

Distribution of Fukugi (*Garcinia subelliptica*) trees as Landscaping trees in Traditional Villages in Ryukyu Islands in Japan

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Abstract: Big Fukugi (*Garcinia subelliptica*) trees exist prevalently around residences in traditional villages in Okinawa Prefecture, Japan. It is thought that such a rural landscape with planting trees, in particular Fukugi trees, as windbreak, was ameliorated based on Feng Shui concept in the then Ryukyu Kingdom around 300 yrs. ago. In order to explore how far Fukugi trees have been utilized in traditional villages in Nansei Islands, the southernmost archipelago in Japan. This study was designed to continue our previous study on the distribution of big Fukugi trees in Okinawa Islands, located in the center of Naisei Islands. We visited all villages, in particular older villages on almost each inhabited islands of Yaeyama Islands and Amami Islands. The biggest Fukugi trees found in each village were measured. It was found that big Fukugi trees are widely distributed on Ryukyu Islands, on the islands north to Amami Islands and south to Yaeyama Islands. In Amami Islands, Okinoerabu and its further south islands have Fukugi trees prevalently existing, while, for its further north islands, the remaining Fukugi trees were sparsely distributed and only a few old Fukugi trees found in few villages. Fukugi trees in Amami Ōshima and Kikai Island were among the biggest trees measured, however, most of them were individual stands around the residence. Even in these few houses with Fukugi trees, it is thought to have the affiliation to Ryukyu Kingdom in the past, and to be strongly influenced by Ryukyu culture. Thus, Okinoerabu Island could be considered as the northern borderline in Ryukyu Islands of such traditional rural landscape with prevalent Fukugi planting, which was established under the influence of Ryukyu culture.

Keyword: residence woodlands, windbreak, East Asia

Introduction

There exist picturesque rural landscapes with orderly lines of green Fukugi trees surrounding each house in the villages in Okinawa. Such a landscape was thought to have been established based on the Feng Shui concept around 300 hundreds ago. Embraced protection (抱護; ho:go) was the primary principle for landscape planning. A typical Ryukyu village also consists of forest belts planted along the sea shore or to enclose along the outer ring of the village. Such a layout is attributed to the topography and local climates: most of the Ryukyu Islands are flat without high hills and suffer from frequent typhoons and strong monsoonal winds.

The planting tree species include Ryukyu Pine trees (*Pinus luchuensis*), adan trees (*Pandanus odoratissimus*), as well as Fukugi (*Garcinia subelliptica*) trees. Pine trees were usually planted along the mountain ranges, to line along the coastline and even on the important spots inside the hamlet. Most of pine tree lines were cut and burned during WWII, or were cut for rural

development projects soon after WWII. Adan, a native species, was usually found along the coastline. Among these tree species, Fukugi trees seem to be used the most commonly and widely, and usually planted as residence woods, still existent in many villages for its longevity. In Bise village, around 70% of the total houses are surrounded by Fukugi trees. A total amount of around 10,000 Fukugi trees were measured (Ando and Ono 2008), among which 1,075 Fukugi trees were measured to be older than 100 yrs. (Chen and Nakama 2011). In Tonaki Island, an isolated small island nearby Okinawa Island, we measured a total amount of 7,700 Fukugi trees whose DBHs were bigger than 5cm, among which around 1,000 trees were older than 100 yrs. There are another several villages in mainland Okinawa and its nearby isolated islands had around 1,000 Fukugi trees older than 100 yrs. (Chen and Nakama 2011). Fukugi trees have been widely planted in Okinawa; it is worth further exploring its distribution span in Okinawa and its nearby regions.

Fukugi tree landscape is a planned cultural landscape on the basis of the Feng Shui concept in Ryukyu

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Kingdom. The survey on the distribution of huge Fukugi trees on Okinawa Islands found: first, huge Fukugi trees were found to be planted to surround the houses, sacred sites and even the remains of the old public offices in Okinawa Islands (Guntō); secondly, almost all huge Fukugi trees found in Okinawa Islands were planted relevant to human settlements; thirdly, the biggest Fukugi trees were found to have a DBH of around 80-90 cm in Okinawa Islands. In this paper, we continue to survey the current distribution of huge Fukugi trees on the other islands except Okinawa Islands in Ryukyu Islands (see Fig. 1); and further discuss whether Fukugi trees planting is limited to Ryukyu culture based on the survey data collected on Yaeyama Islands and Amami Island.

