade, but in the KATADA Residence, these central pillars are absent, and the support is provided by a bundle post placed above the Hiramom. The beams are 15 *shaku* 6 *sun* (about 4,680 mm) long and 9 *sun* square (about 270 mm square) long. Two pieces of lumber are used. Although the wood materials used to construct the KATADA Residence were of a wide variety of species, it is interesting to note that "Hime-komatsu (a type of Japanese white pine)" was used only for the Hiramom, Ushimon, and Harimamon, which characterize the Wakunouchi style (Fig. 9).

Next, we will look at the upper part of the room, the part of the frame structure that consists of a latticework of short pillars and wide plank (horizontal timbers that pass between the pillars). The upper part of the Hiramom, the short pillar, which supports the beams on the west side, is 5 *shaku* 6 *sun* long (about 1,680 mm), a square lumber with a width of 5 *sun* (about 150 mm) and a depth of 4 *sun* (about 120

mm) was used. In addition, regarding the two sides of the north and south, there is a material called "one-sided short pillar" at the position between the corner pillar and the short pillar, which is about half the depth of the short pillar and is 2 *sun* and 5 *bu* (about 75 mm). The species of wood used for both types of short pillars was cedar. The crosswise direction of the short pillar and the one-sided short pillar is pierced by a "Kazarinuki" (decorative lattice). According to the "House Timber-milling Book," the "left-right (north-south) side of the tea room" is 7 *shaku* 5 *sun* (about 2,250 mm) long and wide. 8 *bu* (approx. 24 mm) × 4 *sun* 4 *bu* (approx. 130 mm) in height. Four pieces were used for each. The length of the column is 7 *shaku* 5 *sun*, so it was passed between the corner post and the short pillar through the one-sided short pillar. On the other hand, the "Chanomafront (west side)" is made of wood measuring 5 *shaku* (about 1,500 mm) long with the same cross-section, which is placed between the corner post and the bunch pillar. Like the short pillar, the ornamental tie beams were also made of cedar. Finally, let us look at the threshold of the tea room. The threshold between the corner pillar and the lower pillar is 7 *shaku*

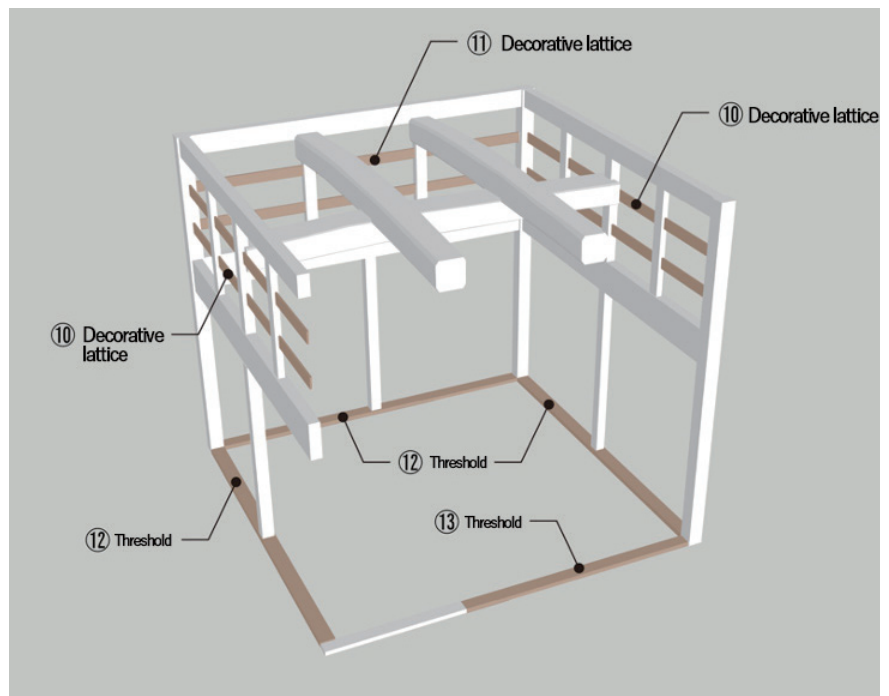


Figure 10. 3D model of a tea room (molding materials)

5 *sun* (approx. 2,250 mm) long and 6 *sun* wide. (approx. 180 mm) × 1 *sun* 8 *bu* (approx. 54 mm) in height, on the north, south and west faces. The floor is installed in the same way as the original. On the east side, a threshold that matches the width of the corner pillar on the border between the hall and the Niwa is set up to the corner pillar in the northeast corner with a length of 9 *shaku*. The tree species used for the threshold is pine, which was selected in consideration of durability (Fig. 10).

From the above, it was confirmed that cedar is used for most of the wooden materials that make up the tea room, while pine is used for the "Hiramon", "Ushimon", and "Harimamon", which require a certain degree of strength, and for the thresholds, which require durability.

Summary

According to the "House Timber-milling Book", cedar was the main wood material used to construct dwellings, followed by pine, and in smaller quantities by zelkova, atte, and zelkova. The composition and species of wood used to make the tea room of the Wakunouchi were also clarified through documents, interviews, and field surveys.

Comparing the amount of wood used in the dwelling to the amount of wood purchased in the "Lumber Purchase Ledger", less than 10 % of the wood used in the main component of cedar was purchased, while less than 4 % of the wood used in the main component of pine was purchased. More than one-fifth of the total was purchased. Other records of zelkova purchases also exist, but no records of atte and

zelkova were found in the existing data.

Thus, the amount of purchased wood materials in the "Lumber Purchase Ledger" is smaller in absolute quantity than the amount of wood materials for construction in the "House Timber-milling Book," suggesting the possibility of wood and bamboo materials provided by village residents, as described in the previous paper. As a previous study (*3) states, "Premises forest is the only growing asset in this region, and as the saying goes, 'Sell your land, but don't sell your "kainyo" (premises forest),' so it was not cut down except for new house construction or expansion." The same is true of the "'kainyo'" forests. In an interview with Mr. KATADA Isao, it is also mentioned that "the family received lumber from the head house family when they built the new house," so it is quite possible that the family obtained most of the wood materials for the new house, mainly cedar, from the property and neighboring premises forests.

Glossary

1 *Ate* is the local name for *asunaro*. Also called *hiba*.

2 A *shaku-jime* is a 1-*shaku* square 2 *ken* (about 0.3m × 0.3m × 3.6m), and a *sai-jime* is a 1-*sun* square 2 *ken* (about 0.03m × 0.03m × 3.6m).) is a unit for counting timber, and there is a relationship of 1 *shaku-jime* = 100 *sai-jime*. Also, 10 *sun* (1 *shaku*) × 10 *sun* (1 *shaku*) = 100 *sai*.

3 TACHI Akira, *the actual condition of the premises forest in the central part of the Tonami Plain-Focusing on the survey materials of Kanoshima in the Gokaya district-*, *Bulletin of the Tonami Dispersed Village Regional Research Institute* 5, March 1988, p.27

Weather in dispersed villages from a Taisho Period diary

Research Institute for Humanity and Nature **NAKAI Minami**



Photo 1. Panoramic view of Goromaru (Jun 7,2020 Photo: Eco-DRR Project)



Photo 2. Heavy snowfall in 1963 (Photo: NAKAJIMA Katsutoshi)

Introduction

The Tonami Plain (Oyabe City, Takaoka City, Tonami City, and Nanto City) has a dispersed village landscape with private houses scattered one by one, far apart from each other. Goromaru in Tonami City is one of the dispersed villages located in the Tonami Plain (Photo 1).

Tonami has a climate influenced by the Sea of Japan, with cold winters and heavy precipitation, and temperatures rising rapidly from spring to summer, yielding to hot and dry summers. The average annual temperature is about 14 °C, with summer highs exceeding 35 °C on some days and freezing temperatures in winter. Annual precipitation exceeds 2,000 mm and is concentrated in the winter months of December through February. Most of the winter precipitation is due to snowfall. Tonami City has a high percentage of snowfall for a plain area in the prefecture, and the history of Tonami City published in 1965 mentions "the heavy snowfall in 1963". The average snowfall was 238 centim with a maximum of 425 centim, and



Figure 1. Cover of the KATADA family diary (Diary1, Diary2 and Diary3) (courtesy of KATADA Isao)

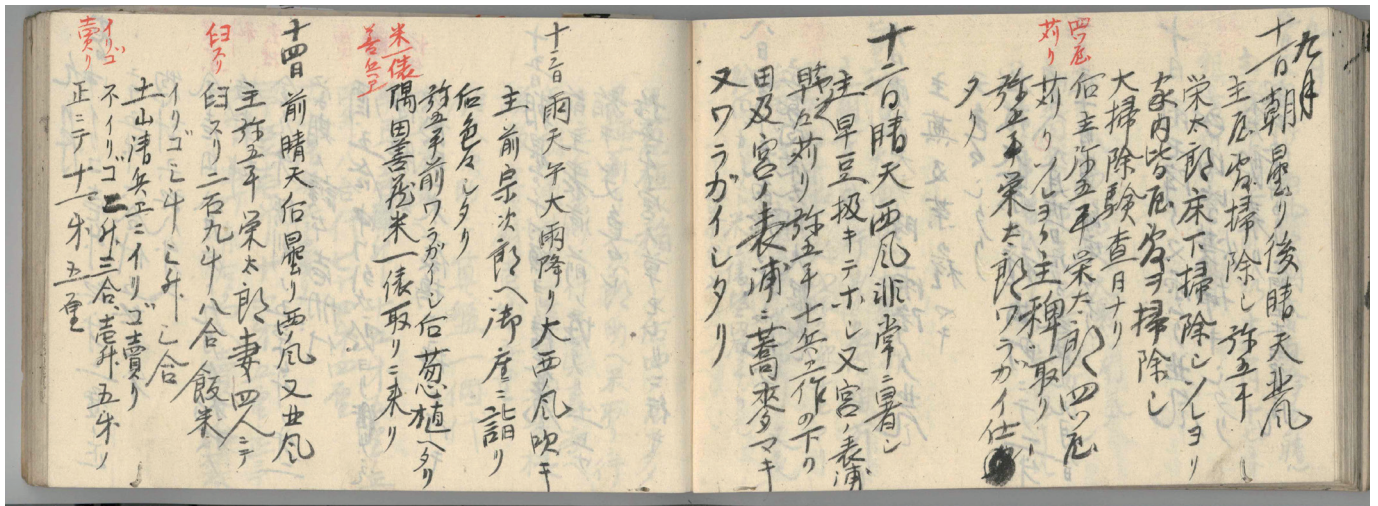


Figure2. Partial copy of Diary 2 contents

there was lingering snow until early April. In Tonami, strong monsoons blow in winter. In addition to this monsoon wind, there is also a strong southerly wind from early spring to the end of May, which is hot, dry, and strong due to the foehn phenomenon. In Tonami City, this wind is strong in the Gokaya district to which Goromaru belongs, and in

preparation for this, the forests on the south side of houses are thickened.

In Goromaru, Gokaya district of Tonami City, three diary books written between the Taisho and early Showa periods were borrowed from a resident (Fig. 1). The author of the diary is KATADA Yahachiro, who was born (in 1875) and raised in Goromaru. In April of 1917, he was 41 years

old. He lived with his parents, his wife, and children in a house surrounded by the premises forest in the Tonami Plain, a harsh natural environment, with farming as his livelihood.

About the diary

The three diary books were written from March 25th, 1917 to April 19th, 1918. (Diary 1), August 1st, 1922 - June 30th, 1924 (Diary 2), January 1st, 1926 - August 15th, 1927 (Diary 3). Although there are a few blank days, each day is recorded meticulously on a half-sheet of paper (Fig 2).

Each diary consists of the date, the weather, and the events of the day. The weather is recorded as sunny or rain, windy, cold or hot, etc. After the weather record, the diary records various events of the day, such as farm work, sales of farm products, purchases, visits, lending and borrowing, cleaning of the house and surrounding area, outings, events, and places Yahachiro's family went or visited.

Table 1. List of terms related to cloud cover, temperature, and humidity

Sunny	上等上日和白日	Sleet	水雪雨
	上等晴天白日		雨雪
	上等晴天		水雪
	晴天白日		雪
	上晴天		雪降り天
	晴天		雪花
	晴ル		大雪
	中晴天		小吹雪
	薄天晴		吹雪
	中天		大吹雪
上中天	大々吹雪		
Cloudy	曇り	Hail	霰
	曇天		アラネ
	曇り天	アラニ	
	雨模様	Light cloudy	上等薄天
	雨ノ気		上薄天
	夕立模様		薄天
	雪模様	薄雲天	
雪降り模様	Thunder	雷	
糸雨		大雷	
Rain	小雨	Haze	霞
	小雨天		大霞
	シボシボ雨	Others	霜 (Frost)
	チボチボ雨降り		雲アリ (There are clouds)
	雨		雨雲アリ (There are rain clouds)
	雨天		日様出
	夕立		(The sun was coming up)
	夕立雨		太陽出
	大雨		
	大雨天		
	ボロボロト降り		
	大々雨		
	ノクサ雨		

Table 2. List of words related to wind

Direction		Wind strength
South wind	1 南風	1-1 南風
		1-2 南中風
		1-3 南大風
		1-4 南大々風
	2 若狭南風	2 若狭南大風
	3 表風	3-1 表風
		3-2 表大風
	4 表風模様	4 表風模様
	5 南氣	5 南氣
6 南氣模様	6 南氣模様	
7 山セ風	7-1 山セ風	
	7-2 山セ大風	
8 山セ風模様	8 山セ風模様	
9 南嵐	9 南嵐	
Southwest wind	1 南西風	1-1 南西風
		1-2 南西中風
		1-3 南西大風
		1-4 南西大々風
	2 南西風模様	2 南西風模様
	3 南西寒風	3 南西寒大風
	4 表西風	4 表西風
5 表西風模様	5 表西風模様	
	6 西南氣風	6 西南氣風
7 山セ西風	7-1 山セ西風	
	7-2 山セ西大風	
North wind	1 北風	1-1 北風
		1-2 北小風
		1-3 北大風
2 北風模様	2 北風模様	
3 浦風	3 浦風	

Direction		Wind strength
Northwest wind	1 北西風	1 北西風
	2 北西風模様	2-1 北西大風 2-2 北西風模様
West wind	1 西風	1-1 西風
		1-2 西小風
		1-3 西中風
		1-4 西大風
		1-5 西大々風
	2 西風模様	2-1 西風模様 2-2 西大風模様
3 西シカタ風	3-1 西シカタ風	
	3-2 西シカタ大風	
Others	1 シカタ風	1-1 シカタ風
		1-2 シカタ大風
	2 表南西風模様	2 表南西風模様
	3 西南北風	3 西南北風
	4 西南北風模様	4 西南北風模様
	5 まわし風	5 まわし風
	6 西ヘカヤシ風	6 西ヘカヤシ大風
	7 風	7-1 風
7-2 小風		
7-3 大風		
8 嵐	8-1 嵐	
	8-2 小嵐	
	8-3 大嵐	
Windless	1 風ナシ	1 風ナシ
	2 南西風ナシ模様	2 南西風ナシ模様

From this diary, we can obtain a variety of information about the weather, people's lives, and local expressions unique to Goromaru and the Taisho period. Here, we will look at April 1st, 1917 - March 31st, 1918 (Diary 1) and August 1st, 1922 - July 31st, 1923 (Diary 2), two years' words of weather (words related to cloud cover, temperature and humidity, and words related to wind) were compiled. This section presents the weather on the plains and how people in the Taisho period perceived the weather. The events of the day are discussed in detail in "Life in a Dispersed Village Based on the Diaries of the Taisho Period" on page 146.