In this study, our field survey extended to Sakishima Islands in the southernmost of Okinawa Prefecture, and Amami Islands in the north of Ryukyu Islands, which now belongs to Kagoshima Prefecture.

Ryukyu Islands stretch southwest from the Japanese island of Kyūshū to within 120 kilometers of the island of Taiwan. The Ryukyu Kingdom was an independent kingdom that ruled most of the Ryukyu Islands from the 15th century to the end of the 19th century.

The Kings of Ryukyu unified Okinawa Mainland Island and extended the kingdom north to Amami Islands in modern-day Kagoshima Prefecture, and south to the Yaeyama Islands near Taiwan. The Ryukyu Kingdom was a Chinese tributary state during much of its existence and, therefore, had a much closer relationship with China than it did with Japan. The Ryukyu Kingdom lost its independence when the Satsuma armies invaded the islands in 1609. The years between 1609 and 1879, are known as the era of “Dual Subordination” because of the Ryukyuan’s dual loyalties to both China and Japan. During this period, the Japanese overlords curtailed the Ryukyuan’s trade and taxed them heavily. Amami Islands were separated from Ryukyu Kingdom after 1614.

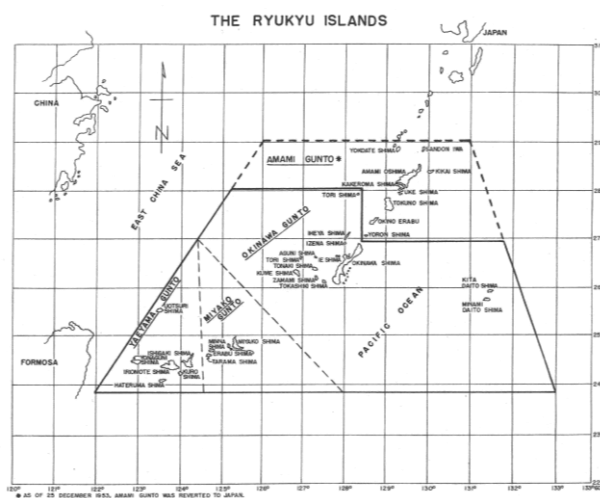


Fig. 1 Map of Ryukyu Islands

Source: in *Ryukyu Islands (1953)* by United States Civil Administration

Methods

We have designed to survey on the remaining big Fukugi trees in all hamlets in Ryukyu Islands, including Sakishima Islands and Amami Islands. A hamlet is a survey unit since it is the smallest but holistic landscape planned or ameliorated. In Okinawa, a hamlet is a community based on a territorial band as well as blood relationship. Trees were commonly planted to surround the premise of each house to protect from the strong winds in Ryukyu Islands.

First we collected related information on existent huge Fukugi trees from the local administrations and literature records. Then we visited almost all villages in each surveyed islands to find out the location of big Fukugi trees and the rate of spread of Fukugi trees in the village. A few houses with the best preserved house-embracing Fukugi trees were selected and the DBHs (the diameter at breast height) and the heights of the biggest trees were measured and tallied in each hamlet.

According to the Ministry of the Environment of Japan, a huge tree is defined as a tree with a trunk circumference bigger than 300 cm at a height of 130 cm above the forest floor. However, for a slow-growing tree species, a trunk circumference smaller than 300 cm is also accepted as that of a huge tree (1991). Since Fukugi is a very slow growing tree species, we define a big Fukugi tree as one planted during the Ryukyu Kingdom Period before 1868. Thus, we surveyed all Fukugi trees with a DBH bigger than 25cm.

The estimated tree age was counted based on the formula [Age (year) = DBH (cm) ÷ 2 × 8] by Hirata (2006). Concerning the approximation of estimated tree age due to the discrepancy of geographical location and competition from other trees, all surveyed house-embracing Fukugi trees were further categorized into five groups (≥ 300 yrs; 250~299 yrs; 200~249 yrs; 150~199 yrs; 100~149 yrs) based on their estimated ages. A 1:25,000 digital map issued by the Geographical Survey Institute was used to map the distribution of the largest residual trees. The five groups of surveyed trees were mapped by different hamlets and presented in different colors. The distribution map of Fukugi trees was reproduced with a reference to the residential map published by Zenrin.

The scientific name of Fukugi is *Garcinia subelliptica*. About 250 species belong to the *Garcinia* genus, and they are widely distributed in the tropics, in particular, tropical Asia (Hatsushima, 1975). In this study we limited our discussion of distribution of Fukugi trees to the species of *Garcinia subelliptica*. Only the biggest Fukugi trees found inside a hamlet would be shown in this paper in order to probe into how early have Fukugi trees been planted in Ryukyu Islands.

Results and discussion

Distribution of Fukugi trees in Sakishima Islands

The Sakishima Islands (先島諸島, Sakishima shotō) are an island chain located at the southernmost end of the Japanese Archipelago. They include the Miyako Islands, and the Yaeyama Islands. The Yaeyama Islands include Ishigaki City and Taketomi Town which consists of several small islands and Iriomote Island which is thickly forested with a small population of around 2000 people due to its infestation by malaria in the history.

The survey results of Fukugi distribution in Ishigaki Island were summarized in Table 1. Among the total 21 villages in Ishigaki Island, around 12 villages were found to have Fukugi trees older than 150 yrs. (see Fig. 2). Shiraho village in the southeast of Ishigaki Island had the biggest Fukugi trees, estimated to be around 350 yrs. old. Two hamlets of Kabira and Ibaruma have Fukugi trees older than 280 yrs. old. However, in the villages close to downtown, the biggest Fukugi trees were measured to be younger than 250 yrs. The mean height of surveyed huge Fukugi tree was around 10m.

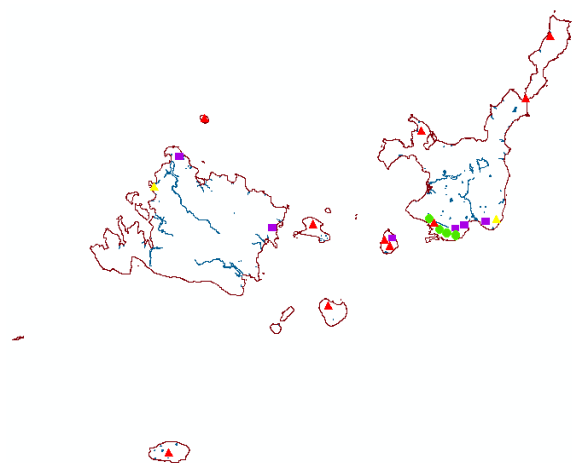


Fig. 2 Different colors mark the distribution of the biggest Fukugi trees distributed in Ishigaki Island and Taketomi Island.

- ▲ A hamlet having a Fukugi tree older than 300 yrs.
- ▲ A hamlet having a Fukugi tree older than 250 yrs.
- A hamlet having a Fukugi tree older than 200 yrs.
- A hamlet having a Fukugi tree older than 150 yrs.

Small islands and Iriomote Island nearby Ishigaki Island belong to Taketomi Town. Iriomote Island is the second largest island in Okinawa Prefecture. It is very sparsely inhabited with a population of 2,000 and consists of seven villages. Hoshitate hamlet of Iriomote *aza* (village) has the biggest Fukugi trees older than 300 yrs. Hoshitate, located in the north along the seashore, has the best preserved big Fukugi tree lines mixed in Iriomote Island. The other four islands of Taketomi,

Kohama, Hatoma and Hateruma have the biggest Fukugi trees older than 250 yrs. Aragusuku village consist of two small islands, which is not accessible to the tourists without the permit of the village head. The biggest Fukugi trees, with DBHs of 80cm and 70cm, were measured around the viewing platform and Mitaki utaki (Hirata 2006). The small islands except Kohama Island have Fukugi trees spreading throughout the village.

In order to explore into the spread of Fukugi trees inside a village, the rate of the number of houses with remaining Fukugi trees to the total number of the houses in the village was also estimated as the coverage of Fukugi residence woodlands in Ishigaki Island and its nearby islands (see Table 1). The mean coverage of Fukugi trees in the surveyed villages in Ishigaki Island and its nearby islands was around 30%. Ibaruma village in the northeast of Ishigaki Island had half of the total village houses surrounded by Fukugi trees. Huge trees were found to be wide spread inside it. It is also worth noticing that Hateruma Island, the southernmost inhabited island in Japan, had coverage of residence Fukugi trees for around 80%. In summary, huge Fukugi trees and Fukugi residence woodlands were prevalently found in Ishigaki Island and its nearby islands.