(1) Terms related to cloud cover, temperature, and humidity

First, words related to cloud cover, temperature, and humidity, such as sunny and rainy, that were recorded in the diary were extracted and tabulated. Words related to cloud cover, temperature, and humidity were recorded for 365 days in Diary 1,

364 days in Diary 2. The number of words used in Diary 1 was 55, 35 in Diary 2. Diary 1 and Diary 2 together totaled 60 words (Table 1).

Of the 60 different words used, 11 words (henceforth, the number in Diary 1 and Diary 2 combined) were used that were thought to mean sunny. Among them, the words used that were thought to mean clear skies were "上等上日和白日", "上等晴天白", "上等晴天", "晴天白日" and "上晴天", while the words used that were not clear skies but were thought to mean sunny were "晴天", "晴ル", "中晴天", "薄天晴", "中天" and "上中天".

Three types of words were used to describe cloudy weather: "曇り", "曇天" and "曇り天". The words used to describe the likelihood of rain or snow were "雨模様", "雨ノ気", "夕立模様", "雪模様" and "雪降り模様".

Fourteen different words for rain were used. The words used were "雨", "雨天", "夕立", "夕立雨

", "糸雨", "小雨", "小雨天", "大雨", "大雨天" and "大々雨" as well as "シボシボ雨", "チボチボト雨降り" and "ボロボロト降り" words that seem to have been used in Yahachiro's personal sense. It seems that he used different words depending on the intensity of the rain and the time of day it rained. In addition, the term "ノクサ雨" was recorded in March 1917, a term that even long-time residents of Goromaru did not know the meaning of.

Three types of words were used to describe sleet: "水雪雨", "雨雪" and "水雪". Eight different words were used for snow, and for snowstorms, four levels of snowstorms were recorded: "小吹雪", "吹雪", "大吹雪" and "大々吹雪". In addition to "雪", "雪降り天" and "大雪", the word "雪花" which refers to the falling snow as if it were a flower, was also recorded. The word "霰 (hail)" was also recorded as "アラネ" and "アラニ" which were written in the dialect as they were.

Other words used were "上等薄天", "上薄天", "薄天 (Light cloudy)", "薄雲天", "霜 (Frost)", "雷 (Thunder)", "大雷", "霞 (haze)", "雲あり (There are clouds)", "雨雲あり (There are rain clouds)" as well as, "日様出" and "太陽出" meaning the sun was coming up.

(2) Terms related to wind

Next, wind-related words were extracted and tabulated. The records of wind in these diaries included not only the presence or absence of wind, but also detailed information on the direction and strength of the wind, as well as the time of day when the wind blew. The wind-related words were recorded for 362 days in Diary 1 and 363 days in Diary 2. There are 27 types of words used (expressions that do not include strength such as "南風" and "表風") in diary 1, 23 types in diary 2, and 34 types in total for diary 1 and diary 2. When wind strength is counted as one of the expressions, such as "南大風" and "南西中風" the number of wind-related words in Diary 1 was 45, while in Diary 2 it was 35 types, and 57 types were used in Diary 1

and Diary 2 combined (Table 2).

The words used to refer to the south wind were "南風", "表風", "南気" and "山セ風". In Goromaru, regardless of the direction of the entrance of the house, the south side of the mansion is called 表 (front) and the north side is called 裏 (back), so "表風" means south wind. "山セ風" means wind blowing from the mountains in the south, and "南気" refers to the warmest of the southern winds.

The meaning of "シカタ風" could not be determined from interviews with Goromaru residents, and the term is no longer in use. It was recorded only in April and May, and may have been a different wind from the others that blew from spring to early summer. A similar expression to "シカタ風" was "西シカタ風". Interviews revealed that this means "west wind". The "西へカヤシ風" is said to mean a wind that turns back to the west, i.e., the direction of the wind has changed to the west.

In addition to these, records of southwesterly, northerly, northwesterly, and westerly winds were found, but no "eastern" winds were recorded at all. Among the wind records in the diary, the term "風ナシ (windless)" was also found. In Diary 1, there were 17 days out of 362 where the word "風ナシ" was written, and 9 days where there were no other wind records and only "風ナシ" was written. In Diary 2, "no wind" was written for 9 days out of 363, and only "風ナシ" was written for 6 days.

Summary

Although it is common to record the weather in a diary book, the KATADA family diary book written in the Taisho period used a great variety of words and unique expressions such as "ノクサ雨" and "西シカタ風", and especially detailed records of wind, including direction and even strength. The abundance of words and expressions in the records suggests how important weather information was to the people who lived in this period, and that they probably paid more attention to the weather in their daily lives than they do today. By using a wide

variety of expressions, they must have been able to read the differences in detail, for example, this wind blows at this time of the year, and when it rains, they have to deal with it in this way, etc. By reading the diaries that remain in the local area, we can learn about the weather specific to that area. They are also very valuable historical documents that provide clues as to the disasters that occurred in the area and how they were handled.

References

Tonami City History Compilation Committee, *Tonami City History*, Tonami City Hall, 1965.

Photo 3. The weather of the Tonami Plain in photos



Cloudy (September 13, 2020 Photo: WANG Wen)



Snow cover (2018 Photo: KATADA Isao)



Sunny (Jun 7, 2020 Photo: WANG Wen)



Wheat swaying in the wind (April 29, 2017 Photo: WANG Wen)

Life in a dispersed village based on the diaries of the Taisho Period

Kyoto University

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Photo 1. Yahachiro KATADA (second from the right in the front row) and his family (June 1927. Photo is provided by KATADA Isao)



Photo 2. KATADA family's residence (February, 1986. Photo is provided by KATADA Isao)

Introduction

In Goromaru Village, Gokaya district (now Tonami City), located in a dispersed village on the Tonami Plain. Electric lights came in during the Taisho Period (1912-1926), and mechanization and breeding of agricultural products began to progress. According to the first national census in 1919, the number of households in Goromaru was 161 with a population of 1,047, signifying an increase since the Meiji period. Mr. Yahachiro KATADA (September 1875-August 1927) was born in Goromaru. The Taisho Period diary written in August 1927 records work related to daily life, livelihood, and annual events. Yahachiro's occupation was farming, and he lived with his parents, wife, and children in a house surrounded by a forest during the period when the diary was written (Photos 1 and 2).

Land use in the Taisho period

Figure 1 shows the land use during the Taisho period in the vicinity of the KATADA family, based on the "Land Registry Map of Goromaru Village" (1875) from the Meiji period and the contents of the diary. The KATADA family was a farming

family located south of Goromaru Shinmei-gu Shrine, who were mainly engaged in rice farming, and also sold rice and vegetables. The surrounding rice paddies were dotted with residences, and rivers such as the Nakamura River, which fed water from the Sho River, and a network of irrigation canals were located in the area. In addition, small-scale farmlands and woodlands where shrubs were harvested for fuel and organic fertilizer were distributed. Most of the farmhouses in the Taisho period had thatched roofs, which were replaced every 10 years or so. The hayfield used by the KATADA family were located on the east side of the Nakamura River in the noguro (noguro: riverside forest along the irrigation channel).

The book, "Keishi no fu - old time rice cultivation and farmers' life -", is a collection of articles from the Meiji period to 1955, summarizing the use and management of agriculture and natural resources in Gokaya. It is noted that rice straw, fallen leaves such as cedar, brushwood, firewood (akashi), and driftwood were used as fuel, and that there were riparian forests such as alder and willow trees on

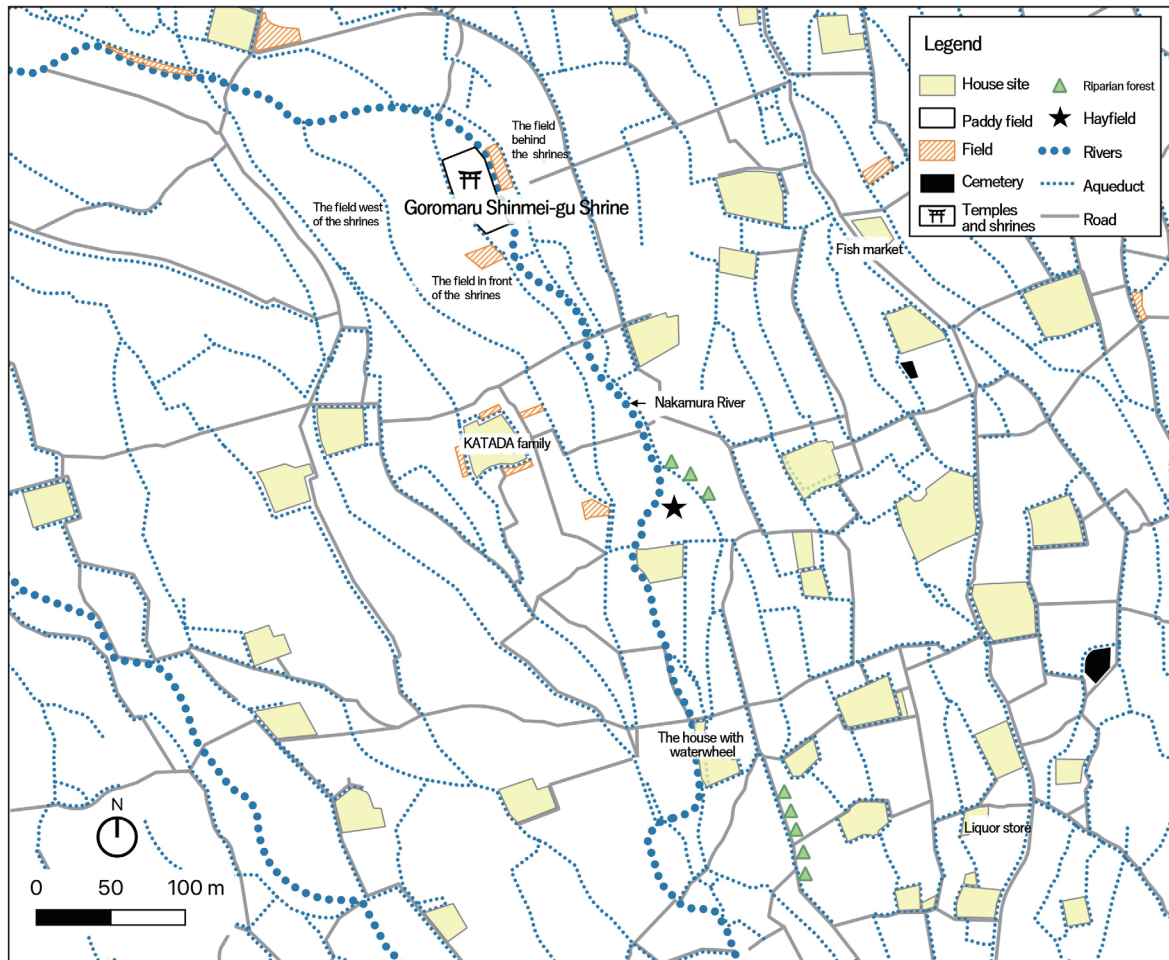


Figure 1. Land use around the KATADA family during the Taisho Period (1912~1926)



Photo 3. Goromaru harvesting rice and a cedar forest in the background (1950s, Photo is provided by MATOIKE Tatsuya)



Photo 4. Willows along a small aqueducts (1949, Photo is provided by MATOIKE Tatsuya)

both sides of the main canal for bank protection and fuel collection, to the extent that they did not shade the fields. There are few photos showing land use in Goromaru during the Taisho period, but a photo from the 1930s (Photo 3) shows how the houses and farmland looked at that time. In Photo 4, a small canal can be seen in the snow-covered farmland, indicating that willows were growing alongside the

river.

Land use and layout of components around the mansion

Figure 2 shows the layout of the KATADA family compound and the distribution of rice paddies and fields owned by the family. The house included an *Azumadachi* main house (*Azumadachi*: a typical architectural style in dispersed village), a garden (a

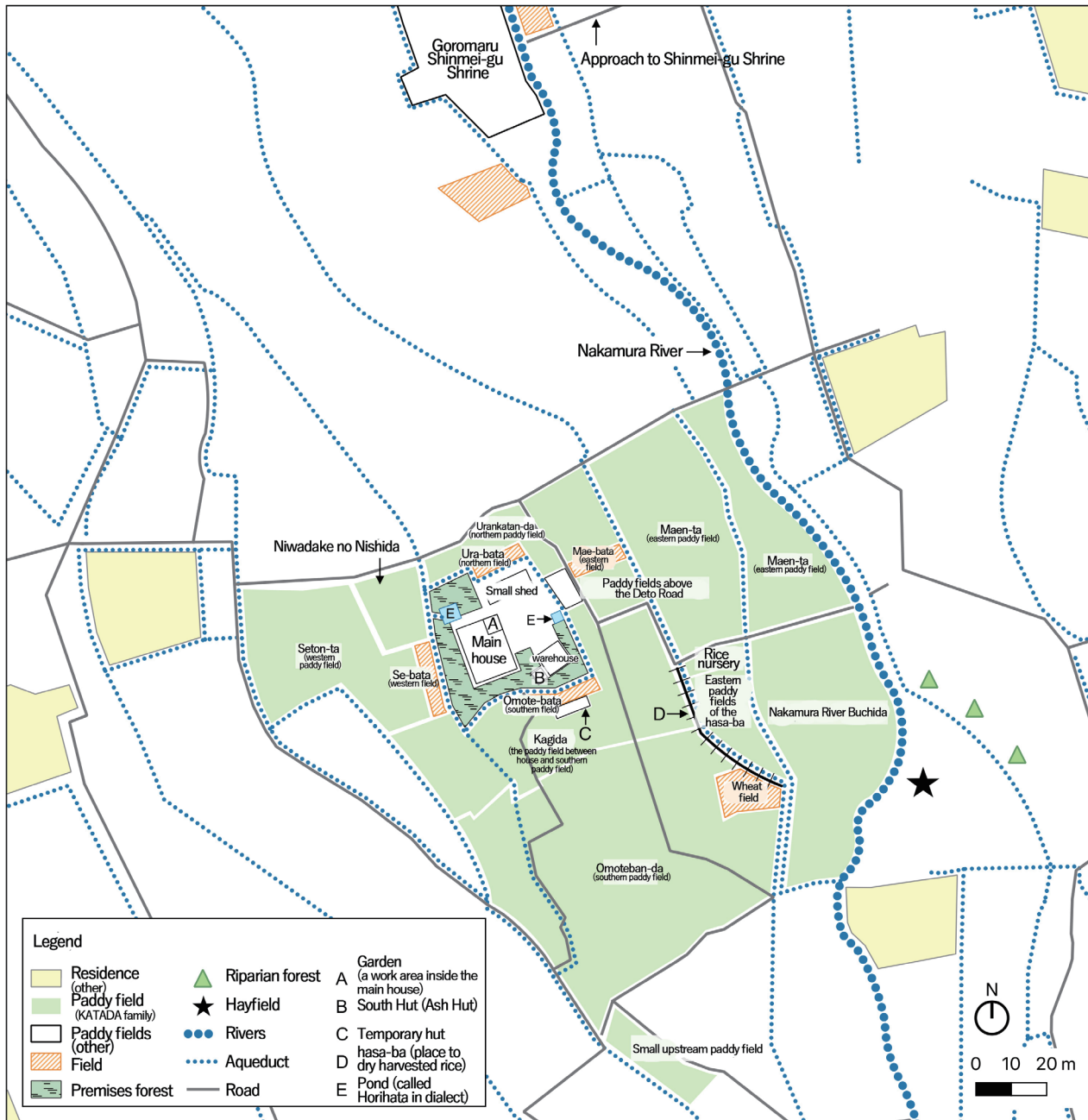


Figure 2. Layout of the KATADA family's residence and farmland in the Taisho Period (1912~1926)

work area that served as an earthen floor and was part of the main house), a small barn, a storehouse, a south hut (ash hut), a forest, and a pond (called Habata in dialect), all surrounded by aqueduct. In the ash hut, ashes from the hearth, fallen leaves and rice husks from the forest were stored and used as fertilizer. The forests were surrounded by hedgerows and trees such as cedar, Japanese white oak, persimmon, Japanese apricot, and Japanese cypress, which provided fuel and food, as well as wind and snow protection. Two ponds in the compound were connected to the aqueduct around



Photo 5. Pond on the west side of the KATADA's main house (July, 2017)

the house. The pond on the west side (Photo 5) was used to precipitate muddy water for domestic use and to cool fruits, while the pond on the east side was used as a place to wash farm tools. There were no wells, and the area was used for obtaining drinking water from the river.

The KATADA family's paddy field area was about 1.422 ha and field area was about 0.043 ha, the majority of which were located around the mansion. To distinguish individual farmlands, they were given names based on their orientation, and if nearby trees, rivers, and roads. For example, the south side of the house was called "Omoteba", the north side "Urakata", the east side "Mae", and the west side "Sedo", and paddy fields had names such as "Omoteban-da", "Urakatan-da", "Maenta", and "Sedon-ta". The western side of the house was a bamboo grove, and "Niwadake no Nishida" (Niwadake means the bamboo which was planted in the garden) was located behind it. There was a "rice field above the Detomichi road" along the Detomichi road (Entrance and exit roads) on the property, a "rice field east of the hasa-ba (place to dry harvested rice)" to the east of the hasa-ba along the aqueduct, and a "nursery" rice field to the north of the hasa-ba. Paddy fields along the "Nakamura River" were called "Nakamura River Buchida" and those located upstream on the south side were called "Kawakami no Ko-da". The fields were named "Omote-bata", "Ura-bata", "Mae-bata", and "Buchida".

Work recorded in the diary

Yahachiro's diary contained a wide variety of tasks necessary for farming and living, such as rice cultivation, field cultivation, maintenance work on the house, forest, aqueducts, and roads, horse care, and shoveling snow. In addition to the work done by Yahachiro and his family, there were also "yui" (tasks in which neighbors helped each other) and tasks that were paid for and performed by others.

Table 1 summarizes the outdoor work (excluding agricultural work) related to the use and management

of familiar natural resources as recorded in the diary. The diaries used are from April 1917 to March 1918, and from August 1922 to June 1923 with the total period being 2 years and 11 months. The locations where work was performed could be categorized as inside the house, both of inside and outside the house, outside the house, aqueduct, and roads.

In addition to daily tasks such as forest maintenance (Photo 6) and weeding, there are also seasonal tasks such as "koshibayui" (tying hedges) in early spring, "Take-maki" and "sugi-maki" (wrapping rope around bamboo groves and cedar trees in preparation for snow) in autumn and early winter, and "sunba" (cedar leaves used as fuel) in the limited season. There were also tasks that were necessary for storing natural resources or as a response to weather (disasters), such as "makigi nyo ni yane shi" (roofing with straw to keep firewood dry) and "kaze no atoshimatsu" (deal with the aftermath of wind).



Photo 6. Cleaning up the premises forest (July, 2017)

Table 1. Work related to the use and management of natural resources outdoors (excluding agricultural work) that was recorded in the diaries

Location	Work Contents	April			May			June			July			August			September		
		early	Mid	late	early	Mid	late	early	Mid	late	early	Mid	late	early	Mid	late	early	Mid	late
inside the house	"koshibayui" (tying hedges)	■	■	■															
	Wooden Roof			■															
	"kaze no atoshimatsu" (deal with the aftermath of wind)																		
	"Yashiki chokochokotoshi" (detail works)				■										■				
	"sunba" (cedar leaves used as fuel)																		
	Mowing of the house						■	■					■	■	■				
	Cleaning of the premises forest		■	■					■						■				■
	wrapping rope around bamboo groves in preparation for snow																		
	wrapping rope around cedar trees in preparation for snow																		
inside and outside the house	Straw	■	■	■															
	Grass (bush)	■	■	■															
	Kaya (thatch)	■		■						■	■								
	Snow shovelling																		
outside the house	Mowing (hills, etc.)							■		■		■	■						
	Collect the woods from mountains																		
	Collect red clay from Yasui village														■				
aqueduct	Raising the soil of the moat, re-doing the moat	■	■											■			■		■
	cleaning up	■		■	■								■		■				
	"Ezarai"	■	■																
	mowing										■	■	■					■	
	garbage pit																		
road	Mowing																	■	■
	Road repair																		■

*The diaries written on April 1917 - March 1918, August 1922 - January 1923 Data for June 2003 is used.

"Yashiki chokochokotoshi" was thought to indicate that detailed work was done in the vicinity of the house.

Work related to straw, brushwood (shiba), and thatch (kaya) was done inside and outside the house. Straw was indispensable in daily life as a material for thatched roofs, rice bales, sandals, etc. Then there were some works such as "Nyoiri" (carrying straw into the house after threshing). Shiba (small thatches and small bushes) were harvested from the ridge along the aqueduct in autumn and early spring, then brought into the house being bundled and stored under a straw cover. In the fall, the thatch was cut, brought to the house, and bundled. From late November to March, shovelling snow was an essential part of the work. As for work outside the house, there are descriptions of trips to Yasui Village (present-day Nanto City) to collect red clay and to Aoshima in Shogawa Town to collect firewood.

In terms of aqueducts, there was the "Ezarai," in which aqueducts in the neighborhood were maintained from spring to autumn by cleaning, weeding, and removing soil from the moat. As well as the "Ezarai," in which the aqueducts were shut off before the spring plowing season and new baskets were installed in a joint effort. In the "Ezarai," farmers related to irrigation canals brought their allotted repair materials (woven mats, straw, rope, bamboo baskets, neso, willow baskets, etc.) and dredged soil to repair and maintain the aqueducts as a labor service.

Conclusion

As described above through the diary entries, in the dispersed villages of the Taisho period, there was an intentional arrangement of house and farmland components which were suitable for living and farming. Specific tasks focused on procuring and storing the natural resources necessary for food,

Life in dispersed villages in the Showa Period

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Introduction

In Goromaru, Tonami City, road renovation progressed throughout the Showa period (1926-1989), and trucks, buses, and other motor vehicles began to drive through the area. In 1948, the Gokaya Agricultural Cooperative Association was established and the Gokaya Community Center was also established. In the period from 1955 to 1964 village road maintenance (Photos 1 and 2) was carried out. Then, in 1970, the field development was started, and in 1976, this construction was completed. Prior to these large-scale construction projects, the area of each paddy field in Goromaru was small, and the numerous aguaducts, large and small, were winding earthen ditch channels. After the field improvement, the dispersed village landscape was greatly transformed with the spread of shaped paddy fields, straight concrete-lined aguaducts, and widened road networks.

We were able to borrow a personal diary from this district. The period covered by the diary falls before the major changes in the development of the village roads and plots. Based on these circumstances, we



Photo 1. Before the construction of the village road (Showa 30 period) Photo is provided by NAKAJIMA Katsutoshi



Photo 2. Village road construction in progress (Showa 30 period) Photo is provided by NAKAJIMA Katsutoshi

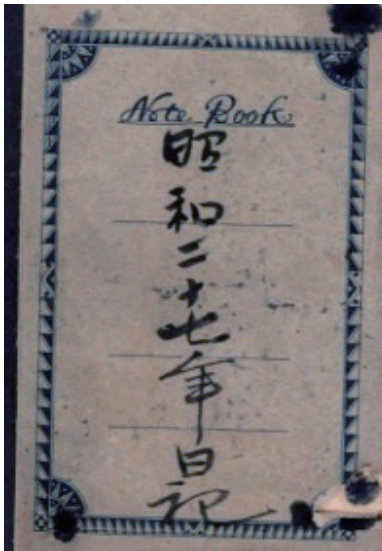


Photo 3. Cover of a diary in Showa year 27

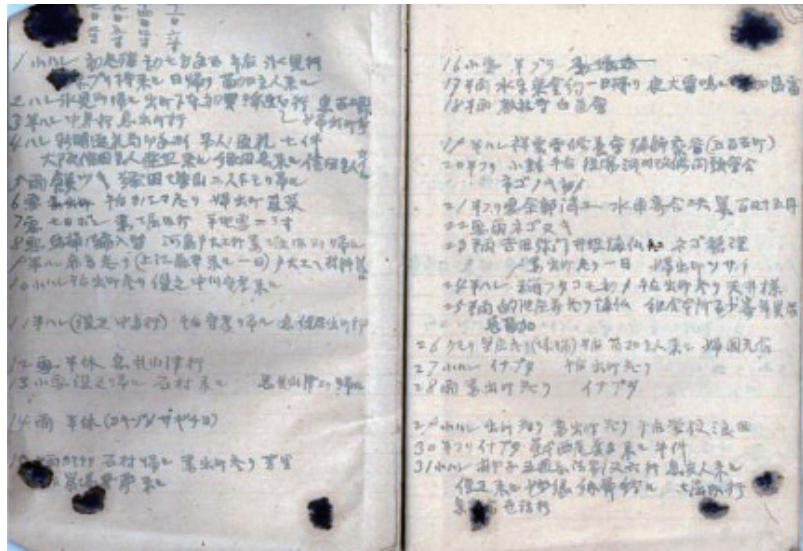


Photo 4. Contents of a diary in Showa year 27

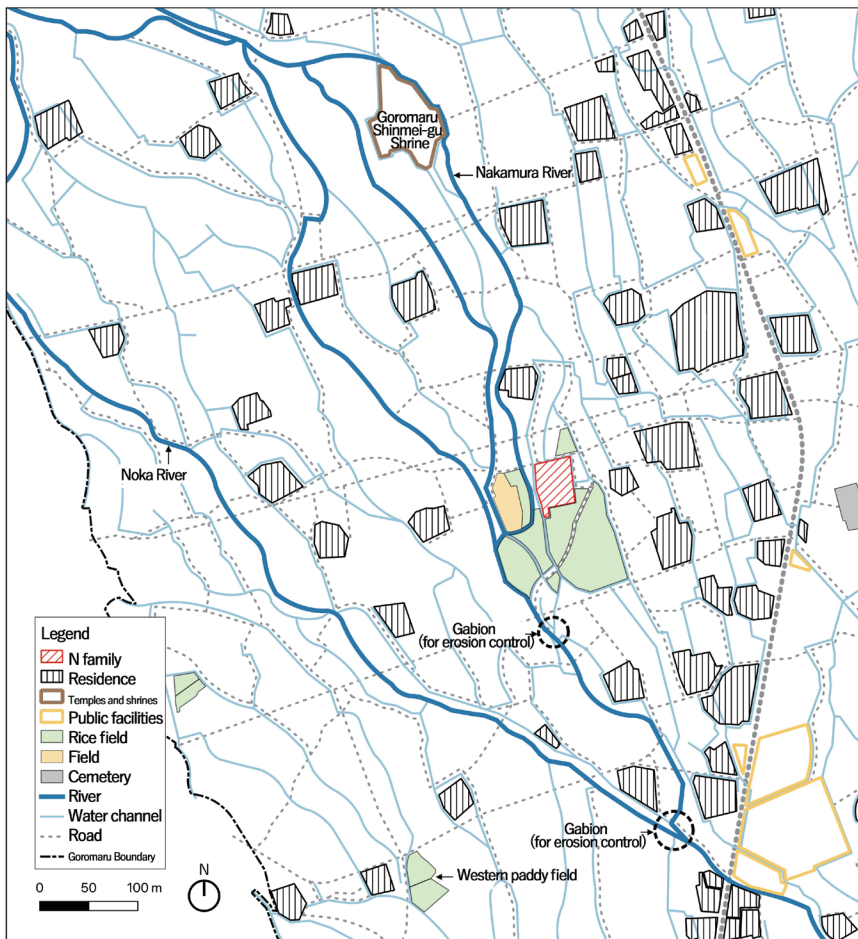


Figure 1. Circumstances around the N house in the Showa year 27 (1952)