From the distribution of Fukugi trees in Ishigaki Island, we confirm the assumption that the rate of remaining Fukugi trees is negatively correlated to urbanization. The result coincides with our findings in mainland Okinawa. For the villages in the south with dense population, Fukugi trees were smaller and less distributed than those in the villages in the north with sparse population. WWII also attributed to the sharp decrease of Fukugi trees in Ishigaki Island. The owner of Miyara Dunchi, located in Okama, told us that the Japanese army cut almost all huge Fukugi trees to build piers during WWII. A study on the disappearing Fukugi residence woodland on basis of the historic aerial photos concluded that war fires during WWII were the major factors contributing to the vanishing of the Fukugi trees (Ando and Ono 2008).

Besides planted Fukugi trees nearby the houses inside the settlement, naturally regenerated huge Fukugi trees were also found in sacred sites in Taketomi Island and Kohama Island, and on the mountains in Iriomote Island. There is a natural Fukugi forest inside Kouki utaki in Kohama Island, among which the biggest Fukugi was measured to have a DBH of 77cm, was 12m tall, and was estimated to be around 300 yrs. old.

Goban pattern village is considered as highly planned village with houses orderly laid out and clustered together. Goban pattern village was settled after 1737 (Nakamatsu 1977), related to *jiwarisei*, the practice of rural villages periodically redistributing land among their members. The total nine Goban pattern villages all have remaining Fukugi trees.

Tab. 1 Biggest Fukugi trees found inside the villages of Ishigaki City

Survey Sites		Biggest House-embracing Fukugi Trees ²⁾			Coverage of Fukugi Trees ⁴⁾	Biggest Fukugi tree in sacred sites			Goban Pattern ⁵⁾ Village	
municipality	Aza ¹⁾	Sub-aza	DBH (cm)	Estimated age (yrs.) ³⁾		Tree Height (cm)	DBH (cm)	Estimated age (yrs.) ³⁾		Tree Height (cm)
Ishigaki City	Tonoshiro		381	152.4	860	<10%				●
	Ōkawa		490	196	910	40%				●
	Ishigaki		615	246	1210	<10%	481	192.4	840	●
	Arakawa		387	154.8	810	<10%				●
	Kabira		711	284.4	1050	20%				
	Hirae		540	216	960	30%				●
	Maetzato		475	190	850	<10%				●
	Oohama		593	237.2	1400	30%				●
	Miyara		531	212.4	900	20%				●
	Shiraho		884	353.6	1280	20%	395	158	850	●
	Ibaruma		715	286	820	50%				
Hirakubo		630	252	710	30%					
Taketomi Town	Kuroshima		572	228.8	900	30%	426	170.4	1000	
	Taketomi	Nakasuji	682	272.8	620	30%	677	270.8	830	
		East	570	228	1020	10%	506	202.4	1100	
		West	700	280	1000	20%	503	201.2	1120	
	Kohama		700	280	710	<10%	770	308	1200	●
	Komi		548	219.2	730	30%				●
	Uehara		600	240	840	<10%				
	Iriomote		770	308	840	<10%				●
	Hatoma		680	272	1100	40%				●
Hateruma		667	266.8	850	80%	605	242	990		

1) *Aza* is a hamlet that comprises of the smallest unit of a community in Okinawa. Several *azas* make up a village. The words *aza*, *shuraku*, and *buraku* are usually used synonymously. *Aza* is more formal, and *buraku* is more familiar. *Buraku* is a social and geographical settlement group.

2) *Yashiki hogo* is translated into house-embracing Fukugi trees in English. *Hogo* is a primary concept of Feng Shui in Okinawa, literally meaning embraced protection. Tree lines planted around the houses shape a sound and effective protection from the strong winds. The remnant huge Fukugi trees now exist in most of the old hamlets.

3) The estimated tree age was calculated based on the formula [Age (years)=DBH(cm)÷2×8] by Hirata (2006)

4) It is the ratio of the number of houses with house-embracing Fukugi trees to the total house numbers built before WWII. The ratio is estimated as an index of existing Fukugi tree coverage.

5) A Goban Pattern village, also called a *jimari* Village, was newly built after 1737 (Nakamatsu, 1977). A Goban village features grid order roads. *Jimari*, was a collectively owned land system in modern Ryukyu.