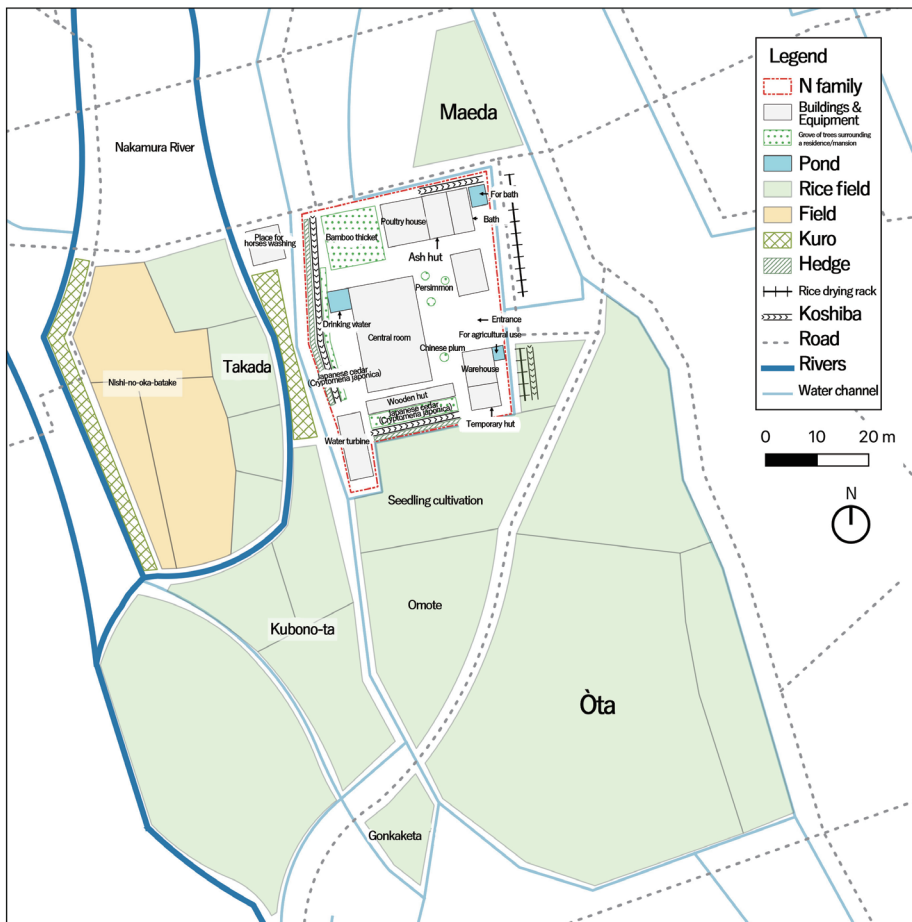


Figure 2. The site of the N family around the year Showa 27 (1952)

would like to take a closer look at life in this area during the Showa period. In examining the diary and its contents, we have supplemented the diary with interviews with the author's sons and relatives.

About the diary

There were a total of seven diaries that we borrowed, divided into sections such as "Diary," "Cash Book," "Memorandum," and "Special Note. (Photos 3 and 4) The diary entries were made from January 1952 to March 1954, and from January 1959 to December 1968 for a total of 12 years and 3 months. The author of this diary is named Mr. N., was born (in 1919) and raised in Goromaru, Tonami. He fought during the Second World War, and was between the ages of 33 and 49 when he wrote the diary, while living with his wife and two children while farming. He passed away in 1989 at the age of 70. In his diary, he wrote something almost every day, including the day's weather, his and his family's farm work, what he bought, weddings and funerals, and annual events. First, we

compared the diary's contents from 1952, the early period of the diary, and 1968, the latter period of the diary, in order to understand the details and to clarify the changes in their lives.

Surroundings of Mr. N's house

First, Figure 1 shows the surrounding conditions of Mr. N's house around 1952, as revealed by the interviews, and Figure 2 shows the inside of the premises. The house is surrounded by rice paddies, and the Nakamura River flows from south to north on the west side of the house. In this river, a place to wash horses and a gabion to prevent the river from overflowing were placed. A aguaduct for turning a waterwheel ran from this river, and the waterwheel to the southwest of the house was used for pounding rice, grinding azuki beans and buckwheat, and softening straw. On the west side of the house, between the river and the stream, there was a thicket called kuro, and on the east side of the house, there were about five cedar trees planted to support the poles used to dry the rice. Surrounding the house, from the outside, there was a aguaduct, a shrub hedge called koshiba, and a forest. Looking around the site, centering on the main house, there was a wooden shed on the south side, a pond (for drinking) and a bamboo grove on the west side, a chicken coop, an ash house, a bath, and a pond (for bathing) on the north side, and a storehouse, a pond (for farming), and a Temporary shed on the east side. Just east of the main house was a garden area (called nyaba) with persimmon trees and

Table 1. Work in the life of the N family (Showa year 27)

	spring			summer
	March	April	May	June
working in the rice paddies		sowing at a rice nursery ridge between grooves in threshold or lintel like water off a rice paddy (watering rice field)	ridge between rice fields raising the soil mowing with a sickle rice planting sprinkle lime	rice planting
making things out of straw (winter work for farmers)	mocco			waragai
working in the fields	planting a potato	planting taro corms	potato field (furrows) Making summer bean hand	take of rapeseed barley harvesting wheat harvest onion scooping potato (<i>Solanum tuberosum</i>) summer bean jam
Tree Use and Management				Peeling timber from a tree Organizing firewood
annual event		spring festival		seasonal planting of rice on a field affiliated with a shrine
aguaduct		Ezarai		Cleaning of river

plum trees.

Next, we will divide the diary into the following categories: rice field work, straw work, field work, use and management of trees, annual events, management of aguaducts for disaster prevention and mitigation, and movement toward field improvement. Table 1 summarizes the N family's lifestyle centered on farming in 1952.

Working in the rice paddies

In April, the seedlings are sown, the topsoil is cut away with dead grass between the rice paddies, mud is plastered onto the rice paddy ridges in May to prevent water leakage, the fields are roughly dug up, and the soil is softened with the sickle. Rice planting was carried out during the month of June. In 1952 a work called "Afternoon Waka-usi Araokoshi Hajime," in the diary which oxen were used for "Sickling," "Roughing," and "Narashi" (Photo 5). In 1968 the text reads, "Tillage start Narashi in rice paddies," which means that cultivators and rice transplanters were used instead of livestock (Photo 6). Furthermore, in 1952, rice planting work was described over a period of eight days, but by 1968, the description of rice planting work was only four days. This suggests that the use of machinery increased work efficiency. In 1952, there was an entry that read, "Afternoon, went to Fugengiro for rice planting," showing them helping each other with rice planting (Photo 7), but in 1968, there was no mention of joint work regarding rice planting. As

summer		autumn			winter		
July	August	September	October	November	December	January	February
	sowing seeds of Astragalus	rice harvesting drying ears of rice in the sun drying rice ears on poles	threshing (e.g. rice) shipping wallaneyotum	Seed rice production			
					straw sandals	nego extraction inabuta	minogo sarugai
plant a sesame field Planting leek seedlings Temporarily Eggplant field maintenance wheat threshing	adding sesame fertilizer early taro digging plant hakusai barley dried	sowing seeds of daikon roll pumpkin harvesting sowing seeds of wakegi plant chrysanthemum seedlings	sowing seeds of wheat fertilizer for hakusai cover green onion with soil digging for taro corms plant a rapeseed seedlings soya bean (soybean) grind	plant an onion digging for Chinese yam take of black soy bean, aomame and azuki bean planting of rapeseed mowing thatch	sorting daikon		Kanran (Cabbage europea)
start to split stumps	split stumps chopping firewood	take firewood in Kanaya		Pruning trees in the terraces	Sorting out the branches of trees in the house		
	Spring cleaning Cleaning Tatami mat drying	lion dance Kyoden Festival		festival of the end of year			
				Cleaning up the river			



Photo 5. Rice paddy being raised by oxen (Showa year 30 period) Photo is provided by MATOIKE Tatsuya



Photo 6. Raising rice fields with a cultivator (Showa year 30 period) Photo is provided by MATOIKE Tatsuya

shown in Figure 2, the author of this diary referred to each rice field in his/her home by a name that could be recognized only within the family, such as "Kubono-ta," "Taka-ta," or "Mae-ta". This is thought to be unique to the period before the field maintenance that began in 1970, when the rice fields were divided into smaller fields. Incidentally, "gon" in "gonkake-ta" means garbage, and in these rice paddies, food scraps were put into the paddies and used as compost.

In August 1952, there were two references to "Chika-ta Genge Maku". Genge, also called rengeso, has been cultivated since the feudal era as a green manure that fixes nitrogen in the air by rhizobium bacteria that live symbiotically in its roots. Along with the application of Shiun "Chika-ta Sown astragalus", lime was also sprayed to control the acidification of the rice fields. There are two references to "lime spray" in May 1952, and it appears that lime was sprayed on the rice fields

where genge was planted. No mention of genge and lime use was found in the 1968 diary.

Rice was "harvested" and "dried" in September (Photo 8). Afterwards, the dried rice was piled up, which was called "katameneyo" (Photo 9). In this area, it seems that for a long time, ground-drying was practiced, in which each handful of harvested rice was dried by spreading the tips of the ears in a circular pattern on the ground with the stubble on top. In 1952, the N family was drying rice ears on poles for drying. There was no description of the method of drying rice from the 1968 diary. In 1952, there was also a description of "failure in drying ears of rice," indicating that the family had difficulty in drying rice in the autumn sky. In 1968, there is a description of "hoboshi inekari tetsudai," which indicates that there was some joint work. The rice was then threshed and shipped. After threshing, the rice was collected and stored as "waraneotsumu", and only the straw was collected and made into processed straw products. The chaff was also called "neka," and a "neka hut" was built to store it, where it was kept and used as a fuel.

Working with straw

After the rice harvest, straw was used to make various items. The months of December through February in particular are the off-season for winter farming, and in January 1968, for 16 out of 31 days, workers spent much of their time working with straw. To name a few specific items, they made "nekoda," a back pad worn when carrying things (Photo 10), "mokko", a tool used to transport soil and compost, "inabuta," a tool used for farm work, and "sarugai," a tool used for rain gear. There were nine types of steam item that we were able to identify. In making straw products, there were processes such as "warasuguri," which involves removing the leaf sheaths from the base of the straw stubble, and "nego-nuki," which involves extracting the core of the straw, "nego," from the rice straw. In particular, the production of "sarugai" required considerable skill and proficiency, so it seems that many people ordered a specific person to make it



Photo 7. Collaborative rice planting (Showa year 30 period)
Photo: MATOIKE Tatsuya



Photo 8. Drying of ears of rice (Showa year 30 period) Photo is provided by MATOIKE Tatsuya



Photo 9. "Katameneyo" (Showa year 30 period) Photo is provided by MATOIKE Tatsuya

for them. In fact, there are descriptions in the diary of the author making and giving various items to people in the vicinity, suggesting that the author of this diary was good at straw work.



Photo 10. Nekoda remaining around Goromaru

Photo 11 shows dried rice cakes, which are made by weaving thin slices of rice cake with straw and drying them. Locals called it "korimochi," meaning rice cakes made during the coldest days of winter. Straw was used for a variety of purposes.

Working in the fields

Like the rice paddies, the fields were named "nishi-no-oka-batake" and various crops were grown throughout the year. In 1952, a total of 19 crops were grown, including kanran (cabbage), potatoes, taro, soybean, eggplant, pumpkin, cucumber, onion, leek, radish, Chinese cabbage, yam, barley, wheat, red beans, sesame, rape seed, chrysanthemum, and hitomochi (leek).



Photo 11. Making korimochi (dried rice cakes) (Showa30 period) Photo is provided by MATOIKE Tatsuya

In 1968, the family was producing a total of 16 varieties of kanran, potato, taro, soybean, eggplant, pumpkin, cucumber, onion, leek, radish, Chinese cabbage, spinach, burdock, sweet potato, tomato, and hoken (kochia). Of the crops grown in both years, 11 were of the same variety. The rapeseed grown only in 1952 was pressed for oil, with the notation "Squeeze 6 sho seed oil and 6 kan oil cake". In both years, there is a description of "Kaya-kari", which indicates that they were harvesting and storing the grass for roofing every year.