Under the *jimari* system, all land is collectively owned, used, and managed. The land was allocated and redistributed in a certain period from 1 to 35 years, differing in hamlets. These Goban villages were marked according to Nakamatsu (1977 pp114-118)

Table 2. Biggest Fukugi trees found inside the villages of Miyako City

Survey Sites		Biggest House-embracing Fukugi Trees ²⁾			Biggest Fukugi tree in sacred sites			Goban Pattern Village
Islands	Aza ¹⁾	DBH (cm)	Estimated age (yrs.) ³⁾	Tree Height (cm)	DBH (cm)	Estimated age (yrs.) ³⁾	Tree Height (cm)	
Miyako Isl.	Karimata	578	231.2	900	769	307.6	1000	
	Higashinakasone							
	Kawamitsu	546	218.4	810				
	Sugama	556	222.4	1120				
	Bora	502	200.8	1100				
	Kadekari	472	188.8	900				
	Miyaguni	430	172	1150				●
Kurima Isl.	Kurima	490	196	850				
Ikema Isl.	Ikema	505	202	1140				
Tarama Isl.	Shiogawa	642.5	257	1030	777	310.8	1282	●
	Nakasuji	655	262	810	680	272	932	●

These Goban pattern villages are all located in the south of Ishigaki Island. These Goban villages might have been constructed after the hit of the Yaeyama tsunami in 1771. The most destructive tsunami directly struck the southeastern coast and eastern coast of Ishigaki Island in 1771, and around one third of the population, for a number of around 12,000 people, was killed. For the villages located along the coast in the east and south, many houses went out. However, it is obvious that these Fukugi trees older than 230 yrs. survived in this disaster.

It is common to find a big Fukugi tree standing in the south east corner of the residence in Taketomi and Hateruma Islands during our survey. It is said that God Nirai comes from the direction of East and South. Fukugi trees planted in the south east corner have been preserved to enhance the solemnity of the sacred spots in the residence. However, a huge Fukugi tree in southeastern corner of the residence is only specific to a few islands.

Miyako Island is the fourth biggest island in Okinawa Prefecture. It has a population of 48,000. The biggest Fukugi trees found in Miyako City were listed as Table 2.

Miyako Island has much fewer remaining big Fukugi trees than in Ishigaki Island (see Fig. 3). Big Fukugi trees were only found in Karimata hamlet in the north of the island and a few villages in the south of the island, in its nearby smaller islands and Hirara City. The biggest Fukugi tree was found to be around 222 yrs. old in Sugama hamlet. Even in these villages, there are only a small number of Fukugi trees remaining. No Fukugi trees were found in the relatively new villages in the east of Miyako Island. The coverage of Fukugi trees in surveyed hamlets is almost less than 10%. Only the older part of Karimata village had coverage of 20%. In

other words, Fukugi trees, in particular old Fukugi trees were found to be few inside a village. The dense population might contribute to the decrease of Fukugi trees on the island.

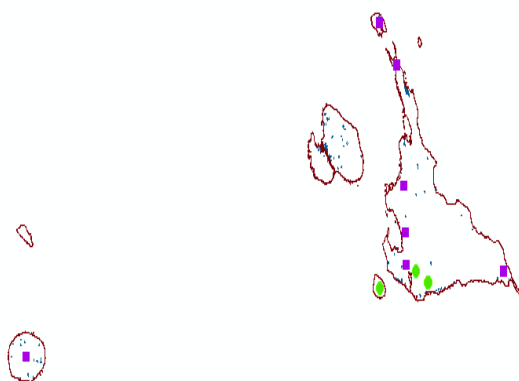


Fig. 3 Different colors mark the distribution of the biggest Fukugi trees distributed in the Miyako Islands and Tarama Island.

Please refer to Fig. 2 for legends.

Except the naturally regenerated Fukugi trees in the sacred sites in Taketomi Town, planted Fukugi forests are common to be found in Yaeyama Islands, in particular, in Tarama Island and Karimata in the north of Miyako Island. A total number of 27 big Fukugi trees in Izutsu utaki line along the coast. The biggest Fukugi tree was estimated to be more than 300 yrs. old. It is assumed that they were planted forest since Izutsu utaki was said to be the original settlement of Karimata hamlet.

Tarama Island is a small island located between Ishigaki Island and Miyako Island. There are a total number of 683 big Fukugi trees were measured in the 11 sacred sites in Tarama Island.

Distribution of Fukugi trees in Amami Islands

Amami Guntō (Amami Islands) consists of six major islands of Amami Ōshima Island, Kikai Island, Kakeromajima, Tokunoshima, Okinoerabu, and Yoron Island from the north to the south. Fukugi trees were found to be more commonly distributed in Okinoerabu and its further south islands than its north islands (Table 3 and Fig. 4).