As for fertilizers to be put into the fields, in 1952, there were descriptions of "take soy sauce cake" and "buy oil cake" in Demachi in downtown Tonami, and these were used, but in 1968, there were no such descriptions. In both years, there was also a description of a "pour urine," and human waste that had been pumped out was also used.

In 1952, the diary author's wife pulled a cart to Demachi to sell the crops that were ready. In August 1952, she went there 9 times, but in August 1968, she went there 0 times. It seems that the way crops were sold and where they were shipped changed.

Tree use and management

In a diary kept in 1952, there are descriptions of "peeling timber," "splitting stumps," and "chopping firewood" throughout the year. It seems that trees were cut down, processed, and the resulting wood was used as fuel. There was also a record of obtaining



Figure 3. Ezarai (Created by OHARA Ayumi)

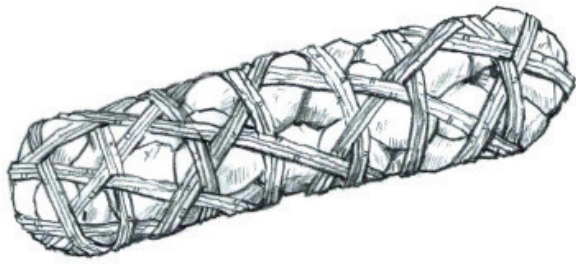


Figure 4. *Jakago*(Created by OHARA Ayumi)

lumber from a "buy Kanaya firewood" (Kanaya is located in Shogawa Town). We also found records of the management of the trees around the house, such as "pruning trees in the terraces" and "sorting out the branches of trees in the house". Even in 1968, there are descriptions of "firewood production" and "firewood work," indicating that the daily use of trees continued. The records of acquiring wood also continued to be found, with one entry that reads, "Take over (takimono) to Demachi's company." The records also show the use and management arrangement of the premises forest, such as "cedar koshiba", "cedar koshiba tsubairu (tsubairu means pruning)", and "kmit koshiba (bamboo to prevent falling trees in case of snow)", as well as "zelkova board bind on the south side". In addition, both banks of the canal before the field development were planted with thickets, willows, and thatch to prevent collapse, and firewood was obtained from a wooded area (Kuro, Figure. 2) on the west side of this house. Note that in 1953, the year after 1952, descriptions of "buying cedar seedling" and "planting cedar seedling" indicate that not only the

lumber from the property was used, but also trees were grown.

Annual event

In this area, there was a "Rice Field Festival" (Photo 12) on June 10, where children go from house to house carrying andon (lanterns), and on September 14, there was a "Lion Dance" (Photo 13), which was also mentioned in the diary. Other festivals include the "Spring Festival" on April 19, the "Kyoden Festival" on September 14, and the "Festival of the End of Year" in early November was mentioned in both the 1952 and 1968 diaries.

Other daily activities are also described, according to the season such as "cutting the grass on the road" starting around June, cleaning the tatami mats to dry before the O-Bon Festival, visiting graves during the O-Bon Festival, preparing miso in winter, removing snow, making snow fences, and pounding rice cakes and shoji paper screens at the end of the year. There were also frequent visits to many temples, as many as 15 temples that we were able to confirm.

Aguaduct management for disaster prevention and mitigation

In this area, there is also an annual event called "Ezarai" (Figure 3), in which each village cleans its aguaducts before spring plowing. This spring "Ezarai" was held in April in 1952 and in 1968, both from March to April. The 1968 "Ezarai" entry specifically stated frames and bamboo baskets were



Photo 12. Rice Field Festival on June 10th (Showa 30 period)
Photo is provided by MATOIKE Tatsuya



Photo 13. Lion Dance event on September 14th (Showa30 Period)
Photo is provided by MATOIKE Tatsuya

needed for the Ezarai. The author of the diary was asked by a local water manager to cut down bamboo from the bamboo grove at his home and make five or six bamboo baskets at a time. This was done using sticky madake bamboo, as moso bamboo would break. Bamboo pieces about 2 cm wide were assembled, and stones about 10-15 cm wide were placed inside (Figure. 4). These bamboo baskets, also called *jakago*, were about 80 cm in diameter, and their length matched the width of the river, about 2 m at the longest. It was placed at the junction of the river so that the stones would not collapse, soil would not be washed away, and the river bottom would not decrease. Placing these *jakago* also served to regulate the amount of water. Two baskets were placed where the river had a large drop-off, and one basket was placed where the drop-off was small (Figure 1). In addition, the river was wide enough at that time to prevent the rice paddies and fields from being flooded immediately after heavy rainfall. Catfish were said to live upstream of the *jakagos*, and eels were said to live downstream.

As for descriptions of the aguaduct, there were three written in June 1952, including "sweep the river along the back field," one in November 1952. In September 1968, there was one mention of "South side river grass cleaning" and in December, this same phrase was found twice. In the spring, the community jointly maintained the aguaduct, and other individual management was also carried out.

Movement toward field development

In the diary, "Town Hall River Repair Question and Answer Meeting" (January 1952), "Noka River Nakamura River Survey" (February 1952), "Town Hall on Nakamura River Repair" (February 1952), and other descriptions show in detail the movement toward the repair of the rivers around the houses. In addition, there are also descriptions such as "Day of the Village Public Works Committee" (February 1952), "Concreting of water for irrigation", "Concreting of kaemonmae waterway", and "Small concreting of suishae waterway" (April 1952). In addition, there is also a "Visit to the repair

work" (November 1968), in which the diary writer observed the changing surroundings.

Summary

In Goromaru, Tonami City, during the postwar period from 1952 to 1968, life was still centered on rice fields and field work. Straw work was actively practiced in daily life, and wood was used in large quantities, a way of life that is less common today. Festivals were held in the spring and fall, and there were also joint activities such as cleaning aguaducts and rice cultivation. On the other hand, the changes in the 16 years between 1952 and 1968 shows that farm machinery was introduced, the types of crops produced changed, the application of fertilizers was changed, and there were also changes in the way farmers sold their produce. In addition, before the field development, a aguaduct ran very close to the house, and to prevent the rice paddies from being inundated by flooding, bamboo baskets were placed according to the width of the river. The local people maintained the infrastructure of daily life with their own hands, and also responded to disaster prevention and mitigation. The documents also provided a detailed picture of how preparations for subsequent field development and river improvement were gradually being made.

References

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Historical transformation of houses and premises forest since the Showa Period

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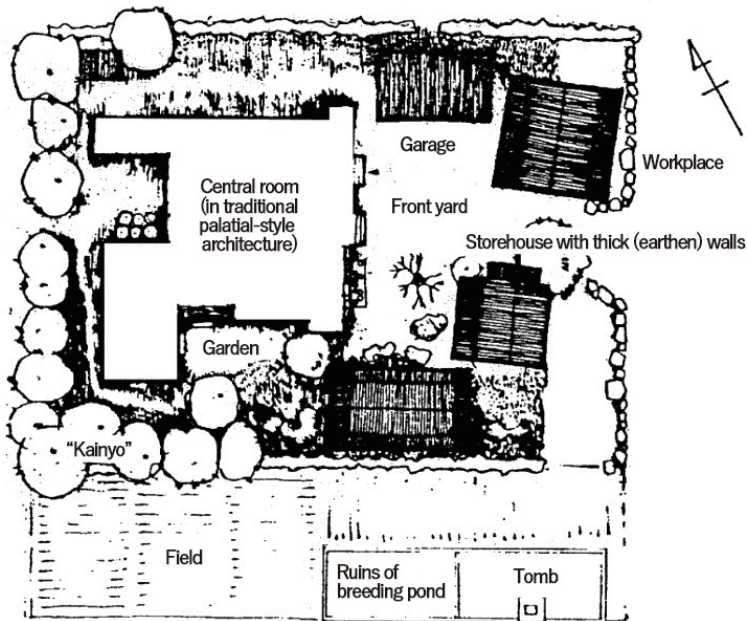


Figure 1. House structure in the Tonami House (Source: YAMANAKA 1979)

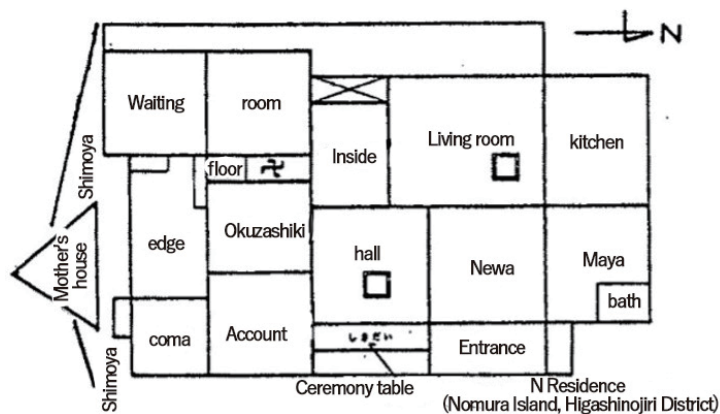


Figure 2. Tonami House floor plan (Hiro-ma III type) (Source: SUMITA 1990)

Introduction

As shown in Figure 1, the Traditional house structure in the Tonami Plain is centered on the main house facing east, with attached buildings such as workshops and storehouses in the front, surrounded by stone walls and hedges, with a forest ("kainyo") on the south and west sides (References 1 and 2). In 1980, the Toyama Prefectural Board of Education compiled a report entitled "Private Houses in Toyama Prefecture: Emergency

Survey of Private Houses ". The main house plan in Toyama Prefecture is categorized into Hiro-ma I, II and III types, and the typical plan of a rural house in the Tonami area is categorized as Hiro-ma type III (Figure 2) (see Reference 3). The composition of the room is centered on a hiro-ma called "oi", which is made of wakunouchi (inside a frame). The traditional layout emphasizes hospitality, with the formal spaces of okuzashiki and kuchizashiki on the upper side and daily living spaces such as newa (earthen floor), chanoma and daidoko (kitchen) on the lower side (see Reference 4). (See also.)

Even in the newly built house (1996) which was confirmed by Sumiya's study (1997), a dining kitchen or living room that accommodates the family unity on one side across the central corridor, and a hall (hiro-ma) type on the other side. A flat structure with a T-shaped customer service space that clearly separates the living space of the family reveals that traditional formal consciousness and customer service practices in the local community remain (see Reference 4).

On the other hand, it is pointed out that the roof form of the main house, which constitutes the house structure, and the premises forest have changed significantly since the

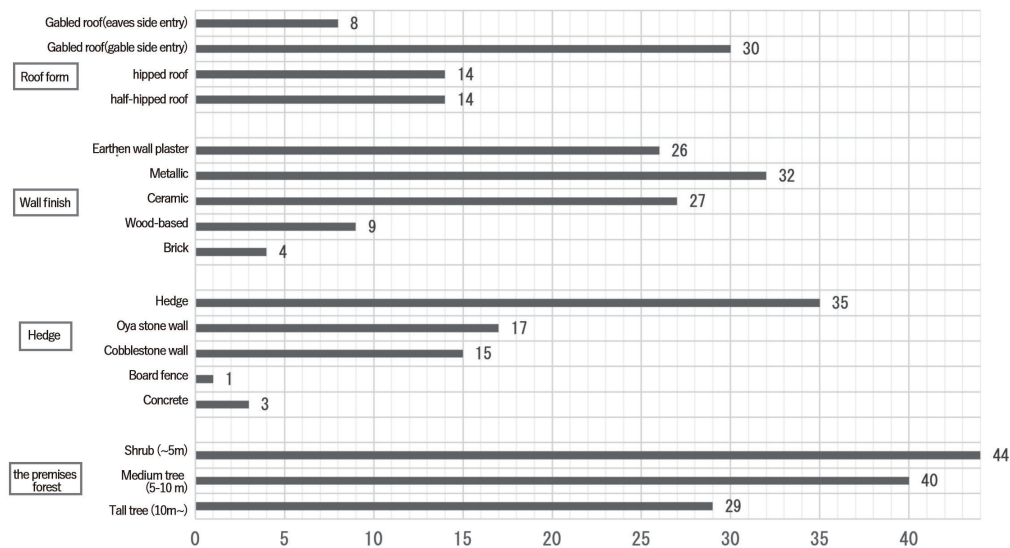


Figure 3. Composition of main house and premises forest (n=44) in the Goromaru No.2 Community Association. Note: Multiple responses are given because one main house consists of multiple composition items.

Meiji period (1868-1912). However, with the spread of tile roofs, there was a shift to *maenagare* (gabled roof with eaves side entry) and *azumadachi* (gabled roofs with decorative woodwork on the gable side) in the Showa year 40 period (1965). From 1965 onward, *irimoya* (half-hipped) roof also began to be seen (see Reference 5). The village types were classified into "dispersed villages", "row villages", and "street villages" from 1990 to 2001, and the residential characteristics of each type were analyzed (Kurono et al., 1990). The number of people who have been living in the area is not yet known. The report points out that field development projects in dispersed villages have had a significant impact on living space. For example, roads were drawn in the process of clearing arable land regardless of the direction of the house structure (see Reference 6), which resulted in the collapse of the house structure and the disappearance of the traditional arrangement of the components of house, arable land, roads, and aqueducts (see Reference 7). In addition, the forests were used for gathering building materials and fuel, and had a symbolic role as windbreak and snow cover forests, and as a sign of family status as property (see Reference 8). Due to mismanagement, the number of premises forests is on the decline (see Reference 9). Typhoons and heavy winds have also been cited as a factor in this

decline (see Reference 9 and 10).