In the biggest island in Amami Island, Amami Ōshima Island, only two villages of Kuninao and Imazato have old Fukugi trees, the biggest trees were measured to be more than 250 yrs. Kuninao, located along the eastern coast, has the best preserved Fukugi tree lines in Amami Ōshima Island with around 20% of the village houses surrounded by Fukugi trees. Some other villages have some small Fukugi trees. However, the majority of the villages in Amami Oshima do not have Fukugi trees.

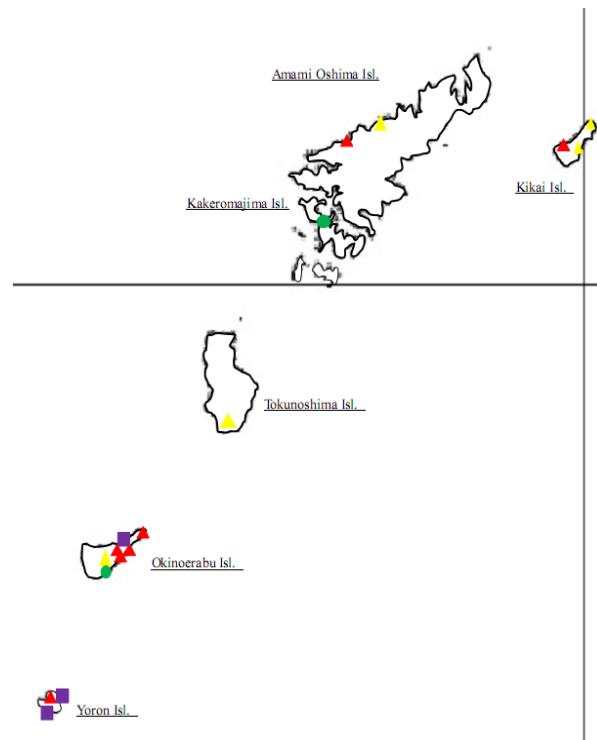


Fig. 4 Different colors mark the distribution of the biggest Fukugi trees distributed in Amami Islands. Please refer to Fig. 2 for legends

Tab.3 Biggest Fukugi trees found inside the villages in Amami Gundo

Survey sites		Biggest House-embracing Fukugi Trees ²⁾		
Islands	Aza	DBH (cm)	Estimated age (yrs.) ³⁾	Tree Height (cm)
Amami Ōshima Isl.	Kuninao	753	301.2	900
	Imazato	660	264	800
Kikai Isl.	Sakiuchi	1141	456.4	1180
	Shidooke	870	348	1170
	Ikeji	715	286	820
Kakeromajima Isl.	Kiji	460	184	1800
Tokunoshima	Isen	755	302	1300
Okinoerabu	Wodomari	690	276	1220
	Tedechina	673	269.2	1220
	Nishibaru	435	174	1000
	Kunigami	504	201.6	1270
	Kibiru	630	252	980
	Amada	460	184	1600
	Kushiken	964	385.6	1240

The biggest Fukugi trees were found to be in Sakiuchi hamlet, Kikai Island, estimated to be over 400 yrs (see Photo 1). and 12m tall. This tree was a single Fukugi tree standing in the south of the garden with other trees, e.g., banyan trees. The second biggest Fukugi tree, along with another 2 trees, was found in Shidoke in the north of the island. Big Fukugi trees were found to be one single tree, or only single house having Fukugi tree lines in Kikai Island.



Photo 1 The biggest single tree of more than 400 yrs. old in Kikai Island.

Fukugi trees are very rarely used in Tokunoshima. Only Ketoku village in the east of the island have young Fukugi trees. Eiki Family in Isen Village has old Fukugi trees. A total number of 36 Fukugi trees were measured. The DBHs of these Fukugi trees vary from 25cm to 75cm, with an average of 47cm. The biggest

tree was found to be in the east of the residence, be around 300 yrs. old and 13m tall. It is worth noting that Fukugi tree lines are mixed with other huge tree species of two banyan (*Ficus microcarpa*) trees in the south and several *Elaeocarpus sylvestris* in the north. The owner said that their ancestor came from Okinawa.