However, we have shown from previous studies that the factors are complex, and that external influences such as arable land consolidation (impact of road widening and rearrangement) and natural disasters (typhoon damage and subsequent administrative response) are triggers for the transformation. However, most of these studies are comparative studies of the settlement form and the plan configuration of the main house at a certain point in time, so in this paper, we conducted interviews with four houses in Goromaru, Tonami, in order to understand in detail the Temporal transformation that led to the current premises forest and the main house. In addition to the fact that Goromaru has been the subject of related research by Ishibai et al. (2018) and is recognized as a "scattered landscape model district" by Tonami City, the central part of the village is located on National Route 156 and the Nanto Super Farm Road traverse the area, which has been affected by the new construction and widening of the main road as well as the field development noted in previous studies, allows for a diachronic view of the various transformations of the postwar private houses and premises forests.

In this paper, information obtained from a complete

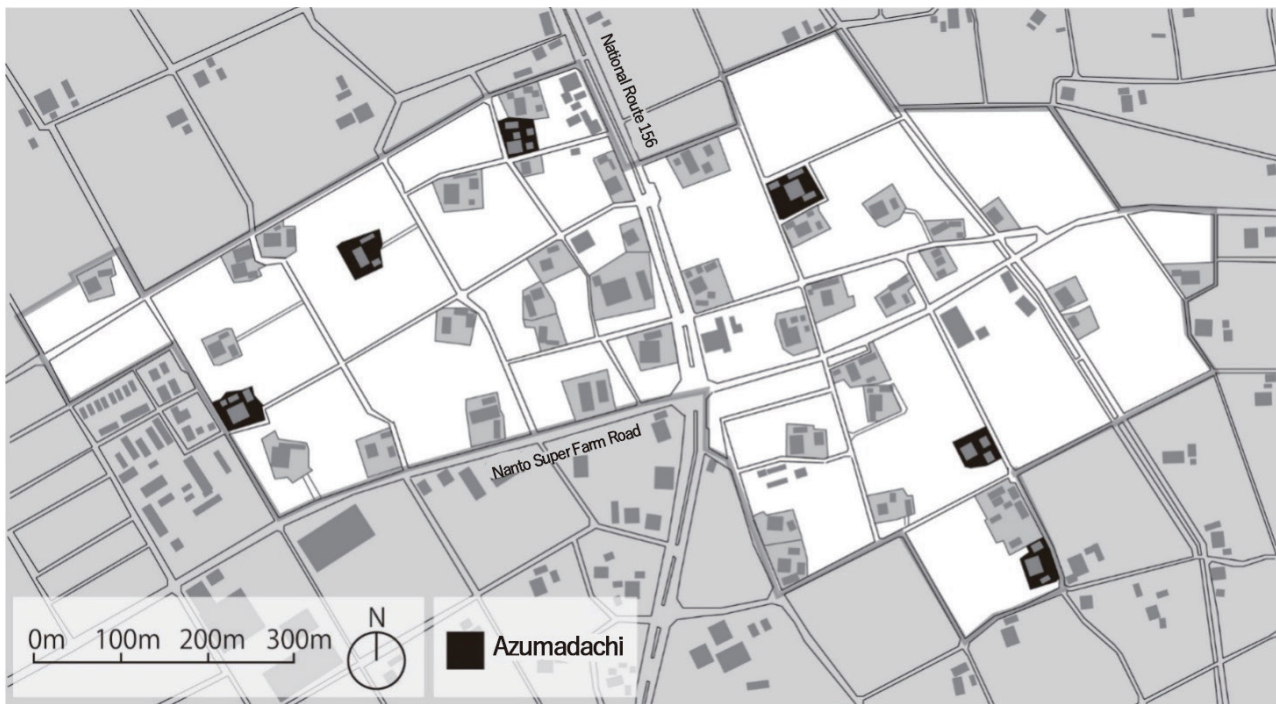


Figure 4. Distribution of *Azumadachi* in Goromaru



Figure 5. Distribution of tall trees (over 10 m) in Goromaru

exterior survey was organized to understand the current status of the form of the main house and the premises forest in Goromaru. Next, four owners (the OM family, the NO family, the NM family and the KD family) were selected and interviewed about the transformation process of their houses and premises forests in the postwar period. The exterior comprehensive survey was conducted in June, August, and October 2018, and the interview survey was conducted in April, July, August, 2018, as well

as in February, June, and August 2017. We visited each mansion eight times in October and February 2019.

Survey in goromaru

(1) Survey method

First, in order to understand the current form of the main houses of Goromaru, which is the subject of the survey, and the situation of the premises forest, the information that can be read from the exterior

Table 1. Transformation of Goromaru village and OM's premises forest

time	event	Impact on premises forests
1943-1945 (S18-S20)	Wartime offerings of trees	cedar offering
1948 (S23)	rural life improvement movement	Japanese cedar logging campaign
1950 (S25)	Typhoon Jane	fallen cedar tree
1960 (S35)	Ise Bay Typhoon (1923)	fallen cedar tree
1961 (S36)	Second Muroto Typhoon (1923)	fallen cedar tree
1962 (S37)	Start of field maintenance	cedar withering
2004 (H16)	Typhoon No. 23	fallen cedar tree

of the 44 houses of the second ordinary session with the cooperation of the survey is as follows (1) roof form, (2) wall finish, (3) hedges, and (4) premises forest. The data was organized in four categories.

The classification of each item is as follows: roof form is classified as "gable roof (eaves side entry)", "gabled roof (gable side entry)", "hipped roof", and "half-hipped roof"; finishing of wall is "earthen wall / plaster", "metal siding", "ceramic siding", "wooden siding", "brick", the type of fence is classified as "hedge", "stone fence", "stacked boulder wall", "plate wall", and "concrete". The height of the premises forest is categorized as "Tall trees (more than 10m in height)", "Medium trees (between 5 m to 10m in height)", and "shrubs (less than 5 m)". According to the Ministry of Land, Infrastructure, Transport and Tourism's road greening standards, tall trees are 3 m or more, medium trees are 1m or more but less than 3 m, and shrubs are 1m or more but less than 3 m. However, as all the houses in Tonami Plain were found to have premises forest of 3 m or more as shown in the survey results described below, we followed the premises forest survey by Ishibai et al (see reference 9). 5 m and 10 m were used as the basis for classification. In addition, since the main house consists of multiple items, each classification has multiple responses.

(2) Survey results and discussion

The results of the simple tabulation of the complete survey are shown in Figure 3, and the distribution of *azumadachi* and tall trees (10 m or more) are shown in Figures 4 and 5.

The roof types are 8 units (18 %) for "Gable roof (eaves

side entry)", 30 units (68 %) for "Gabled roof (gable side entry)", 14 units (32 %) for "Hipped roof", and 14 units (32 %) for "Half-hipped roof". Among them, 6 (14 %) were *Azumadachi*, but as shown in Figure 4, they are scattered throughout the village. The "gabled roof (gable side entry)" houses were of two types: *maenagare* and newly built houses, but in many cases the houses had been extended and remodeled and had composite roofs, so the two types could not be clearly distinguished.

The finish of the wall is "earthen wall / plaster" 26 units (59 %), "metal" 32 units (73 %), "ceramic" 27 units (61 %), and "wooden" 9 units (20 %). There were 4 "brick" units (9 %), with "metal" being the most common, followed by "ceramic" and "earthen wall / plaster". "Metallic", "ceramic" and "woody" are relatively new wall finishes, and it is thought that many of them have been renovated in recent years due to the form of the purlin.

The types of fences are "hedges" 35 houses (80 %), "stone fence" 17 houses (39 %), "stacked boulder wall" 15 houses (34 %), "plate wall" 1 unit (2 %), "concrete" 3 houses (7 %), with the majority of them being categorized as "hedges". This can also be seen as part of the premises forest. In addition, according to interviews with local

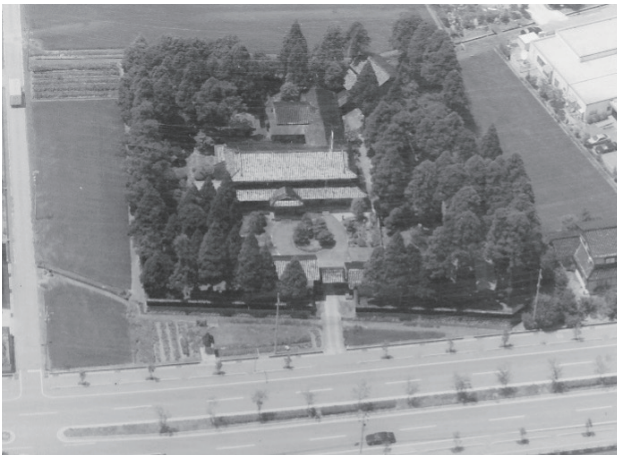


Photo 1. OM house before typhoon (1998 Photo: Mr. OM)



Photo 2. Cedars felled by typhoon in OM's premises forest (Photo: Tonami Municipal Tonami History Museum)

residents, in preparation for the flooding of the Sho River, the foundation of the mansion was built and stone walls were set up using the boulders of the river, so it is considered that the "stacked boulder wall" is one of the oldest types of barriers. On the other hand, the "stone fence" is a relatively new fence that uses factory-produced cut stones. The "board fence" was confirmed only on the property of the OM family.

The categories representing the height of the premises forests surveyed were as follows: 29 (66 %) for "tall trees (10 m or more)", 40 (90 %) for "medium trees (5 m or more and less than 10 m)", and 44 (100 %) for "Shrub (less than 5 m)". This means "shrubs" were confirmed on all the house properties surveyed. Initially, it was predicted that the tall trees would be affected by the field maintenance project and road widening, but looking at the distribution map of "tall trees (10 m or more)" in Fig. 5, there

are also tall trees along the widened main road. It is considered that there was little impact on tall trees due to field maintenance and road widening. As pointed out in the study by Ishibai et al. (2018), Goromaru has been certified as a "Scattered Landscape Model Project," which means that local efforts to prune branches utilizing government support are being carried out. It was reconfirmed that although the size of the premises forest is small, the planting of fruit trees and trees for gardens (see Reference 9) is being used to increase its value. On the other hand,

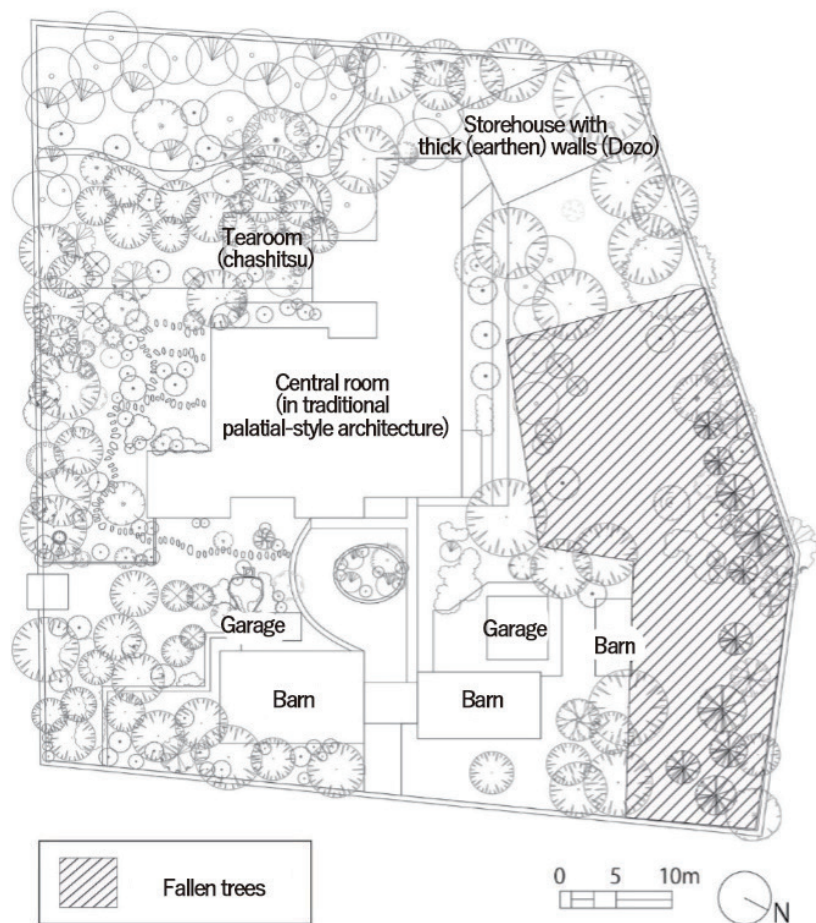


Figure 6. The location of planted trees after the OM's offering during the WWII and felled by typhoons in 2004 (drawing by WANG Wen)

local residents were told that, with the introduction of gas and electricity, the use of sumba (cedar leaf twigs), which used to be used as fuel in the past, has disappeared, and many cedar trees have been cut down due to the labor-intensive process of disposing of large amounts of fallen leaves.

In addition, 43 of the 44 houses (97 %) had outbuildings other than the main house, such as a farm equipment shed and storehouse, and two houses (5 %) retained their row-house gates.

The above shows that although the number of *azumadachi* and *maenagare* (tile-roofed roofs), which became popular after the Meiji period (1868-1912), has decreased, the gabled and flat-roofed styles remain. Although metal, ceramic, and wood siding finishes are prominent, clay and plaster walls were also observed. We confirmed that the form of the main house is partially retained. In addition, almost all of the houses have preserved attached buildings and forests in addition to the main house, and it can be said that Goromaru as a whole has relatively preserved its traditional appearance.

Outline of the surveyed properties

(1) OM family

The OM House faces Route 156 and has the largest lot size in Goromaru. It is the first house in Tonami City to be designated as a building of scenic importance in 2016. "Important Landscape Buildings" are buildings that have been designated in accordance with the Landscape Law enacted

in 2004, and are designated as such based on the nature, history, and culture of the area. In the case of Tonami City, the buildings must meet the following criteria: "widely familiar to residents as a symbol of the community," "traditional architecture," and "located in a model area of a scattered landscape". Buildings of scenic importance are obligated to be managed, and permission is required for extensions, renovations, and changes to the exterior.