Fukugi trees are prevalent in Okinoerabu. The biggest Fukugi tree (see photo 2) in Okinoerabu Island was estimated to be around 385 yrs. and 12m tall in a remaining residence, that is now used as the community center in Kushiken hamlet. It is said the bride of this family was from Motobu Town in Okinawa, and she brought the seeds of Fukugi trees from Okinawa. Kibiru hamlet almost in the center of Okinoerabu also has a lot of remaining Fukugi trees. The owner of the house with the biggest Fukugi trees announced that their ancestors came from Okinawa.



Photo 2 The biggest Fukugi trees of around 385 yrs. old in Okinoerabu Island.

In summary, individual huge Fukugi trees were sparsely distributed on the islands to the north of Okinoerabu Island; in the contrast, big Fukugi trees were prevalently distributed on Okinoerabu and its further south islands.

The difference of Ryukyu's influence on Amami Islands might contribute to the Fukugi trees distribution. After 1429, Shō Hashi unified Okinawa Island, and founded the Ryukyu Kingdom. Okinoerabu and further south islands were directly controlled by Ryukyu, while northern parts were also treated as the outer territories of the kingdom. In 1609, Shimazu attacked Amami Islands and mainland Okinawa. In 1613, Ryukyu ceded the islands to the Satsuma Domain.

In Amami Islands, for the well preserved Fukugi residence woodland or the residence having bigger Fukugi trees older than 250 yrs. old, the majority of the owners ancestors mentioned that they were closely related to Okinawa, the then Ryukyu Kingdom. Thus, Okinoerabu Island can be considered as the northern borderline of the Ryukyu Culture of planting Fukugi trees.

Other residence woodlands in Amami Islands

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In the above mentioned islands, some other tree species were more often found surrounding the residence. Banyan is very common as a landscaping tree. In some old villages, Banyan is even standing around the residence. Banyan trees are commonly planted in the school campus.

Banyan trees are also planted along the seashore to protect the village from strong winds. There exist around eight huge banyan trees along the seashore in Setake village in Kakeroma Island to the north of Amami Ōshima.

For the new settlement, some lower species with thick and close leaves seem be welcomed (see photo 3). Besides Banyan trees, some other native species of *Pittosporum tobira*, *Rhaphiolepis indica* var. *umbellata* and *Symplocos kuroki* are also commonly found surrounding the residence. We also found *Cycas revoluta* in Tokushima Island and *Planchonella obovata* Pierre in Kikai Island.



Photo 3 For the new settlement. some lower species with thick and close leaves are cut very short.

According to Flora of Taiwan (1996, Vol. 2, 2nd edition), *Garcinia subelliptica* grow in the thicket along the seashore in the south of Taiwan Island and Luta Island, which are close to Okinawa. *Garcinia subelliptica* is recently planted as landscaping trees in Taiwan. However, huge Fukugi trees were not found in Taiwan, not even such house-embracing Fukugi landscape exist in Taiwan. Instead of Fukugi trees, bamboo woods have been planted to surround the houses in the mountainous villages in Yilan County in Taiwan.

Planted forest belt

Besides residence woodlands, forest belts that were planted to surround the whole village or several villages existed in Ishigaki Island and still remain in another small island of Tarama Island located between Ishigaki Island and Miyako Island. Four hamlets of Tonoshiro, Ōkawa, Ishigaki and Arakawa are located together along the seashore in the south of Ishigaki Island. There was planted pine trees around 4 km long lining along the north of them. Two hamlets Maezato and Hirae, located to the east of the former four hamlets, were surrounded by a circle of forest belt. In Tarama

island, there exists one Fukugi forest belt about 1.8km long along the front of the village to its south.

A brief record of village Feng Shui inspection in Yaeyama Islands by a Feng Shui master named Tei Ryosa (C. Zheng Liangzuo) from 1863 to 1864 was entitled *Hokubokusan Feng Shui Diary* (1864). In this Feng Shui book, the author writes that Banna Mountain in the north of the four villages, however, too far apart from them, could not give an embraced protection. It also suggests that trees should be planted along the back of the hamlets for their protection.

Concerning Fukugi trees

Flora of Ryukyu (Hastushima 1975) describes that Fukugi tree are widely planted as windbreak on islands, except on Iriomote Island, on which there might exist naturally regenerated Fukugi trees (p.415). Flora of Taiwan (1996, Vol. 2, 2nd edition) writes that Fukugi trees originate in Batan, the Philippines. There are the other similar species of *Garcinia Linii* in Taiwan, which is thought to be native species in Luta and Lanyuta Islands to the east of Taiwan Island. *Garcinia Subelliptica* was found along the seashore of the two islands, and currently widely planted as landscaping tree (p.698).

Collections of Dialectic Names of Flora in Ryukyu Islands (Amano 1979) records the historic distribution and uses of Fukugi trees. Fukugi is also called *kajiki* in Amami Islands, meaning fireproof woods. In Maehida hamlet, we heard a story that an old timber house survived from the neighbor's fire last year. Fukugi trees have played an important role as fireproofing in the north of Amami Islands since most of the houses were made of timber.

In Bise village of mainland Okinawa and in Amami Ōshima Island, local people mentioned Fukugi was also called *Tōfukugi* in the past, meaning Chinese Fukugi. However, we couldn't find any planted big Fukugi trees around the houses in mainland China, or in Taiwan. It is worth further exploring into the distribution of planted Fukugi trees in the other regions nearby Okinawa.

In mainland Okinawa, Fukugi is called *sabagii*, meaning sandal trees, since the paired leaves of Fukugi could be worn as sandals.

Conclusions

Big Fukugi trees were found to be widely distributed on Ryukyu Islands, on the islands north to Amami Islands and south to Yaeyama Islands. The Fukugi trees' distribution was examined in three parts, Yaeyama Islands (Ishigaki City and Taketomi Town; Miyako City; Tarama Village) and Amami Islands on basis of their geographical locations. The biggest Fukugi tree was measured in the east of Nakai Family's garden on Kikaijima Island, north to Amami Ōshima, and was estimated to be over 400 yrs. Fukugi trees

estimated to be over 300 yrs. were also found in the villages in the big islands of Amami Ōshima, Ishigaki Island and Iriomote, and some small islands. The biggest Fukugi trees found in Miyako City was around 250 yrs. The majority of the remaining Fukugi trees have been planted around the houses or sacred sites.

Concerning the rate of village houses with remaining Fukugi trees to the total number of houses, a difference exist among these surveyed islands and even different villages in the same island. The surveyed villages in Ishigaki Island and the isolated islands of Taketomi Town had an average rate of 30% of the village houses with Fukugi trees. However, the survey villages in Miyako City except Tarama Island had very few remaining Fukugi trees. Fukugi trees found in the villages in the southern coast of Ishigaki Island were generally fewer and younger than those in the northern villages. Urbanization due to population growth might have contributed to the sharp decrease of Fukugi trees.

In Amami Islands, Okinoerabu and its further south islands have Fukugi trees prevalently existing, while, for its further north islands, the remaining Fukugi trees were sparsely distributed. Fukugi trees in Amamai Ōshima and Kikai Island were among the biggest trees measured, however most were individual stands. The few houses with Fukugi trees are thought to have the affiliation of Ryukyu Kingdom contributing to the different distribution of Fukugi trees. Thus, Okinoerabu Island could be considered as the northern borderline for a Ryukyu Fukugi landscape.

On the islands further north to Okinoerabu, native species such as banyan trees were commonly planted as residence woodlands. Other species include shrubbery of *Pittosporum tobira* and *Murraya paniculata* etc (Okuda and Nakamura 1988).

Fukugi trees was thought to be recommended and planted around the houses as windbreak based on the Feng Shui concept in on Ryukyu Islands around 300 yrs. ago (Chen and Nakama 2011). Fukugi tree planting has spread through islands of Ryukyu Kingdom and even north to Okinoerabu Island. Fukugi trees were also found to be naturally regenerated on the seashore of the islands of Taketomi Town and in the south of Taiwan region. However, old Fukugi trees were not found nearby human settlement in Taiwan. Whether Fukugi trees were used in Mainland is not clear, although Chinese culture has strongly influenced on the Ryukyu Kingdom.

Concerning the sharp decrease of Fukugi trees in Ryukyu Islands, war fires during WWII, public infrastructure construction and local residents' cutting were mentioned as the major causes (Ando and Ono 2008). Comparing the former two causes, however, the last cause is most far-reaching and will attribute to the recent tree cutting in Okinawa. Thus, it is worth further surveying on the local people's perceptions on Fukugi

trees in order to effectively preserve these natural legacies in the future.

Note: The existent hand written copy of Hokubokusan Feng Shui Diary by Hanayama Soni (花山孫位) in 1965 was found (Machida and Tsuzuki, 1993).

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