(2) KD family

The KD family is one of the six identified *Azumadachi* households in Goromaru, facing National Route 156 and the Nanto Super Farm Road. The front of the house has a traditional structure with a farm equipment hangar on the right, a converted storehouse on the left, and a tall forest grove on the west and south sides.

(3) NO House

The NO house is an addition to the main house in *Maenagare*, and like the KD house, it does not face the national or farm road. The house retains its traditional structure in that there is a farm equipment shed on the right side of the front of the house, with a traditional Japanese garden on the left side of the house, and no tall trees remaining in the forest grove.

(4) NM family

The NM family's house is a two-story mansion



Photo 3. Cedar tree felled by typhoon in KD's premises forest (2004 Photo: Mr. KD)

with an attached gabled roof, facing Route 156. The front of the house has a storehouse on the left and a farm equipment storehouse on the right, with a tall forest of trees remaining on the south side. The house was newly built when Route 156 was widened.

Transformation of the mansion and the premises forest

(1) Transformation of the OM family mansion

The OM family's main house with a thatched roof was built facing east at the beginning of the Meiji period, and has a nagaya style gate at the front entrance of the house, and a storehouse and pickle house near the front-right side. There is a tall tree premises forest on the north side, and the boundary of the site is surrounded by a thatched wall and a wooden wall. It was the most extensive property in Goromaru and the OM family was known to be prestigious. The main house is a hiro-ma-style room with a wakunouchi, and in addition to an okuzashiki and kuchizashiki (Buddhist room), there are two additional tatami rooms for entertaining guests in a "tanoji" style. In 1940, a Western-style room was added as a reception room. In 1948, the roof was converted from a the tched root to a tiled roof. In 1950, the rice warehouse was dismantled to create a form similar to the current residence.

In 1962, the tea room built in 1885 was relocated to the OM family's mansion, and a tea room and a mizuya were added behind

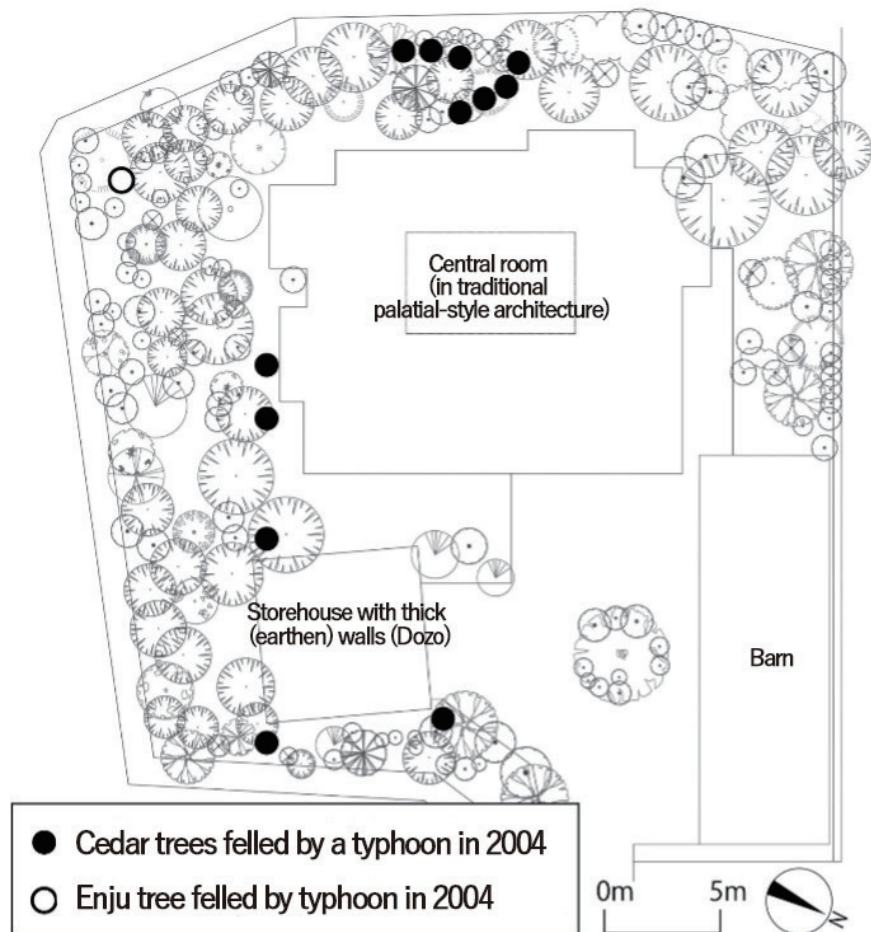


Figure 7. Tree species and placement of trees felled by typhoon in the KD house (drawing by WANG Wen)

the main house. The reason for the expansion was that the relocated tea room was a reverse one, so a real tea room was needed. Mr. OM's parents were not the tea ceremony teachers, but he said that he had many opportunities to invite guests to the tea ceremony. It seems that a part of the premises forest was cut down when this tea room was expanded. In addition, this period coincided with motorization, and Mr. OM also



Photo 4. NO family house before the cedar felled by the typhoon (1992 Photo: Mr. NO)

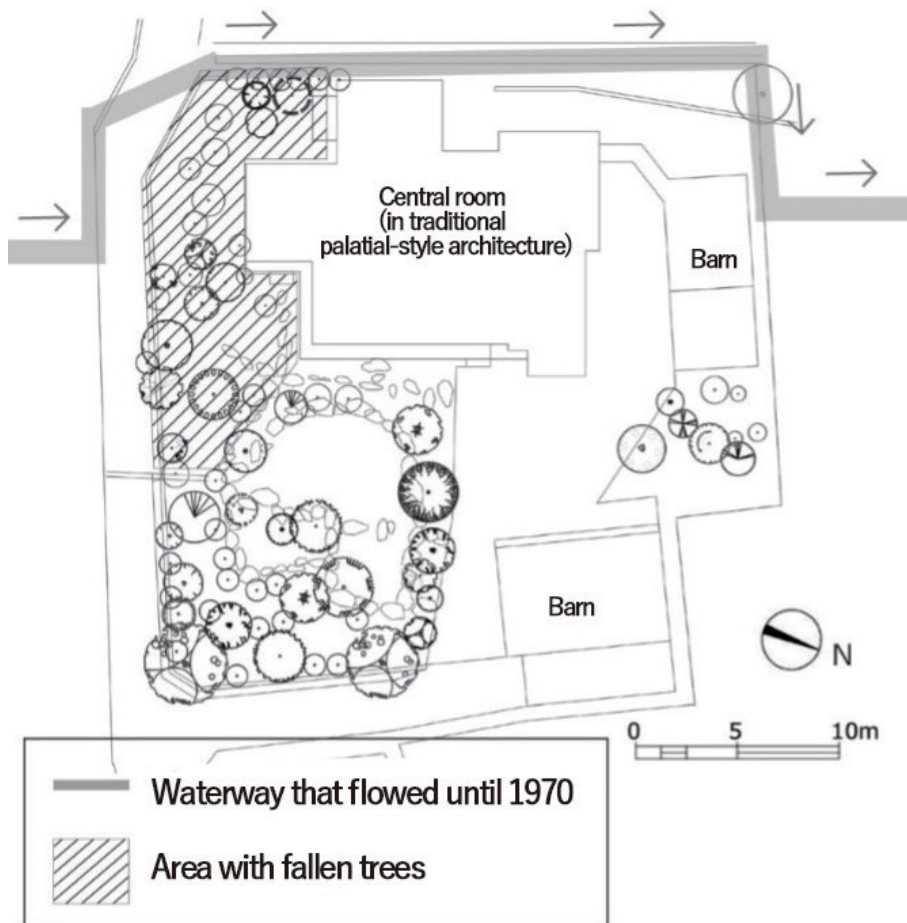


Figure 8. The part of the NO house where the tree fell down (drawing by WANG Wen)

purchased a private car in 1967 and built a garage at the site of the rice brewery. After that, as the number of rooms became necessary as the children grew up, in 1974 the kitchen, which was a dirt floor, was remodeled into a children's room, a well was filled, and the kitchen was expanded to become the current mansion.

Social transformation factors in the Goromaru premises



Photo 5. The NM family's house before road widening (1988 Photo: Mr. NM)

forest based on interviews with Mr. OM can be summarized as shown in Table 1. For example, the OM family offered about 10 cedars with a diameter of 1 m or more, which were located on the south side of the house during the war, and miscellaneous trees were planted. They also planted 50 cedar seedlings in the shaded area on the north side, shown in Figure 6. Thereafter, cedar trees continued to be cut down and felled throughout Goromaru due to the Rural Livelihood Improvement Movement and repeated typhoon damage, but the OM family was not significantly

affected. In 1988, widening work was carried out on National Highway 156 in front of the mansion, and many mansions were relocated or newly built after the land was acquired, but in the OM family, only the paddy fields facing the road were reduced, and the mansion was unaffected.

The OM family's forest was most transformed by the damage caused by Typhoon No. 23, which hit Tonami City on October 20. The maximum instantaneous wind speed was 40.6 m/s, the number of damaged houses was 2,206, and the number of fallen trees over 10 m was 11,001, of which 95 % were cedar trees.(Ref. (See 11). Photo 1 is an aerial view of the OM house before the typhoon damage, and shows tall cedar trees planted after the wartime offerings on the north side of the property, 42 of which were damaged due to the typhoon. In

addition, one Japanese horse chestnut, seven Japanese oaks, two Japanese white oaks, and one Japanese plum tree were also blown over. A cedar tree also fell on top of the main house, but fortunately, as shown in Photo 2, it stopped on the roof and did not cause any serious damage to the main house.

The reason why this typhoon damage was so great is that the premises forest in the Tonami Plain are planted with tall trees on the west and south sides to protect them from the southwest monsoon in winter, but Typhoon No. 23 was from the northeast, which is the opposite direction of the typhoons they usually receive, and the roots of the cedar trees were damaged by the wind. Mr. OM and other local residents believed that the site and the trees were not able to withstand a typhoon coming from the opposite direction. In addition, the fact that the cedars planted after the war were not indigenous to the area, but a fast-growing species, and the fact that the cedars were old, having been planted more than 60 years ago, were also pointed out as factors.

After the disaster, Tonami City distributed seedlings, and Mr. OM received 20 seedlings such as oak and plum in March 2005. It is said that many seedlings died before planting trees because there was snow until the end of March this year, and it was difficult to plant trees.

(2) Transformation of the KD family mansion
The main house of the KD family was built in the early Taisho period (1912-1926), followed by the *Azumadachi* main house, then the storehouse on the left side of the front facade, and in 1949 a barn was built on the front right side. The structure of the house is traditional with tall trees on the south and west sides, and is still largely preserved today. The layout of the main

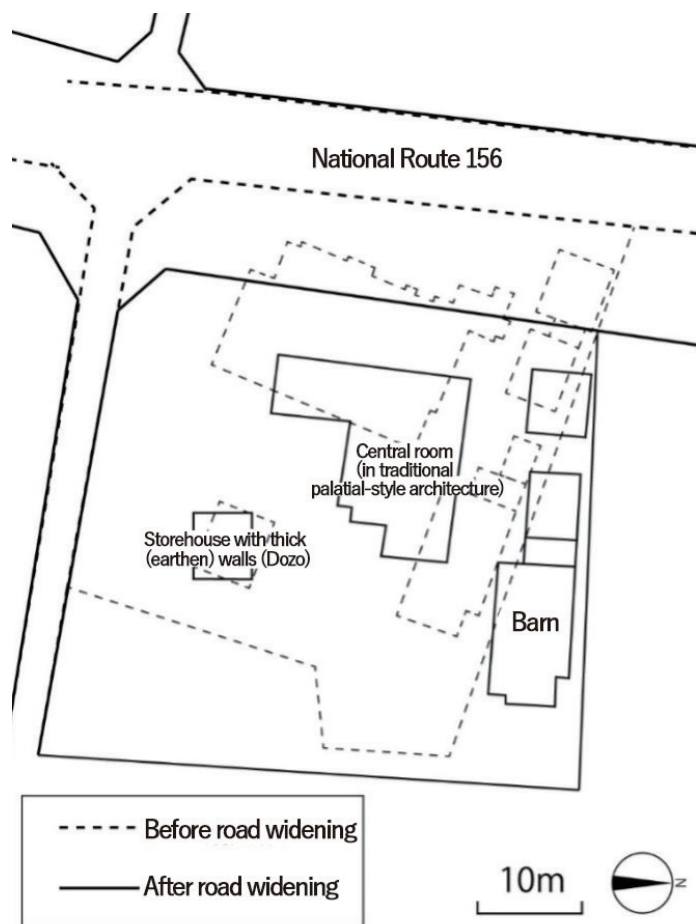


Figure 9. The NM family's house before and after road widening

house at the beginning of the Taisho period (1912-1926) is of the general hall type, centering on the hall, but the wakunouchi of the KD family can be seen not in the hall but in the tea room. The main house was later extended with an antechamber on the south side of the tatami room and a kitchen with a dirt floor on the north side of the garden, however the year of the extension is unknown. In 1965, the kitchen was rebuilt from the dirt floor to the board, the barn was expanded in 1974, the waiting room was further expanded in 1978, and in 1992 the attic was remodeled and a children's room was built. Furthermore, in 2003, the storehouse was rebuilt and used as a residence for the son and his wife. There was no impact on the mansion due to the field maintenance, and since it did not face the main road, it was not affected by the widening work.

As in the case of the OM family, the damage caused by Typhoon No. 23 in 2004 was significant, as shown in Figure 7. A total of 13 trees were damaged, including 12 trees and one Japanese pagoda tree. Photo 3 was taken

by Mr. KD after the damage. A tall cedar tree at the entrance of the mansion fell toward the storehouse, but fortunately there was no serious damage to the storehouse or main house. There was some assistance from Tonami City for removing fallen trees, but some households could not wait for the arrival of heavy machinery and did the removal work at their own expense. The KD family processed the roots of fallen trees by themselves, but later applied for and received subsidies for part of the removal costs.

After the disaster, it is said that he received the seedlings from Tonami City like Mr. OM did. According to Mr. KD, the saplings were not only tall trees such as cedar, but also fruit trees such as peach, etc., which can be selected from the requests of the affected households by the local associations. Mr. KD applied for seedlings of cedar and fruit trees such as plum. He planted them around his house, but cut down a few trees because they were not getting enough sunlight. He chose cedar for the seedlings because he wanted to "live surrounded by trees" and did not worry about the trees falling again in the future.

Although he felt that the management of the forest was time-consuming, he also wanted to live in a forested area, so when he became president of the community, he worked hard to have the area designated as a "scattered landscape model district".

(3) Transformation of the NO family mansion

The NO family built their main house in Maenagare in 1914. As rooms were added in stages, the hall was used as a farmhouse, and the tea room in the back was built as a wakunouchi structure. Through the early Showa period, trees were planted and a premises forest was established on the south and west sides, and a livestock shed was added in 1937. In 1960, an antechamber was added to the south side of the main house. When the couple married in 1985, a Western-style room was added to the west side of the main house, and the attic was reconstructed so that it could be used as a

children's room in the future. In 2012, the kitchen was remodeled to be all-electric.

One of the factors affecting premises forest of the NO family was the field improvement project. During the period from 1970 to 1974 (as shown in Figure 8), the aguaduct that used to run around the house was removed and water was drawn from an irrigation canal as a result of the field improvement project. According to the interview with Mr. NO, the cedars and other trees were not able to take root because of the aguaduct running around the house, and it is assumed that the cedars on the west side of the house were felled by damage caused by Typhoon Isewan in 1960. The aerial photograph in Photo 4, taken in 1992 after the field improvement project, shows that the tall cedar trees on the south side were planted in multiple layers. Subsequently, the tall cedar trees were toppled by typhoon No. 23 in 2004 and other heavy winds. The fallen tree blocked the road in front of the NO house, so they purchased a chainsaw at their own expense to remove the tree without waiting for the Tonami City subsidy program to assist with the removal project. In the sapling distribution project done through Tonami City, the NO family did not choose cedar trees that were suspected to be in danger of falling over, but selected fruit trees for planting instead. Therefore, no tall trees can be seen around the NO house now.

The front yard of the NO family was landscaped in the style of a Japanese garden, and is said to have been maintained by Mr. NO himself. Mr. NO used to prune the branches of the cedar trees himself, but as he grew older this became more difficult, so fewer and fewer cedar trees were planted.

(4) Transformation of the NM family mansion

The main house of the NM family was built between the end of the Edo period and the Meiji period. The current main house was newly built after the original house was demolished during widening work, which took place on Route 156, in 1988. The dotted line in Fig. 9 shows the layout of

the house and the residence before the widening, and the solid line shows the layout of the house and the residence after the widening. There are 2 more tatami rooms in the square shape, today what is known as a Tanoji Plan, including a buddhist altar room and followed the form of okuzashiki and kuchizashiki style homes in the Tonami Plain. By 1945, an antechamber had been built, and two living rooms, a dining room, and a kitchen had been added as living spaces. Later, the earthen floor was reconstructed and turned into a board room, and the bath, which had been outdoors, was installed indoors. Around 1955, a boiler room was added, and in 1965, an antechamber was added. Around 1965, the living room and antechamber were reconstructed to create a central hallway, completely separating the family living space from the reception area. In 1967, the water system, which had been used for both water and drainage, was divided into separate water and drainage systems due to field maintenance.

After that, in 1988, part of the site of the NM family was acquired for road widening work on National Highway 156, and the current house was constructed at the beginning of the Heisei period. The main building was newly built, but the accessory stores such as the farm tool hanger, garage, and dozo have been relocated and are arranged as shown in Fig. 9. The structure of the newly constructed main house is not a wakunouchi structure, but the wood used for the wakunouchi of the original main house was reused in the living room as a design feature, and the living room is centered by a Buddhist room and a reception room, separating living space and reception space. In this way, it was evident that Tonami's traditional sense of formality and customer service practices remain in the newly constructed main building.

Conclusion

In order to understand the transformation that led to the present-day forests and private houses, we conducted a comprehensive survey of Goromaru and interviewed the owners of four houses, detailing the changes in each house and their factors over

time. The changes in private houses and forests can be divided into two main categories: (1) the impact of changes in lifestyle over time, and (2) the impact of natural disasters, such as typhoons, on local livelihoods.

(1) Impact of the times

Some of the influences associated with the times are the change in roof morphology from thatched roofs to tiled roofs, which was confirmed in the OM family, the supply of cedar trees during the war, the felling of cedar trees mainly due to postwar expansion and renovation. The relocation and renovation of NM family due to the road widening work of the house, expansion and renovation of the children's room confirmed in all the houses, and renovation of the kitchen and surrounding water bodies took place. These were due to motorization and lifestyle changes that accompanied modernization. In particular, cedar trees in the premises forests are cited as a maintenance challenge, as fallen leaves used to be used as fuel, but with the introduction of electricity and gas, their use has been eliminated, and the time and effort required to dispose of them has become a major issue. Furthermore, in recent years, bonfire for fallen leaves and twigs has been regulated and subsidies for disposal costs are limited, and some households have begun to cut down their cedar trees when they find it difficult to dispose of fallen leaves.

(2) Impact of natural disasters

The most notable impact of natural disasters is the toppling of cedar trees by typhoons. Since many households were damaged by fallen trees, many of them cut down tall trees in preparation for future typhoon damage. The forests used to be effective as windbreaks to protect the houses from heavy winter winds, but with the evolution of building materials and the use of aluminium sashes for openings, the main house itself has become more disaster-resistant and more comfortable. Coinciding with these changes, the modern value of the forests has apparently been lost, leading to their felling.

In addition to the four case studies in this paper, a comprehensive survey confirmed that the number of tall trees in the premises forest is decreasing, and that the main house has been extended and remodeled, and that the number of *azumadachi* and *maenagare* is decreasing. On the other hand, some households, such as the NO family, have retained the greenery in their Japanese-style garden, while others, such as the NM family, have retained the *wakunouchi* design and maintained the space for entertaining guests even after building a new main house. It was also confirmed that the newly built houses maintained their traditional dark color. This indicates that while changes in lifestyles have forced the transformation of private houses and premises forests, the will to preserve local culture remains deep-rooted. Tonami City's policies also show a movement to utilize vacant traditional houses as migration experience houses and local cultural learning facilities, and to reconstruct *azumadachi* and use them as guesthouses and restaurants.

Today, lifestyles have changed dramatically, leading to improved disaster resistance and comfort in the main residential houses, with the significance of the former premises forest seemingly diminishing over time. In recent years, however, people are re-evaluating their dependence on fossil fuel energy and re-examining how to create a society and community that makes use of natural or renewable energy and traditional local resources. We will continue to examine in detail the significance of dwelling (private homes) and forests in modern society, and together with local residents, we will discuss the ideal system of conservation and disaster countermeasures.

Appendix

This paper is based on field research conducted by the authors, as well as some quotes from MINAMINO Kousuke's 2018 graduation thesis in the Department of Architecture, Faculty of Engineering, Kyoto University.

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【Traditional and Local knowledge of Eco-DRR in dispersed villages located in the Sho River basin of the Tonami Plain】

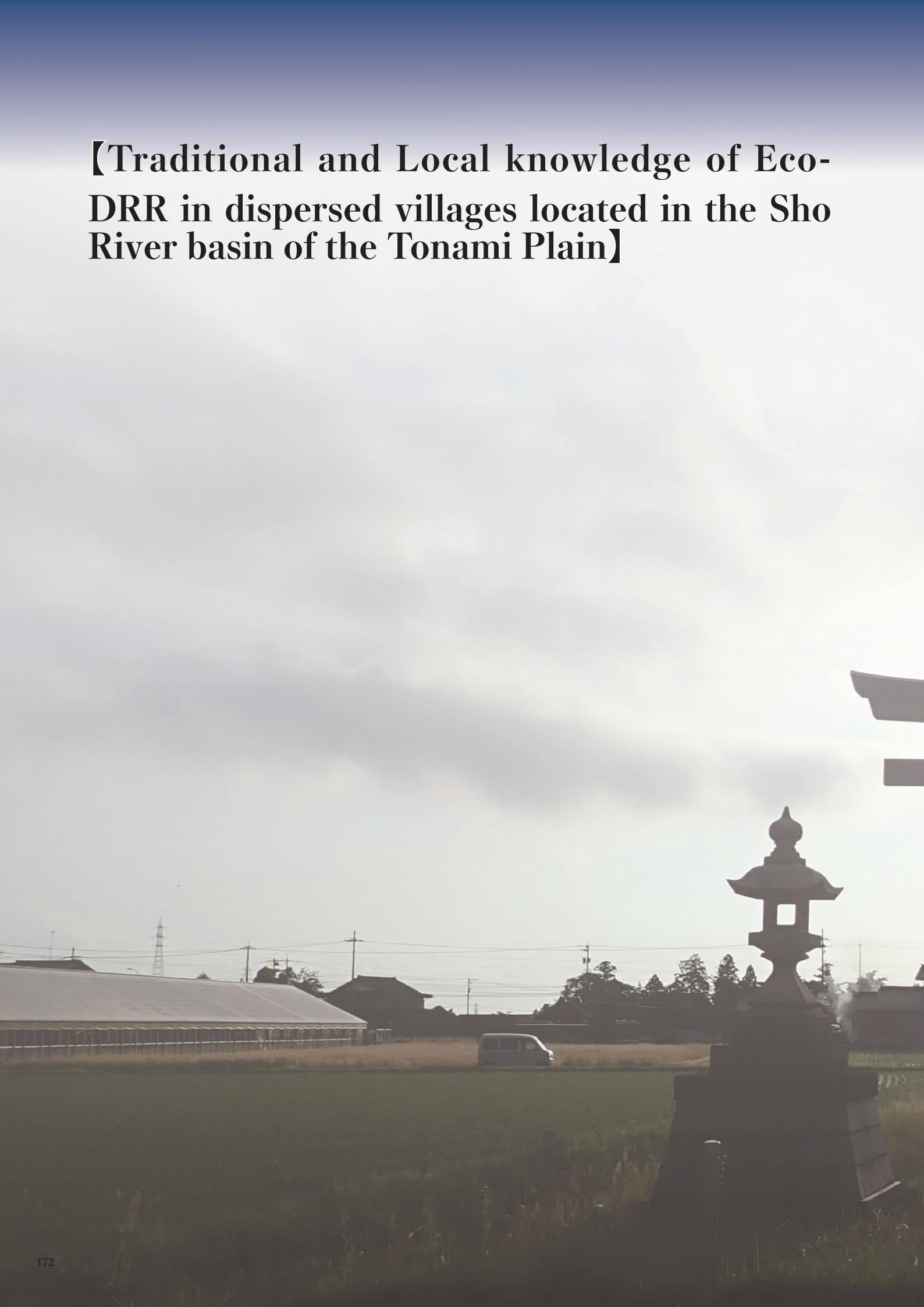




Photo courtesy of Eco-DRR Project

Traditional and local knowledge of the Tonami Plain

Kyoto University **KOBAYASHI Hirohide**



As described in my article "House Construction and Communal Labor in the Meiji Period" in this booklet, I have been involved in field research and reconstruction projects of traditional architecture (風土建築) cultivated in the local climate and culture in various locations. Based on this experience, I believe that vernacular architecture is constructed, maintained, and passed on using three local resources: local materials (natural resources), communal labor (human resources), and indigenous technology (intellectual resources). In addition, the three local resources of vernacular architecture are interconnected. Intellectual resources such as traditional and local knowledge are deeply related to the natural resources that are the object of application and the human resources that handle them. Considering traditional and local knowledge of an area leads to considering the nature and people of the region.

In Tonami, with the cooperation of the residents of Goromaru, we have had the opportunity to survey the traditional dwellings of Tonami, *Azumadachi* and Maenagare, and as of March 2022, this will be the sixth year of this project. During this time, we have learned about the splendor of the dispersed village lifestyle, as well as the difficulties of passing it on to future generations, such as the aging of the residents. As I continued my field research, I wanted to deepen my understanding of Tonami's vernacular architecture and local resources, but traditional dwellings are no longer being built in the modern age which makes this difficult. However, this became possible this time by reading old documents from the time of construction 110 years ago kept by Mr. KATADA, who has lived in *Azumadachi* for generations since his great-grandfather. Of the three local resources, we were able to uncover one aspect of how the village residents worked together, especially regarding the human resource.



Old documents reveal that many more villagers were involved in the construction process, spending more energy and time to build a single dwelling than we realize. We can also see that neighbors provided wood and bamboo from their own forests as construction materials. This process seems to have created a sense of value that has been passed down from generation to generation, and has become part of the memory of the village residents beyond the existence of individual houses, becoming part of the land. I also felt that the total energy of all the community members rooted in the region, not only in the houses but also in the cultivation of the plains, farming in the rice paddies, various events, and daily life, has created the unique landscape of Tonami.

The traditional dwelling seen in Tonami is completely different from the modern concept of a house purchased as a commodity, as in the case of a newly constructed house. In the current living environment where commoditized housing is becoming more prevalent, if we have reaffirmed the significance of the existence of the mansion and the premises forest, we need to think with new wisdom about how it can be passed on. Tonami City's Scattered Residence Landscape Model Project, which started last year, is a conservation project in which local people work together to maintain their residences, forests, and villages, rather than doing these things by themselves I think it is a very good initiative that is in line with the origins of traditional dwellings. For example, there may be an idea to regard the premises forests as public property like roadside trees, and to manage them as a local resource by the local government while entrusting the location to the house owners. In this way, I hope that we can create a system of inheritance by exchanging various ideas and creating and establishing traditional and local knowledge for the future in our modern life.

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Eco-DRR as Learned from Local History

Traditional and Local knowledge of Eco-DRR in dispersed villages located in the Sho River basin of the Tonami Plain

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